USDA Natural Resources Conservation Service

Ecological site R067BY044CO
Shale Breaks

Last updated: 9/08/2023
Accessed: 05/19/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

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 Shale Breaks Ecological Site was developed by an earlier version (2004, revised 2007). This earlier version was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Shale Breaks 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

This site is a run-off site on that lies over shale bedrock within 40 inches of the soil surface. The slopes are greater than 6 percent.

Associated sites

R067BY002CO	**Loamy Plains** This ecological site is commonly adjacent.
R067BY036CO	**Overflow** This ecological site is commonly adjacent.
R067BY042CO	**Clayey Plains** This ecological site is commonly adjacent.
R067BY045CO	**Shaly Plains** This ecological site is commonly adjacent.

Similar sites

R067BY045CO	**Shaly Plains** The Shaly Plains Ecological Site is on slopes of less than six percent.
R067BY063CO	**Gravel Breaks** The Gravel Breaks Ecological Site is deeper than 40 inches to bedrock, and has greater than 15 percent rock fragments on the surface or in the subsoil.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on shoulders or backslopes of the hillslopes and on crests, nose slopes, or sideslopes of the ridges on dissected plains or canyonlands. These landforms are controlled by shale bedrock..

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Hill
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,036–1,829 m
Slope	6–30%
Ponding depth	0 cm
Water table depth	203 cm
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)	356-432 mm
Frost-free period (actual range)	102-132 days
Freeze-free period (actual range)	126-156 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	121 days
Freeze-free period (average)	142 days
Precipitation total (average)	381 mm

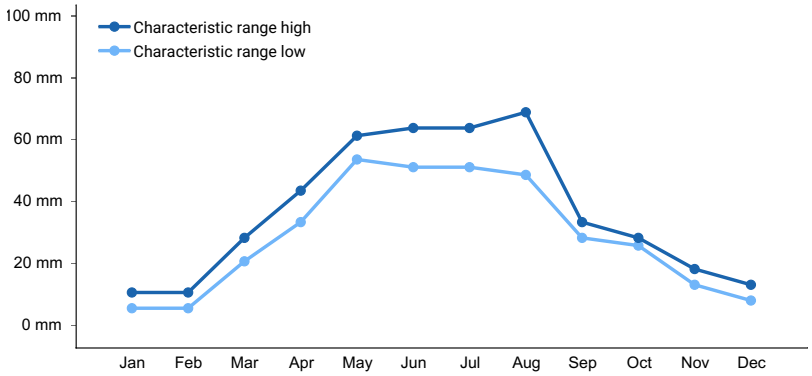


Figure 1. Monthly precipitation range

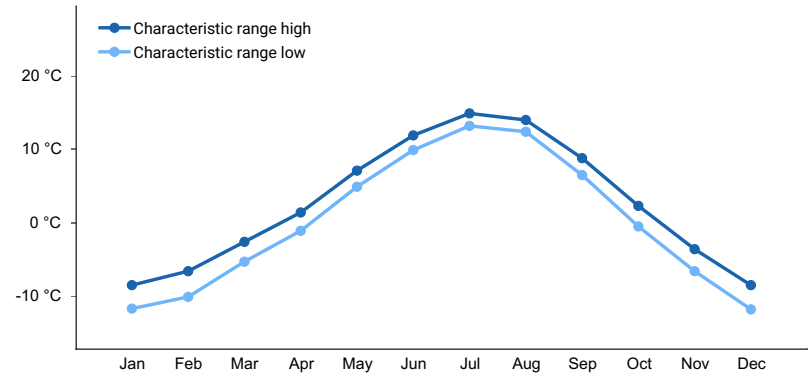


Figure 2. Monthly minimum temperature range

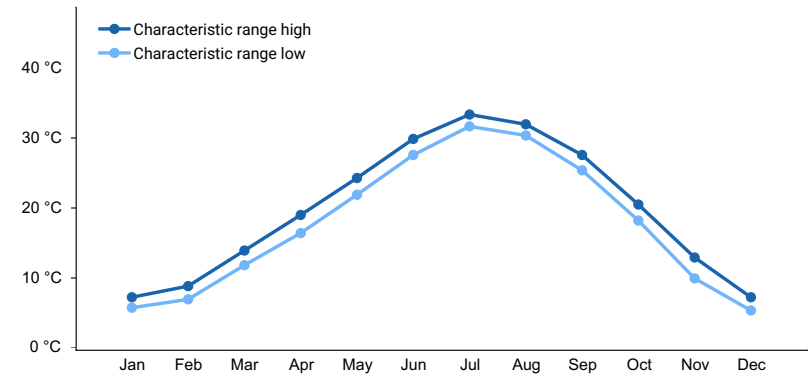


Figure 3. Monthly maximum temperature range

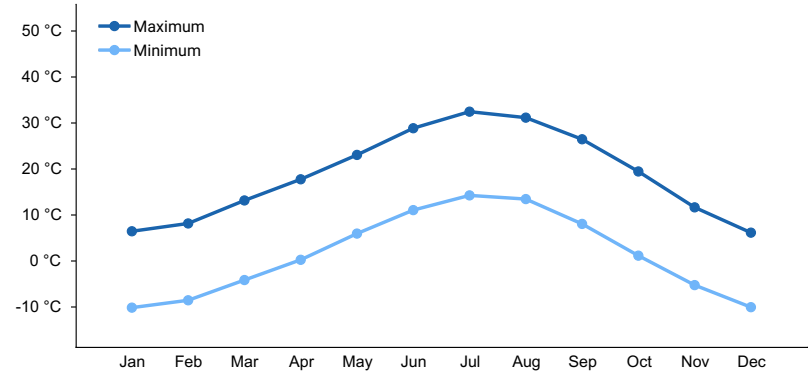


Figure 4. Monthly average minimum and maximum temperature

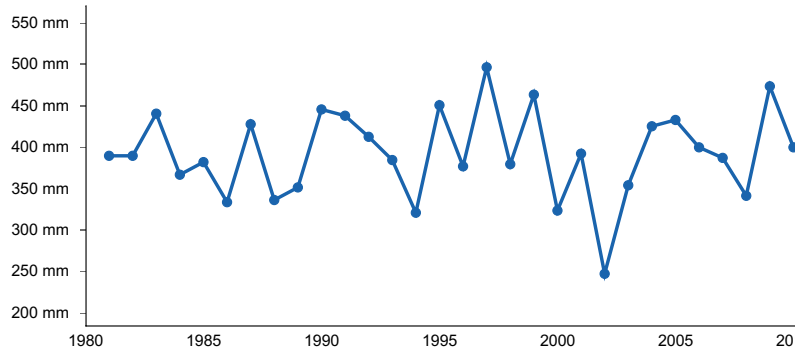


Figure 5. Annual precipitation pattern

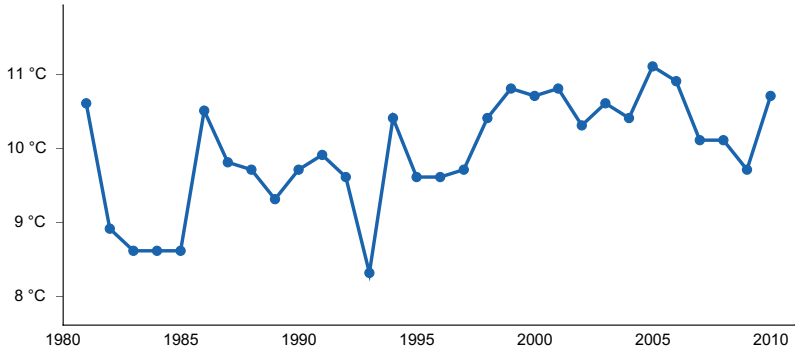


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

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

Soil features

The soils on this site are shallow, well drained soils that formed from residuum weathered from shale. They typically have a slow or very slow permeability class, but ranges to moderately slow in some soils. The soil moisture regime is typically aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically clay loam or silty clay loam, but may include clay or silty clay. The surface layer ranges from a depth of 2 to 6 inches thick. The subsoil is typically clay or silty clay, but may include clay loam and silty clay loam. Shale fragments may occur on the surface or in the soil profile. Soils in this site typically are leached of free carbonates at the surface, but some soils may be leached from 10 to 20 inches. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Major soil series correlated to this ecological site include: Midway, Shingle, Samsil, and Lismas.

Other soil series that have been correlated to this site, but may eventually be re-correlated include: none.

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.

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

Table 4. Representative soil features

Parent material	(1) Residuum–shale
Surface texture	(1) Clay loam (2) Silty clay loam (3) Clay
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Soil depth	15–51 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–15
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Shale Breaks Ecological Site is characterized by three states: Reference, Warm-Season Shortgrass, and Increased *Bare Ground*. The Reference State is characterized primarily by cool-season midgrass (western wheatgrass, green needlegrass), warm-season midgrass (sideoats grama, little bluestem, alkali sacaton), and a minor amount of warm-season shortgrass (blue grama). The Warm-season Shortgrass State is characterized by a warm-season short bunchgrass (blue grama). The Increased *Bare Ground* State is characterized by Fendler threeawn with increased bare ground, annual grasses, and forbs.

Continuous, heavy grazing without allowing for adequate recovery periods between grazing events causes this site to deteriorate. Western wheatgrass, sideoats grama, and green needlegrass decrease in frequency and production as well as key shrubs such as fourwing saltbush and winterfat. American vetch, purple prairie clover, and other highly palatable forbs also decrease. Blue grama increases. Long-term continuous use increases Fendler threeawn, ring muhly, sand dropseed, and bare ground. Tillage is not recommended on this site due to shallow soils steeper slopes, and associated low production potential.

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.

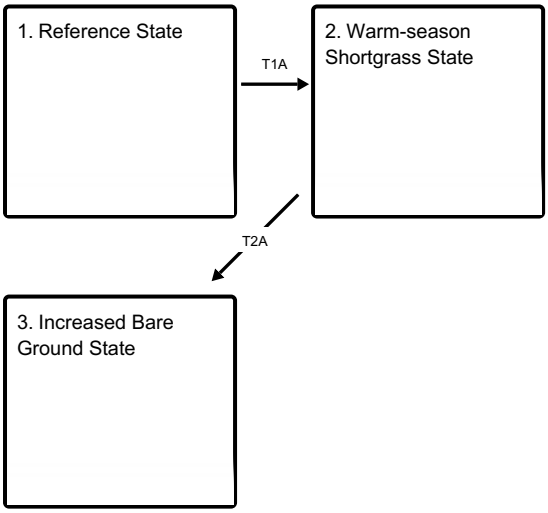
This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely 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.

State and transition model

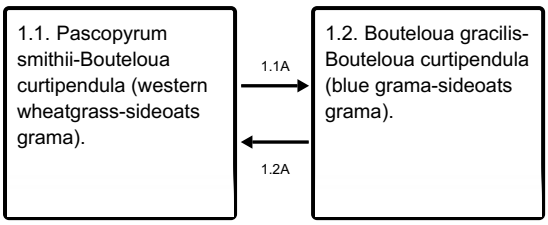
Ecosystem states



T1A - Excessive grazing. Lack of fire.

T2A - Excessive grazing. Lack of fire.

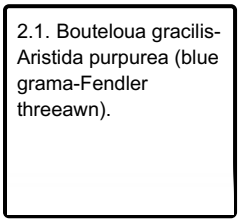
State 1 submodel, plant communities



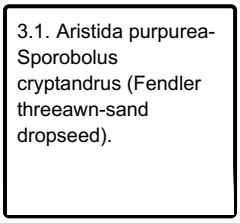
1.1A - Excessive grazing. Lack of fire.

1.2A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

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

Dominant plant species

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

Community 1.1
Pascopyrum smithii-Bouteloua curtipendula (western wheatgrass-sideoats grama).

This is the interpretive plant community for this site. This plant community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock and can be found on areas that are properly managed with grazing that allows for adequate recovery periods following each grazing event. The reference plant community consists mainly of mid cool and warm-season grasses. The principal dominant midgrasses are western wheatgrass and sideoats grama. Blue grama is the dominant shortgrass. Little bluestem and green needlegrass are also present. Forbs and shrubs such as purple prairie clover, American vetch, leafy false goldenweed (in southeastern counties), scarlet globemallow, fourwing saltbush, and winterfat are significant. The reference plant community is about 70 to 80 percent grasses and grass-likes, 10 to15 percent forbs and 10 to15 percent woody plants. This is a sustainable plant community in terms of watershed function and biological integrity. Litter is properly distributed. Some litter movement may occur on steeper slopes. Decadence and natural plant mortality is very low. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. This community is resistant to many

disturbances except heavy, continuous grazing and development into urban or other uses. Total annual production ranges from 350 to 1,000 pounds per acre air-dry weight, with a Reporesentative Value of 650 pounds.

Dominant plant species

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

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	258	547	897
Forb	67	91	112
Shrub/Vine	67	91	112
Total	**392**	**729**	**1121**

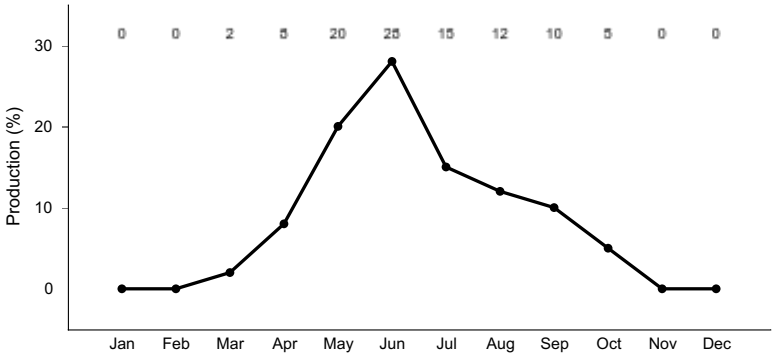


Figure 8. Plant community growth curve (percent production by month). CO6701, Cool-season/warm-season codominant; MLRA-67B; upland fine-textured soils..

Community 1.2
Bouteloua gracilis-Bouteloua curtipendula (blue grama-sideoats grama).

Blue grama has increased. Cool and warm-season grasses such as western wheatgrass, sideoats grama, and green needlegrass have decreased. American vetch, purple prairie clover, fourwing saltbush, and winterfat are reduced. Plant frequency and vigor have decreased. Reduction of rhizomatous wheatgrass, nitrogen-fixing forbs, the shrub component, and increased warm-season short grasses have begun to alter the biotic integrity of this community. The water and nutrient cycles are at risk of becoming impaired. Flow paths and small rills can be found. Some slightly pedestaled plants can be found. Total annual production ranges from 250 to 800 pounds per acre air-dry weight and averages 500 pounds during a normal year.

Dominant plant species

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

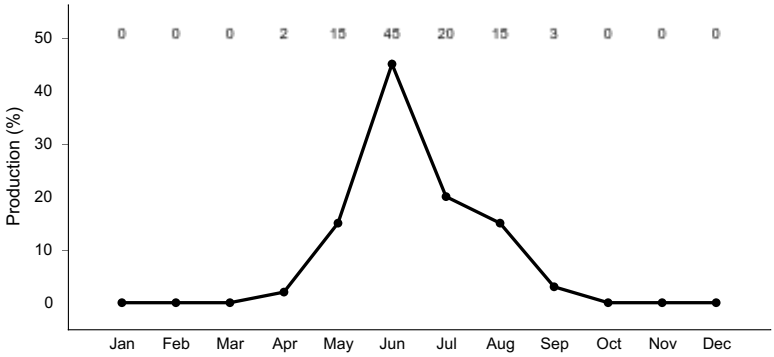


Figure 9. Plant community growth curve (percent production by month). CO6702, Warm-season dominant, cool-season subdominant; MLRA-67B, upland fine textured soils..

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing without adequate recovery opportunity between grazing events and lack of fire shift this plant community to the 1.2 Community. Drought accelerates this process. Recurring spring seasonal grazing decreases cool-season plants. Recurring summer grazing decreases warm-season plants. Biotic integrity is altered and water & nutrient cycles are at risk of becoming impaired.

Pathway 1.2A
Community 1.2 to 1.1

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

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Warm-season Shortgrass State

An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and edaphic (soil characteristics) changes have negatively impacted energy flow and nutrient and hydrologic cycles. The loss of functional/structural groups such as cool-season and warm-season midgrass reduces the biodiversity and productivity of this site.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Community 2.1
Bouteloua gracilis-Aristida purpurea (blue grama-Fendler threeawn).

Blue grama dominates this plant community. Sod bound conditions rarely develop because of shallow soils and rough, broken topography. Western wheatgrass and green needlegrass are absent and have been replaced by increased amounts of Fendler threeawn and sand dropseed. Only a remnant amount of sideoats grama, little bluestem, and shrubs occur. A significant amount of production and diversity has been lost when compared to the reference plant community. Reduction of cool-season grasses, the shrub component and nitrogen fixing forbs have negatively impacted energy flow and nutrient cycling. Soil loss is obvious where flow paths are connected. The

plant community lacks diversity and exhibits a greatly impaired water cycle. This community is at risk of losing sideoats grama, little bluestem, fourwing saltbush, and winterfat. Total annual production ranges from 100 to 500 pounds per acre air-dry weight and averages 250 pounds during a normal year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

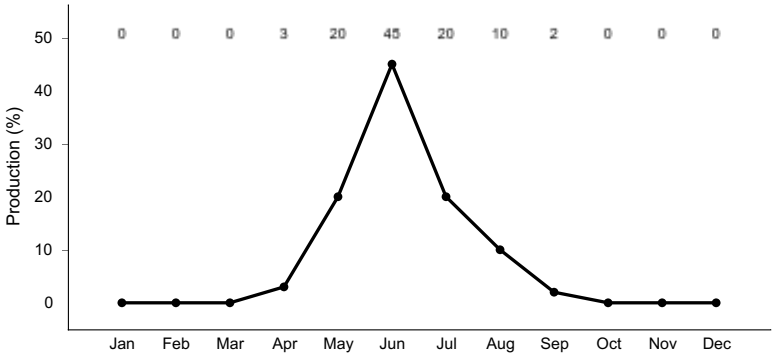


Figure 10. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

State 3
Increased Bare Ground State

Increased bare ground is a major concern, erosion potential is high, and soil loss can be severe. This community lacks stability, diversity, and productivity. An ecological threshold has been crossed. The loss of organic matter and carbon reserves are concerns, and the 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
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 3.1
Aristida purpurea-Sporobolus cryptandrus (Fendler threeawn-sand dropseed).

Remnant amounts of blue grama, fourwing saltbush, and winterfat have been replaced by Fendler threeawn, sand dropseed, ring muhly, little barley (annual barley), plains pricklypear, and broom snakeweed. Annual invaders such as burningbush, Russian thistle, and cheatgrass have increased. Total annual production, during an average year, ranges from 25 to 150 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
- sand dropseed (*Sporobolus cryptandrus*), grass

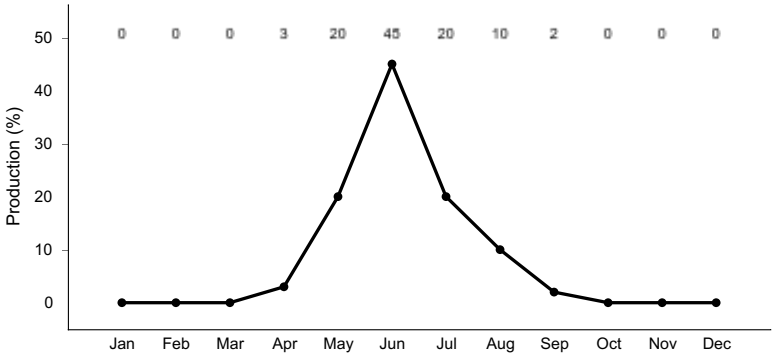


Figure 11. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

Transition T1A
State 1 to 2

Heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire shifts this plant community across an ecological threshold to the Warm-season Shortgrass State. Biotic integrity and hydrologic function are impaired as a result of this transition.

Transition T2A
State 2 to 3

Long-term, heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire causes a shift across an ecological threshold to the Increased *Bare Ground* State. Soil erosion and loss of organic matter and carbon reserves are constraints to recovery. This transition can occur in a relatively short time span.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				510–583	
	western wheatgrass	PASM	*Pascopyrum smithii*	146–219	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	110–183	–
	green needlegrass	NAVI4	*Nassella viridula*	37–110	–
	blue grama	BOGR2	*Bouteloua gracilis*	37–73	–
	little bluestem	SCSC	*Schizachyrium scoparium*	15–52	–
	alkali sacaton	SPAI	*Sporobolus airoides*	22–52	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	8–22	–
	Grass, perennial	2GP	*Grass, perennial*	8–22	–
	threadleaf sedge	CAFI	*Carex filifolia*	8–15	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–8	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–8	–
	big bluestem	ANGE	*Andropogon gerardii*	0–8	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–8	–
	saltgrass	DISP	*Distichlis spicata*	0–8	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–8	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–8	–

	prairie Junegrass	KOMA	*Koeleria macrantha*	0–8	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–8	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–8	–
	switchgrass	PAVI2	*Panicum virgatum*	0–8	–
Forb					
2				73–110	
	Forb, perennial	2FP	*Forb, perennial*	15–37	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	15–37	–
	American vetch	VIAM	*Vicia americana*	8–22	–
	nineanther prairie clover	DAEN	*Dalea enneandra*	8–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	8–15	–
	leafy false goldenweed	OOFO	*Oonopsis foliosa*	8–15	–
	creeping nailwort	PASE	*Paronychia sessiliflora*	0–8	–
	beardtongue	PENST	*Penstemon*	0–8	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–8	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–8	–
	desert princesplume	STPIP	*Stanleya pinnata var. pinnata*	0–8	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–8	–
	povertyweed	IVAX	*Iva axillaris*	0–8	–
	dotted blazing star	LIPU	*Liatris punctata*	0–8	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–8	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–8	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–8	–
	spiny milkvetch	ASKE	*Astragalus kentrophyta*	0–8	–
Shrub/Vine					
3				73–110	
	fourwing saltbush	ATCA2	*Atriplex canescens*	15–52	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	8–37	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	8–22	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–8	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–8	–
	soapweed yucca	YUGL	*Yucca glauca*	0–8	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	0–8	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–8	–

Animal community

WILDLIFE INTERPRETATIONS:

The combination of grasses, forbs, and shrubs found on the ecological site provide habitat for numerous wildlife species. Historic large grazers that influenced these communities were bison, elk, mule deer, and pronghorn. Bison are no longer widely distributed in their historic range. Pronghorn are the most abundant ungulates using this

ecological site, followed by mule deer. Domestic grazers share these habitats with wildlife. The grassland communities of eastern Colorado are home to many bird species. Changes in the composition of the plant community when moving from the Reference Community to other communities on this ecological site may result in species shifts in bird species. The occasional spring found on this site provides essential seasonal water needed for reproductive habitat by some reptiles and amphibians. Because of a lack of permanent water, fish are not common.

Reference Plant Community: Western Wheatgrass, Sideoats Grama, Shrubs

Pronghorn and to a lesser extent, mule deer, use this plant community due to the prevalence of four-wing saltbush and winterfat which provide important browse resources, especially in winter. Black-tailed jackrabbits rely heavily on stands of fourwing saltbush for cover and browse. Reptiles using this community include prairie rattlesnake, bullsnake, western hognose snake, racer, western box turtle, and six-lined racerunner. The structural diversity in the plant community on this site provides habitat for Cassin's and Brewer's sparrow, lark bunting, scaled quail, and ferruginous and Swainson's hawks. Small mammals such as white-tailed jackrabbit, swift fox, and several species of mice are common in this plant community. The shallow soils are limiting to burrowing animals.

1.2 Community: Increased Blue Grama, Decreased Western Wheatgrass, Decreased Sideoats Grama, Decreased Shrubs

All wildlife species found in the Reference Plant Community are expected in this plant community. However, the loss of some of the vegetative structural diversity in this plant community makes it less attractive to the Reference Plant Community species. The reduction of shrubs and taller grasses in this plant community results in a shift of bird species away from the Reference Plant Community birds. Lark bunting and Cassin's sparrow use declines because of the loss in shrub cover. Habitat conditions improve for mountain plover, killdeer, and horned lark. Ferruginous and Swainson's hawks are frequent users of this community. Black-tailed jackrabbit use increases because of the changing plant community. Reptiles are the same as in the Reference Plant Community.

2.1, 3.1 Communities:

As these communities develop into an open landscape the wildlife species shift away from the Reference Plant Community species and toward the species that prefer unvegetated areas and shortgrasses. Texas short- lizard, six-lined racerunner, and black-tailed jackrabbit would be expected more frequently here than in the Reference Plant Community. Habitat conditions improve for mountain plover, killdeer, and horned lark. Ferruginous and Swainson's hawks are frequent users of this community.

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).

Reference PC - (650) (0.18)

1.2 PC - (500) (0.14)

2.1 PC - (250) (0.07)

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.

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

Hydrological functions

Water is the principal factor limiting forage production on this site due to the shallowness of the soil. This site is dominated by soils in hydrologic group D. Infiltration is low and runoff potential for this site varies from moderate to high depending on ground cover. 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

Some questions/comments whether the name “Breaks” should be retained or changed. This needs to go before the technical team for discussion.

There are soil series identified to correlate to Shale Breaks. However, no soil mapunit components are currently correlated in NASIS* database. However, Shale Breaks were originally indicated in several counties (Adams, Arapahoe, Elbert, Morgan), and also likely occur in Lincoln, Weld and Boulder counties. Information needs to be updated in NASIS to indicate Shale Breaks on individual mapunits with shallow soils, steeper slopes, breaks, etc.

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.

Reference Sheet

The Reference Sheet was previously approved in 2007.
It will be updated at the next “Approved” level.

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

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.

Those involved in developing the 2004 site description include: Ben Berlinger, Rangeland Management Specialist, CO-NRCS; Harvey Sprock, Rangeland Management Specialist, CO-NRCS; James Borchert, Soil Scientist, CO-NRCS; Terri Skadeland, Biologist, CO-NRCS.

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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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Acknowledgments

Program Support:
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Josh Saunders, Rangeland Management Specialist-QC, NRCS Fort Morgan, CO
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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, Ben Berlinger, Daniel Nosal
Contact for lead author	Harvey Sprock, Area Rangeland Management Specialist, Greeley, CO
Date	01/13/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Typically none. Rills may occur on steep shale outcrop.

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2. **Presence of water flow patterns:** Water flow paths should be broken and irregular in appearance. As slope and shale outcrops increase, flow paths become more apparent and may be connected.

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3. **Number and height of erosional pedestals or terracettes:** Expect some evidence of pedestalled plants on steeper slopes and shale outcrops.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10 percent or less bare ground, with bare patches generally less than 6 inches. Extended drought may increase bare ground 15 to 20 percent. Exposed shale is inherent to the site and would be considered rock outcrop.

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5. **Number of gullies and erosion associated with gullies:** None to some on steep slopes.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is associated with water flow patterns and may move as much as 1 to 3 feet down slope during severe precipitation events.

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 4 to 5 in interspaces at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM ranges from 0.5 to 2 percent. Soils are shallow and well drained. Surface texture is clay to clay loam. A-horizon ranges from 0 to 4 inches in depth with a light brownish gray color. Structure is very fine granular, soft, friable, calcareous, and moderately alkaline. Gypsum crystals can be found on the surface.

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):** None

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 = warm-season mid bunchgrass >

    Sub-dominant: Cool-season bunchgrass/grasslikes > shrubs/half-shrubs = leguminous forbs > warm-season short bunchgrass >

    Other: Other forbs > warm-season tall bunchgrass = warm-season sod-forming grass

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** None to slight. Expect slight mortality and decadence during and following extended drought.

14. **Average percent litter cover (%) and depth (in):** Litter cover during and following extended drought can range from 10 to 20 percent.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350 lbs./ac. low precip years; 650 lbs./ac. average precip years; 1000 lbs./ac. high precip years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 150-350 lbs./ac.

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 the 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.