USDA Natural Resources
Conservation Service

Ecological site R069XY047CO
Alkaline Plains

Last updated: 9/07/2023
Accessed: 04/17/2024

General information

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

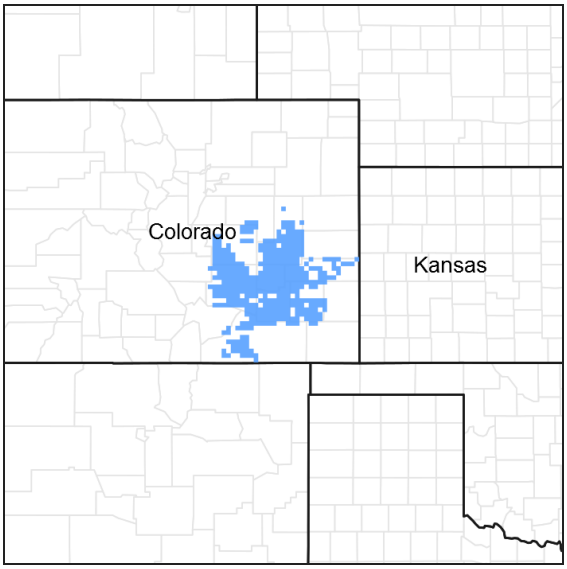


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 069X–Upper Arkansas Valley Rolling Plains

MLRA 69 is in the Arkansas Watershed of southeastern (SE) Colorado. It consists of rolling plains, river valleys, and canyonlands. The Arkansas River flows from the Rocky Mountains to Kansas. Tributaries include the Huerfano and Purgatoire Rivers. The MLRA is traversed by Interstate 25 and U.S. Highway 50, and includes the cities of Pueblo, La Junta, and Lamar. Other cities include Cañon City, and Walsenburg. Bent's Fort was once a major trading post along the Santa Fe Trail. The majority of land use is rangeland (greater than 75 percent), and 6 percent cropland. The remainder is urban, recreation, etc. Land ownership is mostly private. Federal lands include U.S. Forest Service Comanche National Grassland, Department of Defense Piñon Canyon Maneuver Site and Fort Carson. There is a minor amount of Bureau of Land Management and other federal land. State areas include Pueblo and John Martin reservoirs. Elevations MLRA-wide are 3,700 to 6,400 feet.

The "Dust Bowl" region (1930s) included SE Colorado, which is periodically affected by severe drought. Dust storms may form during drought years, in windy periods. Annual precipitation is 10 to 16 inches. 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. Evapotranspiration rates are high. Winter temperatures may be subzero. Snowfall varies from 20 to 40 inches per year. Blizzards can form quickly.

Classification relationships

MLRA 69 is in the Piedmont and Raton Sections of the Great Plains Province. The MLRA is further defined by Land Resource Units (LRUs) A, B, and C. The modal concepts of each LRU can be defined by soil properties and annual precipitation zones (PZ). Other features, such as climate, geology, landforms, and key vegetation, further refine these concepts and are described in the Ecological Site Description (ESD).

LRU A (10 to 12 inches PZ) is 2.4 million acres in the central portion of MLRA 69. There is irrigated cropland in the Arkansas Valley. Precipitation is too limited for dryland crops. Most of LRU A is rangeland, and includes the Comanche National Grassland (FS). This LRU is in portions of Bent, Crowley, Otero, and Pueblo counties. Soil Moisture Regime is Ustic Aridic. The Mean Annual Air Temperature (MAAT) is 51 to 54 degrees Fahrenheit.

LRU B (12 to 14 inches PZ) is 4.7 million acres and includes portions of Baca, Bent, Crowley, El Paso, Fremont, Kiowa, Las Animas, Lincoln, Prowers, and Pueblo counties. Most of the LRU is in rangeland. Land uses include irrigated and dry cropland, small acreage and urban ownership. Land east of Interstate 25 remains largely agricultural. Canyonlands are in the southern half and include Piñon Canyon Maneuver Site and the Picket Wire Canyon of the Comanche National Grasslands. Soil moisture regime is Ustic Aridic. The mean annual air temperature is 50 to 54 degrees Fahrenheit.

The Alkaline Plains Ecological Site, LRUs A and B, was developed from an earlier version of the Alkaline Ecological Site (2004, revised in 2007). This earlier version of the Alkaline Plains Ecological Site (2004) was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Alkaline Plains Range Site descriptions (1975, revised 1983). 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 Alkaline Plains Ecological Site is a run-off site on slopes of less than 10 percent. The soils have calcium carbonate and other salts.

Associated sites

R069XY006CO	**Loamy Plains** The Loamy Plains Ecological Site site is commonly adjacent.
R069XY033CO	**Salt Flat** The Salt Flat Ecological Site site is lower on the landscape and commonly adjacent.
R069XY037CO	**Saline Overflow** The Saline Overflow Ecological Site site is lower on the landscape and commonly adjacent.

Similar sites

R069XY046CO	**Shaly Plains** The Shaly Plains Ecological Site is less than 20 inches to bedrock.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on plains.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Fan remnant (3) Pediment (4) Hillslope (5) Ridge (6) Terrace (7) Drainageway
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	3,800–6,400 ft
Slope	0–15%
Ponding depth	0 in
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

Approximately 75 percent of the annual precipitation occurs during the growing season from mid-April to late September. Snowfall can vary greatly from year to year and can range from 20 to 40 inches per year. Winds are estimated to average 6 to 7 miles per hour annually. Daytime winds are generally stronger than nighttime winds. Occasional strong storms may bring brief periods of high winds with gusts to more than 60 miles per hour. The average length of the freeze-free period (28 °F) is 168 days. The average last freeze in the spring is April 22nd, and the average date of first freeze in fall is October 7th. The average length of the frost-free period (32 °F) is 149 days. The last frost in the spring is May 5th, and the average date for first frost in the fall (32 °F), is October 1. July is the hottest month, and January is the coldest. It is not uncommon for temperature to exceed 100 degrees Fahrenheit during the summer. Summer humidity is low and evaporation is high. The winters are characterized with frequent northerly winds, producing severe cold and temperatures dropping to -30 degrees Fahrenheit.

LRU A, in the Arkansas River Valley, is the hottest and driest portion of the MLRA. Mean Annual Precipitation (MAP) is 10 to 12 inches, and Mean Annual Air Temperature (MAAT) is 51 to 54 degrees Fahrenheit. LRU B is the largest extent. MAP is 12 to 14 inches, and MAAT is 50 to 54 degrees Fahrenheit.

Table 3. Representative climatic features

Frost-free period (characteristic range)	127-134 days
Freeze-free period (characteristic range)	149-161 days
Precipitation total (characteristic range)	12-14 in
Frost-free period (actual range)	121-135 days
Freeze-free period (actual range)	141-164 days
Precipitation total (actual range)	11-16 in
Frost-free period (average)	129 days
Freeze-free period (average)	153 days
Precipitation total (average)	13 in

Climate stations used

- (1) ORDWAY 21 N [USC00056136], Ordway, CO
- (2) PUEBLO MEM AP [USW00093058], Pueblo, CO

- (3) EADS [USC00052446], Eads, CO
- (4) ORDWAY 2 ENE [USC00056131], Ordway, CO
- (5) PUEBLO RSVR [USC00056765], Pueblo, CO
- (6) CHERAW 1 N [USC00051539], La Junta, CO
- (7) LA JUNTA 20 S [USC00054726], La Junta, CO
- (8) ROCKY FORD 2 SE [USC00057167], Rocky Ford, CO
- (9) TACONY 13 SE [USC00058157], Boone, CO

Influencing water features

There is no influential water table or wetland associated with this site.

Wetland description

N/A

Soil features

The soils of this site are moderately deep or very deep. They are well drained with moderately slow or slow permeability. The surface layer thickness ranges from 2 to 12 inches thick. The soil moisture regime is ustic aridic. The soil temperature regime is mesic. Parent material kind includes old alluvium, old alluvium over residuum, and slope alluvium over residuum. Parent material originated from shale.

Major soil series correlated to this ecological site include Absted, Aguilar, Cadoma, Deertrail, Heldt, Keyner, Litle, Manzanola, Ordway, Pultney, Razor, and Tyrone.

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

Figure 8. Ordway Clay

Table 4. Representative soil features

Parent material	(1) Alluvium–shale
Surface texture	(1) Clay loam (2) Clay (3) Silty clay loam
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	20–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-40in)	5–8 in
Calcium carbonate equivalent (0-40in)	0–25%
Electrical conductivity (0-40in)	2–18 mmhos/cm
Sodium adsorption ratio (0-40in)	0–40
Soil reaction (1:1 water) (0-40in)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

Not all scenarios or plants are included. Key indicator plants, animals, and ecological processes are described to inform land management decisions.

This region was historically occupied by large grazing animals, such as bison, along with pronghorn and mule deer. Deer and pronghorn are widely distributed throughout the MLRA. This is an important site for livestock grazing, especially cattle.

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. Recent drought events have increased mortality of blue grama significantly in some locales, along with other bunchgrasses, such as sand bluestem, little bluestem, needle and thread, Fendler threeawn, and squirreltail. Historic fire frequency (pre-industrial) is estimated at 15 to 20 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants were also likely to start fires (deliberate or accidental).

This is a midgrass and shortgrass prairie site with a smaller forb and shrub component. Alkali sacaton (warm-season, mid- bunchgrass), is dominant while blue grama (warm-season, shortgrass), and western wheatgrass (cool-season, rhizomatous), and galleta (warm season, rhizomatous) are the subdominant grass species. Other grasses such as green needlegrass and vine mesquite may be found in lesser amounts. Fourwing saltbush and winterfat, and occasionally shadscale saltbush, James frankennia, greasewood, and rabbitbrush may be present. Perennial forbs are a minor component on this site. Forbs include leafy false goldenweed, two-grooved milkvetch, scarlet globemallow, and American vetch. Others that may occur include desert princesplume, dotted gayfeather (aka dotted blazing star), prairie coneflower, purple prairieclover, and silky sophora (see Species Composition List for others).

This site deteriorates from heavy, continuous grazing without adequate recovery periods. Blue grama, galleta, and inland saltgrass increase. Blue grama develops into a sod-bound condition. Alkali sacaton, alkali bluegrass, green needlegrass, and western wheatgrass all decrease in frequency and production as do key shrubs such as fourwing saltbush and winterfat. American vetch and other highly palatable forbs also decrease. Fendler's threeawn, sand dropseed, ring muhly, annuals, and bare ground increase when subjected to long-term heavy, continuous grazing. Non-use in the absence of fire results in excessive litter and reduced plant density.

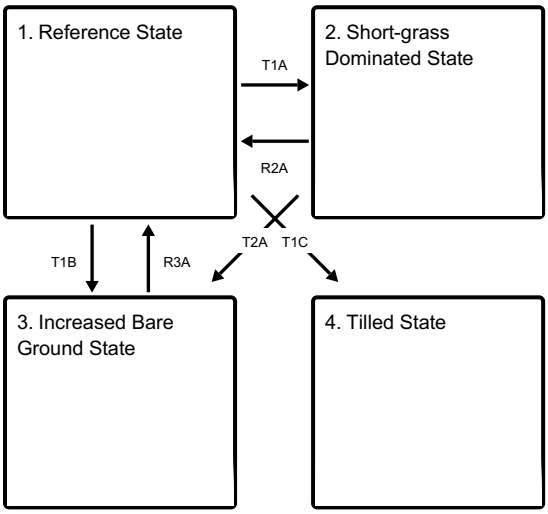
Drier and warmer climatic conditions exist in the central portion of MLRA 69. This area includes the eastern half of Pueblo county, northern Otero, extreme northwestern Bent, western edge of Kiowa, southern edge of Lincoln and all of Crowley County. These conditions are primarily caused by a rain shadow effect from the southern Rocky Mountains. Evapotranspiration rates (atmospheric demand) are higher in this area of MLRA 69. Total annual production is typically lower.

Southeastern Colorado was strongly affected by extended drought conditions in the “Dust Bowl” period of the 1930s, 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. “During periods of drought, high winds give rise to the dust storms which are especially characteristic of the southeastern plains (WRCC, 2022).” Recent drought events have increased mortality of blue grama upwards of 80 percent in some locales. The long-term effects of these latest drought years have yet to be determined.

Growth of native cool-season plants begins about April 15 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 and October in most years, depending on moisture. For detailed information, visit the Western Regional Climate Center website at https://wrcc.dri.edu/.

State and transition model

Ecosystem states



T1A - Heavy, season-long grazing. Prescribed fire.

T1B - Long-term, heavy, continuous grazing. Lack of fire.

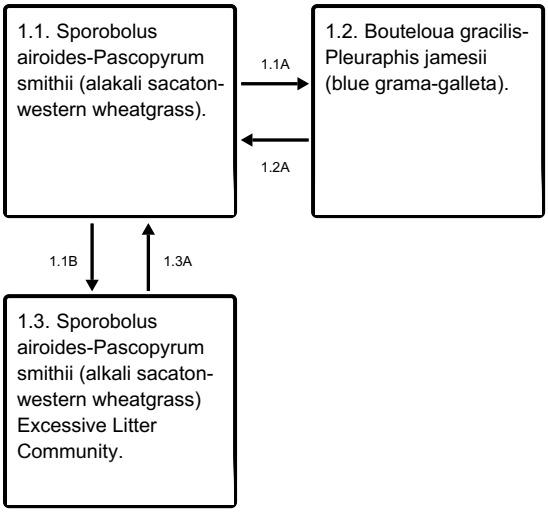
T1C - Mechanical tillage.

R2A - Prescribed grazing. Prescribed fire.

T2A - Long-term, heavy, continuous grazing. Lack of fire.

R3A - Long-term prescribed grazing. Prescribed fire.

State 1 submodel, plant communities



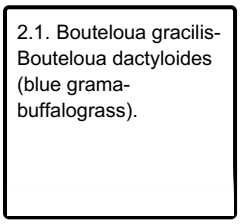
1.1A - Heavy, season-long grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

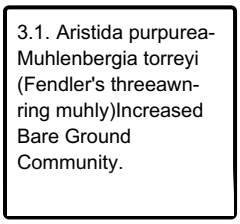
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

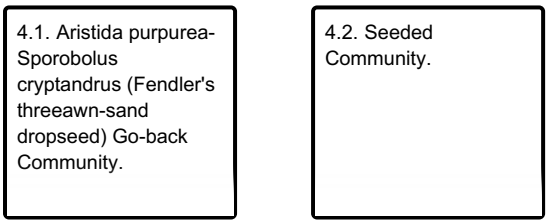
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The Reference State is characterized by three community phases that exist within the natural range of variability for the site. These phases are maintained by a historic fire frequency estimated to be on 15 to 20 year intervals and grazing by large ungulates with adequate recovery periods. High production of perennial grasses and extensive soil cover allow for increased soil moisture retention, vegetative production, and overall soil quality.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub

- alkali sacaton (*Sporobolus airoides*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Community 1.1
Sporobolus airoides-Pascopyrum smithii (alakali sacaton-western wheatgrass).

This is the interpretive plant community and is considered to be the reference plant community. This community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. It is found on areas that are properly managed with prescribed grazing with adequate recovery periods following each grazing event. The plant community consists of 75 to 85 percent grasses and grass-likes, 5 to 10 percent forbs and 10 to 15 percent shrubs. Dominant grasses include alkali sacaton, western wheatgrass, blue grama, and galleta. Other grasses and grass-like plants that occur in minor amounts are green needlegrass, alkali bluegrass, sideoats grama, vine mesquite, and sun sedge. Significant forbs are American vetch, Fremont goldenweed, and scarlet globemallow. Dominant shrubs that occupy this community are fourwing saltbush and winterfat. This plant community is diverse, stable, and productive. It is well suited to carbon sequestration, water yield, wildlife and livestock use, and is aesthetically pleasing. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. This community is resistant to many disturbances except heavy, continuous grazing, tillage, and development into urban or other uses. Total annual production, during an average year, ranges from 500 to 1500 pounds per acre air-dry weight and averages 1200 pounds.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- 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	330	960	1190
Shrub/Vine	115	150	185
Forb	55	90	125
Total	**500**	**1200**	**1500**

Figure 10. Plant community growth curve (percent production by month). CO6901, Warm-season/cool-season co-dominant; MLRA-69; upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	20	30	20	10	3	2	0	0

Community 1.2
Bouteloua gracilis-Pleuraphis jamesii (blue grama-galleta).

Key species such as alkali sacaton, western wheatgrass, green needlegrass, American vetch, fourwing saltbush, and winterfat have been reduced in amounts. Blue grama and galleta have increased in abundance in the community. Sand dropseed, Fendler's threeawn, sixweeks fescue, bottlebrush squirreltail, and hairy goldaster have also increased. This plant community is at risk of losing western wheatgrass, green needlegrass, American vetch, fourwing saltbush, and winterfat. Continuous spring grazing with summer deferment will reduce the cool-season component (western wheatgrass, green needlegrass, and sun sedge) of this plant community and increase the warm-season component. Continuous summer grazing with spring deferment will reduce the warm-season component (sideoats grama & alkali sacaton) of this plant community and increase the cool-season component. The risk of reducing key cool-season grasses and important forbs and shrubs is a major concern. Prescribed grazing with adequate recovery periods between grazing events together with proper stocking will enable the land

user to maintain the vegetation. Continuous, heavy grazing will take this plant community past an ecological and economic threshold resulting in costly revegetation practices or require many years of prescribed grazing to reverse the process. Blue grama is increasing at the expense of the cool-season grasses and deep-rooted shrubs. The water cycle, nutrient cycle, and energy flow are becoming impaired due to a shift in root structure and species composition. Less litter is being produced. Total aboveground carbon has been reduced due to decreases in forage and litter production. Reduction of rhizomatous wheatgrass, nitrogen fixing forbs, shrub component and increased warm-season shortgrasses has begun to alter the biotic integrity of this community. Water and nutrient cycles are impaired. Total annual production during an average year ranges from 300 to 850 pounds per acre air-dry weight and averages 650 pounds.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. glabrata*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- James' galleta (*Pleuraphis jamesii*), grass

Community 1.3
Sporobolus airoides-Pascopyrum smithii (alkali sacaton-western wheatgrass) Excessive Litter Community.

Plant composition is similar to the Reference Plant Community, however individual species production and frequency will be lower. Much of the nutrients are tied up in excess litter. The semiarid environment and the absence of animal impact and herd effect to break down litter slow nutrient recycling. Aboveground litter also limits sunlight from reaching plant crowns, resulting in increased decadence. Many plants, especially bunchgrasses, die off. Thick 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. This plant community is at risk of losing many key species and if undisturbed can go to a vegetative state resembling the Increased *Bare Ground* State. This plant community will change rapidly with the return of natural disturbances of grazing and fire. This plant community is uncommon in the natural range of variability. Total annual production can vary from 300 to 1200 pounds of air-dry vegetation per acre per year air-dry weight.

Dominant plant species

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

Pathway 1.1A
Community 1.1 to 1.2

Heavy, season-long grazing without adequate recovery periods between grazing events, and reduced fire frequency shifts the reference plant community toward the 1.2 community.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire shifts this community to the 1.3 community.

Pathway 1.2A
Community 1.2 to 1.1

The restoration of herbivory and prescribed fire shifts this community back to the reference community.

Conservation practices

Prescribed Burning

Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

The return of normal fire frequency or herbivory shifts this community to the reference plant community. Shifts in community phases are reversible through succession, disturbances, and short-term climatic variations that are within the natural range of variability for the site.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Short-grass Dominated State

The Short-grass Dominated State contains one community phase. This is a very stable state, resistant to change due to the high tolerance of blue grama to grazing, the development of a shallow root system (also known as a root pan), and subsequent changes in hydrology and nutrient cycling. The loss of dominant and subdominant functional/structural groups such as cool-season grasses, nitrogen fixing legumes, and shrubs reduces the biodiversity and productivity of this site and negatively impacts the energy flow and nutrient cycling. Water infiltration is reduced significantly due to the massive shallow root system “root pan”, characteristic of blue grama. Soil loss may be obvious where flow paths are connected.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. glabrata*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- broom snakeweed (*Gutierrezia sarothrae*), grass

Community 2.1
Bouteloua gracilis-Bouteloua dactyloides (blue grama-buffalograss).

Most of the key grass, forb, and shrub species are absent. Alkali sacaton, western wheatgrass, and galleta may persist in trace amounts but are greatly reduced in vigor and not readily seen. Blue grama dominates the community with a tight “sod-bound” appearance. Inland saltgrass, buffalograss, red threeawn, ring muhly, bottlebrush squirreltail, desert princesplume, silky sphora, twogrooved milkvetch, mouse-ear povertyweed, and broom snakeweed have increased. This plant community is resistant to change due to the grazing tolerance of blue grama. A significant amount of production and diversity has been lost from this community when compared to the reference community. It will take a very long time to restore this plant community back to the reference plant community with management. Renovation would be very costly. Total annual production, during an average year, ranges from 100 to 500 pounds per acre air-dry weight and averages 300 pounds.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. consimilis var. nitida*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Figure 11. Plant community growth curve (percent production by month). CO6904, Warm-season dominant; MLRA-69; upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	15	45	25	15	0	0	0	0

State 3
Increased Bare Ground State

This state is characterized by a loss of the more palatable species and a notable increase in bare ground. It lacks stability, diversity, and productivity. Litter levels are extremely low. Due to the increased bare ground erosion is evident where flow paths are continuous. Rills may occur on steeper slopes. The nutrient cycle, water cycle, and overall energy flow are greatly impaired. Organic matter and carbon reserves are greatly reduced.

Dominant plant species

- tree cholla (*Cylindropuntia imbricata var. imbricata*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- ring muhly (*Muhlenbergia torreyi*), grass
- cheatgrass (*Bromus tectorum*), grass

Community 3.1
Aristida purpurea-Muhlenbergia torreyi (Fendler's threeawn-ring muhly)Increased Bare Ground Community.

Species that dominate the community are red threeawn, ring muhly, walkingstick cholla, broom snakeweed, plains pricklypear, and annual plants such as annual barley. Cheatgrass, Russian thistle, and burningbush have invaded. Blue grama may persist in localized areas or be totally absent. Introduced species such as field bindweed can also be present, especially on prairie dog towns. This community lacks stability, diversity, and productivity. Litter levels are extremely low. Due to the increased bare ground erosion is evident where flow paths are continuous. Rills may occur on steeper slopes. The nutrient cycle, water cycle, and overall energy flow are greatly impaired. Organic matter and carbon reserves are greatly reduced. Total annual production, during an average year, can vary from 25 to 150 pounds of air-dry vegetation per acre.

Dominant plant species

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

Figure 12. Plant community growth curve (percent production by month). CO6904, Warm-season dominant; MLRA-69; upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	15	45	25	15	0	0	0	0

State 4
Tilled State

This state is defined by two separate vegetation communities that are highly variable. They are derived through two distinct management scenarios, and are not successionally related. Infiltration, runoff, and soil erosion vary depending on the vegetation present. The designation of the tillage state denotes changes in plant community composition and soil structure. This change in plant species and soil structure affects the hydrologic function, biotic integrity, and soil site stability.

Dominant plant species

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

Community 4.1
Aristida purpurea-Sporobolus cryptandrus (Fendler's threeawn-sand dropseed) Go-back Community.

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All of the native plants are eliminated, soil organic matter is reduced, soil structure is degraded, and a compacted layer (plow pan) is formed. Residual synthetic chemicals may remain from past farming operations and erosion processes are active. Erosion is a major concern. Go-back land succeeds through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, burningbush, and other annuals begin to establish. These plants give some protection from erosion and start to build minor levels of soil organic matter. This early annual plant community lasts for two to several years. Fendler's threeawn, sand dropseed, and several other early perennials can dominate the plant community for five to eight years or more. Eventually western wheatgrass, blue grama, and other natives can become reestablished. Prescribed grazing can accelerate the successional process.

Dominant plant species

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

Community 4.2
Seeded Community.

This plant community can vary considerably. The Seeded Community is represented by applying the conservation practice of rangeland seeding on go-back land or recently cropped land for the purpose of converting it to permanent vegetation. Plant species native to the site are used throughout the MLRA due to their suitability to the semiarid climate. Native species are the most adapted to site conditions and therefore can be sustained in the MLRA. Improved cultivars (named varieties) of plant materials are used to enhance seeding establishment and meet specific reclamation resource objectives. There are several factors that make seeded rangeland a different grazing resource than native rangeland. Factors such as species selected, stand density, varieties, and harvest efficiency all impact the production level and palatability. This results in uneven utilization when both seeded and native rangelands are in the same grazing unit. Therefore, the seeded rangeland should be managed as a separate grazing unit if possible. Species diversity on seeded rangeland is often lower than that of the reference plant community and native forb species will generally take longer to re-establish.

Transition T1A
State 1 to 2

Heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire result in shifts between states. The movement from the Reference State to the Short-grass Dominated State indicates that an ecological threshold has been crossed. This transition involves a major loss of plant diversity resulting in the degradation of biotic integrity.

Transition T1B
State 1 to 3

Long-term, heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire move this plant community across an ecological threshold to the Increased *Bare Ground* State. Resilience and resistance to disturbance will be lost. Soil site stability, hydrologic function, and biotic integrity, will be drastically

altered.

Transition T1C
State 1 to 4

Tillage (plowed & abandoned) will cause all states to transition across an ecological threshold to the Tilled State. The resulting change in plant species and soil structure will adversely affect hydrologic function, biotic integrity, and soil site stability. This transition is considered to be non-restorable.

Restoration pathway R2A
State 2 to 1

Long term prescribed grazing management and prescribed fire are the management actions required to recover to the Reference State. The species to target for management are those that were dominant or sub-dominant within the reference plant community according to documented functional/structural groups. This restoration may take greater than 40 years.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

Long-term, heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire cause a move to the Increased *Bare Ground* State. This transition may take greater than 25 years to occur. Resilience and resistance to disturbance will be lost. Soil site stability, hydrologic function, and biotic integrity will be drastically altered.

Restoration pathway R3A
State 3 to 1

Long-term prescribed grazing with adequate recovery opportunity between grazing events and prescribed fire are the management actions required to recover to the Reference State. The species to target for management are those that were dominant or sub-dominant within the reference plant community according to the documented functional/structural groups. This restoration may take greater than 80 years to accomplish.

Conservation practices

Prescribed Burning
Prescribed Grazing

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				900–1020	
	alkali sacaton	SPAI	*Sporobolus airoides*	360–540	–
	western wheatgrass	PASM	*Pascopyrum smithii*	240–360	–
	blue grama	BOGR2	*Bouteloua gracilis*	180–300	–
	James' galleta	PLJA	*Pleuraphis jamesii*	180–240	–
	green needlegrass	NAVI4	*Nassella viridula*	10–60	–

	green needlegrass	ACVI4	*Nassella viridula*	10–30	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–60	–
	Grass, perennial	2GP	*Grass, perennial*	10–40	–
	saltgrass	DISP	*Distichlis spicata*	0–35	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–35	–
	vine mesquite	PAOB	*Panicum obtusum*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	10–25	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–25	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–10	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–10	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–10	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–10	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–10	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–10	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–10	–
Forb					
2				60–120	
	Forb, perennial	2FP	*Forb, perennial*	10–35	–
	leafy false goldenweed	OOFOF	*Oonopsis foliosa var. foliosa*	10–35	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	10–25	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	10–25	–
	American vetch	VIAM	*Vicia americana*	10–25	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–10	–
	povertyweed	IVAX	*Iva axillaris*	0–10	–
	dotted blazing star	LIPU	*Liatris punctata*	0–10	–
	lacy tansyaster	MAPIP4	*Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida*	0–10	–
	desert princesplume	STPIP	*Stanleya pinnata var. pinnata*	0–10	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–10	–
	silky sophora	SONU	*Sophora nuttalliana*	0–10	–
Shrub/Vine					
3				120–180	
	fourwing saltbush	ATCA2	*Atriplex canescens*	60–120	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	25–60	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	10–40	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	10–25	–
	James' seaheath	FRJA	*Frankenia jamesii*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–10	–
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	0–10	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–10	–

	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–10	–

Animal community

WILDLIFE INTERPRETATIONS:

The variety of grasses, forbs, and shrubs on this ecological site in the various plant communities provides habitat for a wide range of wildlife species. Historic large grazers that influenced these plant communities were bison, elk, and pronghorn. Changes over time have resulted in the loss of bison, the reduction in elk numbers, and pronghorn population swings. Domestic grazers now 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 plant community to other communities on this ecological site may result in dramatic species shifts in the bird community. Because of a lack of permanent water, fish and many amphibians are not expected on this ecological site. Mule and white-tailed deer may use this ecological site, however the shrub cover is too low to expect more than occasional use. The gray wolf and wild bison used this ecological site in historic times. The wolf is thought to be extirpated from Eastern Colorado. Bison in the area are domesticated.

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 Production (lbs. /acre) and Stocking Rate (AUM/acre)

Reference Plant Community - (1200) (0.33)

1.2 Community - (650) (0.18)

2.1 Community - (300) (0.08)

These stocking rates are guidelines and grazing plans should be developed only after a field visit.

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.

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 low 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

None noted.

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 are 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 are complete to Provisional level.
NOTE: Annual Production Table and Species Composition List are from the “Previously Approved” ESD (2004). These need review for future updates at the next Approved level. Minor edit was made to Species Composition List.

Each Alternative State/Community:Complete to Provisional level. Narrative for each state and community has been updated.

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, References):
Updated. All “Required” items are complete to Provisional level.

Animal CommunityWildlife Interpretations:First “overview” paragraph retained.
Individual Plant Community phase interpretations are removed and need to be updated at next “Approved” level.

Livestock Interpretations:
Updated to reflect the plant community name revisions. The Stocking rate calculations remain the same because they are based on the “Legacy” Total Annual Production table.
The stocking rate calculations need to be updated when Total Annual Production and Plant Community annual production is revised at the next “Approved” level.

Hydrology:
From “Previously Approved” ESD (2004). This needs to be updated at next “approved” level.

Other Site Interpretation:
Recreational Uses, Wood Products, Other Products, and Plant Preferences table, and Rangeland Health Reference Sheet carried over from “Previously Approved” ESD (2004).

LRU C Alkaline Plains ESD will be developed at a future date.

“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 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.

Data Source # of Records Sample Period State County
NRI 4 2004 CO Pueblo
NRI 2 2005 CO El Paso
NRI 2 2007 CO Crowley
NRI 1 2010 CO Pueblo
NRI 1 2012 CO Pueblo
NRI 1 2012 CO Crowley
NRI 2 2012 CO Otero
NRI 4 2004 CO Otero
NRI 2 2004 CO Crowley
NAP* 4 sites 2005-2015 Kiowa
*NRI- references to Natural Resource Inventory data

References

Guyette, R.P., M.C. Stambaugh, D.C. Dey, and R. Muzika. 2012. Predicting Fire Frequency with Chemistry and Climate. Ecosystems 15:322–335.

Other references

Data collection for this ecological site was done in conjunction with the progressive soil surveys within the Upper Arkansas Valley (MLRA 69) of Colorado. The site has been mapped and correlated with soils in the following soil surveys: Baca County, Bent County, Crowley County, El Paso County Area, Fremont County Area, Huerfano County Area, Kiowa County, Las Animas County: Parts of Huerfano and Las Animas, Lincoln County, Otero County, Prowers County, and Pueblo Area: Parts of Pueblo and Custer Counties.

30 Year Climatic and Hydrologic Normals (1981-2010) Reports. National Water and climate Center: Portland, OR. August 2015

ACIS-USDA Field Office Climate Data (WETS), period of record 1971-2000 http://agacis.rcc-acis.org (powered by

WRCC) Accessed March 2016

Andrews, R. and R. Righter. 1992. Colorado Birds. Denver Museum of Natural History, Denver, CO. 442

Armstrong, D.M. 1972. Distribution of mammals in Colorado. Univ. Kansas Museum Natural History Monograph #3. 415.

Butler, LD., J.B. Cropper, R.H. Johnson, A.J. Norman, G.L. Peacock, P.L. Shaver, and K.E. Spaeth. 1997, revised 2003. National Range and Pasture Handbook. National Cartography and Geospatial Center's Technical Publishing Team: Fort Worth, TX. http://www.glti.nrcs.usda.gov/technical/publications/nrph.html Accessed August 2015

Clark, J., E. Grimm, J. Donovan, S. Fritz, D. Engrstom, and J. Almendinger. 2002. Drought cycles and landscape responses to past Aridity on prairies of the Northern Great Plains, USA. Ecology, 83(3), 595-601.

Cleland, D., P. Avers, W.H. McNab, M. Jensen, R. Bailey, T. King, and W. Russell. 1997. National Hierarchical Framework of Ecological Units, published in Ecosystem Management: Applications for Sustainable Forest and Wildlife Resources, Yale University Press

Cooperative climatological data summaries. NOAA. Western Regional Climate Center: Reno, NV. Web. http://www.wrcc.dri.edu/climatedata/climsum Accessed August 2015

Egan, Timothy. 2006. The Worst Hard Time. Houghton Mifflin Harcourt Publishing Company: New York, NY.

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History, Denver, CO. 467. Hammerson, G.A. 1986. Amphibians and reptiles in Colorado. CO Div. Wild. Publication Code DOW-M-I-3-86. 131.

Herrick, Jeffrey E., J.W. Van Zee, K.M. Haystad, L.M. Burkett, and W.G. Witford. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems, Volume II. U.S. Dept. of Agriculture, Agricultural Research Service. Jornada Experimental Range, Las Cruces, N.M.

Kingery, H., Ed. (1998) Colorado Breeding Birds Atlas. Dist. CO Wildlife Heritage Foundation: Denver, CO. 636.

National Water & Climate Center. USDA-NRCS. USDA Pacific Northwest Climate Hub: Portland, OR. http://www.wcc.nrcs.usda.gov/ Accessed March 2016

National Weather Service Co-op Program. 2010. Colorado Climate Center. Colorado State Univ. Web. http://climate.atmos.colostate.edu/dataaccess.php March 2016

Pellant, M., P. Shaver, D.A. Pyke, J.E. Herrick. (2005) Interpreting Indicators of Rangeland Health, Version 4. BLM National Business Center Printed Materials Distribution Service: Denver, CO.

PLANTS Database. 2015. USDA-NRCS. Web. http://plants.usda.gov/java/ Accessed August 2015. February 2016

PRISM Climate Data. 2015. Prism Climate Group. Oregon State Univ. Corvallis, OR. http://www.prism.oregonstate.edu/ Accessed August 2015.

Rennicke, J. 1990. Colorado Wildlife. Falcon Press, Helena and Billings, MT and CO Div. Wildlife, Denver CO. 138.

Schoeneberger, P.J., D.A. Wysockie, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center: Lincoln, NE.

The Denver Posse of Westerners. 1999. The Cherokee Trail: Bent's Old Fort to Fort Bridger. The Denver Posse of Westerners, Inc. Johnson Printing: Boulder, CO

U.S. Dept. of Agriculture, Agricultural Research Service. September, 1991. Changes in Vegetation and Land Use I eastern Colorado, A Photographic study, 1904-1986.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource areas of the United States, the Caribbean, and the Pacific Basin. US Department of Agriculture Handbook 296.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. National Geospatial Center of Excellence. Colorado annual Precipitation Map from 1981-2010, Annual Average Precipitation by State

U.S. Dept. of Agriculture, Natural Resources Conservation Service. 2009. Part 630, Hydrology, National Engineering Handbook

U.S. Dept. of Agriculture, Natural Resources Conservation Service. 1972-2012. National Engineering Handbook Hydrology Chapters. http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1043063 Accessed August 2015.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. National Soil Survey Handbook title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242 Accessed July 2015

U.S. Dept. of Agriculture, Soil Survey Division Staff. 1993. Soil Survey Manual.

U.S. Dept. of Agriculture.1973. Soil Survey of Baca County, Colorado.

U.S. Dept. of Agriculture. 1970. Soil Survey of Bent County, Colorado.

U.S. Dept. of Agriculture. 1968. Soil Survey of Crowley County, Colorado.

U.S. Dept. of Agriculture. 1981 Soil Survey of El Paso County Area, Colorado.

U.S. Dept. of Agriculture. 1995. Soil Survey of Fremont County Area, Colorado.

U.S. Dept. of Agriculture. 1983. Soil Survey of Huerfano County Area, Colorado.

U.S. Dept. of Agriculture.1981. Soil Survey of Kiowa County, Colorado.

Western Regional Climate Center. 2022. Climate of Colorado, climate of the eastern plains. https://wrcc.dri.edu/Climate/narrative_co.php (accessed 9 August 2022).

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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)	Ben Berlinger, Daniel Nosal, Kimberly Diller
Contact for lead author	Ben Berlinger, Area Rangeland Management Specialist, La Junta, 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

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2. **Presence of water flow patterns:** Typically none, if present water flow patterns are short and not connected.

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** This site has 5 percent or less bare ground, with bare patches generally less than 2-3 inches in diameter. Extended drought can cause bare ground to increase upwards to 10-20 percent with bare patches reaching 6-12 inches in diameter.

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

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

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. These values need verification at reference site.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM is 2-3 percent. Soils are typically deep but include some that are moderately deep. The A horizon is light brownish-gray, thick platy structure that part to weak, fine, crumb and is approximately 0-3 inches in depth.

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: warm-season mid bunchgrass > cool-season mid rhizomatous >

    Sub-dominant: warm-season short bunchgrass > shrubs = warm-season mid rhizomatous > cool-season mid bunchgrass >

    Other: warm-season forbs > leguminous forbs > cool-season forbs > sedges > warm-season short stoloniferous

    Additional:

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

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

25 percent.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 lbs./ac. low precipitation years; 1200 lbs./ac. average precipitation years; 1500 lbs./ac. above average precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 200 – 450 lbs./ac.

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

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