USDA Natural Resources Conservation Service

Ecological site R067BY035CO
Salt Meadow

Last updated: 9/08/2023
Accessed: 05/18/2024

General information

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

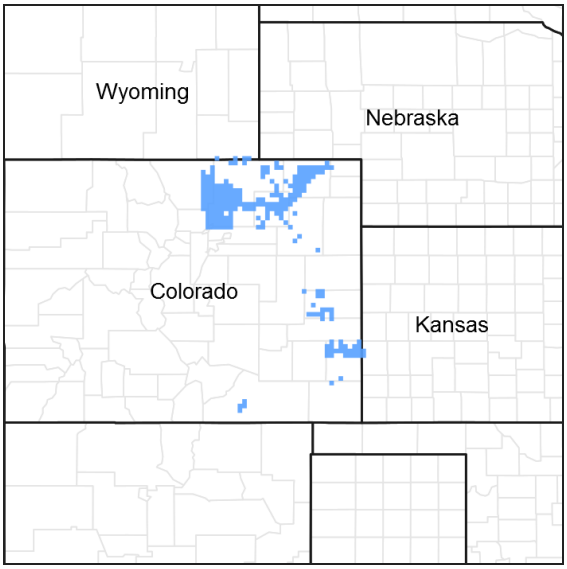


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 067B–Central High Plains, Southern Part

MLRA 67B occurs in eastern Colorado and consists of rolling plains and river valleys. Some canyonlands occur in the southeast portion. The major rivers are the South Platte and Arkansas which flow from the Rocky Mountains to Nebraska and Kansas. Other rivers in the MLRA include the Cache la Poudre and Republican and associated tributaries. This MLRA is traversed by Interstate 25, 70 and 76; and U.S. Highways 50 and 287. Major land uses include 54 percent rangeland, 35 percent cropland, and 2 percent pasture and hayland. Urban, developed open space, and miscellaneous land occupy approximately 9 percent. Major Cities in this area include Fort Collins, Greeley, Sterling, and Denver. Other cities include Limon, Cheyenne Wells, and Springfield. Land ownership is mostly private. Federal lands include Pawnee and Comanche National Grasslands (U.S. Forest Service), Sand Creek Massacre National Historic Site (National Park Service), and Rocky Mountain Arsenal National Wildlife Refuge (U.S. Fish & Wildlife Service). State Parks include Cherry Creek and Chatfield Reservoirs, and Barr and Jackson Lakes.

This region is periodically affected by severe drought, including the historic “Dust Bowl” of the 1930s. Dust storms may form during drought years in windy periods. Elevations range from 3,400 to 6,000 feet. The Average annual precipitation ranges from 14 to17 inches per year and ranges from 13 inches to over 18 inches, depending upon location. 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. Winter temperatures may be sub-zero, and snowfall varies from 20 to 40 inches per year. Snow cover frequently melts between snow events.

LRU notes

Land Resource Unit (LRU) A is the northeast portion of MLRA 67B, to an extent of approximately 9 million acres. Most of the LRU is rangeland, and includes the Pawnee National Grassland. Dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) are grown in most counties. Irrigated cropland is utilized in the South Platte Valley. Small acreage and urban ownership are more concentrated on the Front Range. This LRU is found in portions of Adams, Arapahoe, Elbert, Kit Carson, Larimer, Lincoln, Logan, Washington, and Weld counties. Other counties include Boulder, Cheyenne, Denver, Jefferson, and Yuma. The soil moisture regime is aridic ustic. The mean annual air temperature (MAAT) is 50 degrees Fahrenheit.

LRU B is in the southeast portion of MLRA 67B (2.6 million acres) and includes portions of Baca, Bent, Cheyenne, Kiowa, Las Animas, and Prowers counties. Most of the LRU remains in rangeland and includes the Comanche National Grassland. On the farmed land, a system of dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) is implemented. Irrigated cropland is found in the Arkansas Valley. The soil moisture regime is aridic ustic and the MAAT is 52 degrees Fahrenheit.

LRU C occurs in portions of Morgan and Weld counties (approximately 1.2 million acres). Most of LRU C is in rangeland. On the farmed land, a system of dryland winter wheat/fallow rotations (that may include dryland corn, sunflowers, and sorghum) is implemented. The soil moisture regime is ustic aridic and the MAAT is 48 degrees Fahrenheit.

Classification relationships

MLRA 67B is in the Colorado Piedmont and Raton Sections of the Great Plains Province (USDA, 2006). The MLRA is further defined by Land Resource Units (LRUs) A, B, and C. Features such as climate, geology, landforms, and key vegetation further refine these concepts and are described in other sections of the Ecological Site Description (ESD). NOTE: To date, these LRUs are DRAFT.

Relationship to Other Hierarchical Classifications:
NRCS Classification Hierarchy: Physiographic Division, Physiographic Province, Physiographic Section, Land Resource Region, Major Land Resource Area, Land Resource Unit (Fenneman, 1946).
USFS Classification Hierarchy: Domain, Division, Province, Section, Subsection,
Land Type Association: Land Type, Land Type Phase (Cleland et al, 1997).

REVISION NOTES:
The Salt Meadow Ecological Site was developed from an earlier version, (2004, revised 2007). This earlier version 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). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Salt Meadow Ecological Site is a run-on site that is within four feet of the water table, and there are often redoximorphic mottles in the upper soil profile. There are also visible salts present in the soil profile or on the soil surface.

Associated sites

R067BY031CO	**Sandy Bottomland** This ecological site is commonly adjacent.
R067BY033CO	**Salt Flat** This ecological site is commonly adjacent.

R067BY038CO	**Wet Meadow** This ecological site is commonly adjacent.

Similar sites

R067BY033CO	**Salt Flat** The Salt Flat Ecological Site is not within four feet of the water table.
R067BY038CO	**Wet Meadow** The Wet Meadow Ecological Site does not have visible salts in the soil profile or on the soil surface

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens*
Herbaceous	(1) *Sporobolus airoides* (2) *Panicum virgatum*

Physiographic features

This site occurs on nearly level floodplains and terraces adjacent to streams and rivers. It is also found on drainageways associated with intermittent and perennial streams.

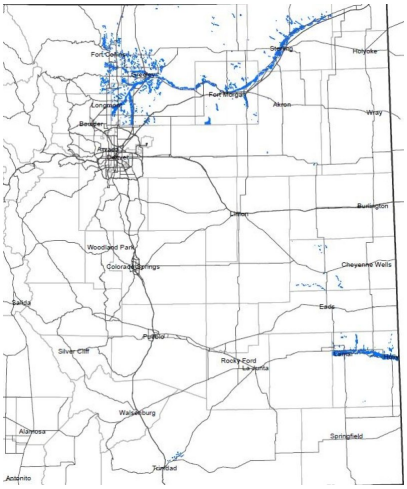


Figure 2. The distribution of the Salt Meadow site in MLRA 67B.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Drainageway (3) Terrace
Runoff class	Low to high
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	1,097–1,707 m
Slope	0–3%
Ponding depth	0 cm
Water table depth	30–122 cm
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation across the MLRA extent is 14 to 17 inches, and ranges from 13 to over 18 inches, depending on location. Precipitation increases from north to south. Mean Annual Air Temperature (MAAT) is 50 degrees Fahrenheit in the northern part and increases to 52 degrees Fahrenheit in the southern part. Portions of Morgan and Weld counties are cooler and drier, the MAAT is 48 degrees Fahrenheit, and average precipitation is 13 to14 inches per year.

Two-thirds of the annual precipitation occurs during the growing season from mid-April to late September. Snowfall averages 30 inches per year, area-wide, but varies by location from 20 to 40 inches per year. Winds are estimated to average 9 miles per hour annually. Daytime winds are generally stronger than at night, and occasional strong storms may bring periods of high winds with gusts to more than 90 mph. High-intensity afternoon thunderstorms may arise. The average length of the freeze-free period (28 degrees Fahrenheit) is 155 days from April 30th to October to 3rd. The average frost-free period (32 degrees Fahrenheit) is 136 days from May 11th to September 24th. July is the hottest month, and December and January are the coldest months. Summer temperatures average 90 degrees Fahrenheit and occasionally exceed 100 degrees Fahrenheit. Summer humidity is low and evaporation is high. Winters are characterized with frequent northerly winds, producing severe cold with temperatures occasionally dropping to -30 degrees Fahrenheit or lower. Blizzard conditions may form quickly. For detailed information, visit the Western Regional Climate Center website:
Western Regional Climate Center Historical Data Western U.S. Climate summaries, NOAA Coop Stations Colorado http://www.wrcc.dri.edu/summary/Climsmco.html.

Table 3. Representative climatic features

Frost-free period (characteristic range)	119-129 days
Freeze-free period (characteristic range)	134-151 days
Precipitation total (characteristic range)	356-432 mm
Frost-free period (actual range)	102-132 days
Freeze-free period (actual range)	126-156 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	121 days
Freeze-free period (average)	142 days
Precipitation total (average)	381 mm

Climate stations used

- (1) BRIGHTON 3 SE [USC00050950], Brighton, CO
- (2) BYERS 5 ENE [USC00051179], Byers, CO
- (3) GREELEY UNC [USC00053553], Greeley, CO
- (4) LIMON WSMO [USW00093010], Limon, CO
- (5) BRIGGSDALE [USC00050945], Briggsdale, CO
- (6) NUNN [USC00056023], Nunn, CO
- (7) CHEYENNE WELLS [USC00051564], Cheyenne Wells, CO
- (8) FLAGLER 1S [USC00052932], Flagler, CO
- (9) FT MORGAN [USC00053038], Fort Morgan, CO
- (10) KIT CARSON [USC00054603], Kit Carson, CO
- (11) SPRINGFIELD 7 WSW [USC00057866], Springfield, CO

Influencing water features

There is a seasonal water table that influences the kinds and amounts of vegetation on this site. The water table in some areas is anthropogenic, caused by seepage from nearby irrigation ditches, canals, and reservoirs.

Wetland Description (Cowardin System)

System Subsystem Class
Palustrine N/A Emergent Wetland

Note: This is not a wetland determination.

Soil features

The soils on this site are very deep, poorly to somewhat poorly drained soils that formed from alluvium. They typically have a slow to moderately rapid permeability class. The available water capacity is typically low, but ranges to moderate. The soil moisture regime is typically aquic, but may include oxyaquic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically loam, clay loam, or fine sandy loam, but may include clay or sandy loam. The surface layer ranges from 4 to 10 inches thick. The subsoil is typically clay, clay loam, or loam, but may include stratified layers with sandy loam, sand, or coarse sand with varying amounts of rock fragments. Rock fragments range from 0 to 35 percent in the underlying material. Soils in this site typically have free carbonates at the surface, but some soils may be leached from 4 to 10 inches. These soils are saline and alkaline. The high levels of salinity adversely affects plant species composition and growth. These soils are susceptible to erosion by water and wind.

Major soil series correlated to this ecological site include: Apishapa, Las (saline), Loveland, and Wann (saline).

Other soil series that have been correlated to this site, but may eventually be re-correlated include: Alda variant, Aquolls, Fluvaquents, Las, Nunn (wet), Nunn (water table), Wann, Heldt (saline), and Limon (saline).

*Feature listed in “( )” relates to the salt content or the wetness of the soil.

The attributes listed below represent 0 to 40 inches in depth or to the first restrictive layer.

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

The attributes listed below represent 0 to 40 inches in depth or to the first restrictive layer.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Clay loam (3) Fine sandy loam
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–16.51 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	2–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–30

Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Salt Meadow Ecological Site is characterized by three states: Reference, Warm-Season Shortgrass, and Increased *Bare Ground* State. The Reference State is characterized by warm-season bunchgrass (alkali sacaton, switchgrass), cool-season midgrass (western wheatgrass), warm-season tall rhizomatous grass, and a minor component of cool-season grasslike (Nebraska sedge). The Warm-Season Shortgrass State is characterized by a warm-season short rhizomatous grass (inland saltgrass). The Increased *Bare Ground* State is characterized by early successional cool-season grass (foxtail barley), annual grasses, and annual forbs.

The site has a high water table throughout the growing season. The availability of water has a major influence on the vegetation that will persist on this site.

Continuous, heavy grazing without adequate recovery opportunity following each grazing occurrence will cause prairie cordgrass, switchgrass, alkali sacaton, and eventually western wheatgrass to decrease in frequency and production while inland saltgrass and Baltic rush increase. In time, the plant community will become dominated by inland saltgrass and develop into a sodbound condition with alkali sacaton and western wheatgrass persisting 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 plant decadence can result from the lack of fire and non-use.

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

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically occupied by large grazing animals, such as bison, elk, pronghorn, and mule deer. Grazing by these large herbivores, along with climatic and seasonal weather fluctuations, had a major influence on the ecological dynamics of the site. Deer and pronghorn are widely distributed throughout the MLRA. Secondary influences of herbivory by species such as prairie dogs and other small rodents, insects, and root-feeding organisms continues to impact the vegetation.

Historically, grazing patterns by herds of large ungulates were driven by water distribution, precipitation events, drought events, and fire. It is believed that grazing periods would have been shorter, followed by longer recovery periods. These large migrating herds impacted the ecological processes of nutrient and hydrologic cycles, by urination, trampling (incorporation of litter into the soil surface), and breaking of surface crust, (which increases water infiltration).

Today, livestock grazing, especially beef cattle has been a major influence on the ecological dynamics of the site. Grazing management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site.

Recurrent 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. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in some locales.

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely to start fires for various reasons

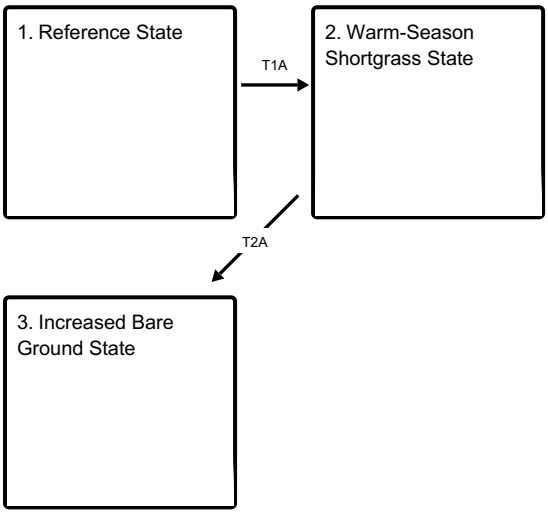
(deliberate or accidental). It is believed that fires were set as a management tool for attracting herds of large migratory herbivores (Stewart, 2002). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

Mechanical treatment consisting of contour pitting, furrowing, terracing, chiseling, and disking has been practiced in the past. It was theorized that the use of this high-input technology would improve production and plant composition on rangeland. These high-cost practices have shown to have no significant long-term benefits on production or plant composition and have only resulted in a permanently rough ground surface. Prescribed grazing that mimics the historic grazing of herds of migratory herbivores, as described earlier, has been shown to result in desired improvements based on management goals for this ecological site.

Eastern Colorado was strongly affected by extended drought conditions in the “Dust Bowl” period of the 1930’s, 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. Long-term effects of these latest drought events have yet to be determined. Growth of native cool-season plants begins about April 1 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 in most years, depending on the availability of moisture.

State and transition model

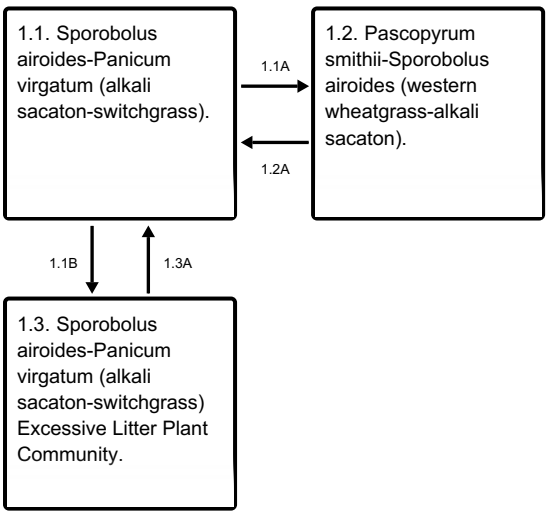
Ecosystem states



T1A - Excessive grazing. Lack of fire.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Haying. Prescribed fire.

State 2 submodel, plant communities

2.1. Distichlis spicata (saltgrass).

State 3 submodel, plant communities

3.1. Salsola-Bassia scoparia-Hordeum jubatum-Bromus tectorum (Russian thistle-burningbush - foxtail bartley-cheatgrass).

State 1
Reference State

The Reference State is characterized by three distinct plant community phases. These plant communities and various successional stages between them represent the natural range of variability within the Reference State.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Sporobolus airoides-Panicum virgatum (alkali sacaton-switchgrass).

This plant community is the interpretive plant community for this site. This community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. 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 to10 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, little bluestem, alkali cordgrass, Nebraska sedge, and Baltic rush. Key forbs and shrubs include American licorice, prairie gentian, rag sumpweed, 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 2,000 to 4,000 pounds of air-dry vegetation per acre with a Representative Value of 3,000 pounds.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- switchgrass (*Panicum virgatum*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2085	2942	3755
Forb	95	219	364
Shrub/Vine	62	202	364
Total	**2242**	**3363**	**4483**

Figure 10. Plant community growth curve (percent production by month). CO6713, Warm-season dominant, cool-season subdominant; MLRA-67B; lowland water-influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	20	30	20	12	5	3	0	0

Community 1.2
Pascopyrum smithii-Sporobolus airoides (western wheatgrass-alkali sacaton).

This plant community developed with heavy, continuous grazing without adequate recovery opportunity between grazing events. Inland saltgrass has increased. Alkali sacaton, prairie cordgrass, switchgrass, Indiangrass, little 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 reduced amounts. This plant community is at risk of losing warm-season tallgrasses, palatable forbs, and shrubs. This community has decreased in plant 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. Total annual production, during a normal year, ranges from 1,000 to 2,000 pounds per acre air-dry weight and averages 1,500 pounds.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- alkali sacaton (*Sporobolus airoides*), grass

Figure 11. Plant community growth curve (percent production by month). CO6713, Warm-season dominant, cool-season subdominant; MLRA-67B; lowland water-influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	20	30	20	12	5	3	0	0

Community 1.3
Sporobolus airoides-Panicum virgatum (alkali sacaton-switchgrass) Excessive Litter Plant Community.

This plant community developed under the absence of grazing, fire, and haying. The dominant plants are similar to those found in the Reference Plant Community. Plant density has been reduced. Grazing, haying, or fire followed by prescribed grazing can quickly move this plant community back toward the Reference Plant Community. Much of the nutrients are tied up in excessive litter. Some organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact. Increased litter levels and standing dead canopy prevent sunlight from reaching plant crowns and in time can stagnate the plant community. Bunchgrasses such as alkali sacaton, little bluestem, and switchgrass have a tendency to exhibit dead centers and eventually entire plant die off. Total annual production varies substantially from 800 to 3,000 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
- alkali sacaton (*Sporobolus airoides*), grass

- switchgrass (*Panicum virgatum*), grass

Figure 12. Plant community growth curve (percent production by month). CO6715, Warm-season/cool-season codominant, excess litter; MLRA-67B; lowland water influenced soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	7	20	35	20	10	5	2	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing without adequate recovery opportunity between grazing events, and lack of fire shifts this plant community to the 1.2 Community. Recurring spring seasonal grazing decreases cool-season plants. Recurring summer grazing decreases warm-season plants and increases cool-season plants over time. Biotic integrity will be altered and water and nutrient cycles may become impaired.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire causes the Reference Plant Community to shift to the 1.3 Community. Plant decadence and standing dead material impedes energy flow. Water and nutrient cycles are impaired.

Pathway 1.2A
Community 1.2 to 1.1

Grazing that allows for adequate recovery opportunity between grazing events, proper stocking rates, and prescribed fire shift this community back to the Reference Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

The return of grazing or haying with adequate recovery opportunity and normal fire frequency facilitate a return to the Reference Plant Community. This change can occur in a relatively short time frame with the return of these disturbances.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Warm-Season Shortgrass State

An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and edaphic (soil characteristics) changes have negatively impacted energy flow and nutrient and hydrologic cycles. 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 (aka root pan), and subsequent changes in hydrology and nutrient cycling. The loss of functional/structural groups such as warm-season mid- and tallgrass, and cool and warm-season rhizomatous grasses reduces the biodiversity and productivity of this site.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- saltgrass (*Distichlis spicata*), grass

Community 2.1
Distichlis spicata (saltgrass).

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, switchgrass), as well as little bluestem, Nebraska sedge, and fourwing saltbush have been removed. Scratchgrass (alkali muhly), foxtail barley, Baltic rush, and Kentucky bluegrass may be increasing or invading. This community remains stable but has lost much of its production and diversity. It is extremely resistant to change because of the aggressive rhizomatous growth form 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 a normal year, ranges from 800 to 1,500 pounds per acre air-dry weight and averages 950 pounds.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- saltgrass (*Distichlis spicata*), grass

Figure 13. Plant community growth curve (percent production by month). CO6718, Warm-season dominant; MLRA-67B; lowland water-influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	15	40	23	12	3	2	0	0

State 3
Increased Bare Ground State

Wind and water erosion may occur at low amounts. Litter amounts are low. Mineral crusting caused by raindrop impact disrupts surface soil aggregates, increasing ponding and slowing infiltration. Compaction, if severe enough, can negatively affect water infiltration. Carbon storage and nutrient cycling has been greatly reduced. Animal wastes can contaminate ground water or runoff. An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are concerns. Nutrient and water cycles and energy flow are impaired.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- foxtail barley (*Hordeum jubatum*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 3.1
Salsola-Bassia scoparia-Hordeum jubatum-Bromus tectorum (Russian thistle-burningbush - foxtail bartley-cheatgrass).

The plant composition is made up of foxtail barley, annuals, and scattered areas of inland saltgrass and Baltic rush. Annuals such as Russian thistle, burningbush, and cocklebur have invaded the community. Kentucky bluegrass has invaded and may persist in localized areas. 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. In southeastern Colorado, tamarisk may invade this plant community from an adjacent riparian area, along the Arkansas River and its tributaries. Bare ground may be enhanced by the tamarisk’s presence. Total annual production, during a normal year, ranges from 50 to 400 pounds per acre air-dry weight.

Dominant plant species

- rubber rabbitbrush (*Ericameria nauseosa ssp. nauseosa var. nauseosa*), shrub
- foxtail barley (*Hordeum jubatum*), grass
- cheatgrass (*Bromus tectorum*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Figure 14. Plant community growth curve (percent production by month). CO6714, Cool-season dominant, warm-season subdominant; MLRA-67B; lowland water-influenced soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	25	40	15	7	3	1	0	0

Transition T1A
State 1 to 2

Heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire shifts this plant community across an ecological threshold to the Warm-Season Shortgrass State. Biotic integrity and hydrologic function are impaired as a result of this transition.

Transition T2A
State 2 to 3

Heavy, continuous grazing without adequate recovery opportunity between grazing events and lack of fire cause a shift across an ecological threshold to the Increased *Bare Ground* State. Erosion, loss of organic matter and carbon reserves, and flooding are concerns. Non-native exotic plants such as field bindweed and knapweeds are likely to invade.

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				2690–3194	
	alkali sacaton	SPAI	*Sporobolus airoides*	1009–1177	–
	western wheatgrass	PASM	*Pascopyrum smithii*	504–773	–
	switchgrass	PAVI2	*Panicum virgatum*	504–673	–
	prairie cordgrass	SPPE	*Spartina pectinata*	336–673	–
	Sandberg bluegrass	POSE	*Poa secunda*	101–336	–
	big bluestem	ANGE	*Andropogon gerardii*	101–235	–
	Canada wildrye	ELCA4	*Elymus canadensis*	34–168	–
	Grass, perennial	2GP	*Grass, perennial*	67–168	–
	alkali cordgrass	SPGR	*Spartina gracilis*	34–168	–
	little bluestem	SCSC	*Schizachyrium scoparium*	34–168	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–168	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	34–101	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	34–101	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	34–101	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	34–101	–
	saltgrass	DISP	*Distichlis spicata*	34–101	–
	Grass-like, perennial	2GLP	*Grass-like, perennial*	67–101	–
	vine mesquite	PAOB	*Panicum obtusum*	0–67	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–34	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–34	–
Forb					
2				101–336	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	34–168	–
	Forb, perennial	2FP	*Forb, perennial*	34–168	–
	showy prairie gentian	EUEXR	*Eustoma exaltatum ssp. russellianum*	0–67	–
	leafy false goldenweed	OOFOF	*Oonopsis foliosa var. foliosa*	0–34	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–34	–
	false boneset	BREU	*Brickellia eupatorioides*	0–34	–
Shrub/Vine					
3				67–336	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–168	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	34–101	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	34–67	–

Animal community

WILDLIFE INTERPRETATIONS:

Salt Meadow sites support a unique suite of wildlife species due to their association with river and stream systems. Riparian corridors generally represent areas of increased biodiversity compared to adjacent upland sites, and these sites often occur in those riparian systems. Salt meadows provide habitat components for white-tailed and mule deer, wild turkey, and bobwhite quail. These areas can also have increased diversity of herpetile species.

1.1 Reference Plant Community
The Reference Plant Community provides important habitat components for white-tailed and mule deer, including foraging, bedding, and fawning areas, especially when a healthy shrub component of snowberry is present. Wild turkeys use the shrubs in this community for nesting and brood-rearing, also incidentally the rest of the year. The taller grasses, especially switchgrass and prairie cordgrass, provide important nesting habitats for northern bobwhite quail, and snowberry provides the highest quality loafing and escape habitat for this species on this site. Plains and common garter snakes may be found in this plant community, especially if low areas with seasonal water are present.

1.2 Community

This Community has reduced tallgrasses and shrubs which degrade the overall quality of the site for wildlife. White-tailed and mule deer may move through this community and feed to some extent, but with reduced cover the value for bedding and fawning is also reduced. Northern bobwhite quail use of this community is reduced as well.

1.3 Community

This community has greatly reduced value for wildlife due to the loss of tallgrasses and a reduced abundance of shrubs. White-tailed and mule deer may move through this community and feed to some extent, but with reduced cover the value for bedding and fawning is also reduced. Northern bobwhite quail use of this community is reduced as the tallgrass and shrub components decline, and because the litter layer is too thick and dense for quail to walk through.

2.1 Community

This Community represents the lowest amount of wildlife diversity as well. White-tailed and mule deer may move through this community but spend little time feeding or bedding. Wild turkey may use the edges of these meadows in the spring for breeding displays but nesting and brood-rearing value has been lost. If this plant community is adequately grazed during the summer and the pasture is of sufficient size, Canada geese and snow geese will graze on the new inland saltgrass regrowth during the spring, fall and winter.

3.1 Community
Due to the greatly reduced plant diversity of this site and impairment to nutrient cycling and water infiltration processes, the wildlife community that uses this site is also greatly reduced.

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).

Reference PC - (3000) (0.82)

1.2 PC - (1500) (0.41)

2.1 PC - (950) (0.26)

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.

An on-site inventory is required prior to developing a grazing plan.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group C and D. 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 and Testing Plan

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):

Updated. All “Required” items 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 complete to Provisional level.
NOTE: Annual Production Table is from the “Previously Approved” ESD 2004. The Species Composition List is also from the 2004 version, with minor edits. These will need review for future updates at Approved level.

Each Alternative State/Community:

Complete to Provisional level

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

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

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

Wildlife interpretations, general narrative, and individual plant communities updated to the Provisional level. Hydrology, Recreational Uses, Wood Products, Other Products, Plant Preferences table, and Rangeland Health Reference Sheet carried over from previously “Approved” ESD 2004.

Reference Sheet

The Reference Sheet was previously approved in 2007.
It will be updated at the next “Approved” level.

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

Other information

Relationship to Other Hierarchical Classifications:

NRCS Classification Hierarchy:
Physiographic Divisions of the United States (Fenneman, 1946): Physiographic DivisionPhysiographic ProvincePhysiographic SectionLand Resource RegionMajor Land Resource Area (MLRA)Land Resource Unit (LRU).
USFS Classification Hierarchy:
National Hierarchical Framework of Ecological Units (Cleland et al, 181-200):
DomainDivisionProvinceSectionSubsectionLandtype AssociationLandtypeLandtype Phase.

Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates and other inventory data. Field observations from experienced range trained personnel were used extensively to develop this ecological site description. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

Those involved in developing the 2004 site description include: Harvey Sprock, Rangeland Management Specialist, CO-NRCS; Ben Berlinger, Rangeland Management Specialist, CO-NRCS; James Borchert, Soil Scientist, CO-NRCS; Terri Skadeland, Biologist, CO-NRCS.

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.

Stewart, O.C., H.T. Lewis, and M.K. Anderson. 2002. Forgotten Fires: Native Americans and the Transient Wilderness. University of Oklahoma Press, Norman, OK. 351p.

Other references

Data collection for this ecological site was done in conjunction with the progressive soil surveys within the 67B Central High Plains (Southern Part) of Colorado. It has been mapped and correlated with soils in the following soil surveys: Adams County, Arapahoe County, Baca County, Bent County, Boulder County, Cheyenne County, El Paso County Area, Elbert County, Eastern Part, Kiowa County, Kit Carson County, Larimer County Area, Las Animas County Area, Lincoln County, Logan County, Morgan County, Prowers County, Washington County, Weld County, Northern Part, and Weld County, Southern Part.

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).

Additional Literature:

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.

Collins, S. and S. Barber. (1985). Effects of disturbance on diversity in mixed-grass prairie. Vegetation, 64, 87-94.

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

Hart, R. and J. Hart. 1997. Rangelands of the Great Plains before European Settlement. Rangelands, 19(1), 4-11.

Hart, R. 2001. Plant biodiversity on shortgrass steppe after 55 years of zero, light, moderate, or heavy cattle grazing. Plant Ecology, 155, 111-118.

Heitschmidt, Rodney K., J.W. Stuth, (edited by). 1991. Grazing Management, an Ecological Perspective. Timberland Press, Portland, OR.

Jackson, D. 1966. The Journals of Zebulon Montgomery Pike with letters & related documents. Univ. of Oklahoma Press, First edition: Norman, OK.

Mack, Richard N., and J.N. Thompson. 1982. Evolution in Steppe with Few Large, Hooved Mammals. The American Naturalist. 119, No. 6, 757-773.

Reyes-Fox, M., Stelzer H., Trlica M.J., McMaster, G.S., Andales, A.A., LeCain, D.R., and Morgan J.A. 2014. Elevated CO2 further lengthens growing season under warming conditions. Nature, April 23 2014.Available online. http://www.nature.com/nature/journal/v510/n7504/full/nature13207.html, accessed March 2017.

Stahl, David W., E.R. Cook, M.K. Cleaveland, M.D. Therrell, D.M. Meko, H.D. Grissino-Mayer, E. Watson, and B.H. Luckman. Tree-ring data document 16th century megadrought over North America. 2000. Eos, 81(12), 121-125.

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. 2004. Vascular plant species of the Comanche National Grasslands in southeastern Colorado. US Forest Service. Rocky Mountain Research Station. Fort Collins, CO.

Zelikova, Tamara Jane, D.M. Blumenthal, D.G. Williams, L. Souza, D.R. LeCain, J.Morgan. 2014. Long-term Exposure to Elevated CO2 Enhances Plant Community Stability by Suppressing Dominant Plant Species in a Mixed-Grass Prairie. Ecology, 2014 issue. Available online. www.pnas.org/cgi/doi/10.1073/pnas.1414659111.

Contributors

Kimberly Diller, Ecological Site Specialist, NRCS MLRA, Pueblo SSO
Andy Steinert, MLRA 67B Soil Survey Leader, NRCS MLRA Fort Morgan SSO
Ben Berlinger, Rangeland Management Specialist, Retired NRCS La Junta, CO
Doug Whisenhunt, Ecological Site Specialist, NRCS MLRA, Pueblo SSO

Approval

Kirt Walstad, 9/08/2023

Acknowledgments

Program Support:
Rachel Murph, NRCS State Rangeland Management Specialist-QC, Denver, CO
David Kraft, NRCS MLRA Ecological Site Specialist-QA, Emporia, KS
Josh Saunders, Rangeland Management Specialist-QC, NRCS Fort Morgan, CO
Patty Knupp, Biologist, Area 3, NRCS Pueblo, CO
Noe Marymor, Biologist, Area 2, NRCS Greeley, CO
Richard Mullaney, Resource Conservationist, Retired., NRCS, Akron, CO
Chad Remley, Regional Director, N. Great Plains Soil Survey, Salina, KS
B.J. Shoup, State Soil Scientist, Denver
Eugene Backhaus, State Resource Conservationist, Denver
Carla Green Adams, Editor, NRCS, Denver, CO

Partners/Contributors:
Rob Alexander, Agricultural Resources, Boulder Parks & Open Space, Boulder, CO
David Augustine, Research Ecologist, Agricultural Research Service, Fort Collins, CO
John Fusaro, Rangeland Management Specialist, NRCS, Fort Collins, CO
Jeff Goats, Resource Soil Scientist, NRCS, Pueblo, CO
Clark Harshbarger, Resource Soil Scientist, NRCS, Greeley, CO
Mike Moore, Soil Scientist, NRCS MLRA Fort Morgan SSO
Tom Nadgwick, Rangeland Management Specialist, NRCS, Akron CO
Dan Nosal, Rangeland Management Specialist, NRCS, Franktown, CO
Steve Olson, Botanist, USFS, Pueblo, CO
Randy Reichert, Rangeland Specialist, retired, USFS, Nunn, CO
Don Schoderbeck, Range Specialist, CSU Extension, Sterling CO

Terri Schultz, The Nature Conservancy, Ft. Collins, CO
Chris Tecklenburg, Ecological Site Specialist, Hutchison, KS

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)	Harvey Sprock, Ben Berlinger, Daniel Nosal
Contact for lead author	Harvey Sprock, Area Rangeland Management Specialist, Greeley, 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:** 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 is anticipated to be near 6 at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** SOM

ranges from 2 to 4 percent. Soils are deep, poorly drained with a water table depth from 5 to 36 inches. Color of the A-horizon is dark grayish brown at 0 to 11 inches in depth. Surface structure is moderate fine granular.

---

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

---

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

---

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

    Dominant: Warm-season mid bunchgrass >

    Sub-dominant: Warm-season tall bunchgrass > cool-season mid rhizomatous > warm-season tall rhizomatous > cool-season mid bunchgrass > cool-season grasslikes > 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. Expect slight shrub and grass mortality and decadence during and following extended drought or long-term lack of disturbance.

---

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):** 2000 lbs./ac. low precipitation years; 3000 lbs./ac. average; 4000 lbs./ac. high. Extended drought may reduce annual production by 700 to 900 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.

---

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