USDA Natural Resources
Conservation Service

Ecological site R069XY030CO
Salt Meadow

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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.

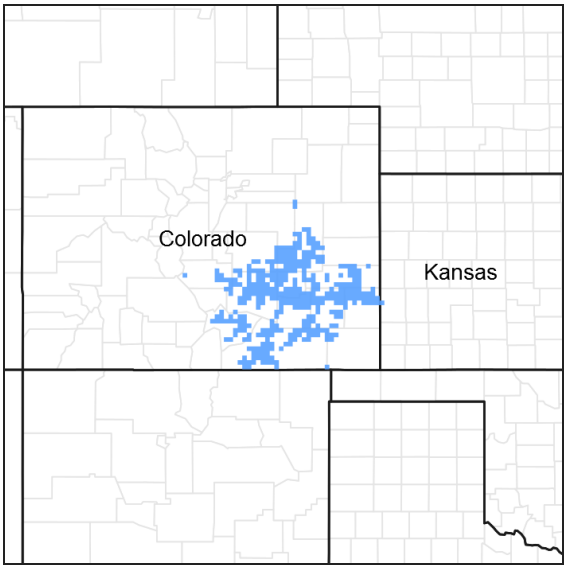


Figure 1. Mapped extent

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 (1930’s) included SE Colorado, which is periodically affected by severe drought. Dust storms may form during drought years, in windy periods. Annual precipitation is 10 to 16 inches. Precipitation occurs mostly during the growing season, often during rapidly developing thunderstorms. Mean annual air temperature (MAAT) is 48 to 52 degrees Fahrenheit. Summer temperatures may exceed 100 degrees Fahrenheit. Evapotranspiration rates are high. Winter temperatures may be subzero. Snowfall varies from 20 to 40 inches per year. Blizzards can form quickly.

LRU notes

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

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

The Salt Meadow ecological site, LRUs A and B, was developed from an earlier version of the Salt Meadow ecological site (2005, revised in 2007). This earlier version of the Salt Meadow ESD (2005) was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Salt Meadow 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.

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).

Ecological site concept

The Salt Meadow ecological site is in a run-on landscape position and has redoximorphic features that are expressed as gray or red mottles in the soil profile. It also has calcium carbonate and other salts.

Associated sites

R069XY031CO	**Sandy Bottomland** Sandy Bottomland Ecological Site is commonly adjacent to the Salt Meadow Ecological Site.
R069XY006CO	**Loamy Plains** Loamy Plains Ecological Site is commonly adjacent to the Salt Meadow Ecological Site.
R069XY033CO	**Salt Flat** Salt Flat Ecological Site is commonly adjacent to the Salt Meadow Ecological Site.

Similar sites

R069XY033CO	**Salt Flat** Salt Flats Ecological Sites are not directly associated with the water table and have no mottles.
R069XY031CO	**Sandy Bottomland** Sandy Bottomland Ecological Site has no salts.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Ericameria nauseosa ssp. nauseosa var. nauseosa*

Herbaceous	(1) *Sporobolus airoides* (2) *Panicum virgatum*

Physiographic features

This site occurs in river valleys.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Flood plain (3) Fan remnant (4) Drainageway (5) Terrace
Runoff class	Very low to very high
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	None
Elevation	1,067–1,768 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	0–132 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) PUEBLO RSVR [USC00056765], Pueblo, CO
- (3) CHERAW 1 N [USC00051539], La Junta, CO
- (4) LA JUNTA 20 S [USC00054726], La Junta, CO
- (5) ROCKY FORD 2 SE [USC00057167], Rocky Ford, CO
- (6) TACONY 13 SE [USC00058157], Boone, CO
- (7) EADS [USC00052446], Eads, CO
- (8) ORDWAY 21 N [USC00056136], Ordway, CO
- (9) PUEBLO MEM AP [USW00093058], Pueblo, CO

Influencing water features

There is an 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 poorly, somewhat poorly, or moderately well drained with slow to rapid permeability. The surface layer thickness ranges from 3 to 10 inches thick. The soil moisture regime is ustic aridic. The soil temperature regime is mesic. Parent material kind includes alluvium, alluvium from irrigation water, alluvium from irrigation water over old alluvium and/or eolian material. Parent material originated from mixed sources.
Major soil series correlated to this ecological site include Apishapa, Bentfort, Bloom, Cheraw, Fluvaquents, Kreybill, Las, Las Animas, Saline wet land, Seldom.

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) Silty clay (2) Clay loam (3) Silty clay loam (4) Loam (5) Sandy loam (6) Loamy sand
Drainage class	Poorly drained to moderately well drained
Permeability class	Slow to rapid
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	2.03–22.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%

Electrical conductivity (0-101.6cm)	0–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–12
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
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 primary grasses consist of warm-season mid bunch grass (alkali sacaton), warm-season tall bunchgrass (switchgrass), warm-season tall rhizomatous grass (prairie cordgrass), and cool- season mid-rhizomatous western wheatgrass. Secondary grasses and grass-likes occurring in the community include warm-season tall bunchgrasses (big bluestem, Indiangrass), warm-season mid stoloniferous grass (vine mesquite), cool-season tall bunch grass (Canada wildrye), and cool-season grass-like plants (Nebraska sedge, Baltic rush). Minor grasses include little bluestem, slender wheatgrass, alkali cordgrass and inland saltgrass. Key forbs and shrubs include American licorice, showy prairie gentian, rag sumpweed, Illinois bundleflower, rubber rabbitbrush and fourwing saltbush.

Recurring seasonal herbivory without adequate recovery opportunity following each grazing occurrence causes prairie cordgrass, switchgrass, alkali sacaton, and eventually western wheatgrass to decrease in frequency and production while inland saltgrass increases. In time, the plant community will become dominated by inland saltgrass and develop into a sod bound condition, with alkali sacaton and western wheatgrass persisting only in remnant amounts. Heavy, continuous grazing will ultimately result in a plant community dominated by foxtail barley, annual invaders, and increased bare ground. Excessive litter, plant mortality, and decadence can result from the lack of fire, non-use, or both. Extended periods of non-use, lack of fire, or heavy, long term continuous grazing can lead to increased bare ground. Persistent water table alteration or drainage causes a complete alteration and disruption of the hydrologic function and biotic integrity resulting in the crossing of an ecological threshold.

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

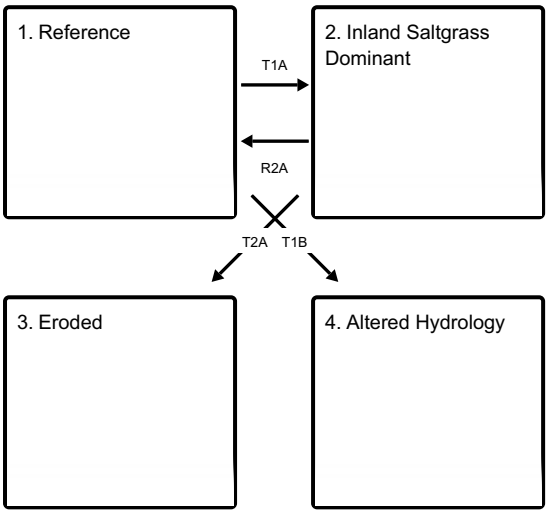
production is typically lower.

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



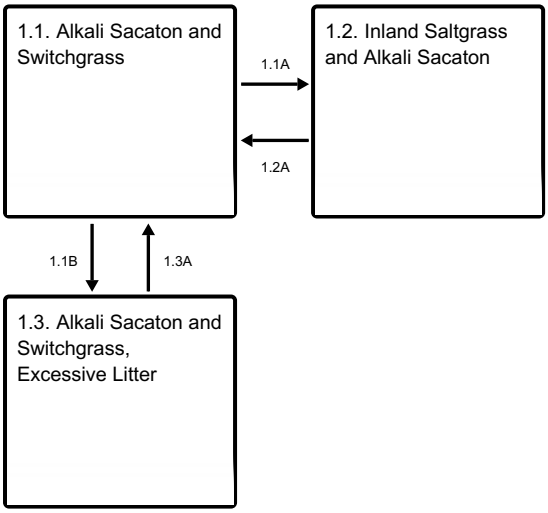
T1A - Continuous, heavy grazing. Lack of fire.

T1B - Drainage.

R2A - Prescribed grazing. Prescribed burning.

T2A - Heavy, continuous grazing. Lack of fire.

State 1 submodel, plant communities



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

1.1B - Non-use. Lack of fire.

1.2A - Prescribed grazing. Prescribed burning.

1.3A - Prescribed grazing. Prescribed burning.

State 2 submodel, plant communities

2.1. Inland Saltgrass and Foxtail Barley

State 3 submodel, plant communities

3.1. Foxtail Barley and Inland Saltgrass

State 4 submodel, plant communities

4.1. Altered Hydrology

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, 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
- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Alkali Sacaton and Switchgrass

This plant community is the interpretive plant community for this site and is considered to be the reference plant community. This community evolved with herbivory by large herbivores and is well suited for grazing. Historically, fires occurred infrequently. This plant community can be found on areas that are grazed and where the grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 80 to 95 percent grasses and grass-likes, 3 to 10 percent forbs and 2 to 10 percent woody plants. The community is dominated by tall and mid-warm and cool-season grasses. Major grasses include alkali sacaton, switchgrass, prairie cordgrass, and western wheatgrass. Other grasses and grass-likes occurring on the community include big bluestem, vine mesquite, little bluestem, alkali cordgrass, Canada wildrye, Baltic rush, and Nebraska sedge. Key forbs and shrubs include American licorice, prairie gentian, rag sumpweed, Illinois bundleflower, rubber rabbitbrush, and fourwing saltbush. The high water table supplies much of the moisture for plant growth. Plant litter is properly distributed with little movement and natural plant mortality is very low. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity. Total annual production ranges from 1500 to 3700 pounds of air-dry vegetation per acre and averages 2600 pounds during a normal year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- switchgrass (*Panicum virgatum*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1541	2550	3531
Forb	84	191	308
Shrub/Vine	56	174	308
Total	**1681**	**2915**	**4147**

Figure 9. Plant community growth curve (percent production by month). CO6908, Warm-season and cool-season co-dominant; MLRA-69; lowland water influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	23	30	17	10	3	2	0	0

Community 1.2
Inland Saltgrass and Alkali Sacaton

This plant community developed as a result of heavy herbivory without adequate recovery opportunity between grazing occurrences, lack of fire, and extended drought. Inland saltgrass has increased at the expense of the primary plants in the community. Alkali sacaton, prairie cordgrass, switchgrass, Indiangrass, big bluestem, Canada wildrye, and Nebraska sedge have decreased. Western wheatgrass may initially increase or decrease depending upon the season of use. Forbs and shrubs are still present in decreased amounts. This plant community is at risk of losing warm-season tallgrasses, palatable forbs, and shrubs. This plant community has decreased in frequency and production. Less litter can be expected however, the soil remains stable and can become very resistant to change depending on the degree to which the inland saltgrass has increased in the community. Total annual production, during an average year, ranges from 700 to 1900 pounds per acre air-dry weight and will average 1300 pounds.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- fourwing saltbush (*Atriplex canescens*), shrub
- saltgrass (*Distichlis spicata*), grass
- alkali sacaton (*Sporobolus airoides*), grass

Figure 10. Plant community growth curve (percent production by month). CO6909, Warm-season dominant, cool-season sub-dominant; MLRA-69; lowland water influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	15	35	25	10	3	2	0	0

Community 1.3
Alkali Sacaton and Switchgrass, Excessive Litter

This plant community developed under a 20-year absence of herbivory and fire. The dominant plants tend to be somewhat similar to those found in the reference plant community. Much of the nutrients are tied up in excessive litter. Organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact. Excessive litter levels prevent sunlight from reaching plant crowns and in time can stagnate the plant community. Bunchgrasses such as alkali sacaton, switchgrass, and big bluestem have a tendency to exhibit dead

centers and eventually entire plants can die off. Total annual production can vary substantially from 600 to 2800 pounds of air-dry vegetation per acre depending on how long this plant community has developed in the absence of haying, grazing, or fire.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- switchgrass (*Panicum virgatum*), grass

Figure 11. Plant community growth curve (percent production by month). CO6910, Warm-season dominant, cool-season sub-dominant, excess litter; MLRA-69; lowland water influenced soi.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	20	30	20	10	7	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Recurring, heavy seasonal herbivory without adequate recovery opportunity between grazing occurrences and lack of fire shifts this plant community toward the 1.2 Community.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire moves this plant community toward the 1.3 Plant Community. Initially, excess litter begins to build-up. Eventually native plants can show signs of mortality and decadence.

Pathway 1.2A
Community 1.2 to 1.1

Herbivory with adequate recovery opportunity following each grazing occurrence, prescribed burning, and animal-forage balance will move this plant community toward the reference plant community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

Herbivory with adequate recovery opportunity between grazing events and prescribed fire will move this plant community toward the reference plant community. This transition can occur in a relatively short period of time (3-5 years).

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Inland Saltgrass Dominant

The Inland Saltgrass Sod state contains one community phase. This state evolved under continuous, heavy grazing pressure without adequate recovery and a lack of fire. This is a very stable state, resistant to change due to the high

tolerance of inland saltgrass to grazing, the development of a shallow root system (also known as a root pan), and subsequent changes in hydrology and nutrient cycling. Extended drought may cause extensive mortality of any remnant mid- and tall grasses. The loss of dominant and sub-dominant functional/structural groups such as cool-season grasses, nitrogen fixing legumes, and shrubs significantly reduces the biodiversity and productivity of this state.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- greasewood (*Sarcobatus vermiculatus*), shrub
- saltgrass (*Distichlis spicata*), grass
- foxtail barley (*Hordeum jubatum*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 2.1
Inland Saltgrass and Foxtail Barley

This plant community develops under continuous, heavy grazing without adequate recovery opportunity between grazing events and lack of fire. The plant community exhibits a dense sod made up of primarily inland saltgrass. Remnant amounts of western wheatgrass and alkali sacaton may still be present. Tallgrasses (prairie cordgrass, big bluestem, Indiangrass, and switchgrass) and little bluestem, Nebraska sedge, and fourwing saltbush have been removed. Alkali muhly, foxtail barley, and Kentucky bluegrass may be increasing or invading. Salt cedar can invade this plant community from adjacent riverbottom areas. This community remains stable but has lost much of its production and diversity. This plant community is extremely resistant to change because of the aggressive behavior (vigorous rhizomes) of inland saltgrass. Nutrient cycle is impaired due to the loss of tallgrass species, deep-rooted forbs (legumes and others), and shrubs. Total annual production, during an average year, ranges from 300 to 900 pounds per acre air-dry weight and averages 600 pounds.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- greasewood (*Sarcobatus vermiculatus*), shrub
- saltgrass (*Distichlis spicata*), grass
- foxtail barley (*Hordeum jubatum*), grass

Figure 12. Plant community growth curve (percent production by month). CO6911, Warm-season dominant; MLRA-69; lowland water influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	15	45	20	10	5	0	0	0

State 3
Eroded

The Eroded state is characterized by a major reduction of the grasses that dominate the Reference State. Less palatable plants now dominate the landscape, and plant diversity and production have decreased significantly. The Reference state ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold. This state describes the complete deterioration of ecological processes.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- greasewood (*Sarcobatus vermiculatus*), shrub
- tamarisk (*Tamarix*), shrub
- foxtail barley (*Hordeum jubatum*), grass
- cheatgrass (*Bromus tectorum*), grass
- saltgrass (*Distichlis spicata*), grass
- Russian thistle (*Salsola*), other herbaceous
- cocklebur (*Xanthium*), other herbaceous

Community 3.1
Foxtail Barley and Inland Saltgrass

This plant community develops under continuous, heavy grazing and lack of fire. The plant composition is made up of foxtail barley, annuals, and scattered areas of inland saltgrass. Annuals such as Russian thistle, burningbush, and cocklebur have invaded the community. Kentucky bluegrass may persist in localized areas. Salt cedar can increase significantly depending on proximity to a seed source. Compared to the reference plant community, all perennial plants have been greatly reduced with only remnants of the most grazing tolerant species surviving. Plant diversity and production are very low. Planned rest periods during the growing season will improve the vigor of the plant species present and eventually reduce the amount of bare ground. Wind and water erosion may occur at low amounts due to increased bare ground. Litter amounts are low. Mineral crusting caused by raindrop impact disrupts surface soil aggregates, increasing ponding and slowing infiltration. Compaction, if severe enough, can also affect water infiltration. Carbon storage and nutrient cycling has been greatly reduced. Animal wastes can contaminate groundwater or runoff. Total annual production, during an average year, ranges from 50 to 300 pounds per acre air-dry weight.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- greasewood (*Sarcobatus vermiculatus*), shrub
- foxtail barley (*Hordeum jubatum*), grass
- saltgrass (*Distichlis spicata*), grass
- Russian thistle (*Salsola*), other herbaceous

Figure 13. Plant community growth curve (percent production by month). CO6908, Warm-season and cool-season co-dominant; MLRA-69; lowland water influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	10	23	30	17	10	3	2	0	0

State 4
Altered Hydrology

This state represents the influence of the manipulation of the hydrology affecting the site. It can develop from any of the states pertaining to the site. This state denotes complete alteration or disruption of the hydrologic function and biotic integrity resulting in replacement of the natural states and plant communities applicable to the site.

Community 4.1
Altered Hydrology

If any plant community is subjected to persistent water table depletion due to irrigation or drainage, a different ecological site will form. The new site would typically resemble a Salt Flat or similar ecological site. An ecological threshold has been crossed with the complete or partial alteration of the hydrology on the site.

Transition T1A
State 1 to 2

Continuous, heavy grazing without adequate recovery opportunity between grazing events and lack of fire shifts this plant community across an ecological threshold toward the Inland Saltgrass Dominated State. This transition results in significant loss of biologic integrity, nutrient cycling, and energy flow.

Transition T1B
State 1 to 4

Persistent water table alteration or drainage. This transition causes a complete alteration and disruption of the hydrologic function and biotic integrity resulting in replacement of the natural states and plant communities applicable to the site. This anthropologic transition can occur from any of the states or plant communities pertaining

to the site.

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing and prescribed burning moves this plant community toward the Reference State.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

Heavy, continuous grazing or excessive defoliation without adequate recovery periods following each grazing event and a lack of fire will shift this plant community across an ecological threshold to the Eroded State.

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				2331–2768	
	alkali sacaton	SPAI	*Sporobolus airoides*	1020–1166	–
	switchgrass	PAVI2	*Panicum virgatum*	583–874	–
	western wheatgrass	PASM	*Pascopyrum smithii*	437–729	–
	prairie cordgrass	SPPE	*Spartina pectinata*	291–437	–
	vine mesquite	PAOB	*Panicum obtusum*	56–146	–
	big bluestem	ANGE	*Andropogon gerardii*	28–146	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	28–90	–
	saltgrass	DISP	*Distichlis spicata*	28–90	–
	Canada wildrye	ELCA4	*Elymus canadensis*	28–90	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–90	–
	Grass-like, perennial	2GLP	*Grass-like, perennial*	28–90	–
	Grass, perennial	2GP	*Grass, perennial*	28–90	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	28–90	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	28–90	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–90	–
	Indiangrass	SONU2	*Sorghastrum nutans*	28–90	–
	alkali cordgrass	SPGR	*Spartina gracilis*	28–90	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	0–28	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–28	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–28	–
Forb					
2				90–291	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	28–146	–
	Forb, perennial	2FP	*Forb, perennial*	28–90	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	28–56	–
	showy prairie gentian	EUEXR	*Eustoma exaltatum ssp. russellianum*	0–56	–
	leafy false goldenweed	OOFOF	*Oonopsis foliosa var. foliosa*	0–28	–
	giant goldenrod	SOGI	*Solidago gigantea*	0–28	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0–28	–
	false boneset	BREU	*Brickellia eupatorioides*	0–28	–
Shrub/Vine					
3				56–291	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–146	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	28–90	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	28–56	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–28	–

Animal community

WILDLIFE INTERPRETATIONS:

This ecological site is wetter than many 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 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. Ferruginous and Swainson’s hawks are commonly seen using this site. Mammals that may use the site for foraging or cover include jackrabbit, badger, coyote, swift fox, and pocket mouse.

Plant Community 1.2:
The 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.

Plant Community 1.3:
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. Cassin’s and Brewer's sparrow stop using the community altogether. Use by species such as mountain plover, horned lark, and long-billed curlew would increase. Mammals, reptiles, and amphibians from the reference plant community may continue to use these communities.

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: (2600) (0.71)

Community 1.2: (1300) (0.36)

Community 1.3: (600) (0.16)

Stocking rates are guidelines only and actual grazing plans should be derived from a field visit to each site.

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. Soils in hydrologic group C and D dominate this site. Infiltration is moderate and runoff potential for this site varies from moderate to high depending on ground cover. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan:

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

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

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

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

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

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

- Follow-up need to support the Altered Hydrology State and Plant Community. Review of existing NRI inventories, archived 417 data sheets etc. are available for this site. More field data collection may be needed.

Animal Community
Wildlife Interpretations:

- Wildlife interpretations, general narrative, are updated (Provisional). Interpretations for individual plant community states/phases are pending. Pending PK update.

- Individual Plant Community phase interpretations are removed, and will be updated at the next "Approved" level.

Livestock Interpretations:

- Updated to reflect the Plant Community name revisions. The Stocking rate calculations remain the same since they are based on the "Previously Approved" Total Annual Production table.

- The stocking rate calculations will 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 should be updated at next "Approved" level.

- An updated hydrology model needs to be developed at the next "Approved" level.

Other Site Interpretations:
- 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: There is a small extent of Salt Meadow 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).

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Rangeland health reference sheet

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

Author(s)/participant(s)	Ben Berlinger, Kimberly Diller, Daniel Nosal
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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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** None

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):** Typically slight, however during major flooding events this site slows water flow and captures litter and sediment.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating anticipated to be 5-6 at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** SOM ranges from 3-4 percent. Soils are very deep, poorly drained with a water table depth from 6-36 inches. Color of the A-horizon is dark grayish brown at 0-8 inches in depth. Surface structure is weak, thick platy that parts to moderate, fine sub-angular blocky.

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 = warm-season tallgrasses >>

    Sub-dominant: Cool-season mid rhizomatous > cool-season grasslike = cool-season mid bunchgrass = warm-season mid sod-former = forbs >

    Other: Shrubs

    Additional:

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

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1500 lbs./ac. low precipitation years, 2600 lbs./ac. average precipitation, 3700 lbs./ac. high precipitation years. Extended drought may reduce annual production by 500 – 800 lbs./ac.

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

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