USDA Natural Resources
Conservation Service

Ecological site R069XY026CO
Sandy Plains

Last updated: 9/07/2023
Accessed: 05/01/2024

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.

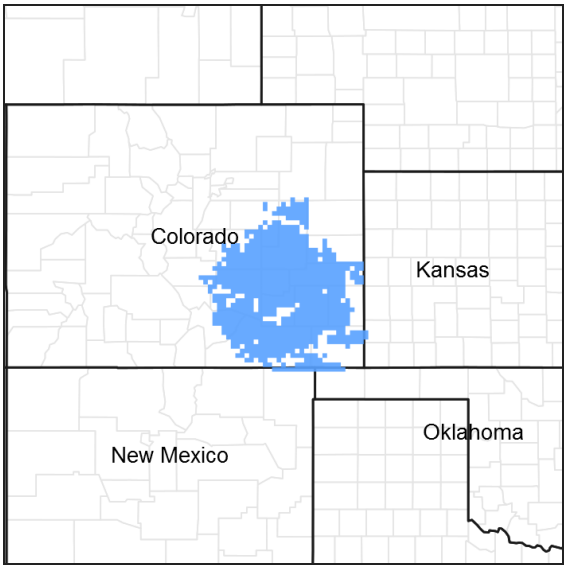

Figure 1. Mapped extent

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.

LRU notes

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.

REVISION NOTES:
The Sandy Plains Ecological Site, LRUs A and B, was developed from an earlier version of the Sandy ESD (2004, re-named Sandy Plains Ecological Site in 2007). The earlier version of the Sandy Ecological Site (2004) was based on input from NRCS and historical information obtained from the Sandy Plains Range Site descriptions (Soil Conservation Service 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.

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.

REVISION NOTES:
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Ecological site concept

The Sandy Plains Ecological Site is in an upland run-off position on plains. The slope is less than 10 percent and the soil is deeper than 20 inches. Calcium carbonate is the only salt in the soil, and the surface texture is sandy loam or loamy sand.

Associated sites

R069XY006CO	**Loamy Plains** Loamy Plains Ecological Site is commonly adjacent to Sandy Plains Ecological Site.
R069XY019CO	**Deep Sand** The Deep Sand Ecological Site is on similar landforms and commonly adjacent to the Sandy Plains Ecological Site.
R069XY053CO	**Sandstone Breaks** Sandstone Breaks Ecological Sites are on shallow soils and commonly adjacent to Sandy Plains Ecological Sites.

Similar sites

R069XY019CO	**Deep Sand** The Deep Sand Ecological Site is on stabilized dunes on slopes of greater than 10 percent.
R069XY031CO	**Sandy Bottomland** Sandy Bottomlands Ecological Sites are run-on sites.
R069XY006CO	**Loamy Plains** The surface textures of the Loamy Plains Ecological Site includes loam, silt loam, silty clay loam, and clay loam.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Prunus pumila var. besseyi*
Herbaceous	(1) *Calamovilfa longifolia* (2) *Andropogon hallii*

Physiographic features

This site occurs on gently sloping to moderately sloping uplands and plains.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Hillslope (3) Ridge (4) Sand sheet (5) Fan remnant
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,128–1,890 m
Slope	1–9%
Ponding depth	0 cm
Water table depth	152 cm
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)	305-356 mm
Frost-free period (actual range)	121-135 days
Freeze-free period (actual range)	141-164 days
Precipitation total (actual range)	279-406 mm
Frost-free period (average)	129 days
Freeze-free period (average)	153 days
Precipitation total (average)	330 mm

Climate stations used

- (1) CHERAW 1 N [USC00051539], La Junta, CO
- (2) LA JUNTA 20 S [USC00054726], La Junta, CO
- (3) ROCKY FORD 2 SE [USC00057167], Rocky Ford, CO
- (4) TACONY 13 SE [USC00058157], Boone, CO
- (5) ORDWAY 21 N [USC00056136], Ordway, CO
- (6) PUEBLO MEM AP [USW00093058], Pueblo, CO
- (7) EADS [USC00052446], Eads, CO
- (8) ORDWAY 2 ENE [USC00056131], Ordway, CO
- (9) PUEBLO RSVR [USC00056765], Pueblo, 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 very deep. They are well drained or somewhat excessively drained with rapid to moderately slow permeability. The surface layer thickness ranges from 2 to 7 inches thick. The soil moisture regime is ustic aridic. The soil temperature regime is mesic.
Major soil series correlated to this ecological site include Ascalon, Bijoudry, Bresser, Fort, Gilcrest, Haxtun, Kimera, Minnequa, Olney, Oterodry, Romound, Sitcan, Stoneham, Truckton, Ulm, Vonid, and Yattle.

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.

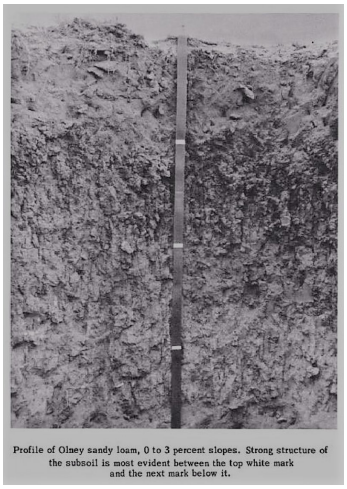


Figure 8. Olney sandy loam (Soil Survey of Otero County, Colorado 1972)

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian sands
Surface texture	(1) Sandy loam (2) Fine sandy loam (3) Loamy sand
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to rapid
Soil depth	102–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
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).

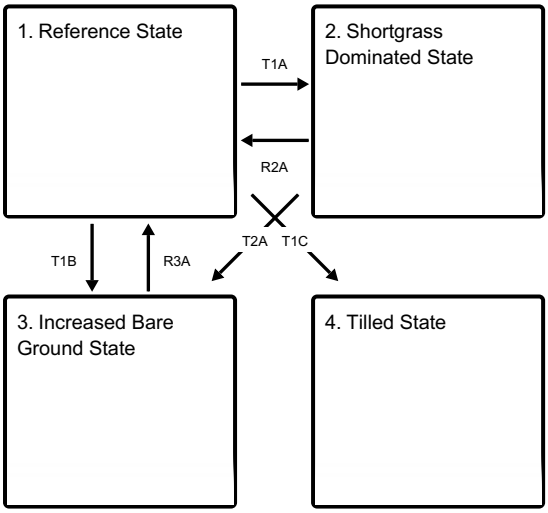
Blue grama is the primary grass species (warm-season bunchgrass) while prairie sandreed and sand bluestem (tallgrasses) are secondary. Shrubs such as fourwing saltbush, spreading buckwheat, and plains pricklypear vary in amounts. Western sandcherry, small soapweed, and sand sagebrush may occur in lesser amounts. Perennial forbs are a minor component on this site. Forbs include dotted gayfeather (dotted blazing star), purple prairieclover, scarlet globemallow, and American vetch. Others that may occur include white sagebrush, sand lily (starlily), tenpetal blazingstar, prairie spiderwort, Nuttall's evolvulus, and sand verbena (see Species Composition List for others).

Continuous grazing without adequate recovery following each grazing event during the growing season causes blue grama to increase, and eventually form a sod-bound condition. Major warm-season grasses such as sand bluestem, prairie sandreed, yellow Indiangrass, and switchgrass decrease in frequency and production. Needle and thread initially increases, then decreases. Key forbs and shrubs such as American vetch, purple prairie clover, scarlet globemallow, western sandcherry, and fourwing saltbush also decrease. Red threeawn, annuals, and bare ground increase with excessive defoliation. Years of non-use or lack of fire allows litter to accumulate and reduce plant density.

Drier and warmer climatic conditions exist in the central portion of MLRA 69 (LRU A). 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 Counties. These conditions are primarily caused by a rain shadow effect from the southern Rocky Mountains. Evapotranspiration rates (atmospheric demand) is higher in LRU A and total annual production is typically lower.

State and transition model

Ecosystem states



T1A - Continuous, heavy grazing. Lack of fire.

T1B - Heavy, continuous grazing. Lack of fire.

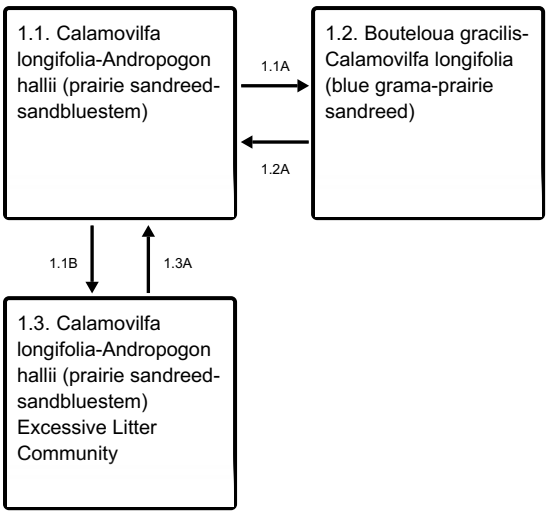
T1C - Tillage.

R2A - Prescribed grazing. Prescribed fire.

T2A - Heavy, continuous grazing. Lack of fire.

R3A - Prescribed grazing. Prescribed fire.

State 1 submodel, plant communities



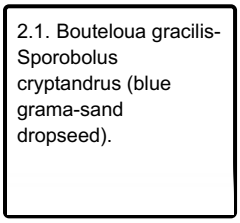
1.1A - Heavy, season long grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

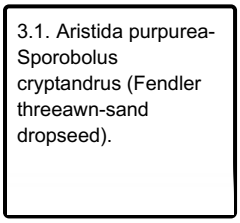
1.2A - Prescribed grazing. Prescribed burning.

1.3A - Prescribed grazing. Prescribed fire.

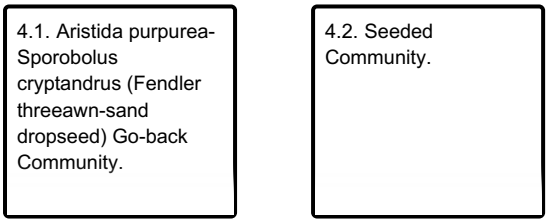
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The Reference State contains three community phases. These phases are historically maintained by a fire return interval of 15 to 20 years (Guyette and others.), herbivory, and adequate recovery periods. High production of perennial grasses and extensive cover allow for increased soil moisture retention, vegetative production, and overall soil quality.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- sand bluestem (*Andropogon hallii*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Calamovilfa longifolia-Andropogon hallii (prairie sandreed-sandbluestem)

This is the interpretive plant community that evolved in the presence of the natural disturbance regimes of grazing and fire. The potential vegetation is about 70 to 85 percent grasses and grass-like plants, 10 to 15 percent forbs and 5 to 15 percent woody plants. The dominant tall warm-season grasses are prairie sandreed, sand bluestem, and switchgrass. Blue grama dominates the understory. Important cool-season grasses and grass-likes are needle and thread, western wheatgrass, and sun sedge. Key forbs and shrubs are American vetch, purple prairie clover, western sandcherry, and fourwing saltbush. This plant community is characteristic of the Western Great Plains and is resistant to many disturbances except heavy, continuous grazing, sodbusting, and urban and other development. The diversity in plant species allows for high drought tolerance. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity. Production in this community can vary from 800 to 2100 pounds of air-dry vegetation per acre per year depending on weather conditions, and averages 1500 pounds. NOTE: The following Reference Plant Community Species Composition list and Annual Production Table is from the Legacy ESD 2004 and needs to be updated in the future.

Dominant plant species

- fourwing saltbush (*Atriplex canescens var. angustifolia*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- sand bluestem (*Andropogon hallii*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	785	1300	1754
Forb	191	213	244
Shrub/Vine	90	168	243
Total	**1066**	**1681**	**2241**

Figure 10. Plant community growth curve (percent production by month). CO6905, Warm-season dominant, cool-season sub-dominant; MLRA-69; upland coarse-textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	22	35	15	10	3	0	0	0

Community 1.2
Bouteloua gracilis-Calamovilfa longifolia (blue grama-prairie sandreed)

Sand bluestem, yellow Indiangrass, prairie sandreed, switchgrass, and western sandcherry have decreased in frequency and production. Blue grama is beginning to dominant the grass species. Sand dropseed, red threeawn, hairy goldaster, Texas croton, slimflower scurfpea, Cuman ragweed, stickleaf, heath aster, lupine, loco, milkvetch, and cactus have increased. Soils that have a sandy loam or coarser subsoil show an increase in sand sagebrush. Continuous, heavy spring grazing with summer deferment will reduce the cool-season component (needle and thread, western wheatgrass, sun sedge) of this plant community and increase the warm-season component. Continuous, heavy summer grazing with spring deferment will reduce the warm-season component (sand bluestem, yellow Indiangrass, prairie sandreed, switchgrass) of this plant community and increase the cool-season component. The risk of losing key tall warm-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 or move it toward the reference state. Continuous, heavy grazing will take this plant community past an ecological and economical 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 tallgrasses and deep-rooted shrubs. The water cycle, nutrient cycle, and energy flow are becoming impaired do to a shift in root structure and species composition. Less litter is being produced. Production in this community can vary from 600 to 1600 pounds of air-dry vegetation per acre per year depending on weather conditions, and averages 1100 pounds.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- fourwing saltbush (*Atriplex canescens var. angustifolia*), shrub
- blue grama (*Bouteloua gracilis*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Figure 11. Plant community growth curve (percent production by month). CO6905, Warm-season dominant, cool-season sub-dominant; MLRA-69; upland coarse-textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	22	35	15	10	3	0	0	0

Community 1.3
Calamovilfa longifolia-Andropogon hallii (prairie sandreed-sandbluestem) Excessive Litter Community

This plant community occurs when there is a lack of disturbance by grazing or fire. Most of the species occurring in the reference plant community are present, but reduced in abundance and production. Many of the nutrients are tied up in excessive litter. The semiarid environment and the absence of animal impact and herd effect to break down litter slows 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. This plant community is at risk of losing many key species and if left ungrazed and without fire can go to a vegetative state resembling the Eroded State. This plant community will change rapidly if plant manipulation is allowed to occur (grazing by domestic livestock or possibly fire). In advanced stages, plant mortality and erosion potential increase as bare ground increases, increasing the risk of a transition to the Increased *Bare Ground* State (3.0). This plant community is uncommon in the natural range of variability. Production can vary from 400 to 1400 pounds of air-dry vegetation per acre per year and averages 900 pounds depending on weather conditions and the plants that are present.

Dominant plant species

- fourwing saltbush (*Atriplex canescens var. angustifolia*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- sand bluestem (*Andropogon hallii*), grass

Figure 12. Plant community growth curve (percent production by month). CO6906, Warm-season dominant, cool-season sub-dominant, excess litter; MLRA-69; upland coarse-textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	25	30	15	10	3	2	0	0

Pathway 1.1A
Community 1.1 to 1.2

Recurring heavy, seasonal herbivory without adequate recovery periods between grazing events, and reduced fire frequency shifts the reference plant community toward the 1.2 community. Blue grama increases with a corresponding reduction in the amount of tall warm-season grasses. Biotic integrity will be altered and water and

nutrient cycles will be negatively impacted.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire will shift the reference plant community toward the1.3 community. Due to the accumulation of standing plant litter nutrient cycling can be impaired. Plant decadence and mortality can increase.

Pathway 1.2A
Community 1.2 to 1.1

The restoration of an appropriate grazing regime facilitates the shift back to the reference plant community. Prescribed fire will accelerate this process.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

The restoration of an appropriate grazing regime facilitates the shift back to the reference plant community. Prescribed fire will accelerate this process.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shortgrass Dominated State

This state is dominated by blue grama, and evolved under long-term, heavy grazing pressure. 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. Extended drought may cause extensive mortality of blue grama. The loss of dominant and sub-dominant functional/structural groups such as tall warm-season grasses, nitrogen fixing legumes, and shrubs reduces the biodiversity and productivity of this site.

Dominant plant species

- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Community 2.1
Bouteloua gracilis-Sporobolus cryptandrus (blue grama-sand dropseed).

This plant community evolves with long term heavy, continuous grazing caused by lack of adequate recovery periods between grazing events together with improper stocking rates. Sodbound blue grama dominates this plant community. Large amounts of sand dropseed and red threeawn are common. White sage, lupine, tenpetal blazingstar, Texas croton, hairy goldaster, loco, wormwood, broom snakeweed, and small soapweed have increased. Sand sagebrush may increase on sandy loam or coarser subsoils. Sand bluestem, prairie sandreed,

needle and thread, Indiangrass, switchgrass, western sandcherry, and fourwing saltbush have been removed. A significant amount of production and diversity has been lost when compared to the reference plant community. An ecological threshold has been crossed. The soil is stable at this stage however, the nutrient cycle, water cycle, community dynamics, and energy flow are all impaired do to the substantial increase of blue grama and loss of tall warm-season grasses, nitrogen fixing legumes, and shrubs. Production varies from 300 to 1100 pounds of air-dry vegetation per acre per year depending on weather and averages 700 pounds.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Figure 13. Plant community growth curve (percent production by month). CO6907, Warm-season dominant; MLRA-69; upland coarse-textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	30	40	20	5	0	0	0	0

State 3
Increased Bare Ground State

The Increased *Bare Ground* State is characterized by low litter, pedestalling, and erosion. Organic matter is greatly reduced and the nutrient, water, and energy cycles are greatly impaired. The Reference State has been driven beyond the limits of ecological resilience and has crossed a threshold into this state. This designation denotes complete deterioration of the ecological processes.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- field bindweed (*Convolvulus arvensis*), other herbaceous

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

This plant community develops under an excessive defoliation regime. Fendler threeawn is the dominant species. Sand dropseed may also be present in varying amounts. A number of annual plants such as Russian thistle, burningbush, and cheatgrass will increase or invade. Field bindweed is often present. Litter levels are extremely low. The nutrient cycle, water cycle, and energy flow are greatly impaired. Erosion is occurring. Pedestalling is evident. Organic matter and carbon reserves are greatly reduced. Production can vary from 50 to 250 pounds of air-dry vegetation per acre per year depending on weather conditions and the plants that are present.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- field bindweed (*Convolvulus arvensis*), other herbaceous

Figure 14. Plant community growth curve (percent production by month). CO6907, Warm-season dominant; MLRA-69; upland coarse-textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	30	40	20	5	0	0	0	0

State 4
Tilled State

The Tilled 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 reference state ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold into the tillage state. 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 following ecological processes: hydrologic function, biotic integrity, and soil site stability.

Dominant plant species

- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous

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

This plant community 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 plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations and erosion processes may be 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. Red threeawn, sand dropseed, and several other early perennials can dominate the plant community for the following five to eight years. Eventually other native species become reestablished. Prescribed grazing can accelerate the successional process.

Dominant plant species

- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous

Community 4.2
Seeded Community.

The seeded plant community is created by applying the conservation practice of Rangeland Seeding on go-back 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 semi-arid 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

Continuous, heavy grazing without adequate recovery opportunity between grazing events contributes to the loss of

resilience and result in shifts between states. Lack of fire accelerates this process. The movement from the Reference State to the Shortgrass 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 moves this plant community across an ecological threshold to the Increased *Bare Ground* State. Lack of fire can accelerate this process. Resilience and resistance to disturbance are compromised. Soil site stability, hydrologic function, and biotic integrity are significantly impaired.

Transition T1C
State 1 to 4

Tillage (plowed & abandoned) will cause this state 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 to the due to irreversible alterations of the soil structure.

Restoration pathway R2A
State 2 to 1

Long term grazing management with proper stocking rates and adequate rest to facilitate recovery of the remnant reference plant community species are the management actions required to recover to the reference state. Prescribed fire will accelerate this process.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

Long-term heavy, continuous grazing without adequate recovery opportunity and lack of fire will move the Blue Grama State across an ecological threshold to the Increased *Bare Ground* State. This transition may take greater than 25 years. Resilience and resistance to disturbance are degraded. Soil site stability, hydrologic function, and biotic integrity significantly impaired.

Restoration pathway R3A
State 3 to 1

Long-term prescribed grazing with adequate recovery opportunity between grazing events together with proper stocking are the management actions required to recover to the remnant Reference State. Prescribed fire will accelerate this process.

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 (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					

Grass/Grasslike					
1				1177–1429	
	blue grama	BOGR2	*Bouteloua gracilis*	336–471	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	135–269	–
	sand bluestem	ANHA	*Andropogon hallii*	95–202	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	67–135	–
	switchgrass	PAVI2	*Panicum virgatum*	28–95	–
	little bluestem	SCSC	*Schizachyrium scoparium*	28–95	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	28–95	–
	Grass, perennial	2GP	*Grass, perennial*	11–67	–
	western wheatgrass	PASM	*Pascopyrum smithii*	11–67	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–45	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	11–45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–28	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–28	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–28	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–28	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–27	–
	little barley	HOPU	*Hordeum pusillum*	0–13	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–13	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–13	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–11	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–11	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
Forb					
2				168–252	
	Forb, perennial	2FP	*Forb, perennial*	11–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–28	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	11–28	–
	dotted blazing star	LIPU	*Liatris punctata*	11–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–28	–
	American vetch	VIAM	*Vicia americana*	11–28	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–13	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–13	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–11	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–11	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–11	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0–11	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	0–11	–

	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–11	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0–11	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–11	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–11	–
	purple poppymallow	CAIN2	*Callirhoe involucrata*	0–11	–
	sanddune cryptantha	CRFE3	*Cryptantha fendleri*	0–11	–
	Texas croton	CRTE4	*Croton texensis*	0–11	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–11	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–11	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–11	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–11	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–11	–
	common starlily	LEMO4	*Leucocrinum montanum*	0–11	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0–11	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–11	–
Shrub/Vine					
3				84–252	
	fourwing saltbush	ATCA2	*Atriplex canescens*	28–67	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	11–45	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–45	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–45	–
	soapweed yucca	YUGL	*Yucca glauca*	0–28	–
	spreading buckwheat	EREF	*Eriogonum effusum*	11–28	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–27	–
	tree cholla	CYIM2	*Cylindropuntia imbricata*	0–13	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–11	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–11	–
	leadplant	AMCA6	*Amorpha canescens*	0–11	–

Animal community

Wildlife Interpretations

The combination of sandy soils and grasses, forbs, and shrubs on the ecological site, provide habitat for numerous wildlife species. Historic large grazers that influenced these communities were bison and pronghorn. Bison are currently found only as domestic livestock. Pronghorn, mule and white-tailed deer use this ecological site. 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 wetland or 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.

Grazing Interpretations

The following table lists suggested initial stocking rates for an animal unit (1,000 pound beef cow) under continuous grazing (yearlong 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. A properly stocked and applied prescribed grazing management system that provides adequate recovery periods following each grazing event, and 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 (total lbs./acre) and Stocking Rate (AUM/acre) are listed below:

Example: Reference Community (1,500) (0.41) :
1,500 lbs. per acres X 25% Harvest Efficiency = 375 lbs. forage demand for one month. 375 pounds per acre/ 912.5 demand per AUM = 0.41

Reference Community (1,500) (0.41)

1.2 Community (1,100) (0.30)

1.3 Community (900) (0.25)

2.1 Community (700) (0.19)

All stocking rates are estimates and an on-site inventory should be conducted prior to developing a grazing plan.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration and runoff potential for this site varies from high to moderate depending on soil hydrologic group and 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 opportunities for hiking, horseback riding, wildlife viewing including bird watching, and photography. Hunting for large and small game may be available in rural areas and on public land. The wide variety of flowering plants from spring until fall are aesthetically pleasing.

Wood products

No appreciable wood products are present on this site.

Other products

Site Development & Testing Plan:

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):
Updated, All “Required” items 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.

Increased *Bare Ground* Plant Community: It’s unknown whether this plant community can be restored within an 80 year timeframe, if ever. More discussion and analysis is needed at the next Approved level.

NOTE: Annual Production Table updated to reflect a higher total annual production per data review. Species Composition List (SCL) is the Legacy ESD with minor species addition. The SCL and APT will be re-visited at the Approved level.

Each Alternative State and Community:
Complete to Provisional level

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

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

Livestock Interpretations are updated to reflect Total Annual Production revisions in each plant community.

Wildlife interpretations and general narrative are updated. Interpretations for individual plant community states and phases are pending. Hydrology, Recreational Uses, Wood Products, Other Products, and Plant Preferences table, and Rangeland Health Reference Sheet are carried over from previously “Approved” ESD (2004).

Reference Sheet:

The Reference Sheet was previously approved in 2005.
Attribute #12 Expected Annual Production is updated.

LRU C Sandy 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)

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: NRI
Number of Records: 7
Sample Period: 2004-2013
State: CO
Counties: El Paso, Kiowa, Lincoln, Pueblo

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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Kirt Walstad, 9/07/2023

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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, Kimberly Diller, Daniel Nosal
Contact for lead author	Ben Berlinger, Area Rangeland Management Specialist, La Junta, CO,
Date	01/12/2005
Approved by	Rachel E. Murph, State Rangeland Management Specialist
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 broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers, usually following intense rainfall events.

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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):** Five (5) percent or less bare ground, with bare patches ranging from 3-5 inches in diameter. Prolonged drought, or wildfire events causes bare ground to increase upwards to 15-20 percent with bare patches ranging from 8-12 inches in diameter.

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

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

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

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating is anticipated to be 4-5 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 1-3 percent. Soils are very deep, light brownish gray, weak, fine crumb structure at a 0-4 inch depth.

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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 short bunchgrass >

    Sub-dominant: Warm-season tall bunchgrass > warm-season tall rhizomatous > cool-season mid bunch = warm-season mid bunch > shrubs >

    Other: Leguminous forbs = warm-season forbs > cool-season forbs > cool-season mid rhizomatous > warm-season mid rhizomatous

    Additional:

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

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14. **Average percent litter cover (%) and depth (in):** Litter cover during and following drought can range from 15-25 percent, and 5-15 percent following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 950 lbs./ac. low precipitation years; 1,500 lbs./ac. average precipitation years; 2,000 lbs./ac. high precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 300 – 600 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. Following fire or extended drought, cheatgrass, Russian thistle, and burningbush may invade 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.
