USDA Natural Resources Conservation Service

Ecological site R067BY037CO
Saline Overflow

Last updated: 12/05/2024
Accessed: 05/10/2025

General information

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

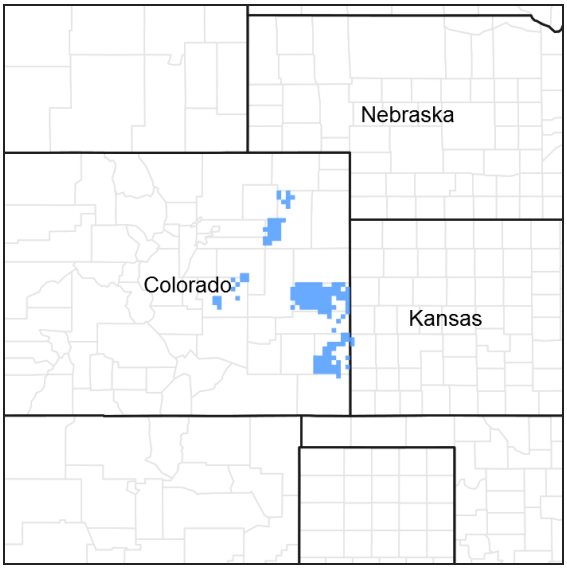


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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 Saline Overflow Ecological Site was developed by 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 Saline Overflow 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

This ecological site is a run-on site that has no mottles in the top layers of the soil, and the water table is deeper than four feet. The site is subject to flooding, and does not have sandy subsoil textures. It does have visible salts on the surface or in the subsoil.

Associated sites

R067BY002CO	**Loamy Plains** This ecological site is commonly adjacent.
R067BY033CO	**Salt Flat** This ecological site is commonly adjacent.

R067BY042CO	**Clayey Plains** This ecological site is commonly adjacent.
R067BY047CO	**Alkaline Plains** This ecological site is commonly adjacent.

Similar sites

R067BY036CO	**Overflow** The Overflow Ecological Site does not have visible salts on the surface or in the subsoil.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens*
Herbaceous	(1) *Sporobolus airoides* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on the floodplains of ephemeral or intermittent streams, but may also occur on drainageways or draws that may or may not have a channel. These sites receive water from channel flooding or from runoff from surrounding areas during precipitation events.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Flood plain (3) Draw
Runoff class	Medium to high
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	3,400–5,200 ft
Slope	0–3%
Ponding depth	0 in
Water table depth	80 in
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)	14-17 in
Frost-free period (actual range)	102-132 days
Freeze-free period (actual range)	126-156 days
Precipitation total (actual range)	14-17 in
Frost-free period (average)	121 days
Freeze-free period (average)	142 days
Precipitation total (average)	15 in

Climate stations used

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

Influencing water features

There are no influencing water features associated with this ecological site.

Soil features

The soils on this site are very deep, well drained soils that formed from alluvium. They typically have a slow to moderate permeability class. The available water capacity is typically moderate. The soil moisture regime is typically aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically clay loam or silty clay loam, but may include loam. The surface layer ranges from 4 to 20 inches thick. The subsoil is typically clay or clay loam, but may include silty clay loam or silt loam. Soils in this site typically have free carbonates at the surface, but some soils may range from 0 to 10 inches. These soils are saline and alkaline in the substratum or underlying material. The higher levels of salinity adversely affects plant species composition and growth. These soils are susceptible to erosion by water and wind. The potential for erosion increases where vegetative cover is inadequate. Channel cutting, deposition, and removals may occur adjacent to ephemeral or intermittent streams.

Major soil series correlated to this ecological site include: Manzanola.

Other soil series that have been correlated to this site, but may eventually be re-correlated include: Haverson (saline).

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

The attributes listed below represent 0-40 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.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6.5–8 in
Calcium carbonate equivalent (0-40in)	5–15%
Electrical conductivity (0-40in)	2–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–13
Soil reaction (1:1 water) (0-40in)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Saline Overflow Ecological Site is characterized by three states: Reference, Warm-Season Shortgrass, and Increased *Bare Ground*. The Reference State is characterized by warm-season mid bunchgrass (alkali sacaton), cool-season mid-rhizomatous (western wheatgrass), and warm-season short bunchgrass (blue grama). The Warm-season Shortgrass State is characterized by warm-season short bunchgrass (blue grama) and warm-season short rhizomatous grass (inland saltgrass). The Increased *Bare Ground* State is characterized by early successional warm-season short bunchgrass (Fendler threeawn, ring muhly), annual grasses (sixweeks fescue, annual barley), and forbs (hairy goldenaster). Common annual invasives (cheatgrass, Russian thistle) and perennial invasives (bindweed) may also occur.

Excessive grazing by large herbivores causes this site to deteriorate. Species such as blue grama and inland saltgrass increase. Alkali sacaton, switchgrass, green needlegrass, and western wheatgrass decrease in frequency and production, as do American vetch and fourwing saltbush. Continued excessive grazing causes blue grama and inland saltgrass to form into a sod-bound condition and eventually eventually result in a plant community consisting of various low successional perennials, annuals, and increased bare ground. Non-use and lack of fire results in a plant community having high litter levels with low plant density.

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.

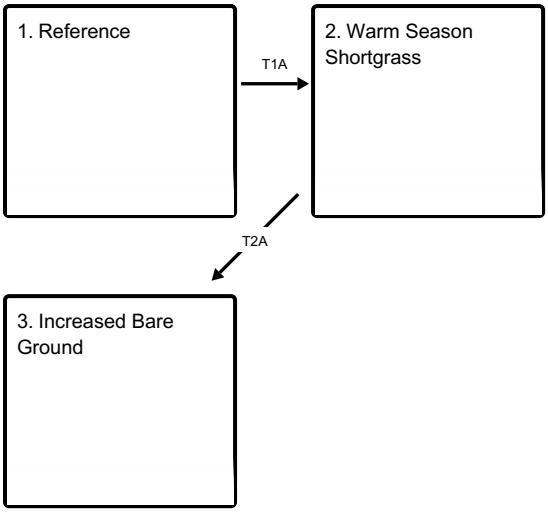
This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely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

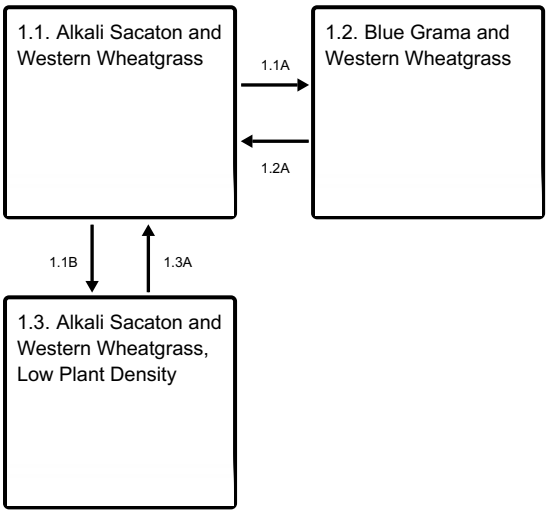
Ecosystem states



T1A - Excessive grazing. Lack of fire.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



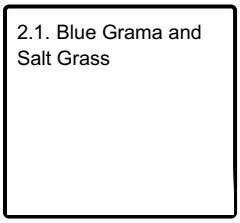
1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

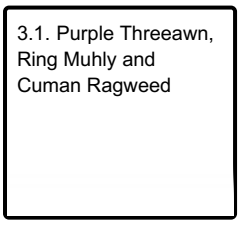
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

The Reference state is characterized by three plant communities. These plant communities and the various successional stages between them represent the natural range of variation within the Reference state.

Dominant plant species

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

Community 1.1
Alkali Sacaton and Western Wheatgrass

This is the interpretive plant community. It developed with grazing by large herbivores and is well suited for grazing by domestic livestock. The potential vegetation is about 75 to 90 percent grasses and grass-likes, 5 to 10 percent forbs and 5 to15 percent shrubs by air-dry weight. Dominant grasses include alkali sacaton, western wheatgrass, and switchgrass. Grasses of secondary importance are blue grama, vine mesquite, and inland saltgrass. Sun sedge is common. Forbs and shrubs such as American vetch, American licorice, leafy false goldenweed, scarlet globemallow, and fourwing saltbush are significant. This plant community is diverse, stable, and productive. Litter is properly distributed with very little movement and natural plant mortality is low. It is well suited to carbon sequestration, watershed function, wildlife use by many species, livestock use, and is aesthetically pleasing due to the diverse plant composition. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. This community is resistant to many disturbances except excessive grazing and development into urban or other uses. Total annual production ranges from 800 to 2,800 pounds of air-dry vegetation per acre with a Representative Value of 1,700 pounds.

Dominant plant species

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

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	640	1400	2075
Shrub/Vine	80	170	250
Forb	80	130	175
Total	**800**	**1700**	**2500**

Figure 9. Plant community growth curve (percent production by month). CO6708, Warm-season/cool-season codominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	20	35	18	10	5	2	0	0

Community 1.2
Blue Grama and Western Wheatgrass

Blue grama and inland saltgrass have increased but have not developed into a sod-bound condition. Alkali sacaton is scattered in reduced amounts. Western wheatgrass, switchgrass, and vine-mesquite have decreased. American vetch and green needlegrass have been removed. Forbs and shrubs such as scarlet globemallow, leafy false goldenweed, rubber rabbitbrush (green plume rabbitbrush), and broom snakeweed have increased. Fourwing saltbush is significantly reduced in abundance. Plant vigor, litter, frequency, and production have decreased.

Reduction of key warm- and cool-season grasses, nitrogen fixing legumes and shrubs, and an increase in blue grama and inland saltgrass have negatively affected nutrient cycling. The biological integrity and water and nutrient cycles of this plant community are at risk of becoming impaired. Total annual production ranges from 450 to 1,400 pounds of air-dry vegetation per acre and averages 850 pounds during a normal year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Figure 10. Plant community growth curve (percent production by month). CO6702, Warm-season dominant, cool-season subdominant; MLRA-67B, upland fine textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2	15	45	20	15	3	0	0	0

Community 1.3
Alkali Sacaton and Western Wheatgrass, Low Plant Density

Plant composition is similar to the Reference Plant Community, however individual species production and frequency will be lower. Much of the nutrients are tied up in excessive litter. The semiarid environment and the absence of animal traffic impair nutrient recycling. Increased standing dead canopy limits sunlight from reaching plant crowns. Many plants, especially bunchgrasses die off. Increased litter and absence of grazing animals (animal impact), or fire reduce seed germination and seedling establishment. Plants typically die off and erosion can become a concern. Once this happens it requires increased energy input in terms of practice cost and management to stabilize the plant community. Total annual production ranges from 550 to 2,000 pounds of air-dry vegetation per acre and averages 1,200 pounds during a normal year.

Dominant plant species

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

Figure 11. Plant community growth curve (percent production by month). CO6705, Warm-season/cool-season codominant, excess litter; MLRA-67B; upland fine textured soils.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	7	18	35	18	13	5	2	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing without adequate recovery opportunity between grazing events and reduced fire frequency shifts this plant community to the 1.2 Community. Drought accelerates this process. Recurring spring seasonal grazing decreases cool-season plants. Recurring summer grazing decreases warm-season plants and increases cool-seasons. Biotic integrity will be altered and water & 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 the1.3 Community. Plant decadence and standing dead plant 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 rate, and prescribed fire shift this community back to the Reference Plant Community. When normal precipitation resumes, western wheatgrass may expand into bare areas, created by drought.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

The return of grazing with adequate recovery periods and normal fire frequency shift this community to the Reference Plant Community. This change can occur in a relatively short time.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Warm Season Shortgrass

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 blue grama and 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 tallgrasses, forbs, and shrubs reduces the biodiversity and productivity of this site.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- saltgrass (*Distichlis spicata*), grass

Community 2.1
Blue Grama and Salt Grass

Saltgrass and blue grama dominate the site and have developed into a sod-bound condition. Isolated small bunches of low vigor alkali sacaton may persist. Warm-season tallgrasses and fourwing saltbush have been removed. Western wheatgrass may persist in remnant amounts but be reduced in vigor. This plant community is resistant to change due to the grazing tolerance of blue grama and saltgrass. A significant amount of production and diversity has been lost when compared to the Reference Plant Community. Loss of key warm- and cool-season grasses, the shrub component, and nitrogen fixing forbs have negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the massive shallow root system “root pan”, characteristic of blue grama and inland saltgrass. Soil loss may be obvious where flow paths are connected. Total annual production ranges from 200 to 700 pounds of air-dry vegetation per acre and averages 450 pounds during a normal year.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- saltgrass (*Distichlis spicata*), grass

Figure 12. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	3	20	45	20	10	2	0	0	0

State 3
Increased Bare Ground

Litter levels are extremely low. Erosion is evident where flow paths are continuous. Rills may be evident as well as some gully erosion. The nutrient cycle, water cycle and overall energy flow are greatly impaired. Organic matter and carbon reserves are greatly reduced. This State is not stable.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- ring muhly (*Muhlenbergia torreyi*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Community 3.1
Purple Threeawn, Ring Muhly and Cuman Ragweed

Some saltgrass and blue grama may persist in localized areas. Lower successional species which dominate the community are purple threeawn, ring muhly, sand dropseed, Cuman ragweed (western ragweed), and mouse-ear povertyweed. Typical annual invaders include burninbush, Russian thistle, and cheatgrass. Erosion and loss of organic matter and carbon reserves are concerns. Nutrient and water cycles and energy flow are impaired. Total annual production ranges from 50 to 350 pounds of air-dry vegetation per acre.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- ring muhly (*Muhlenbergia torreyi*), grass
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Figure 13. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	3	20	45	20	10	2	0	0	0

Transition T1A
State 1 to 2

Excessive grazing and lack of fire move this state across an ecological threshold to the Warm-Season Shortgrass State.

Transition T2A
State 2 to 3

Heavy, continuous grazing without adequate recovery opportunity between grazing events, and lack of fire shifts the Warm-Season Shortgrass State across an ecological threshold to the Increased *Bare Ground* State. This transition may require several years. Erosion and loss of organic matter and carbon reserves are concerns.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				1275–1530	
	alkali sacaton	SPAI	*Sporobolus airoides*	425–595	–
	western wheatgrass	PASM	*Pascopyrum smithii*	255–425	–
	blue grama	BOGR2	*Bouteloua gracilis*	255–340	–
	switchgrass	PAVI2	*Panicum virgatum*	85–170	–
	vine mesquite	PAOB	*Panicum obtusum*	85–170	–
	saltgrass	DISP	*Distichlis spicata*	17–85	–
	Grass, perennial	2GP	*Grass, perennial*	17–85	–
	big bluestem	ANGE	*Andropogon gerardii*	0–85	–
	buffalograss	BODA2	*Bouteloua dactyloides*	17–85	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	17–51	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	17–51	–
	green needlegrass	NAVI4	*Nassella viridula*	0–51	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–34	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–34	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–34	–
	alkali cordgrass	SPGR	*Spartina gracilis*	0–34	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–17	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	0–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–17	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–17	–
Forb					
2				85–170	
	Forb, perennial	2FP	*Forb, perennial*	17–85	–
	American vetch	VIAM	*Vicia americana*	17–51	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	17–34	–
	leafy false goldenweed	OOFO	*Oonopsis foliosa*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–17	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–17	–
	povertyweed	IVAX	*Iva axillaris*	0–17	–
	dotted blazing star	LIPU	*Liatris punctata*	0–17	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–17	–
	lacy tansyaster	MAPIP4	*Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida*	0–17	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0–17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–17	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–17	–

	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–17	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–17	–
	stiff greenthread	THFI	*Thelesperma filifolium*	0–17	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–17	–
	white locoweed	OXSE	*Oxytropis sericea*	0–17	–
	New Mexico groundsel	PANEM	*Packera neomexicana var. mutabilis*	0–17	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	0–17	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–17	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–17	–
Shrub/Vine					
3				85–255	
	fourwing saltbush	ATCA2	*Atriplex canescens*	85–170	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	17–51	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–17	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	0–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
	soapweed yucca	YUGL	*Yucca glauca*	0–17	–

Animal community

WILDLIFE INTERPRETATIONS:

The combination of grasses, forbs, and shrubs found on this ecological site provide habitat for numerous wildlife species. Historic large grazers that influenced these communities were bison, elk, mule deer, and pronghorn. Herbivory and soil disturbance by black-tailed prairie dogs influenced ecological processes, supporting unique wildlife species. Bison are no longer widely distributed in their historic range. Prairie dogs occupy a small fraction of their historic range. Pronghorn are the most abundant ungulates using this ecological site, followed by mule deer. Domestic grazers share these habitats with wildlife. The grassland communities of eastern Colorado are home to many bird species. Changes in the composition of the plant community when moving from the Reference Community to other communities on this ecological site may result in shifts in bird species. The occasional wetland or spring found on this site provides essential seasonal water needed for reproductive habitat by some reptiles and amphibians. Because of a lack of permanent water, fish are not common.

1.1 Reference Community: Alkali Sacaton, Western Wheatgrass, Switchgrass, Fourwing Saltbush

Pronghorn are the most abundant ungulate on this site, followed by mule deer. This site also supports a high diversity of migratory grassland birds including grasshopper sparrow, McCown's longspur, chestnut-collared longspur, and loggerheaded shrike among others. Reptiles using this community include prairie rattlesnake. Swift fox use this community, especially for denning activities. If black-tailed prairie dogs are present, ferruginous hawks, burrowing owls, and mountain plover may occur. However, the higher vegetative production and structure (midgrasses and shrubs), may limit use.

1.2 Community: Increased Blue Grama, Increased Inland Saltgrass, Decreased Alkali Sacaton, Decreased Fourwing Saltbush

This community is very similar to the Reference Community therefore the value for wildlife is not significantly different.

1.3 Community: Low Plant Density, Increased Litter, Increased Standing Dead Canopy

The wildlife species found here, will be similar to those in the Reference Plant Community.

2.1 Community: Blue Grama, Inland Saltgrass

The loss of tall structure grasses and reduced forb diversity affects the diversity of wildlife species using this plant community. Pronghorn still use this community, but it has reduced forage value. Swift fox continue to use these areas due to decreased visual obstruction. Grassland birds preferring shorter structure grasses live here, including horned lark, McCown's chestnut collared longspurs, and loggerheaded shrike among others. If black-tailed prairie dogs are present, ferruginous hawks, burrowing owls, and mountain plover may be as well.

3.1 Community: Fendler Threeawn, Ring Muhly, Annuals, *Bare Ground*

This community is similar to the 2.1 Community. However blue grama and saltgrass have been reduced, and bare ground and soil erosion have increased, reducing the value for wildlife. Wildlife species using this this plant community would be similar to those using the 2.1 Community. Black-tailed prairie dogs and their obligate species may also use this community.

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 - (1700) (0.47)

1.2 PC - (850) (0.23)

2.1 PC - (450) (0.12)

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 D. Infiltration is moderate and runoff potential for this site varies from moderate to high depending on ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities

and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are present on the site.

Other products

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 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.

Those involved in developing the 2004 site description include: Ben Berlinger, Rangeland Management Specialist, CO-NRCS; Harvey Sprock, 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

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

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
Kimberly Diller, Ecological Site Specialist, NRCS MLRA, Pueblo SSO

Approval

Kirt Walstad, 12/05/2024

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 to slight.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground amounts to 3 percent or less ranging from 3 to 4 inches in diameter. Extended drought may cause bare ground to increase up to 10 percent.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** None to minimal. Litter can move downslope during flooding events.

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** SOM ranges from 1 to 2 percent. Soils are deep well drained, calcareous and slightly alkaline at the surface. A-horizon color is grayish brown at 0 to 5 inches in depth. Structure is strong very fine granular.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Raindrop impact is reduced by the diverse grass, forb, shrub

functional/structural groups and root structure. This slows overland flow and provides increased time for infiltration to occur. Extended drought, wildfire or both may reduce basal density, canopy cover, and litter amounts (primarily from tall, warm-season bunch and rhizomatous grasses), resulting in decreased infiltration and increased runoff on steep slopes following intense rainfall events.

---

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

---

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

    Dominant: Warm-season mid bunchgrass >

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

    Other: forbs > warm-season short rhizomatous > warm-season short/mid stoloniferous

    Additional:

---

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

---

14. **Average percent litter cover (%) and depth (in):** Litter cover during and following extended drought ranges from 20 to 30 percent.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 800 lbs./ac. low precipitation years; 1700 lbs./ac. average years; 2800 lbs./ac. high years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 400 to 700 lbs./ac.

---

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

---

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