USDA Natural Resources Conservation Service

Ecological site R067BY010CO
Closed Depression

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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.

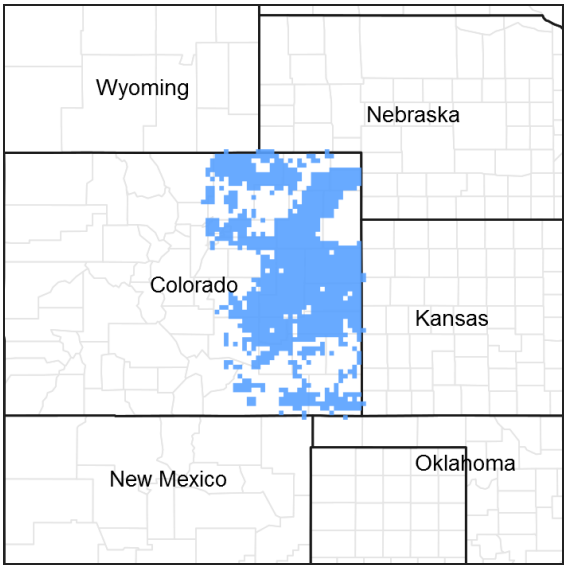


Figure 1. Mapped extent

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): 067B–Central High Plains, Southern Part

MLRA 67B occurs in eastern Colorado and consists of rolling plains and river valleys. Some canyonlands occur in the southeast portion. The major rivers are the South Platte and Arkansas which flow from the Rocky Mountains to Nebraska and Kansas. Other rivers in the MLRA include the Cache la Poudre and Republican and associated tributaries. This MLRA is traversed by Interstate 25, 70 and 76; and U.S. Highways 50 and 287. Major land uses include 54 percent rangeland, 35 percent cropland, and 2 percent pasture and hayland. Urban, developed open space, and miscellaneous land occupy approximately 9 percent. Major Cities in this area include Fort Collins, Greeley, Sterling, and Denver. Other cities include Limon, Cheyenne Wells, and Springfield. Land ownership is mostly private. Federal lands include Pawnee and Comanche National Grasslands (U.S. Forest Service), Sand Creek Massacre National Historic Site (National Park Service), and Rocky Mountain Arsenal National Wildlife Refuge (U.S. Fish & Wildlife Service). State Parks include Cherry Creek and Chatfield Reservoirs, and Barr and Jackson Lakes.

This region is periodically affected by severe drought, including the historic “Dust Bowl” of the 1930s. Dust storms may form during drought years in windy periods. Elevations range from 3,400 to 6,000 feet. The Average annual precipitation ranges from 14 to17 inches per year and ranges from 13 inches to over 18 inches, depending upon location. Precipitation occurs mostly during the growing season, often during rapidly developing thunderstorms. Mean annual air temperature (MAAT) is 48 to 52 degrees Fahrenheit. Summer temperatures may exceed 100

degrees Fahrenheit. Winter temperatures may be sub-zero, and snowfall varies from 20 to 40 inches per year. Snow cover frequently melts between snow events.

LRU notes

Land Resource Unit (LRU) A is the northeast portion of MLRA 67B, to an extent of approximately 9 million acres. Most of the LRU is rangeland, and includes the Pawnee National Grassland. Dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) are grown in most counties. Irrigated cropland is utilized in the South Platte Valley. Small acreage and urban ownership are more concentrated on the Front Range. This LRU is found in portions of Adams, Arapahoe, Elbert, Kit Carson, Larimer, Lincoln, Logan, Washington, and Weld counties. Other counties include Boulder, Cheyenne, Denver, Jefferson, and Yuma. The soil moisture regime is aridic ustic. The mean annual air temperature (MAAT) is 50 degrees Fahrenheit.

LRU B is in the southeast portion of MLRA 67B (2.6 million acres) and includes portions of Baca, Bent, Cheyenne, Kiowa, Las Animas, and Prowers counties. Most of the LRU remains in rangeland and includes the Comanche National Grassland. On the farmed land, a system of dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) is implemented. Irrigated cropland is found in the Arkansas Valley. The soil moisture regime is aridic ustic and the MAAT is 52 degrees Fahrenheit.

LRU C occurs in portions of Morgan and Weld counties (approximately 1.2 million acres). Most of LRU C is in rangeland. On the farmed land, a system of dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) is implemented. The soil moisture regime is ustic aridic and the MAAT is 48 degrees Fahrenheit.

Classification relationships

MLRA 67B is in the Colorado Piedmont and Raton Sections of the Great Plains Province (USDA, 2006). The MLRA is further defined by Land Resource Units (LRUs) A, B, and C. Features such as climate, geology, landforms, and key vegetation further refine these concepts and are described in other sections of the Ecological Site Description (ESD).NOTE: To date, these LRUs are DRAFT.

Relationship to Other Hierarchical Classifications:
NRCS Classification Hierarchy: Physiographic Division, Physiographic Province, Physiographic Section, Land Resource Region, Major Land Resource Area, Land Resource Unit (Fenneman, 1946).
USFS Classification Hierarchy: Domain, Division, Province, Section, Subsection,
Land Type Association: Land Type, Land Type Phase (Cleland et al, 1997).

REVISION NOTES:
The Closed Depression Ecological Site Description was developed by an earlier version of the Plains Swale Ecological Site Description (2004, revised 2007). This earlier version was based on input from Natural Resource Conservation Services (formerly Soil Conservation Service) and historical information obtained from the Plains Swale Range Site descriptions (1975). 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 run-on site with no mottles, and is at least four feet above the water table. It lies in a closed depression that may pond water, but is not subject to flooding.

Associated sites

R067BY024CO	**Sandy Plains** This ecological site is commonly adjacent.
R067BY042CO	**Clayey Plains** This ecological site is commonly adjacent.

R067BY002CO	**Loamy Plains** This ecological site is commonly adjacent.

Similar sites

R067BY042CO	**Clayey Plains** This ecological site is a run-off site.

Table 1. Dominant plant species

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

Physiographic features

This site occurs in playas or closed depressions on the dissected plains.

Table 2. Representative physiographic features

Landforms	(1) Playa (2) Depression
Runoff class	Negligible
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	Rare to frequent
Elevation	3,400–6,000 ft
Slope	0–1%
Ponding depth	0–36 in
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation across the MLRA extent is 14 to 17 inches, and ranges from 13 to over 18 inches, depending on location. Precipitation increases from north to south. Mean Annual Air Temperature (MAAT) is 50 degrees Fahrenheit in the northern part and increases to 52 degrees Fahrenheit in the southern part. Portions of Morgan and Weld counties are cooler and drier, the MAAT is 48 degrees Fahrenheit, and average precipitation is 13 to14 inches per year.

Two-thirds of the annual precipitation occurs during the growing season from mid-April to late September. Snowfall averages 30 inches per year, area-wide, but varies by location from 20 to 40 inches per year. Winds are estimated to average 9 miles per hour annually. Daytime winds are generally stronger than at night, and occasional strong storms may bring periods of high winds with gusts to more than 90 mph. High-intensity afternoon thunderstorms may arise. The average length of the freeze-free period (28 degrees Fahrenheit) is 155 days from April 30th to October to 3rd. The average frost-free period (32 degrees Fahrenheit) is 136 days from May 11th to September 24th. July is the hottest month, and December and January are the coldest months. Summer temperatures average 90 degrees Fahrenheit and occasionally exceed 100 degrees Fahrenheit. Summer humidity is low and evaporation is high. Winters are characterized with frequent northerly winds, producing severe cold with temperatures occasionally dropping to -30 degrees Fahrenheit or lower. Blizzard conditions may form quickly. For detailed information, visit the Western Regional Climate Center website:

Western Regional Climate Center Historical Data Western U.S. Climate summaries, NOAA Coop Stations Colorado http://www.wrcc.dri.edu/summary/Climsmco.html.

Table 3. Representative climatic features

Frost-free period (characteristic range)	119-129 days
Freeze-free period (characteristic range)	134-151 days
Precipitation total (characteristic range)	14-17 in
Frost-free period (actual range)	102-132 days
Freeze-free period (actual range)	126-156 days
Precipitation total (actual range)	14-17 in
Frost-free period (average)	121 days
Freeze-free period (average)	142 days
Precipitation total (average)	15 in

Climate stations used

- (1) CHEYENNE WELLS [USC00051564], Cheyenne Wells, CO
- (2) FLAGLER 1S [USC00052932], Flagler, CO
- (3) FT MORGAN [USC00053038], Fort Morgan, CO
- (4) SPRINGFIELD 7 WSW [USC00057866], Springfield, CO
- (5) BRIGGSDALE [USC00050945], Briggsdale, CO
- (6) GREELEY UNC [USC00053553], Greeley, CO
- (7) KIT CARSON [USC00054603], Kit Carson, CO
- (8) LIMON WSMO [USW00093010], Limon, CO
- (9) BRIGHTON 3 SE [USC00050950], Brighton, CO
- (10) BYERS 5 ENE [USC00051179], Byers, CO
- (11) NUNN [USC00056023], Nunn, CO

Influencing water features

The Closed Depression Ecological Site has no surface drainage outlet. It is located in a receiving position that collects runoff from adjacent upland sites in response to precipitation events. The water escapes only by evaporation or subsurface drainage. The kinds and amount of existing vegetation are influenced by the amount and timing of precipitation events, as well as the duration of ponding. Several of the map units associated with the playa floors on this site have a 1 to 5 percent hydric component.

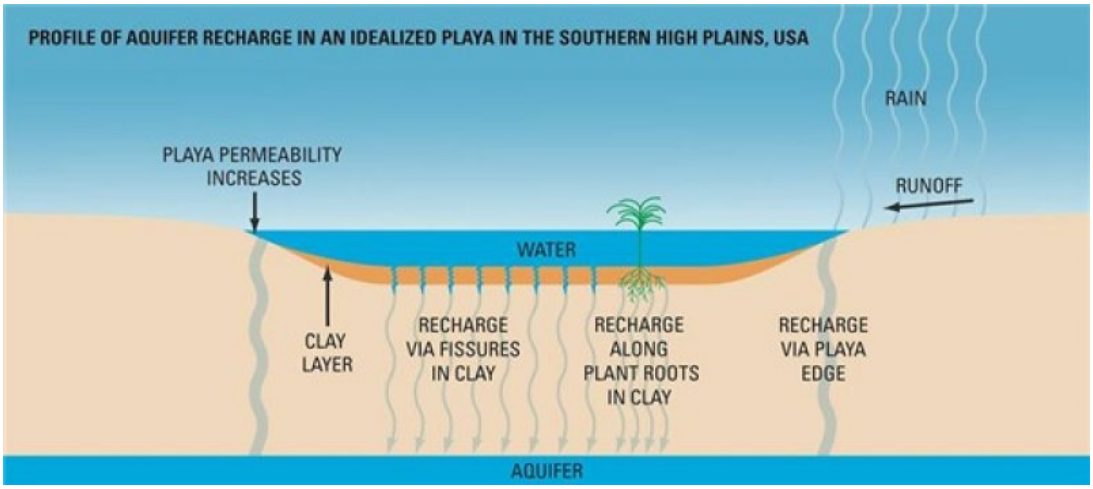


Figure 8. Recharge of a playa

Soil features

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

The surface layer of the soils in this site are typically clay, clay loam, or silty clay loam, but may include silty clay. The surface layer ranges from 3 to 8 inches thick. The subsoil is typically clay or silty clay, but may include clay loam or silty clay loam. This soil cracks when dry due to the high shrink-swell of the clay in the subsoil textures. Soils in this site typically are leached of free carbonates at the surface and in the subsoil, some soils may contain carbonates below 50 inches. These soils are susceptible to erosion by water and wind. The potential for erosion increases where vegetative cover is inadequate.

Major soil series correlated to this ecological site include: Apishapa and Pleasant.

Other soil series that have been correlated to this site, but may eventually be re-correlated include: Feterita, Playas, and Udic Haplusterts.

The attributes listed below represent 0-40 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.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Clay (2) Clay loam (3) Silty clay loam
Drainage class	Moderately well drained to well drained
Permeability class	Slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–12 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–8.2
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ESD, including the state-and-transition model diagram (STM), was developed using archeological and historical data, professional experience, and scientific studies. The information is representative

of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration or time-controlled grazing strategies, and historical accounts.

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

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

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

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

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely to start fires for various reasons (deliberate or accidental). It is believed that fires were set as a management tool for attracting herds of large migratory herbivores (Stewart, 2002). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

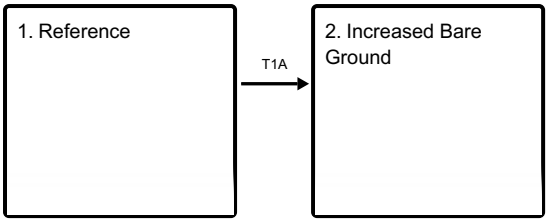
Mechanical treatment consisting of contour pitting, furrowing, terracing, chiseling, and disking has been practiced in the past. It was theorized that the use of this high-input technology would improve production and plant composition on rangeland. These high-cost practices have shown to have no significant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

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.

The Closed Depression (formerly Plains Swale) Ecological Site is characterized by two states: Reference and Increased *Bare Ground* State. The Reference State is characterized by cool-season midgrass (western wheatgrass, green needlegrass), warm-season shortgrass (blue grama), and warm-season mid stoloniferous grass (vine mesquite). The Increased *Bare Ground* State is characterized by early successional warm-season grass (Fendler threeawn), annual grasses, and annual forbs. The Closed Depression is subject to occasional ponding. It receives significant runoff from adjacent sites following intense summer thunderstorms and spring snowmelt. These sources significantly increase the effective moisture with a corresponding increase in plant production.

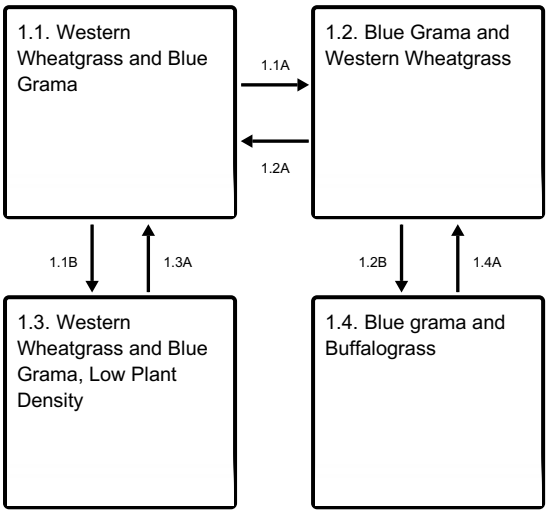
State and transition model

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.

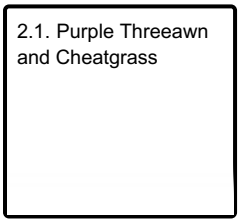
1.2A - Prescribed grazing. Prescribed fire.

1.2B - Excessive grazing. Lack of fire.

1.3A - Prescribed grazing. Prescribed burning.

1.4A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 1
Reference

The Reference state for the Closed Depression site within MLRA 67B exhibits four distinct plant community phases. These plant community phases are a reflection of the natural variability and grazing management affecting the ecological functioning of the site. It is diverse, stable, and productive. Litter is properly distributed with very little movement off-site and natural plant mortality is low. It is well suited to carbon sequestration, effective water cycle, wildlife use by many species, livestock use, and is aesthetically pleasing. This state is resistant to many disturbances except excessive grazing, lack of fire, mechanical disturbance, and long-term non-use.

Dominant plant species

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

- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Western Wheatgrass and Blue Grama

This community is the interpretive plant community for this site. This community evolved with grazing by large herbivores and is well suited for grazing. Historically, fires occurred infrequently. The site developed with run-in water occasionally ponding intermittently during April through August. Ponded conditions most likely occurred one year in five for at least 14 consecutive days during the growing season. The potential vegetation is about 80 to 85 percent grasses and grass-like plants, 10 to 15 percent forbs, and 5 percent or less woody plants. The community is primarily dominated by western wheatgrass, and to a lesser extent, green needlegrass and vine mesquite in the southeastern counties. Secondary grasses include blue grama and buffalograss. Sun sedge is the major occurring grass-like species. A variety of forbs and shrubs such as American vetch, scarlet globemallow, fourwing saltbush, and winterfat occur, but not in great amounts. Periodic drought is inherent to the site causing decreased ponding duration. Total annual production ranges from 800 to 1,900 pounds of air-dry vegetation per acre and averages 1,300 pounds during a normal year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	675	1105	1635
Forb	100	135	170
Shrub/Vine	25	60	95
Total	**800**	**1300**	**1900**

Figure 10. Plant community growth curve (percent production by month). CO6701, Cool-season/warm-season codominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	20	28	15	12	10	5	0	0

Community 1.2
Blue Grama and Western Wheatgrass

The dominant grasses are blue grama and western wheatgrass. Western wheatgrass is reduced and green needlegrass and vine mesquite are nearly absent. Blue grama has increased significantly. Grasses and grass-likes include buffalograss, bottlebrush squirreltail, prairie junegrass, and sun sedge. Forbs present may include scarlet globemallow and hairy goldenaster. Palatable forbs and shrubs such as American vetch, fourwing saltbush, and winterfat have decreased. Plant frequency, production, and litter have been reduced. Reduction of rhizomatous wheatgrass, nitrogen fixing forbs, the palatable shrub component, and increased warm-season short grasses has begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired. Total annual production, during an average year, ranges from 400 to 1,300 pounds per acre air-dry weight and averages 800 pounds.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- blue grama (*Bouteloua gracilis*), grass

- western wheatgrass (*Pascopyrum smithii*), grass

Figure 11. Plant community growth curve (percent production by month). CO6702, Warm-season dominant, cool-season subdominant; MLRA-67B, upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2	15	45	20	15	3	0	0	0

Community 1.3
Western Wheatgrass and Blue Grama, Low Plant Density

This community phase represents a decreased plant vigor condition resulting from increase grass plant decadence, increased litter, and low plant density. Species composition can be highly variable, but will most likely resemble the vegetation that was present when non-use or rest began. Species production and density will decrease as non-use and reduced fire frequency persists. Much of the nutrients are tied up in increased litter. The semiarid environment and the absence of animal traffic impairs nutrient cycling. Aboveground standing dead canopy limits sunlight from reaching plant crowns. Many plants, especially bunchgrasses die off. Increased litter and absence of grazing or fire reduce seed germination and establishment. In advanced stages, plant mortality can increase and erosion may eventually occur if bare ground increases. The introduction of grazing or fire can quickly change the plant community. Total annual production can vary depending on how long this plant community has developed in the absence of grazing or fire, but ranges from 600 to 1,500 pounds of air-dry vegetation per acre and averages 1,050 pounds during a normal year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass

Figure 12. Plant community growth curve (percent production by month). CO6703, Cool-season/warm-season codominant, excess litter; MLRA-67B; upland fine textured soils..

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

Community 1.4
Blue grama and Buffalograss

This plant community represents the sod-bound condition that results from blue grama and buffalograss dominating the site. Green needlegrass, vine mesquite, 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, sand dropseed, hairy goldenaster (aka hairy goldaster), and plains pricklypear increase. In some instances, broom snakeweed also significantly increases. 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 the deep-rooted grasses, fourwing saltbush, 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 & grass-like species. Total annual production, during a normal year, ranges from 200 to 700 pounds per acre air-dry weight and averages 500 pounds.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Figure 13. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	3	20	45	20	10	2	0	0	0

Pathway 1.1A
Community 1.1 to 1.2

Excessive grazing and lack of fire shift this community to the 1.2 community.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire move this plant community to the 1.3 community. Initially, excess litter begins to build-up. Eventually, native plant density begins to decrease and weeds and introduced species may begin to invade.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with adequate recovery opportunity between grazing events, proper stocking rate, and prescribed fire move this plant community back to the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.4

Excessive grazing and lack of fire shift this plant community to the 1.4 community.

Pathway 1.3A
Community 1.3 to 1.1

Grazing with adequate recovery periods between grazing events or prescribed burning moves this plant community to the reference plant community. This transition can occur relatively fast.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.4A
Community 1.4 to 1.2

Long-term prescribed grazing with adequate recovery periods following grazing events, proper stocking rates, and prescribed fire move this plant community to the 1.2 community. Extended drought followed by normal precipitation can reduce the sod-bound condition and facilitate the shift in plant communities. This is a long-term process.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Increased Bare Ground

In the Increased *Bare Ground* state, all perennial plants have been greatly reduced with only remnants of the most grazing tolerant species remaining. Litter levels are extremely low, and wind erosion can be a hazard due to increased bare ground. Mineral crusting caused by raindrop impact magnifies the situation by decreasing infiltration. Bare ground is a major concern. Erosion and loss of organic matter and carbon reserves are concerns. Nutrient and water cycles and energy flow are impaired.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 2.1
Purple Threeawn and Cheatgrass

This plant community develops with heavy, continuous grazing. Plant composition is typically comprised of purple threeawn, annuals, and scattered areas of blue grama and buffalograss. Annuals such as Russian thistle, burningbush, and cheatgrass have invaded. Increased bare ground is common. Total annual production, during an average year, ranges from 50 to 200 pounds per acre air-dry weight.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Figure 14. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	3	20	45	20	10	2	0	0	0

Transition T1A
State 1 to 2

Excessive grazing and lack of fire shifts this plant community across an ecological threshold to the Increased *Bare Ground* State.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				26–91	
	western wheatgrass	PASM	*Pascopyrum smithii*	845–910	–
	blue grama	BOGR2	*Bouteloua gracilis*	39–130	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	26–91	–

	buffalograss	BODA2	*Bouteloua dactyloides*	26–91	–
	Grass, perennial	2GP	*Grass, perennial*	13–65	–
	green needlegrass	NAVI4	*Nassella viridula*	13–65	–
	vine mesquite	PAOB	*Panicum obtusum*	40–65	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–39	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–26	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	13–26	–
	saltgrass	DISP	*Distichlis spicata*	0–26	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–13	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–13	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–13	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–13	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–13	–
Forb					
2				104–169	
	Forb, perennial	2FP	*Forb, perennial*	13–65	–
	American vetch	VIAM	*Vicia americana*	13–39	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–13	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–13	–
	tickseed	COREO2	*Coreopsis*	0–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–13	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–13	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	spotted evening primrose	OECA3	*Oenothera canescens*	0–13	–
	wedgeleaf	PHCU3	*Phyla cuneifolia*	0–13	–
	oppositeleaf bahia	PIOP	*Picradeniopsis oppositifolia*	0–13	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–13	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–13	–
	silky sophora	SONU	*Sophora nuttalliana*	0–13	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–13	–
	poison suckleya	SUSU2	*Suckleya suckleyana*	0–13	–
Shrub/Vine					
3				26–91	
	fourwing saltbush	ATCA2	*Atriplex canescens*	13–65	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–39	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–39	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–13	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–13	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	0–13	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–13	–

	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–15	

Animal community

WILDLIFE INTERPRETATIONS:

The wildlife assemblage using the Closed Depression Ecological Site varies as these sites are ponded, drying, in a post-ponding early successional stage and then reclaimed by upland, grass dominated vegetation. When wet, these sites are of international significance to migratory waterfowl, shorebirds, and sandhill cranes. The wet state also supports unique amphibian species that breed when the depressions are inundated and estivate (i.e. hibernate) when they are dry. Due to the dynamic nature of this site and the unique plant communities it can produce, it represents an area of increased biodiversity compared to surrounding upland sites.

1.1 Reference Community
When dry and not recently ponded, the increased western wheatgrass in the reference plant community provides early-season forage for pronghorns and deer.

NOTE: When inundated, this community provides important loafing and feeding habitats for migratory dabbling ducks and roosting habitat for sandhill cranes. These ponded depressions have been recognized as habitats of international significance for migratory waterfowl. Wet depressions are also important summer feeding habitat for long-billed curlew. The plains spadefoot and Great Plains toad are two species of amphibians that use this site. They are adapted to living in seasonal wetlands that dry during some part of the year. As the depressions dry down, migratory shorebirds use the shallow pond edges for feeding as well. If ponding and drying causes enough of an increase in moist soil plant seed production, resident and migratory passerine birds including mourning dove use this area heavily for feeding. Small mammal communities also take advantage of the increased seed production and use this community more frequently. The inundated phase can occur in any of the following plant communities.

1.2 Community

When dry and not recently ponded, the pronghorns and deer use this community for some feeding, but the decreased western wheatgrass provides less valuable forage than the reference community.

When inundated, this community provides important loafing and feeding habitats for migratory dabbling ducks and roosting habitat for sandhill cranes.

1.3 Community

When dry and not recently ponded, the pronghorns and deer use this community for some feeding, but the increased plant decadence and excessive litter provide less valuable forage than the reference community.

When inundated, this community provides important loafing and feeding habitats for migratory dabbling ducks and roosting habitat for sandhill cranes.

1.4 Community

When dry and not recently ponded, the pronghorns and deer use this community for some feeding, but the decreased western wheatgrass provides less valuable forage than the reference community.

When inundated, this community provides important loafing and feeding habitats for migratory dabbling ducks and roosting habitat for sandhill cranes.

2.1 Community

The increased bare ground community provides little forage for deer or pronghorns when dry.

When inundated, this community provides important loafing and feeding habitats for migratory dabbling ducks and

roosting habitat for sandhill cranes.

GRAZING INTERPRETATIONS:
The following table lists suggested initial stocking rates for an animal unit (1000-pound beef cow) under continuous grazing (yearlong grazing or growing-season-long grazing) based on normal growing conditions. However, continuous grazing is not recommended. These estimates should only be used as preliminary guidelines in the initial stages of the conservation planning process. Often, the existing plant composition does not entirely match any particular plant community described in this ecological site description. Therefore, field inventories are always recommended to document plant composition, total production, and palatable forage production. Carrying capacity estimates that reflect on-site conditions should be calculated using field inventories.

If the following production estimates are used, they should be adjusted based on animal kind or class and on the specific palatability of the forage plants in the various plant community descriptions. Under a properly stocked, properly applied, prescribed grazing management system that provides adequate recovery periods following each grazing event, improved harvest efficiencies eventually result in increased carrying capacity. See USDA-NRCS Colorado Prescribed Grazing Standard and Specification Guide (528).

The stocking rate calculations are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency divided by 912.5 pounds of ingested air-dry vegetation for an animal unit per month (AUM).

Plant Community (PC) Production (lbs./acre) and Stocking Rate (AUM/acre)

Reference PC - (1300) (0.36)

1.2 PC - (800) (0.22)

1.4 PC - (500) (0.14)

1.3 PC - (1050) (*)

An on-site inventory must be performed prior to developing a grazing plan.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide yearlong forage under prescribed grazing for cattle, sheep, horses and other herbivores.

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Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is moderate to slow and runoff potential for this site varies from moderate to high depending on 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).

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 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.
NOTE: Annual Production Table is from the “Previously Approved” ESD 2004. The Species Composition List is also from the 2004 version, with minor edits. These will need review 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 updated to reflect Total Annual Production revisions in each plant community.

Wildlife interpretations, general narrative, and individual plant communities updated to the Provisional level. Hydrology, Recreational Uses, Wood Products, Other Products, Plant Preferences table, and Rangeland Health Reference Sheet carried over from previously “Approved” ESD 2004.

Other information

Relationship to Other Hierarchical Classifications:

NRCS Classification Hierarchy:
Physiographic Divisions of the United States (Fenneman, 1946): Physiographic DivisionPhysiographic ProvincePhysiographic SectionLand Resource RegionMajor Land Resource Area (MLRA)Land Resource Unit (LRU).
USFS Classification Hierarchy:
National Hierarchical Framework of Ecological Units (Cleland et al, 181-200): DomainDivisionProvinceSectionSubsectionLandtype AssociationLandtypeLandtype Phase.

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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Data collection for this ecological site was done in conjunction with the progressive soil surveys within the 67B Central High Plains (Southern Part) of Colorado. It has been mapped and correlated with soils in the following soil surveys: Adams County, Arapahoe County, Baca County, Bent County, Boulder County, Cheyenne County, El Paso County Area, Elbert County, Eastern Part, Kiowa County, Kit Carson County, Larimer County Area, Las Animas County Area, Lincoln County, Logan County, Morgan County, Prowers County, Washington County, Weld County, Northern Part, and Weld County, Southern Part.

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Rangeland health reference sheet

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

Author(s)/participant(s)	Harvey Sprock, Daniel Nosal
Contact for lead author	Harvey Sprock, Area Rangeland Management Specialist, Greeley, CO
Date	01/12/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None

2. **Presence of water flow patterns:** None

3. **Number and height of erosional pedestals or terracettes:** None

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 3 perent or less bare ground, with bare patches generally less than 2-3 inches in diameter. Extended drought or long-term ponding can cause bare ground to increase to 10-20 percent or more with bare patches reaching to

6-12 inches in diameter or more.

5. **Number of gullies and erosion associated with gullies:** None

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

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should be uniformly distributed with little movement.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating is anticipated to be 5-6 in interspace at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM is 2-5 percent. A-horizon ranges from 0-5 inches. Surface texture is loam to clay loam. Soils are typically deep to very deep, grayish to very dark brown, strong very fine granular to medium sub-angular blocky structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Raindrop impact is reduced by the diverse grass, forb, shrub functional/structural groups and root structure. This slows overland flow and provides increased time for infiltration to occur. Extended drought, wildfire or both may reduce basal density, canopy cover, and litter amounts (primarily from tall, warm-season bunch and rhizomatous grasses), resulting in decreased infiltration and increased runoff on steep slopes following intense rainfall events.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Typically none. Physical impact during wet or ponded periods may cause some compaction.

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: Cool-season mid rhizomatous > >

    Sub-dominant: Warm-season short bunchgrass > cool-season mid bunchgrasses/grasslikes > shrubs >

    Other: leguminous forbs > warm-season short stoloniferous > warm-season forbs > warm-season mid bunchgrass > cool-season forbs

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typically minimal. Expect some mortality during and following extended drought or extended inundation.

14. **Average percent litter cover (%) and depth (in):** Litter cover during and following extended drought or inundation ranges from 15-35 percent.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 800 lbs./ac. low precip years; 1300 lbs./ac. average precip years; 1900 lbs./ac. above average precip years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 350 – 650 lbs./ac. or more.

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:** Invasive plants should not occur in reference plant community. Cheatgrass, Russian thistle, burningbush, and other non-native annuals may invade following extended drought or fire assuming a seed source is available.

17. **Perennial plant reproductive capability:** The only limitations are weather-related, wildfire, natural disease, and insects that may temporarily reduce reproductive capability.