USDA Natural Resources Conservation Service

Ecological site R069XY033CO
Salt Flat

Last updated: 9/07/2023
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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.

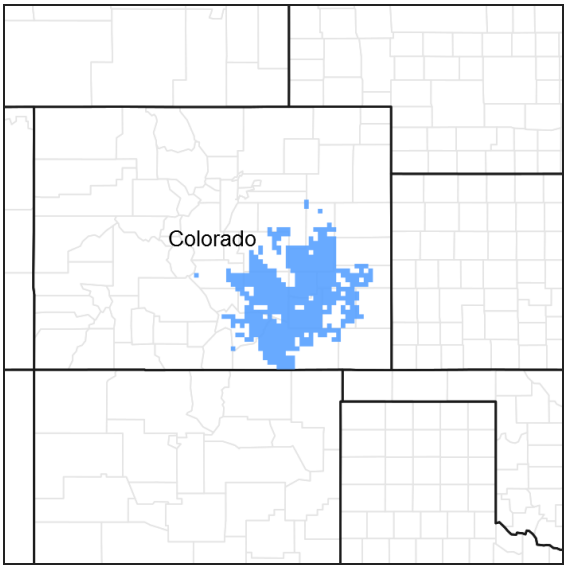


Figure 1. Mapped extent

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 Salt Flats Ecological Site, LRUs A and B, was developed from an earlier version of the Salt Flats Ecological Site (2005, revised in 2007). This earlier version of the Salt Flats Ecological Site (2005) was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Salt Flats 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 Salt Flat Ecological Site is a run-on site that has both calcium carbonate and other salts.

Associated sites

R069XY037CO	**Saline Overflow** Saline Overflow Ecological Site is commonly adjacent to the Salt Flats Ecological Site.
R069XY047CO	**Alkaline Plains** Alkaline Plains Ecological Site is upslope and commonly adjacent to the Salt Flats Ecological Site.
R069XY006CO	**Loamy Plains** The Loamy Plains Ecological Site is upslope and commonly adjacent to the Salt Flats Ecological Site.
R069XY030CO	**Salt Meadow** Salt Meadow Ecological Site is commonly adjacent to the Salt Flats Ecological Site.

Similar sites

R069XY030CO	**Salt Meadow** The Salt Meadow Ecological Site has an available water table resulting in redoximorphic features expressed as mottles in the upper horizons.
R069XY031CO	**Sandy Bottomland** The Sandy Bottomland Ecological Site has no salts.
R069XY032CO	**Sandy Salt Flat** The Sandy Salt Flat Ecological Site has a loamy sand surface texture.

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 river valleys.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Terrace (3) Drainageway (4) Fan remnant (5) Interfluve
Runoff class	Very low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	1,128–1,951 m
Slope	0–5%
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) ORDWAY 2 ENE [USC00056131], Ordway, CO
- (2) LA JUNTA 20 S [USC00054726], La Junta, CO
- (3) TACONY 13 SE [USC00058157], Boone, CO
- (4) EADS [USC00052446], Eads, CO
- (5) PUEBLO RSVR [USC00056765], Pueblo, CO
- (6) CHERAW 1 N [USC00051539], La Junta, CO
- (7) ORDWAY 21 N [USC00056136], Ordway, CO
- (8) ROCKY FORD 2 SE [USC00057167], Rocky Ford, CO
- (9) PUEBLO MEM AP [USW00093058], 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 or moderately well drained with moderately slow or slow permeability. The surface layer thickness ranges from 2 to 12 inches. The soil moisture regime is ustic aridic. The soil temperature regime is mesic.

Major soil series correlated to this ecological site include Arvada, Deertrail, and Limon (Beckton-mostly 69C).

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.

Table 4. Representative soil features

Parent material	(1) Alluvium–shale
Surface texture	(1) Silty clay (2) Clay loam (3) Clay (4) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately slow
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.11–21.34 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	2–16 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0–40
Soil reaction (1:1 water) (0-101.6cm)	7.4–9.6
Subsurface fragment volume <=3" (Depth not specified)	0%
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).

The site is dominated by warm-season mid bunchgrass (alkali sacaton). Secondary grasses are cool-season mid rhizomatous grass (western wheatgrass), warm-season short bunchgrass (blue grama) and warm-season mid rhizomatous grass (galleta). Minor grasses include warm-season short rhizomatous grass (inland saltgrass), cool-season mid bunchgrass (green needlegrass), and warm-season mid stoloniferous grasses (vine mesquite). Other minor grasses and grass-like plants that occur in small amounts are scratchgrass, bottlebrush squirreltail, ring muhly, annual barley, sixweeks fescue, and sun sedge. Various shrubs (fourwing saltbush, winterfat, rabbitbrush) and forbs (American vetch, leafy false goldenweed, scarlet globemallow, and twogrooved milkvetch) occur on the site.

Recurring seasonal herbivory without adequate recovery opportunity, and extended drought cause this site to degrade. Grasses such as alkali sacaton, western wheatgrass, green needlegrass, and vine mesquite decrease in frequency and production, as do key shrubs such as fourwing saltbush and winterfat. Blue grama and inland saltgrass increase. Forbs such as American vetch, purple prairie clover, and dotted gayfeather decrease. Slick spots (high sodium areas of bare ground) develop or increase. With continuous grazing, mid and tallgrasses can eventually be removed from the plant community. Blue grama and inland saltgrass become dominant and eventually form a sod-bound appearance. Over the long-term, continuous use without adequate recovery opportunity, or long term non-use and lack of fire will result in large amounts of bare ground and increased slick spots. Scratchgrass, annuals, and bare ground increase with long term continuous grazing. Species such as red threeawn, ring muhly, sand dropseed, black greasewood, broom snakeweed, and annuals also increase. 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

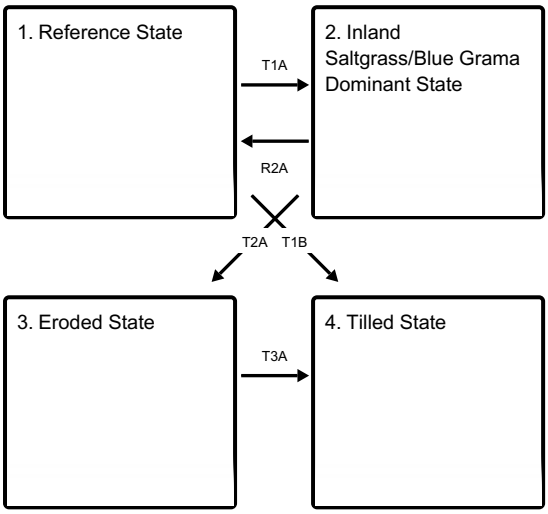
production is typically lower.

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 - Continuous, heavy grazing. Lack of fire.

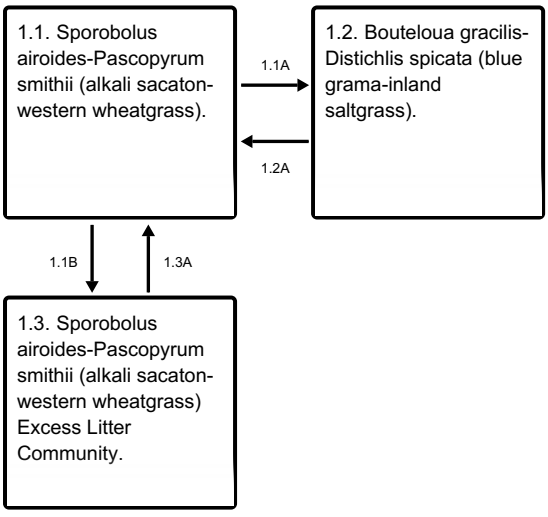
T1B - Mechanical tillage.

R2A - Prescribed grazing. Prescribed fire.

T2A - Heavy, continuous grazing. Lack of fire.

T3A - Mechanical tillage.

State 1 submodel, plant communities



1.1A - Continuous , heavy 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

2.1. Bouteloua gracilis-Distichlis spicata (saltgrass-blue grama) Community

State 3 submodel, plant communities

3.1. Muhlenbergia asperifolia-Muhlenbergia torreyi (scratchgrass-ring muhly)

State 4 submodel, plant communities

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

4.2. Seeded Plant Community

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, herbivory by large ungulates, and adequate recovery opportunity. 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 (alkali sacaton-western wheatgrass).

This is the interpretive plant community and is considered to be the reference plant community. This plant community evolved with herbivory by large herbivores, and is well suited for grazing. The plant community consists mainly of mid warm- and cool-season grasses. The principle dominant plants are alkali sacaton, western wheatgrass, and blue grama. Grasses of secondary importance are galleta, vine mesquite, green needlegrass, and inland saltgrass. Forbs and shrubs such as American vetch, leafy false goldenweed, fourwing saltbush, and winterfat are significant. The Reference Plant Community is about 75 to 90 percent grasses and grass-likes, 5 to 10 percent forbs, and 5 to 15 percent shrubs. This plant community is diverse, stable, and productive. Litter is properly distributed with very little movement off-site and natural plant mortality is very low. Slick spots (bare exposed areas, high in sodium) are an inherent characteristic occupying less than 3 percent of the community. This is a sustainable plant community in terms of soil stability, watershed function, and biological integrity. Total annual production ranges from 400 to 1400 pounds of air-dry vegetation per acre and averages 1000 pounds during an average year.

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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	347	925	1278
Shrub/Vine	50	112	174
Forb	50	84	118
Total	**447**	**1121**	**1570**

Figure 9. 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-Distichlis spicata (blue grama-inland saltgrass).

This community developed with heavy, season-long grazing with a lack of adequate recovery period between grazing events, and reduced fire frequency. Blue grama and inland saltgrass have increased but have not yet developed into a sodbound condition. Alkali sacaton has been reduced. Cool-season grasses such as western wheatgrass, vine mesquite, and green needlegrass have been reduced. American vetch has also decreased. Fourwing saltbush and winterfat are reduced in abundance. Forbs and shrubs such as scarlet globemallow, leafy false goldenweed, rabbitbrush, and broom snakeweed have increased. A measure of the above ground carbon has been lost due to decreases in forage and litter production. A reduction of rhizomatous wheatgrass, nitrogen fixing forbs, the shrub component, and increased warm-season short-grasses has begun to alter the biotic integrity of this community. Water and nutrient cycles are becoming impaired. Slick spots (bare high sodium areas) may be developing or increasing. Total annual production ranges from 200 to 700 pounds of air-dry vegetation per acre and averages 450 pounds during an average year.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. glabrata*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- saltgrass (*Distichlis spicata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Figure 10. Plant community growth curve (percent production by month). CO6903, Warm-season dominant, cool-season sub-dominant; MLRA-69; upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	15	35	25	15	5	0	0	0

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

This plant community occurs when grazing is removed for long periods of time in the absence of fire. Plant composition is similar to the reference plant community, however individual species production and frequency are

lower. Much of the nutrients are tied up in excessive litter. The semiarid environment and the absence of animal traffic to break down litter slow nutrient recycling. Aboveground litter also limits the sunlight reaching plant crowns. Many plants, especially bunchgrasses, die off. Thick litter and absence of grazing animals (animal impact) and fire reduce seed germination and establishment. In advanced stages, plant mortality increases and erosion may eventually occur if bare ground increases. Total annual production ranges from 300 to 1000 pounds of air-dry vegetation per acre.

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

Figure 11. Plant community growth curve (percent production by month). CO6902, Warm-season/cool-season co-dominant, excess litter; MLRA-69; upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	22	33	18	12	5	0	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing without adequate recovery opportunity and lack of fire shifts the reference plant community to the 1.2 community.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and absence of fire moves the reference plant community to the 1.3 community.

Pathway 1.2A
Community 1.2 to 1.1

Herbivory with adequate recovery opportunity and proper animal-forage balance, and normal fire frequency will return this plant community to the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

Herbivory with adequate recovery opportunity or fire can restore this plant community back to the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Inland Saltgrass/Blue Grama Dominant State

A significant amount of production and diversity have been lost when compared to the Reference Plant Community. Inland saltgrass and blue grama are now the dominant species and have developed into a sodbound condition. A major reduction or loss of cool-season grasses, the shrub component, and nitrogen fixing forbs has negatively impacted energy flow and nutrient cycling. Slick spots have increased in size and may be connected by developing flow paths. The plant community exhibits an impaired water cycle.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. glabrata*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- saltgrass (*Distichlis spicata*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 2.1
Bouteloua gracilis-Distichlis spicata (saltgrass-blue grama) Community

Inland saltgrass and blue grama are the dominant species and have developed into a sod bound condition. Slick spots have increased in size. Vine mesquite, green needlegrass, fourwing saltbush, and winterfat have been eliminated. Rabbitbrush, plains pricklypear, broom snakeweed, curlycup gumweed, poison suckleya, red threeawn, and scratchgrass have increased. Western wheatgrass and alkali sacaton may be present in remnant amounts where moisture conditions are favorable. A significant amount of production and diversity have been lost. Major reduction or loss of cool-season grasses, the shrub component, and nitrogen fixing forbs has negatively impacted energy flow and nutrient cycling. Slick spots have increased in size and may be connected by developing flow paths. It will take a long time to bring this plant community back to the Reference Community with management alone. Renovation (mechanical or chemical) is not recommended due to high salt content of the soil and saltgrass persistence. Total annual production ranges from 100 to 400 pounds of air-dry vegetation per acre and averages 200 pounds during an average year.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- saltgrass (*Distichlis spicata*), grass

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 3
Eroded State

In the Eroded State, most of the more palatable species have been greatly reduced or eliminated. Litter levels are extremely low and bare ground is increasing. Slick spots, soil crusting, reduced infiltration, and ponding are present. Flow paths are connected and plant pedestalling is evident. Organic matter and carbon reserves are greatly reduced. This community is not stable. Desertification is advanced.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. glabrata*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- scratchgrass (*Muhlenbergia asperifolia*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous

Community 3.1

Muhlenbergia asperifolia-Muhlenbergia torreyi (scratchgrass-ring muhly)

Blue grama and western wheatgrass have been removed. Some inland saltgrass persists in localized areas. Lower successional perennial and annual species that dominate the community are scratchgrass, red threeawn, ring muhly, and annual barley. Russian thistle, burningbush, and cheatgrass are common invading annuals. Litter levels are extremely low and bare ground is a major concern. Increased slick spots, soil crusting, reduced infiltration, and ponding are present. Flow paths are connected and plant pedestalling is evident. Organic matter and carbon reserves are greatly reduced. This community is not stable. Desertification is advanced. Total annual production ranges from 50 to 150 pounds of air-dry vegetation per acre.

Dominant plant species

- scratchgrass (*Muhlenbergia asperifolia*), grass
- ring muhly (*Muhlenbergia torreyi*), grass

State 4
Tilled State

This state is defined by having undergone mechanical tillage and subsequently abandoned. The difference in management following abandonment creates two separate vegetation communities that are highly variable. Infiltration, runoff, and soil erosion varies 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

- scratchgrass (*Muhlenbergia asperifolia*), grass
- cheatgrass (*Bromus tectorum*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

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

Go-back land is created when any plant community 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 plow pan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations and erosion processes may be active. Go-back land evolves 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 persists from 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 longer. Inland saltgrass has the ability to withstand tillage and persists. Eventually western wheatgrass, blue grama, and other natives become reestablished.

Dominant plant species

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

Community 4.2
Seeded Plant Community

The Go-Back Land Plant Community (or any plant community), which has been degraded or tilled and seeded to adapted native plant species is considered to be the Seeded Plant Community. A seed mixture of grasses, forbs, and shrubs can be used to accomplish various management objectives. Revegetation practices are extremely

difficult and costly to install due to severe soil and climatic limitations.

Transition T1A
State 1 to 2

Continuous, heavy grazing without an adequate recovery period following each grazing event and lack of fire shifts this state to the Inland Saltgrass, Blue Grama State.

Transition T1B
State 1 to 4

Tilled or farmed (sodbusted) and abandoned cropland are the drivers of this transition. An ecological threshold has been crossed, resulting in the elimination all native vegetation. The soil organic matter is reduced, the soil structure degraded, and a plow pan or compacted layer forms.

Restoration pathway R2A
State 2 to 1

Long term prescribed grazing with adequate recovery periods following each grazing occurrence, proper stocking rate, and prescribed fire move this state to the Reference State.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

Heavy, continuous grazing without adequate recovery periods between grazing events and lack of fire shift this plant community across an ecological threshold to the Eroded State.

Transition T3A
State 3 to 4

Tilled or farmed (sodbusted) and abandoned cropland are the drivers of this transition. An ecological threshold has been crossed, resulting in the elimination all native vegetation. The soil organic matter is reduced, the soil structure degraded, and a plow pan or compacted layer forms.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				841–1009	
	alkali sacaton	SPAI	*Sporobolus airoides*	336–448	–
	western wheatgrass	PASM	*Pascopyrum smithii*	168–224	–
	blue grama	BOGR2	*Bouteloua gracilis*	112–168	–
	James' galleta	PLJA	*Pleuraphis jamesii*	56–112	–
	saltgrass	DISP	*Distichlis spicata*	34–56	–
	green needlegrass	NAVI4	*Nassella viridula*	22–56	–
	vine mesquite	PAOB	*Panicum obtusum*	11–56	–

	scratchgrass	MUAS	*Muhlenbergia asperifolia*	11–34	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	11–34	–
	Grass, perennial	2GP	*Grass, perennial*	11–34	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–34	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–22	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–22	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–11	–
	little barley	HOPU	*Hordeum pusillum*	0–11	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–11	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–11	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–11	–
Forb					
2				56–112	
	Forb, perennial	2FP	*Forb, perennial*	11–34	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–22	–
	American vetch	VIAM	*Vicia americana*	11–22	–
	leafy false goldenweed	OOFOF	*Oonopsis foliosa var. foliosa*	11–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–22	–
	desert princesplume	STPIP	*Stanleya pinnata var. pinnata*	0–11	–
	poison suckleya	SUSU2	*Suckleya suckleyana*	0–11	–
	broadleaf milkweed	ASLA4	*Asclepias latifolia*	0–11	–
	scrambled eggs	COAU2	*Corydalis aurea*	0–11	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–11	–
	fetid marigold	DYPA	*Dyssodia papposa*	0–11	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–11	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–11	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–11	–
	lacy tansyaster	MAPIP4	*Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida*	0–11	–
Shrub/Vine					
3				56–168	
	fourwing saltbush	ATCA2	*Atriplex canescens*	56–112	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–34	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	0–22	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	11–22	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–11	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–11	–

	James' seaheath	FRJA	*Frankenia jamesii*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–

Animal community

WILDLIFE INTERPRETATIONS:
This ecological site may be wetter than some others in MLRA 69, potentially providing breeding habitat for amphibian species that is missing on drier ecological sites. Even with the wetter conditions, this site is not expected to support a fishery or permanent water bodies. Some species may use this area for reproductive functions or for other phases of their lives then move into the grassland once those needs are met. Historic large grazers that influenced these plant communities were bison, elk, and pronghorn. Changes to the plant community 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. 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 are currently found only as domestic livestock.

Reference Plant Community:
The loamy soils and landscape position of this ecological site may discourage some burrowing amphibians, reptiles, and mammals found on adjacent upland sites from using this site. Woodhouse’s toad is expected on this site along with reptiles such as bullsnake and glossy snake. The structural diversity in the plant community found on the reference plant community is attractive to a number of bird species such as Cassin’s and Brewer’s sparrow and ferruginous and Swainson’s hawks. Mammals that may use the site for foraging or cover include jackrabbit, badger, coyote, swift fox, and pocket mouse.

1.2 Community:
Most wildlife found in the reference plant community are expected in this plant community. The reduction in mid and tallgrasses and the increase in shorter species may attract mountain plover, horned lark, long-billed curlew, and black-tailed jackrabbit.

1.3, 2.1, 4.1 Communities:
The reduction of shrubs and taller grasses in these plant communities results in a shift of bird species away from the reference plant community birds. Use by species such as mountain plover, horned lark, and long-billed curlew increases. Mammals, reptiles, and amphibians from the reference plant community continue to use these communities.

3.1 Community:
The presence of tall species such as burningbush, Russian thistle, rabbitbrush, snakeweed, and others in this community may limit use by mountain plover and other species requiring unobstructed visual distances.

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 - (1000) (0.27)

1.2 Community - (450) (0.12)

1.3 Community - (200) (0.05)

These stocking rates are guidelines and stocking rates for conservation planning should stem from on-site observations.

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

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups B, C, and D. Infiltration is moderate to slow. Runoff potential varies from moderate to high depending on the soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

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.

Action Item: Need to find supporting data for The Sand Sagebrush and Grass Dominant Plant Communities. Further group discussion is needed.

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).

Rangeland Health Reference Sheet:
From “Previously Approved” ESD (2004). This needs to be updated at the “Approved” level.

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

Other information

Relationship to Other 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 Association LandtypeLandtype Phase.

Inventory data references

NRI: references to Natural Resource Inventory data
Information presented here has been derived from data collection on private and federal lands using:
• Double Sampling (clipped 2 of 5 plots)*
• Rangeland Health (Pellant et al., 2005)
• Soil Stability (Pellant et al., 2005)
• Line Point Intercept : Foliar canopy, basal cover (Forb, Graminoid, Shrub, subshrub, Lichen, Moss, Rock fragments, bare ground, % Litter) (Herrick et al., 2005)
• Soil pedon descriptions collected on site (Schoeneberger et al., 2012)

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

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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.

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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	
Date	01/12/2005
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** None where vegetation is continuous. Slick spots (high sodium areas) can pond water and concentrate overland flow. Flow paths should be short in length and disconnected.

3. **Number and height of erosional pedestals or terracettes:** None to slight depending on flow coming from slick spots.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** The site has 5-10 percent bare ground or less. Bare areas can range from 3-5 inches around bunch grasses and up to 1-2 feet when slick spots exist. Bare ground includes slick spots, which are inherent to this site. Extended drought may cause bare ground to increase up to 15 percent (includes slick spots).

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** None to minimal.

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 under canopy, and 3-4 on slick spots. On-site verification is needed.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** SOM ranges from 1-2 percent. Soils are deep, well drained, strongly sodic, saline, and very strongly alkaline. The A-horizon color is light brownish-gray at 0-4 inches in depth. The structure is weak, very fine granular.

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 >

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

Other: forbs = warm-season mid rhizomatous > warm-season short rhizomatous

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** None to minimal. Slight mortality and decadence can be observed on warm-season bunch grasses.

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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):** 400 lbs./ac. low precipitation years; 1000 lbs./ac. average precipitation years; 1400 lbs./ac. high precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 250 – 400 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. Russian thistle, burninbush, or other non-native alkali tolerant species 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 reduces reproductive capability.
