USDA Natural Resources
Conservation Service

Ecological site R069XY031CO
Sandy Bottomland

Last updated: 12/09/2024
Accessed: 05/12/2025

General information

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

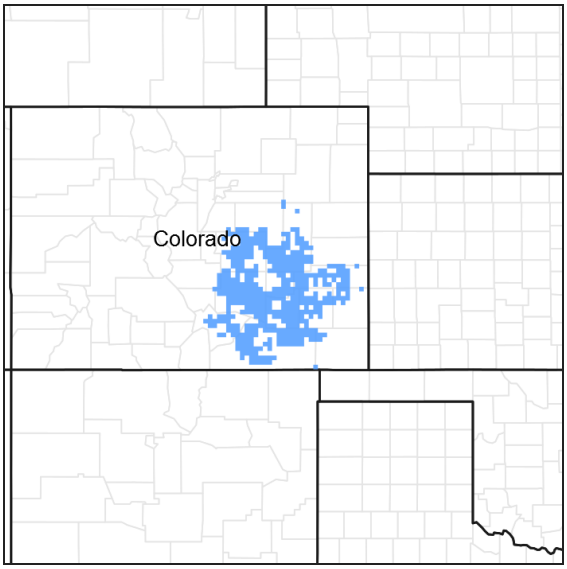


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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 Sandy Bottomland ecological site, LRUs A and B, was developed from an earlier version of the Sandy Bottomland ecological site (2005, revised in 2007). This earlier version of the Sandy Bottomland ecological site (2005) was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Sandy Bottomland 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 Sandy Bottomland Ecological Site is a run-on site that is not a closed depression and has no salts associated with it.

Associated sites

R069XY019CO	**Deep Sand** The Deep Sand Ecological Site is located upslope and commonly adjacent to the Sandy Bottomland Ecological Site.
R069XY006CO	**Loamy Plains** The Loamy Plains Ecological Site is located upslope and commonly adjacent to the Sandy Bottomland Ecological Site.
R069XY026CO	**Sandy Plains** The Sandy Plains Ecological Site is located upslope and commonly adjacent to the Sandy Bottomland Ecological Site.

Similar sites

R069XY019CO	**Deep Sand** The Deep Sand Ecological Site is a run-off site.

Table 1. Dominant plant species

Tree	(1) *Populus deltoides*
Shrub	(1) *Amorpha canescens* (2) *Prunus pumila var. besseyi*
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs in river valleys.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Flood-plain step
Runoff class	Very low to low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	1,067–1,798 m
Slope	0–2%
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) TACONY 13 SE [USC00058157], Boone, CO
- (2) LA JUNTA 20 S [USC00054726], La Junta, CO
- (3) EADS [USC00052446], Eads, CO

- (4) ORDWAY 21 N [USC00056136], Ordway, CO
- (5) PUEBLO RSVR [USC00056765], Pueblo, CO
- (6) PUEBLO MEM AP [USW00093058], Pueblo, CO
- (7) CHERAW 1 N [USC00051539], La Junta, CO
- (8) ORDWAY 2 ENE [USC00056131], Ordway, CO
- (9) ROCKY FORD 2 SE [USC00057167], Rocky Ford, 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 somewhat excessively or excessively drained with moderate to very rapid permeability. The surface layer thickness ranges from 2 to 11 inches. The soil moisture regime is ustic aridic. The soil temperature regime is mesic. Parent material originated from mixed sources.
Major soil series correlated to this ecological site include Bankard, Ellicott, and Glenberg.

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
Surface texture	(1) Loam (2) Sandy loam (3) Loamy sand (4) Loamy coarse sand (5) Sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderate to very rapid
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.05–16.26 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ecological site description, 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 predominantly tall warm-season bunchgrasses (sand bluestem, switchgrass, Indiangrass). Secondary grasses include tall warm-season rhizomatous grass (prairie sandreed), mid cool-season bunchgrasses (needle and thread, Indian ricegrass, Canada wildrye), and mid warm-season grasses (little bluestem, sideoats grama, sand dropseed, and blowout grass). Various forbs and shrubs occur on the site and are subdominant in composition. Short warm-season grasses such as blue grama and hairy grama occur on the site and are subdominant. Minor grasses and grass-likes are western wheatgrass, prairie junegrass, sand paspalum, and flatsedge.

Continuous, heavy grazing without adequate recovery opportunities following each grazing event during the growing season causes major warm-season grasses such as sand bluestem, prairie sandreed, Indiangrass, and switchgrass to decrease in frequency and production. Needle and thread increase with cool-season deferment. Key forbs and shrubs such as purple prairie clover, western sandcherry, and leadplant also decrease . Red threeawn, annuals, and bare ground increase with long term, continuous grazing, heavy, continuous grazing, or excessive defoliation. Years of non-use and lack of fire causes litter to accumulate and reduce plant density.

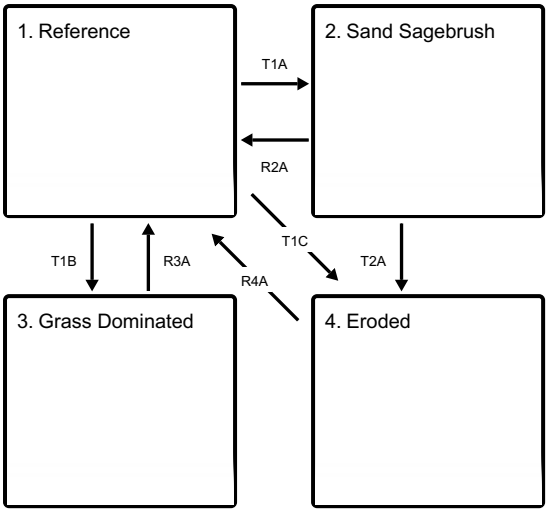
Drier and warmer climatic conditions exist in the central portion of MLRA-69. This area includes the eastern half of Pueblo county, northern Otero, extreme northwestern Bent, western edge of Kiowa, southern edge of Lincoln and all of Crowley County. These conditions are primarily caused by a rain shadow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

Southeastern Colorado was strongly affected by extended drought conditions in the “Dust Bowl” period of the 1930s, with recurrent drought cycles in the 1950s and 1970s. Extreme to exceptional drought conditions have re-visited the area from 2002 to 2012, with brief interludes of near normal to normal precipitation years. “During periods of drought, high winds give rise to the dust storms which are especially characteristic of the southeastern plains (WRCC, 2022).” Recent drought events have increased mortality of blue grama upwards of 80 percent in some locales. The long-term effects of these latest drought years have yet to be determined.

Growth of native cool-season plants begins about April 15 and continues to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occurs in September and October in most years, depending on moisture. For detailed information, visit the Western Regional Climate Center website at https://wrcc.dri.edu/.

State and transition model

Ecosystem states



T1A - Heavy, continuous grazing. Lack of fire.

T1B - Chemical brush management. Prescribed grazing.

T1C - Non-use. Lack of fire.

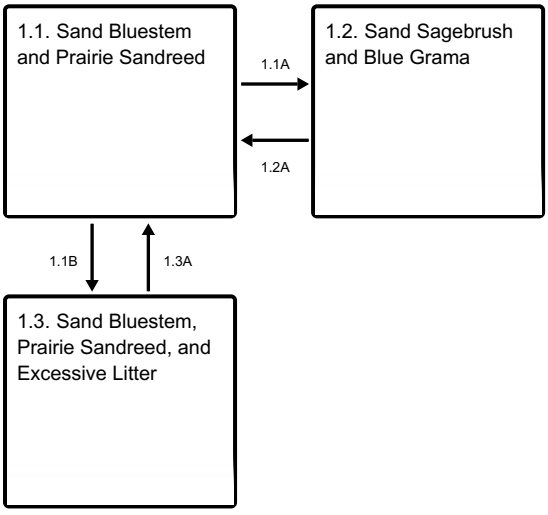
R2A - Prescribed grazing. Prescribed fire.

T2A - Heavy, continuous grazing. Chemical brush management.

R3A - Prescribed grazing.

R4A - Prescribed grazing. Prescribed fire.

State 1 submodel, plant communities



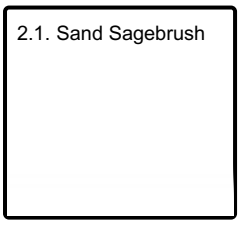
1.1A - Heavy, season-long grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Sand Dropseed and Purple Threeawn

State 4 submodel, plant communities

4.1. Bare Ground, Sand Dropseed and Purple Threeawn

State 1
Reference

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, grazing by large ungulates, and adequate recovery periods. High production of perennial grasses and extensive soil cover allow for increased soil moisture retention, vegetative production, and overall soil quality.

Dominant plant species

- cottonwood (*Populus*), tree
- leadplant (*Amorpha canescens*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- sand sagebrush (*Artemisia filifolia*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Sand Bluestem and Prairie Sandreed

This is the interpretive plant community and is considered to be the reference plant community. This plant community evolved with grazing by large herbivores, is well suited for grazing by domestic livestock, and can be found on areas that are properly managed with grazing. The reference plant community consists chiefly of tall warm-season grasses. Principle dominants are sand bluestem, prairie sandreed, switchgrass, and yellow Indiangrass. Sub-dominant grasses include needle and thread and blue grama. Significant forbs and shrubs are silky prairie clover, lemon scurfpea, dotted gayfeather, leadplant, and western sandcherry. The potential vegetation is about 70 to 85 percent grasses or grass-like plants, 10 to 15 percent forbs and 5 to 15 percent shrubs. Prescribed grazing that allows for adequate recovery opportunity after each grazing event, and proper stocking will maintain this plant community. Continual or repeated spring grazing and summer deferment reduces the cool-season component of this plant community and increases the warm-season component. Spring deferment and continual or repeated summer grazing increases the cool-season component and decreases the warm-season component. This plant community is resistant to many disturbances with the exception of heavy, continuous grazing, plowing, uncontrolled fire events, and urban 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 1000 to 2200 pounds of air-dry vegetation per acre per year depending on the weather conditions and averages 1600 pounds.

Dominant plant species

- cottonwood (*Populus*), tree
- (*Amaranthus acutilobus*), shrub

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

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	863	1390	1905
Tree	–	112	336
Shrub/Vine	84	179	280
Forb	174	224	280
Total	**1121**	**1905**	**2801**

Figure 9. 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
Sand Sagebrush and Blue Grama

This plant community evolves with heavy, continuous grazing without adequate recovery opportunity between grazing events during the growing season and lack of fire. Sand bluestem, yellow Indiangrass, switchgrass, prairie sandreed, western sandcherry, and leadplant have decreased in frequency and production. Blue grama and sand sagebrush have increased and dominate the community. Sand dropseed, red threeawn, lemon scurfpea, hairy goldaster, Texas croton, Cuman ragweed, tenpetal blazingstar, lupine, loco, and groundplum milkvetch have also increased. This plant community is relatively stable but at risk of losing some of the tallgrass species, palatable forbs, and shrubs. The reduction of tallgrass species, nitrogen-fixing forbs, key shrub components, and the increase in warm-season shortgrass species has altered the biotic integrity of this plant community. Nutrient cycle, water cycle, and energy flow may be impaired. The production varies from 400 to 1100 pounds of air-dry vegetation per acre per year depending on the weather conditions and amount of mid and tallgrass species still present. Production averages 850 pounds of air-dry vegetation per acre per year.

Dominant plant species

- cottonwood (*Populus*), tree
- sand sagebrush (*Artemisia filifolia*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- lemon scurfpea (*Psoralidium lanceolatum*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous

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 1.3
Sand Bluestem, Prairie Sandreed, and Excessive Litter

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, in time, individual species production and

frequency is lower. Many of the nutrients are tied up in excessive litter. The semiarid environment and the absence of animal impact to break down litter slows nutrient cycling. Aboveground litter also limits sunlight from reaching plant crowns. Many plants, especially bunchgrasses die off. Thick litter and absence of grazing and fire reduce seed germination and establishment. This plant community changes rapidly with prescribed grazing or prescribed fire. Long-term non-use (greater than 20 years), will cause plant decadence and mortality to increase and erosion (blowouts, wind scoured areas) occurs as bare ground increases. This plant community is uncommon in the natural range of variability. Production can vary from 200 to 1000 pounds of air-dry vegetation per acre per year depending on weather conditions and the plants that are present.

Dominant plant species

- cottonwood (*Populus*), tree
- leadplant (*Amorpha canescens*), shrub
- western sandcherry (*Prunus pumila var. besseyi*), shrub
- sand bluestem (*Andropogon hallii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass

Figure 11. 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

Heavy, season-long grazing without adequate recovery opportunity between grazing events and lack of fire moves this plant community toward the 1.2 community.

Pathway 1.1B
Community 1.1 to 1.3

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

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that allows adequate recovery opportunity between each grazing event, proper stocking, and prescribed fire move this plant community back to the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

Grazing that allows for adequate recovery periods following each grazing event and prescribed burning shift this plant community toward the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Sand Sagebrush

The Sand Sagebrush state is dominated almost entirely by sand sagebrush with little understory species present. Favorable species that remain are few and are protected by the sagebrush. The state is characterized by a lack of resilience and resistance to disturbances. Site stability and hydrologic function along with biological diversity are greatly reduced.

Dominant plant species

- cottonwood (*Populus*), tree
- sand sagebrush (*Artemisia filifolia*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 2.1
Sand Sagebrush

This plant community is dominated almost entirely by sand sagebrush with little understory species present. Favorable species that remain are few and are protected by the sagebrush. Species diversity and production have dropped substantially. Litter levels are low. Watershed function and carbon sequestration are greatly reduced. Nutrient cycle and energy flow has been impaired. Bare areas can form or enlarge rather easily leading to possible blowouts or wind scoured areas. Production can vary from 50 to 1000 pounds of air-dry vegetation (primarily sand sagebrush) per acre per year depending on the amount of sand sage present and the weather conditions. An average of 500 pounds can be expected, primarily from sand sagebrush.

Dominant plant species

- cottonwood (*Populus*), tree
- sand sagebrush (*Artemisia filifolia*), shrub
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- blue grama (*Bouteloua gracilis*), grass

Figure 12. 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
Grass Dominated

The Grass Dominated state consists primarily of mid- and short-grasses, and It is a result of chemical brush management and prescribed grazing. Plant diversity has been significantly decreased. Nutrient and water cycles are significantly impaired. The state is resistant to change but lacks resilience to disturbances.

Dominant plant species

- cottonwood (*Populus*), tree
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 3.1
Sand Dropseed and Purple Threeawn

This plant community develops with chemical brush management and prescribed grazing. The brush management

controls the sand sagebrush removing most if not all of the other forbs and shrubs. The community can vary from predominately sand dropseed, purple threeawn, and blue grama to nearly pure stands of sand dropseed. There is little plant diversity since most of the forbs and shrubs have been eliminated by brush control efforts. Nutrient and water cycling are impaired due to lack of deep-rooted shrubs, forbs, and native nitrogen fixing legumes. Erosion can vary, depending on production and density of grasses. Production can vary from 300 to 1400 pounds of air-dry vegetation per acre per year depending on the grass species present, their density, and weather conditions.

Dominant plant species

- cottonwood (*Populus*), tree
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- blue grama (*Bouteloua gracilis*), grass

Figure 13. 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

State 4
Eroded

In the Eroded state, production and litter levels are extremely low. The plant community is dominated by less palatable grasses, forbs, and shrubs and the nutrient cycle, water cycle, and energy flow are greatly reduced. Erosion is occurring. Pedestalling is evident. Organic matter and carbon reserves are greatly reduced. Desertification is advanced, and blowouts may develop.

Dominant plant species

- cottonwood (*Populus*), tree
- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass

Community 4.1
Bare Ground, Sand Dropseed and Purple Threeawn

This community is composed of purple threeawn, sand dropseed, sandhill muhly, lemon scurfpea, wormwood, sixweeks fescue, and cheatgrass. More bare ground is apparent and small blowouts can be present due to accelerated wind scour. Production and litter levels are extremely low. The nutrient cycle, water cycle, and energy flow are greatly reduced. Erosion is occurring. Pedestalling is evident. Organic matter and carbon reserves are greatly reduced. Production can vary greatly (50 to 300 pounds of air-dry vegetation per acre per year) depending on the plant density and weather conditions in any year.

Dominant plant species

- cottonwood (*Populus*), tree
- sand sagebrush (*Artemisia filifolia*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- cheatgrass (*Bromus tectorum*), grass

Transition T1A
State 1 to 2

Heavy, continuous grazing, particularly when combined with chemical brush management eliminates tallgrasses, palatable forbs, and shrubs, and moves this plant community across an ecological threshold to the Sand Sagebrush State. Lack of fire accelerates this process.

Transition T1B
State 1 to 3

Chemical brush management and prescribed grazing move this plant community across an ecological threshold to the Grass Dominated State.

Transition T1C
State 1 to 4

Long-term non-use and lack of fire move the Reference State across an ecological threshold to the Eroded State.

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing and prescribed fire move this state back to the Reference State.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 4

Heavy, continuous grazing without providing adequate recovery opportunity and chemical brush management shift this state to the Eroded State.

Restoration pathway R3A
State 3 to 1

Long-term prescribed grazing moves the Grass Dominated State to the Reference State. This transition can take greater than 20 years to achieve.

Conservation practices

Prescribed Grazing

Restoration pathway R4A
State 4 to 1

Long-term prescribed grazing moves the Eroded State to the Reference State. This transition may take greater than 20 years to accomplish. Prescribed fire accelerates this process.

Conservation practices

Prescribed Burning
Prescribed Grazing

Additional community tables

Table 6. Community 1.1 plant community composition

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	(Kg/Hectare)	(%)
Tree					
1	**Deciduous Tree**			0–224	
	eastern cottonwood	PODE3	*Populus deltoides*	0–112	–
Grass/Grasslike					
1				1255–1524	
	sand bluestem	ANHA	*Andropogon hallii*	359–538	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	269–359	–
	switchgrass	PAVI2	*Panicum virgatum*	179–359	–
	Indiangrass	SONU2	*Sorghastrum nutans*	90–179	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	90–123	–
	little bluestem	SCSC	*Schizachyrium scoparium*	56–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	56–123	–
	Grass, perennial	2GP	*Grass, perennial*	17–90	–
	Canada wildrye	ELCA4	*Elymus canadensis*	17–56	–
	blowout grass	REFL	*Redfieldia flexuosa*	17–56	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	17–56	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	17–56	–
	western wheatgrass	PASM	*Pascopyrum smithii*	17–34	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	17–34	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	17–34	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	17–34	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0–34	–
	saltgrass	DISP	*Distichlis spicata*	0–17	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–17	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–17	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–17	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–17	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–17	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–17	–
Forb					
2				179–269	
	Forb, perennial	2FP	*Forb, perennial*	17–56	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	17–34	–
	silky prairie clover	DAVI	*Dalea villosa*	17–34	–
	othake	PASP	*Palafoxia sphacelata*	0–34	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	17–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0–17	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–17	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–17	–
	gilia beardtongue	PEAM	*Penstemon ambiguus*	0–17	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	0–17	–

	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0–17	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–17	–
	stiff sunflower	HEPAP2	*Helianthus pauciflorus ssp. pauciflorus*	0–17	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–17	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–17	–
	common starlily	LEMO4	*Leucocrinum montanum*	0–17	–
	dotted blazing star	LIPU	*Liatris punctata*	0–17	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0–17	–
	Colorado four o'clock	MIMU	*Mirabilis multiflora*	0–17	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0–17	–
	prostrate pigweed	AMAL	*Amaranthus albus*	0–17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–17	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–17	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–17	–
	painted milkvetch	ASCEF	*Astragalus ceramicus var. filifolius*	0–17	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–17	–
	Texas croton	CRTE4	*Croton texensis*	0–17	–
	white prairie clover	DACA7	*Dalea candida*	0–17	–
	nineanther prairie clover	DAEN	*Dalea enneandra*	0–17	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–17	–
Shrub/Vine					
3				90–269	
	leadplant	AMCA6	*Amorpha canescens*	34–90	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	17–90	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	34–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	17–56	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–34	–
	soapweed yucca	YUGL	*Yucca glauca*	0–34	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–17	–
	prairie rose	ROAR3	*Rosa arkansana*	0–17	–
	spreading buckwheat	EREF	*Eriogonum effusum*	0–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–

Animal community

WILDLIFE INTERPRETATIONS:

This ecological site is wetter than many others in MLRA 69, potentially providing breeding habitat for amphibian species that are not present 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 in the area are domestic livestock.

Reference Plant Community:
The structural diversity in the plant community found on the reference plant community is attractive to a number of wildlife species. Common bird species expected include Cassin's and Brewer's sparrow, lark bunting, western meadowlark, and ferruginous and Swainson's hawks. The combination of mid and tallgrasses and shrubs provides habitat for lesser prairie chicken in the eastern parts of this site. Scaled quail may also use this site. White-tailed and black-tailed jackrabbit, badger, pronghorn, coyote, swift fox, plains pocket gopher, long-tailed weasel, and several species of mice are mammals that commonly use this plant community. Reptiles using this community include western rattlesnake, bullsnake, western hognose snake, racer, western box turtle, and six-lined racerunner.

Plant Community 1.2:
All reference plant community species are expected in this plant community, however, the loss of some of the vegetative structural diversity makes it less attractive to many species.

Plant Community 1.3:
All wildlife found in the reference plant community are expected in this plant community. However, the wildlife species are shifting toward the typical shortgrass prairie species such as horned lark, killdeer, long-billed curlew, and mountain plover.

Plant Community 2.1:
Species typically associated with sand sagebrush communities are pronghorn, scaled quail, lesser and greater prairie chicken, Eastern fence lizard, and mule deer.

Plant Community 3.1:
This plant community can be quite variable. The wildlife species expected here would be those listed for the plant community most similar to this community.

Plant Community 4.1:
The presence of tall species such as kochia, pigweed, sunflower, Russian thistle, and others in this community limit use by mountain plover, prairie dogs, and other species requiring unobstructed visual distances. Most reference plant community species are not expected here in large numbers.

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 Community - (1600) (0.44)

1.2 Plant Community - (850) (0.23)

2.1 Plant Community - (500) (0.14)

These stocking rates are guidelines and an on-site determination is required before developing a grazing plan.

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration potential is high to moderate. Runoff potential for this site varies from moderate to low 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 hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan

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

Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant Community, Species Composition List, Annual Production Table):

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

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

- Complete to Provisional level. Narrative for each state/community has been updated.

- Need supporting data for the 2.0 Sand Sagebrush and 3.0 Grass Dominant States and Plant Communities.

- Need to determine the presence and amount of cottonwoods on this site. The role of fire, flooding frequency, etc. on cottonwood stands.

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

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

There are only seven Inventory Data References (NRI). These are in lower condition (<25 percent). More field data collection is needed to support this site concept.

Animal Community
Wildlife Interpretations:
First “overview” paragraph retained (pending peer review-Patty K 8/12/16)
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.

Note: Sandy Bottomland ESD does not occur in LRU C.

“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.

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).

Contributors

Doug Whisenhunt Ecological Site Specialist NRCS
Laura L. Craven MLRA Project Leader NRCS
Ben P. Berlinger Rangeland Management Specialist NRCS Retired
Kimberly A. Diller Ecological Site Specialist NRCS

Approval

Kirt Walstad, 12/09/2024

Acknowledgments

Project Staff:
Kimberly Diller, Ecological Site Specialist, NRCS MLRA, Pueblo SSO
Laura Craven, MLRA 69 Soil Survey Leader, NRCS MLRA Pueblo SSO
Amber Wyndham, Soil Scientist, NRCS MLRA Pueblo SSO
Ben Berlinger, Rangeland Management Specialist, Retired NRCS La Junta, CO

Program Support:
Rachel Murph, NRCS State Rangeland Management Specialist
David Kraft, NRCS MLRA Ecological Site Specialist-QA (acting), Emporia, KS
Chad Remley, Regional Director, N. Great Plains Soil Survey, Salina, KS
B.J. Shoup, State Soil Scientist, Denver
Eugene Backhaus, State Resource Conservationist, Denver
Chanda Garcia, NRCS State Biologist, NRCS, Denver CO
Patty Knupp, Area 3 Biologist, NRCS, Pueblo CO

Partners/Contributors:
James Kulbeth, Natural Resources Specialist, Department of the Army, Fort Carson, CO
John Lamman, Rangeland Management Specialist, BLM, Cañon City, CO
Steve Olson, Botanist, USFS, Pueblo, CO
Renee Rondeau, Ecologist, CO Natural Heritage Program, Hesperus, CO
Terri Schultz, The Nature Conservancy, Ft. Collins, CO
John Valentine, District Manager, CO State Land Board, Pueblo, CO

Those involved in developing earlier versions of this site description include: Ben Berlinger, rangeland management specialist (RMS); Scott Woodall, RMS; Lee Neve, soil scientist; Julie Elliott, RMS; Terri Skadeland, Colorado State biologist; and Herman Garcia, Colorado State RMS.

Rangeland health reference sheet

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

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

Indicators

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

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.

3. **Number and height of erosional pedestals or terracettes:** Pedestalled plants caused by wind erosion are minor. Terracettes are nonexistent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** The site has 3 percent or less bare ground, with bare patches ranging from 3-5 inches in diameter. Prolonged drought or wildfire events cause bare ground to increase upwards to 10-15 percent with bare patches ranging from 8-12 inches in diameter.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** Minor wind scouring naturally occurs on knolls. An increase in wind erosion can result from disturbances, such as wildfire, extended drought, and rodent activity.

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating is anticipated to be 4-5 in the interspaces at soil surface. Soil surface is stabilized by decomposing organic matter. Biological crusts (lichens, algae, cyanobacteria, mosses) may be present on or just below 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, pale brown, weak coarse granular to crumbly structure, at a 0-5 inch depth.

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Warm-season tall bunchgrass >>

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

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

    Additional:

---

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.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover during and following drought can range from 20-30%, and 5-15 percent following wildfire.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1000 lbs. /ac. low precipitation years; 1600 lbs. /ac. average precipitation years; 2200 lbs. /ac. high precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 350 – 700 lbs./ac.

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Invasive plants should not occur in reference plant community. Following fire or extended drought, Russian thistle, kochia, Rocky Mountain beeplant may invade assuming a seed source is available.

---

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