USDA Natural Resources Conservation Service

# Ecological site R067BY029CO
# Sandy Meadow

Last updated: 9/08/2023
Accessed: 05/19/2024

## 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.

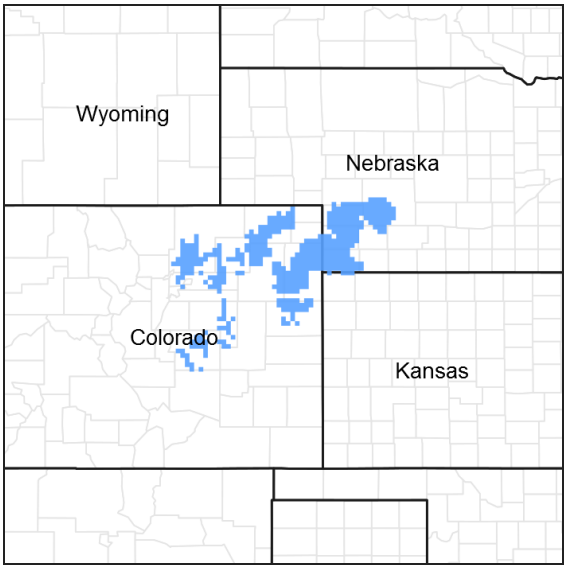



**Figure 1. Mapped extent**

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 Sandy Meadow Ecological Site was developed by an earlier version of the Sandy Meadow Ecological Site (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 Siltstone Plains 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 commonly adjacent. is a run-on site and is within four feet of the water table. There are no visible salts present in the soil profile or on the surface, and the site is not in a river or creek channel or floodplain adjacent to a river or creek. The subsoil textures are coarse sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand.

## Associated sites

| | |
|---|---|
| R067BY015CO | **Deep Sand**<br>This ecological site is commonly adjacent. |
| R067BY022CO | **Choppy Sands**<br>This ecological site is commonly adjacent. |

| | |
|---|---|
| R067BY031CO | **Sandy Bottomland**<br>This ecological site is commonly adjacent. |
| R067BY035CO | **Salt Meadow**<br>This ecological site is commonly adjacent. |
| R067BY073CO | **Riparian**<br>This ecological site is commonly adjacent. |

## Similar sites

| | |
|---|---|
| R067BY035CO | **Salt Meadow**<br>This ecological site is commonly adjacent. has visible salts in the profile or on the surface. |
| R067BY031CO | **Sandy Bottomland**<br>This ecological site is commonly adjacent. is greater than four feet from the water table. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Amorpha fruticosa* |
| Herbaceous | (1) *Andropogon hallii*<br>(2) *Panicum virgatum* |

## Physiographic features

This site occurs on the interdunes in the dune fields or on nearly level stream terraces and floodplains in the river valleys. There is an influential water table associated with this site.

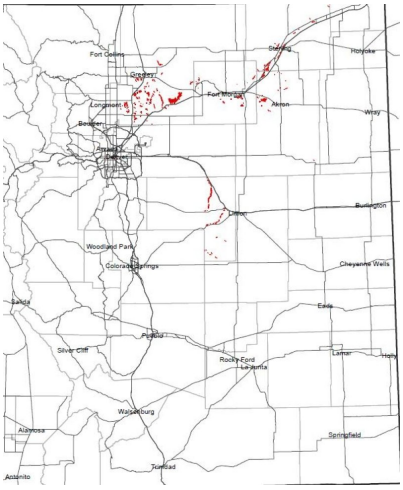



**Figure 2. The distribution of the Sandy Meadow site in MLRA 67B.**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Interdune<br>(2) Stream terrace<br>(3) Flood plain |
| Runoff class | Negligible to very low |
| Flooding duration | Brief (2 to 7 days) |
| Flooding frequency | None to occasional |
| Ponding duration | Brief (2 to 7 days) |
| Ponding frequency | None to occasional |
| Elevation | 1,097–1,524 m |

| | |
|---|---|
| Slope | 0–3% |
| Ponding depth | 0–3 cm |
| Water table depth | 0–91 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) LIMON WSMO [USW00093010], Limon, CO
- (2) BRIGHTON 3 SE [USC00050950], Brighton, CO
- (3) BYERS 5 ENE [USC00051179], Byers, CO
- (4) CHEYENNE WELLS [USC00051564], Cheyenne Wells, CO
- (5) SPRINGFIELD 7 WSW [USC00057866], Springfield, CO
- (6) FLAGLER 1S [USC00052932], Flagler, CO
- (7) FT MORGAN [USC00053038], Fort Morgan, CO
- (8) BRIGGSDALE [USC00050945], Briggsdale, CO
- (9) GREELEY UNC [USC00053553], Greeley, CO
- (10) KIT CARSON [USC00054603], Kit Carson, CO
- (11) NUNN [USC00056023], Nunn, CO

## Influencing water features

There is a seasonal-long water table that influences the kinds and amounts of vegetation on this site. The variability in water table provides a mosaic of drier and wetter areas on a meadow. This provides a diversity of non-hydrophytic and hydrophytic vegetation on the site. The water table in some areas is artificially induced, 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 a general overview for the site concept, and is not a wetland determination.

## Soil features

The soils on this site are very deep, poorly to somewhat poorly drained soils that formed from eolian sands or alluvium. They typically have a rapid to moderately rapid permeability class. 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 loamy sand or sand, but may include fine sand or sandy loam. The surface layer ranges from 3 to 20 inches thick. The subsoil is typically loamy sand, sandy loam, sand, or fine sand. Rock fragments range from 0 to 20 percent in the underlying material. Soils in this site are typically leached of carbonates at the surface to greater than 20 inches; some soils may have carbonates at the surface and throughout the profile. These soils are typically not susceptible to erosion by water and wind due to the wetness of the soil profile by the seasonal water table. However, these areas may be prone to wind erosion if these areas are drained and the surface is not protected by vegetation.

Major soil series correlated to this ecological site include: Boel, Els, and Loup.

Other soil series that have been correlated to this site, but may eventually be re-correlated include: Ipage variant, Dwyer wet*, Manter watertable*, and Manter wet*.

*Dwyer and Manter are typically found in the uplands and do not have water tables.

*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<br>(2) Eolian sands |
| Surface texture | (1) Loamy sand<br>(2) Sand<br>(3) Sandy loam |
| Drainage class | Poorly drained to somewhat poorly drained |
| Permeability class | Moderately rapid to rapid |
| Soil depth | 203 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |

| | |
|---|---|
| Available water capacity (0-101.6cm) | 6.35–10.16 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0–5% |
| Electrical conductivity (0-101.6cm) | 0–2 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0 |
| Soil reaction (1:1 water) (0-101.6cm) | 6.6–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–20% |
| Subsurface fragment volume >3" (Depth not specified) | 0% |

## Ecological dynamics

The Sandy Meadow Ecological Site is characterized by three states: Reference, Warm-Season Midgrass, and Increased *Bare Ground*. The Reference State is characterized by warm-season tall bunchgrass (sand bluestem, switchgrass, Indiangrass), and warm-season tall rhizomatous grass (prairie cordgrass, prairie sandreed), and a minor component of cool-season grasslikes (Nebraska sedge). The Warm- Season Midgrass State is characterized by a warm-season mid bunchgrass (sand dropseed). The Increased *Bare Ground* State is characterized by early successional cool-season grass (foxtail barley), annual grasses, and annual forbs.

This is an important site for livestock grazing, especially beef cattle. Today the management of livestock grazing by humans has been a major influence on the ecological dynamics of the site. This management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site. Continuous, heavy grazing without adequate recovery periods following each grazing occurrence initially causes prairie cordgrass, switchgrass, Indiangrass, sand bluestem, Nebraska sedge, and false indigo bush to decrease in frequency and production. Prairie sandreed, sand dropseed, alkali sacaton, inland saltgrass, Baltic rush, and Cuman ragweed gradually increase. Further excessive grazing produces a plant community comprised of alkali tolerant species, remnant prairie sandreed, and Kentucky bluegrass (invasive). Excessive litter, decadence, and plant mortality results from the lack of fire or non-use. Heavy, long-term continuous grazing can lead to increased bare ground.

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).

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.

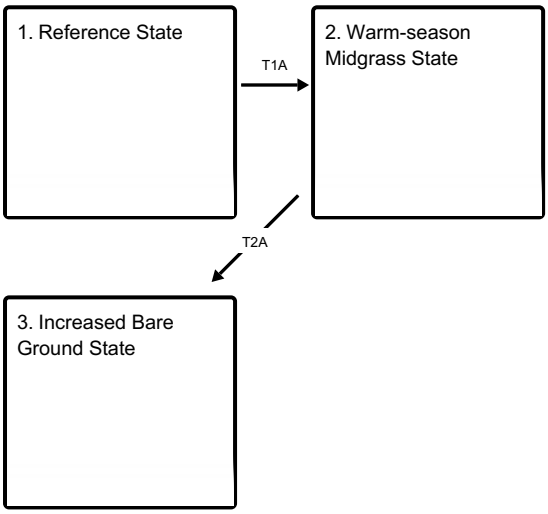
This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely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

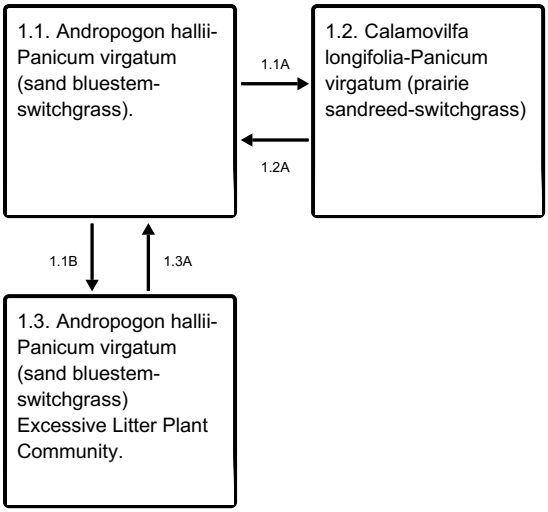
**Ecosystem states**




**T1A** - Excessive grazing. Lack of fire.

**T2A** - Excessive grazing. Lack of fire.

**State 1 submodel, plant communities**



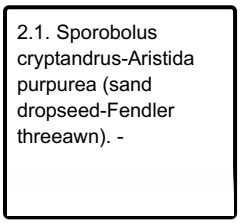

**1.1A** - Excessive grazing. Lack of fire.

**1.1B** - Non-use. Lack of fire.

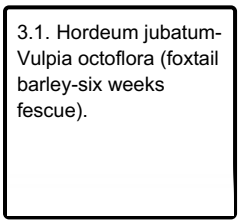
**1.2A** - Prescribed grazing. Prescribed fire.

**1.3A** - Prescribed grazing. Haying. Prescribed fire.

**State 2 submodel, plant communities**




**State 3 submodel, plant communities**




## State 1
## Reference State

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

### Dominant plant species

- false indigo bush (*Amorpha fruticosa*), shrub
- sand bluestem (*Andropogon hallii*), grass
- switchgrass (*Panicum virgatum*), grass

## Community 1.1
## Andropogon hallii-Panicum virgatum (sand bluestem-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 receive adequate recovery periods following each grazing event during the growing season. The potential vegetation is about 85 to 95 percent grasses and grass-likes, 4 to10 percent forbs and 1 to 5 percent woody plants. Warm-season tallgrasses dominate this plant community. The major grasses

include sand bluestem, Indiangrass, prairie cordgrass, and switchgrass. Other grasses and grass-likes occurring in the community include prairie sandreed, little bluestem, western wheatgrass, Canada wildrye, mountain rush, Baltic rush, and Nebraska sedge. Important forbs and shrubs include American licorice, Colorado butterfly plant, prairie gentian, and false indigo bush. 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 2,500 to 4,500 pounds of air-dry vegetation per acre with a Representative Value of 3,500 pounds.

### Dominant plant species

- false indigo bush (*Amorpha fruticosa*), shrub
- sand bluestem (*Andropogon hallii*), 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 | 2617 | 3531 | 4422 |
| Forb | 151 | 275 | 420 |
| Shrub/Vine | 34 | 118 | 202 |
| **Total** | **2802** | **3924** | **5044** |

**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
## Calamovilfa longifolia-Panicum virgatum (prairie sandreed-switchgrass)

Sand bluestem, prairie cordgrass, switchgrass, Indiangrass, Nebraska sedge, and false indigo bush have decreased. Prairie sandreed has increased. Western wheatgrass may initially increase or decrease depending upon the season of use. Baltic rush and Cuman ragweed have increased. This plant community is relatively stable but is at risk of losing warm-season tallgrasses, palatable forbs, and shrubs. The plants of this community have decreased in frequency and production compared to the Reference Plant Community. The reduction of key tallgrass species, deep-rooted forbs, and shrubs has begun to alter the biotic integrity of this plant community. The nutrient cycle, water cycle, and energy flow may be impaired. Total annual production, during an average year, ranges from 1,200 to 3,000 pounds per acre air-dry weight and averages 2,000 pounds during a normal year.

### Dominant plant species

- false indigo bush (*Amorpha fruticosa*), shrub
- prairie sandreed (*Calamovilfa longifolia*), grass
- switchgrass (*Panicum virgatum*), 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
## Andropogon hallii-Panicum virgatum (sand bluestem-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. Much of the nutrients are tied up in excessive litter. Organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact. Excessive litter levels and standing dead canopy prevent sunlight from reaching plant crowns and in time can stagnate the plant community. Tallgrasses such as sand bluestem, prairie cordgrass, switchgrass, and Indiangrass can become decadent and eventually die. Grazing, haying, or fire followed by prescribed grazing with adequate recovery opportunity can move this plant community to the Reference Plant Community in a relatively short time frame. Total annual production varies substantially from 600 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**

- false indigo bush (*Amorpha fruticosa*), shrub
- sand bluestem (*Andropogon hallii*), grass
- switchgrass (*Panicum virgatum*), grass

**Figure 12. Plant community growth curve (percent production by month). CO6716, Warm-season dominant, cool-season subdominant, high litter; MLRA-67B; lowland water-influenced soils.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 2 | 8 | 20 | 28 | 20 | 12 | 6 | 4 | 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 shift 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. Biotic integrity is altered and water and nutrient cycles may become impaired.

## Pathway 1.1B
## Community 1.1 to 1.3

Non-use and lack of fire cause the Reference Plant Community to shift to the 1.3 Community. Plant decadence and standing dead plant material impede 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, 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 with adequate recovery opportunity, haying, or normal fire frequency shift this community 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 Midgrass 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. The loss of functional/structural groups such as warm-season tallgrass reduces the biodiversity and productivity of this site.

**Dominant plant species**

- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

## Community 2.1
## Sporobolus cryptandrus-Aristida purpurea (sand dropseed-Fendler threeawn). -

Prairie cordgrass, sand bluestem, Indiangrass, and false indigo bush have been removed. Sand dropseed, red threeawn, inland saltgrass, foxtail barley, alkali sacaton, Baltic rush, and Cuman ragweed have increased. Kentucky bluegrass has likely invaded the community. Remnant amounts of low vigor prairie sandreed, switchgrass, and western wheatgrass may still be present. This community has lost much of its production and diversity. Nutrient cycle is impaired due to the loss of most tallgrass species, deep-rooted forbs (legumes and others) and shrubs. Soil compaction can be a concern if continuously grazed during wet cycles. Total annual production, during an average year, ranges from 900 to 1,700 pounds per acre air-dry weight and averages 1,300 pounds in a normal year.

**Dominant plant species**

- sand dropseed (*Sporobolus cryptandrus*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), 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

Compared to the Reference State, all perennial plants have been greatly reduced with only remnants of the most grazing tolerant species present. Plant diversity and production are very low. Wind erosion can be a concern due to increased bare ground. Litter amounts are low. Carbon storage and nutrient cycling has been greatly reduced. Compaction, if severe enough, can affect water infiltration. 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. Water cycling and energy flow are impaired.

**Dominant plant species**

- foxtail barley (*Hordeum jubatum*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

## Community 3.1
## Hordeum jubatum-Vulpia octoflora (foxtail barley-six weeks fescue).

The plant composition is made up of primarily foxtail barley, sixweeks fescue, Cuman ragweed, and introduced

annuals such as Russian thistle and burningbush. Kentucky bluegrass (invasive) may persist in small amounts. Remnants of western wheatgrass, inland saltgrass, Baltic rush, and other species may be present. Compared to the Reference Plant Community, all perennial plants have been greatly reduced with only remnants of the most grazing tolerant species present. Plant diversity and production are very low. Planned rest periods during the growing season improves the vigor of the plant species present. Total Annual Production ranges from 100 to 400 pounds per acre air-dry weight.

**Dominant plant species**

- foxtail barley (*Hordeum jubatum*), grass
- sixweeks fescue (*Vulpia octoflora*), 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 shift this State across an ecological threshold to the Warm-season Midgrass State. Biotic integrity and hydrologic function will be 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 Increase *Bare Ground* State. Erosion, loss of organic matter, loss of 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 | | | | 3335–3727 | |
| | sand bluestem | ANHA | *Andropogon hallii* | 588–785 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 588–785 | – |
| | prairie cordgrass | SPPE | *Spartina pectinata* | 392–785 | – |
| | Indiangrass | SONU2 | *Sorghastrum nutans* | 392–785 | – |
| | prairie sandreed | CALO | *Calamovilfa longifolia* | 392–588 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 196–392 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 39–196 | – |
| | alkali sacaton | SPAI | *Sporobolus airoides* | 0–196 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 39–196 | – |
| | Nebraska sedge | CANE2 | *Carex nebrascensis* | 39–118 | – |
| | Canada wildrye | ELCA4 | *Elymus canadensis* | 39–78 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 39–78 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–39 | – |
| | sixweeks fescue | VUOC | *Vulpia octoflora* | 0–39 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–39 | – |
| | foxtail barley | HOJU | *Hordeum jubatum* | 0–39 | – |
| | mountain rush | JUARL | *Juncus arcticus ssp. littoralis* | 0–39 | – |
| | marsh muhly | MURA | *Muhlenbergia racemosa* | 0–39 | – |
| | saltgrass | DISP | *Distichlis spicata* | 0–39 | – |
| | Fendler threeawn | ARPUL | *Aristida purpurea var. longiseta* | 0–39 | – |
| **Forb** | | | | | |
| 2 | | | | 157–392 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 39–196 | – |
| | showy prairie gentian | EUEXR | *Eustoma exaltatum ssp. russellianum* | 39–78 | – |
| | American licorice | GLLE3 | *Glycyrrhiza lepidota* | 39–78 | – |
| | Colorado butterfly plant | OECOC | *Oenothera coloradensis ssp. coloradensis* | 0–39 | – |
| | beardtongue | PENST | *Penstemon* | 0–39 | – |
| | giant goldenrod | SOGI | *Solidago gigantea* | 0–39 | – |
| | white heath aster | SYER | *Symphyotrichum ericoides* | 0–39 | – |
| | vervain | VERBE | *Verbena* | 0–39 | – |
| | Colorado butterfly plant | GANEC | *Gaura neomexicana ssp. coloradensis* | 0–39 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–39 | – |
| **Shrub/Vine** | | | | | |
| 3 | | | | 39–196 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 39–78 | – |
| | false indigo bush | AMFR | *Amorpha fruticosa* | 39–78 | – |

## Animal community

WILDLIFE INTERPRETATIONS:

The combination of grasses, forbs, and shrubs found on the ecological site provide habitat for numerous wildlife species. Historic large grazers that influenced these communities were bison, elk, mule deer, and pronghorn. Bison are no longer widely distributed in their historic range. Mule deer are the most abundant ungulates using this ecological site, followed by pronghorn. 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 species shifts in bird species.

1.1 Reference Plant Community

The structural diversity in the plant community found on the Reference Site is attractive to a number of wildlife species. Common bird species expected on in this plant community include grasshopper sparrow, western meadowlark, and dickcissel. The combination of tall grasses and increased production of forbs provides brood rearing habitat greater prairie chicken in the northern portion of the MLRA. In the southern portion of the MLRA, scaled quail may also use the fringes of this community where sandy meadows abut other sites with a sand sage component. Mule deer, and to a lesser extent, pronghorn occur on this site and use it for feeding and bedding. Mule deer may use this site for fawning. Reptiles using this community include prairie rattlesnake, bullsnake, western hognose snake, racer, ornate box turtle, and six-lined racerunner.

1.2 Community

The wildlife community has not substantially changed from the reference community.
1.3 Community
The wildlife community has not substantially changed from the reference community.

2.1 Community

Due to the shortened vegetative structure in this community, use by grassland birds requiring tall cover has decreased. Use by prairie chickens also decreases. Scaled quail continue to use the site due to the increase in annual forbs and bare ground. Mule deer and pronghorn no longer spend much time feeding in this areas and deer do not use this community for fawning.

3.1 Community

In the increased bare ground community, most species of wildlife that were present in the reference plant community are no longer found on the site. The exception is scaled quail which continue to use this community due to the abundance of annual forbs and bare ground.

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 - (3500) (.96)

1.2 PC - (2000) (0.55)

2.1 PC - (1300) (0.36)

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 management plan.

## Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration varies from moderate to high and runoff potential for this site varies from moderate to low depending on and ground cover. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

## Recreational uses

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

## Wood products

No appreciable wood products are present on the site.

## Other products

Site Development 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

Inventory Data Ref:
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: 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.

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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.

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## Approval

Kirt Walstad, 9/08/2023

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## Rangeland health reference sheet

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

| | |
|---|---|
| Author(s)/participant(s) | Harvey Sprock, 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):** Typically none. Prolonged drought or wildfire events may cause bare ground to increase to 3 to 5 percent with bare patches ranging from 4 to10 inches in diameter.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** Minor wind erosion may occur with disturbances such as fire or extended drought.

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

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating is anticipated to be 4 to 5 at soil surface.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM ranges from 2 to 4 percent. Surface texture is typically a fine sand to a fine sandy loam. A-horizon ranges from 0 to 10 inches in depth. Soils are very deep, dark gray, weak fine granular structure.

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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.

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

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

    Dominant: Warm-season tall bunchgrass >

    Sub-dominant: Warm-season tall rhizomatous > cool-season mid rhizomatous/grasslike >

    Other: Warm-season mid bunchgrass = forbs > shrubs

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal

---

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):** 2500 lbs./ac. low precipitation years; 3500 lbs./ac. average years; 4500 lbs./ac. high years. After extended drought or the first growing season following wildfire, production may be reduced by 500 to 1000 lbs./ac. or more.

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize**

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

---

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

---