USDA Natural Resources Conservation Service

Ecological site R067BY002CO
Loamy Plains

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.

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 Loamy Plains Ecological Site was developed by an earlier version of the Loamy Ecological Site (2004, re-named Loamy Plains in 2007). This earlier version of the Loamy Ecological Site 2005 was based on input from NRCS (formerly Soil Conservation service) and historical information obtained from the Loamy Plains Range Site descriptions (1975, revised 1983). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Loamy Plains Ecological Site is a run-off site on slopes greater than six percent. There is no bedrock within 40 inches of the surface, and no visible salts or calcium carbonate in the upper soil profile.

Associated sites

R067BY024CO	**Sandy Plains** This ecological site is commonly adjacent.
R067BY036CO	**Overflow** This ecological site is commonly adjacent.
R067BY042CO	**Clayey Plains** This ecological site is commonly adjacent.
R067BY060CO	**Limestone Breaks** This ecological site is commonly adjacent.
R067BY063CO	**Gravel Breaks** This ecological site is commonly adjacent.

Similar sites

R067BY042CO	**Clayey Plains** This ecological site has surface textures of clay loam, clay, or silty clay.
R067BY009CO	**Siltstone Plains** This ecological site has calcium carbonate at the surface.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Krascheninnikovia lanata*

Herbaceous	(1) *Bouteloua gracilis* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on narrow to broad, flat, interfluves and terraces on dissected plains.

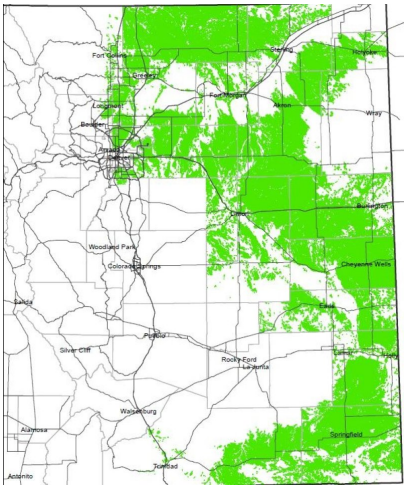


Figure 1. Loamy Plains distribution map for MLRA 67B.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Terrace
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	3,400–6,000 ft
Slope	0–6%
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

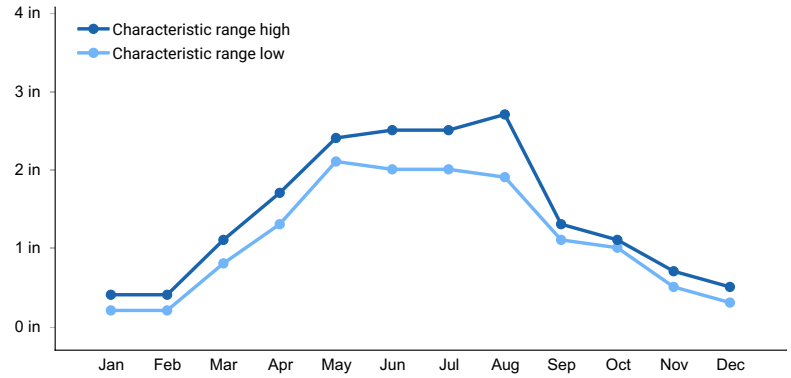


Figure 2. Monthly precipitation range

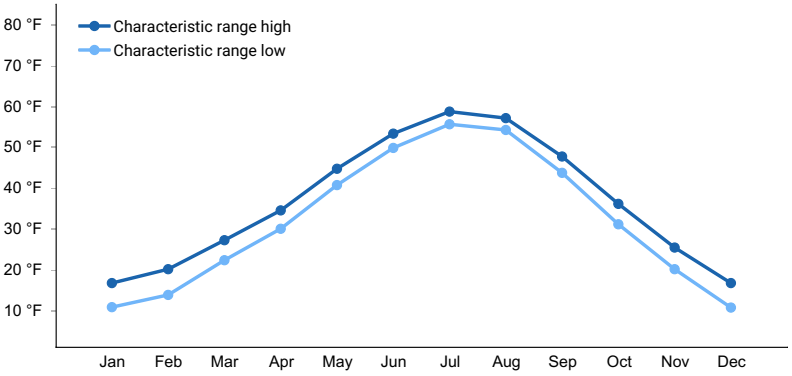


Figure 3. Monthly minimum temperature range

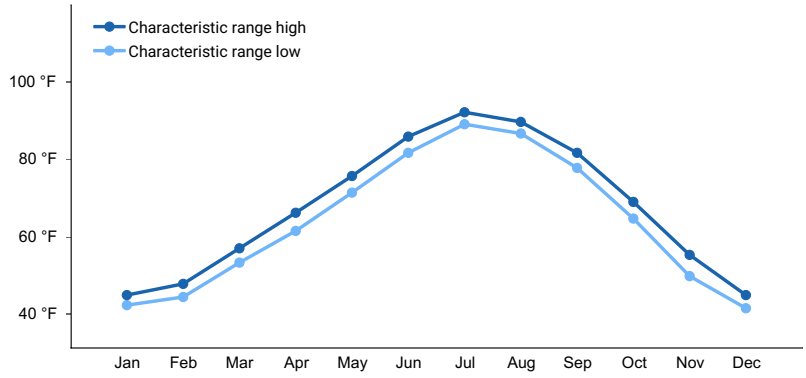


Figure 4. Monthly maximum temperature range

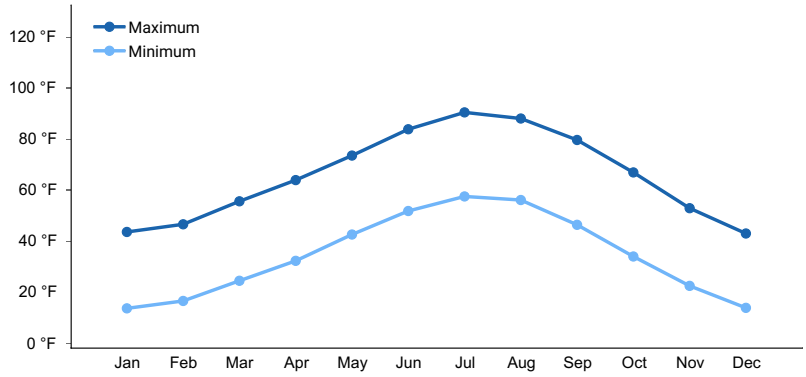


Figure 5. Monthly average minimum and maximum temperature

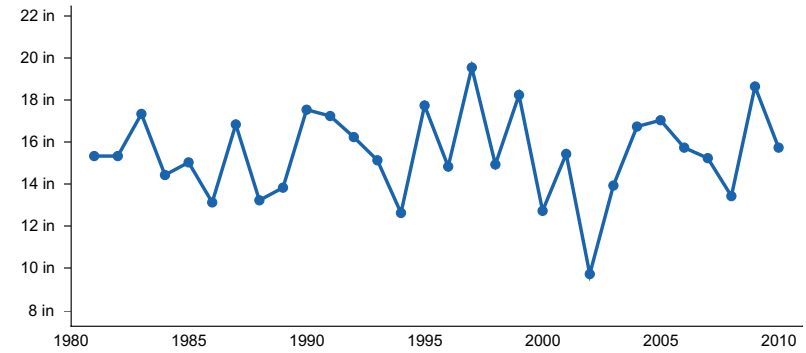


Figure 6. Annual precipitation pattern

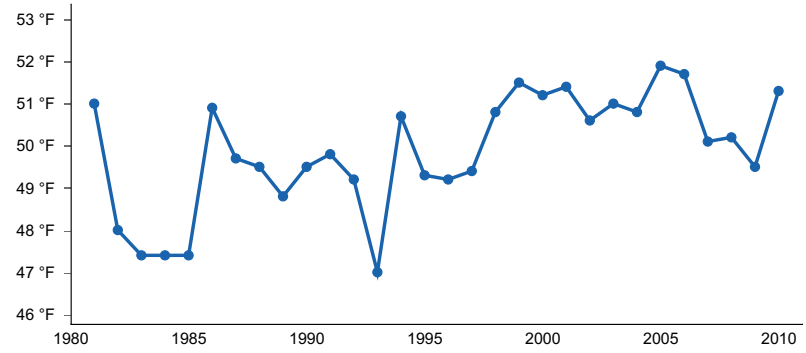


Figure 7. Annual average temperature pattern

Climate stations used

- (1) SPRINGFIELD 7 WSW [USC00057866], Springfield, CO
- (2) FT MORGAN [USC00053038], Fort Morgan, CO
- (3) NUNN [USC00056023], Nunn, CO

- (4) BRIGHTON 3 SE [USC00050950], Brighton, CO
- (5) LIMON WSMO [USW00093010], Limon, CO
- (6) CHEYENNE WELLS [USC00051564], Cheyenne Wells, CO
- (7) GREELEY UNC [USC00053553], Greeley, CO
- (8) BRIGGSDALE [USC00050945], Briggsdale, CO
- (9) FLAGLER 1S [USC00052932], Flagler, CO
- (10) KIT CARSON [USC00054603], Kit Carson, CO
- (11) BYERS 5 ENE [USC00051179], Byers, CO

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils on this site are very deep, well drained soils that formed from loess, alluvium, and eolian deposits. They typically have a moderate to moderately slow permeability class, but range to slow in some soils. The available water capacity is typically high, but ranges from moderate to very high. The soil moisture regime is typically aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils in this site is primarily moderately-fine textured to medium textured, but the range includes fine-textured. The surface layer ranges from a depth of 4 to 12 inches thick. The subsoil and underlying material have a similar range in texture as the surface layer. However, a contrasting gravelly sand layer occurs at depths below 24 to 36 inches in the Altvan soil series and 20 to 35 inches in the Dacono soil series. Soils in this site are generally high in fertility and can have free carbonates below 6 inches. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Major soil series correlated to this ecological site include: Adena, Altvan, Ascalon (loam), Baca (loam), Colby (0 to 6 percent), Columbo (loam), Dacono (loam), Fort Collins, Harbord, Keith, Kim, Kimst, Norka, Nucla, Nunn (loam), Platner, Rago (loam), Satanta, Stoneham, Ulysses, Ulmet (loam), Wages, Weld, and Wiley.

Other soil series that have been correlated to this site include Sampson (terrace) and Ulm (loam).

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

*Feature listed in “( )” relates to either the surface texture of the soil or slope class.

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.

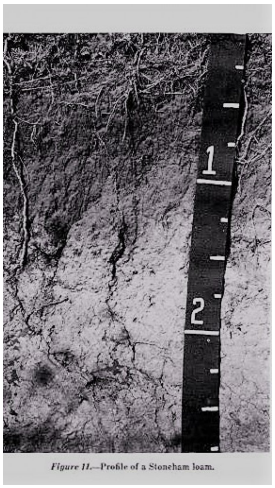


Figure 8. Stoneham loam (Soil Survey of Adams Co., Colorado, 1974)

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess (3) Eolian deposits
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–9 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

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 Loamy Plains ecological site is characterized by four states: Reference, Warm-Season Shortgrass, Increased *Bare Ground*, and Tilled. The Reference State is characterized by co-dominant warm-season shortgrass (blue grama), and cool-season midgrass (western wheatgrass, green needlegrass). The Warm-Season Shortgrass State is characterized by a warm-season short bunchgrass (blue grama) and stoloniferous grass (buffalograss). The Increased *Bare Ground* State is characterized by early successional warm-season bunchgrass (Fendler's threeawn), cool-season short bunchgrass (squirreltail), annual grasses, and annual forbs. The Tilled State has been mechanically disturbed by equipment and includes either a variety of reseeded warm- and cool-season grasses (seeded community) or early successional plants as well as annual grasses and forbs (go-back community).

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.

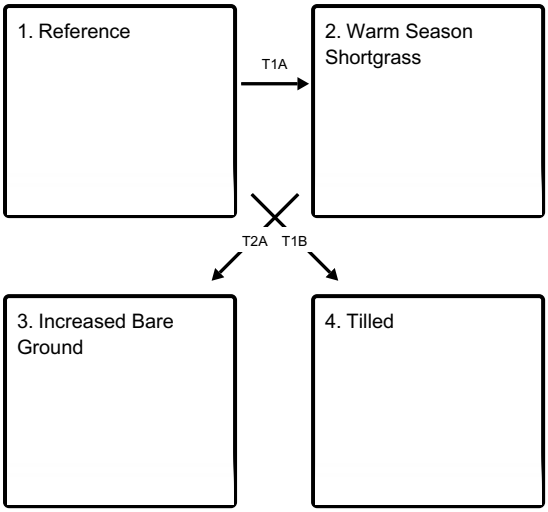
Excessive grazing by large herbivores causes blue grama and buffalograss to increase. Blue grama and buffalograss may eventually form a sod-like appearance. Cool-season grasses such as western wheatgrass and green needlegrass decrease in frequency and production. Eventually green needlegrass is removed and western wheatgrass may persist in depressions. Fourwing saltbush, American vetch, and other highly palatable species also decrease. Fendler's threeawn, ring muhly, annuals, and bare ground increase under excessive defoliation or long-term non-use. Much of this ecological site has been tilled and used for crop production. Other areas of this ecological site have been converted to suburban residences and small acreages, especially near the larger communities.

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

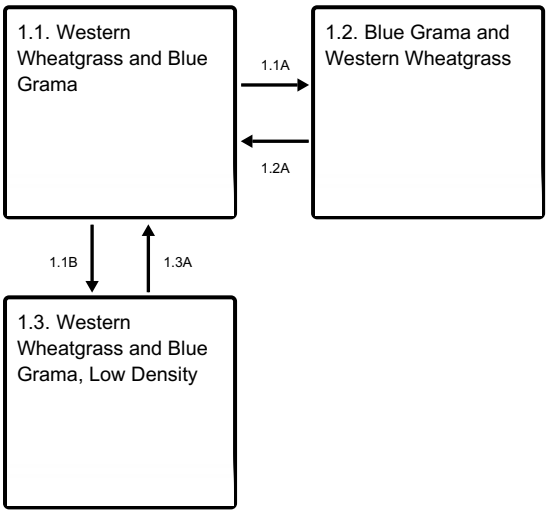


T1A - Excessive grazing. Lack of fire.

T1B - Mechanical tillage.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



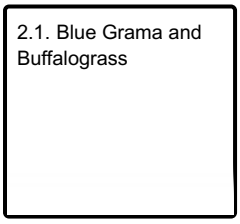
1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed burning.

State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Purple Threeawn and Sand Dropseed

State 4 submodel, plant communities

4.1. Russian Thistle and Purple Threeawn, Go-Back Land	4.2. Seeded

State 1
Reference

The Reference state is characterized by three distinct plant communities. The plant communities and various successional stages between them represent the natural range of variability due to the disturbance regimes associated with to the site.

Dominant plant species

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

Community 1.1
Western Wheatgrass and Blue Grama

Figure 9. Loamy Plains, Lincoln County, CO

This community evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. It can be found on areas that are properly managed with prescribed grazing that allows for adequate recovery periods following each grazing event. The potential vegetation is about 70 to 85 percent grasses and grass-like plants, 5 to 5 percent forbs, and 10 to 15 percent woody plants. The major grasses include western wheatgrass, green needlegrass, and blue grama. Western wheatgrass is a major cool-season grass in this plant community and is a valuable forage plant in late spring and early summer. Sub-dominant grasses include needle and thread, buffalograss, and sand dropseed. Major forbs include American vetch, upright prairie coneflower, scarlet globemallow, and dotted blazingstar (dotted gayfeather). A minor amount of shrubs such as fourwing saltbush and winterfat may also occur. This plant community is diverse and productive. Litter is properly distributed with very little movement off-site, and natural plant mortality is very low. It is well-suited to carbon sequestration, effective water

cycle, wildlife use by many species, livestock use, and is aesthetically pleasing. Community dynamics, nutrient and water cycles, and energy flow are functioning properly. This community is resistant to disturbances except excessive grazing, tillage, or development into urban or other uses. Total annual production ranges from 600 to 1,800 pounds of air-dry vegetation per acre and averages 1,300 pounds during an average year. These production figures are the fluctuations expected during favorable, normal, and unfavorable years due to the timing and amount of precipitation and temperature. Total annual production should not be confused with species productivity, which is annual production and variability by species throughout the extent of the community phase.

Dominant plant species

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

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	415	1007	1400
Shrub/Vine	125	163	200
Forb	60	130	200
Total	**600**	**1300**	**1800**

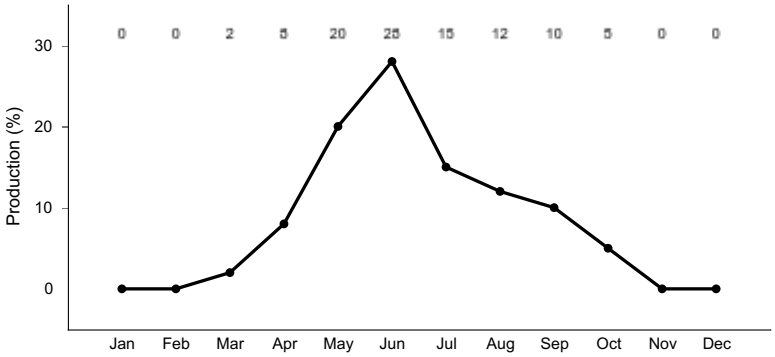


Figure 11. Plant community growth curve (percent production by month). CO6701, Cool-season/warm-season codominant; MLRA-67B; upland fine-textured soils..

Community 1.2
Blue Grama and Western Wheatgrass

Key species from the reference plant community, such as green needlegrass, western wheatgrass, American vetch, fourwing saltbush, and winterfat have been reduced in production. Blue grama has increased in abundance and western wheatgrass has decreased. Buffalograss, sand dropseed, purple threeawn, sixweeks fescue, plains pricklypear, hairy false goldenaster, and bottlebrush squirreltail also have increased. This plant community is at risk of losing the cool-season grasses, key forbs such as American vetch and purple prairie clover, and key shrubs. Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrass, nitrogen-fixing forbs, the shrub component, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired. Total annual production can vary from 200 to 900 pounds of air-dry vegetation per acre and averages 700 pounds during an average year.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

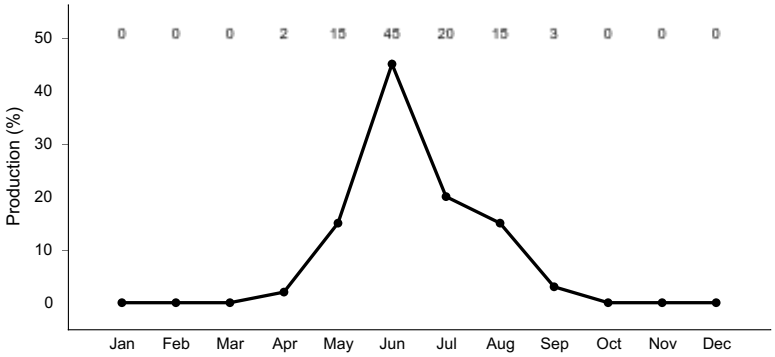


Figure 12. Plant community growth curve (percent production by month). CO6702, Warm-season dominant, cool-season subdominant; MLRA-67B, upland fine textured soils..

Community 1.3
Western Wheatgrass and Blue Grama, Low Density

This plant community occurs when grazing is removed for long periods of time in the absence of fire. Plant composition is similar to the reference plant community but individual species production and frequency are lower. Most of the available nutrients are tied up in standing dead plant material and increased amounts of litter. The semiarid environment and the absence of animal traffic to break down litter slows nutrient recycling. A standing dead canopy also limits sunlight from reaching plant crowns. Many plants die off, especially the centers of bunchgrasses. Litter and absence of grazing or fire reduces seed germination and establishment. In advanced stages, plant mortality increases and erosion occurs if bare ground increases. Total annual production can vary from 400 to 1,300 pounds of air-dry vegetation per acre and averages 850 pounds during an average year.

Dominant plant species

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

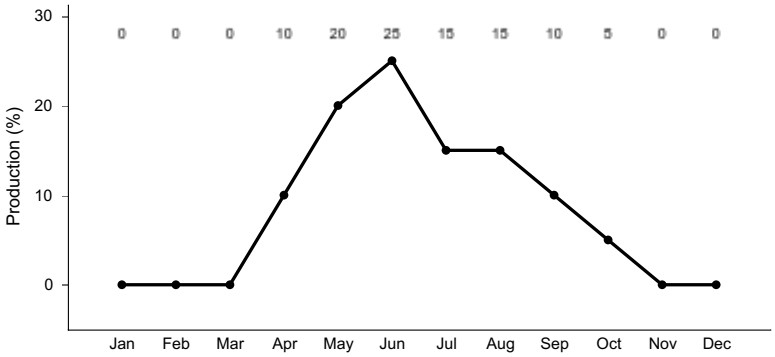


Figure 13. Plant community growth curve (percent production by month). CO6703, Cool-season/warm-season codominant, excess litter; MLRA-67B; upland fine textured soils..

Pathway 1.1A
Community 1.1 to 1.2

Excessive grazing and reduced fire frequency shift this plant community toward the 1.2 community. Biotic integrity is altered and water and nutrient cycles may be slightly impaired.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire move this plant community to the 1.3 community. Plant decadence and standing dead plant material impede energy flow and the water and nutrient cycles.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with adequate recovery periods and proper stocking return this plant community back to the reference community. Prescribed fire will expedite the process.

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 return this community to the reference plant community. This change can occur in a relatively short time frame.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Warm Season Shortgrass

This state is characterized by one community. An ecological threshold has been crossed and a significant amount of production and diversity lost when compared to the Reference state. Significant biotic and edaphic (soil characteristics) changes have negatively impacted energy flow and the nutrient and hydrologic cycles. This is a very stable state, resistant to change due to the high tolerance of blue grama and buffalograss to grazing, the development of a shallow root system (root pan), and subsequent changes in hydrology and nutrient cycling. The loss of other functional/structural groups such as cool-season bunchgrasses, warm-season bunchgrasses, forbs, and shrubs reduces the biodiversity and productivity of this site.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Community 2.1
Blue Grama and Buffalograss

This plant community developed with excessive grazing and lack of fire. Green needlegrass, American vetch, purple prairie clover, fourwing saltbush, and winterfat have been removed. Western wheatgrass may persist in trace amounts in protected areas, small depressions, and higher precipitation regimes within the MLRA. Blue grama and buffalograss dominate the community and can form a “sod-bound” appearance. Purple threeawn, sand dropseed, tumblegrass, bottlebrush squirreltail, sixweeks fescue, plains pricklypear, and hairy false goldenaster increase in varying amounts. In some instances, broom snakeweed also increases. This plant community is resistant to change due to grazing tolerance of buffalograss and blue grama. A significant amount of production and diversity has been lost when compared to the reference community. Loss of cool-season grasses, fourwing saltbush, winterfat, and nitrogen-fixing forbs has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced due to the massive shallow root system (root pan) characteristic of sod-bound blue grama and buffalograss. Soil loss may be obvious where flow paths are connected.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

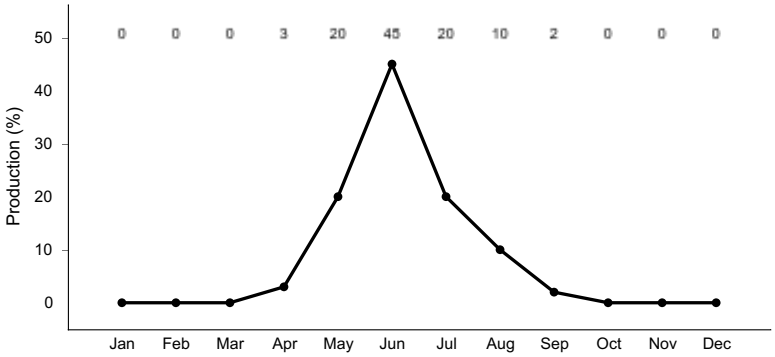


Figure 14. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

State 3
Increased Bare Ground

Litter levels are extremely low. Erosion is evident where flow paths are continuous. Rills may occur on steeper slopes. Wind scoured areas may be apparent on knolls or unprotected areas. Plant pedestals caused by wind scouring are common. The nutrient and water cycles and overall energy flow are greatly impaired. Organic matter and carbon reserves are greatly reduced. This community is not stable. Erosion and loss of organic matter and carbon reserves are concerns.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 3.1
Purple Threeawn and Sand Dropseed

Purple threeawn is the dominant species with sand dropseed and ring muhly present in small amounts. Blue grama may persist in localized areas. Pricklypear cactus and fringed sage may increase. Introduced annuals such as burningbush and Russian thistle are present. Introduced species such as field bindweed can also be present, especially on prairie dog towns. Total annual production can vary from 50 to 200 pounds of air-dry vegetation per acre and averages 100 pounds during an average year.

Dominant plant species

- plains pricklypear (*Opuntia polyacantha*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

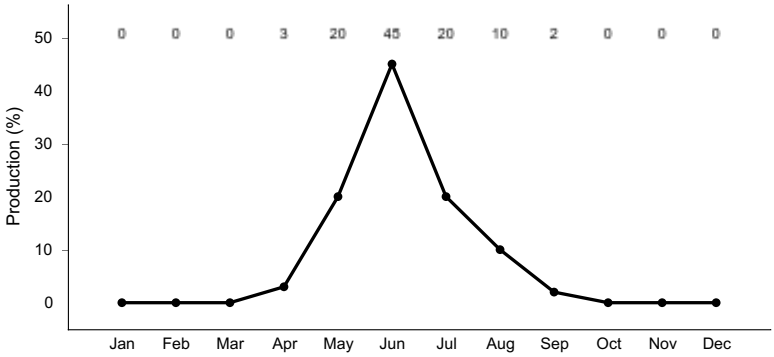


Figure 15. Plant community growth curve (percent production by month). CO6707, Warm-season dominant; MLRA-67B; upland fine-textured soils..

State 4
Tilled

The Tilled state is the result of mechanical farming operations. An ecological threshold has been crossed due to complete removal of vegetation and years of soil tillage. Physical, chemical, and biological soil properties have been significantly altered. There is no restorative pathway known at this time. This state includes the Go-Back and Seeded Communities.

Dominant plant species

- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 4.1
Russian Thistle and Purple Threeawn, Go-Back Land

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All of the native plants are destroyed, soil organic matter is reduced, soil structure is degraded, and a plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations and erosion processes may be active. Go-back land evolves through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, burningbush, and other annuals begin to establish. These plants give some protection from erosion and start to build minor levels of soil organic matter. This early annual plant community lasts for two to several years. Purple threeawn, sand dropseed, and several other early perennials can dominate the plant community for five to eight years or more. Buffalograss establishes next and dominates for many years. Eventually western wheatgrass, blue grama, and other natives become reestablished.

Dominant plant species

- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 4.2
Seeded

This plant community can vary considerably depending upon the amount of soil loss, the species seeded, and stand establishment. Portions of the Loamy Plains have been converted to cropland in some areas.

Transition T1A
State 1 to 2

Excessive grazing and lack of fire shift this plant community across an ecological threshold to the Warm-Season

Shortgrass State.

Transition T1B
State 1 to 4

Mechanical tillage of this ecological site causes an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T2A
State 2 to 3

Excessive grazing and lack of fire shift this plant community to the Increased *Bare Ground* State. This transition may take greater than 40 years. Erosion and loss of organic matter and carbon reserves are resource 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	**Cool Season Mid-Rhizomatous**			260–390	
	western wheatgrass	PASM	*Pascopyrum smithii*	260–390	–
2				65–195	
	green needlegrass	NAVI4	*Nassella viridula*	65–195	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–13	–
	squirreltail	ELEL5	*Elymus elymoides*	0–13	–
	needle and thread	HECO26	*Hesperostipa comata*	0–13	–
3	**Warm Season Short Bunch**			260–325	
	blue grama	BOGR2	*Bouteloua gracilis*	260–325	–
4	**Warm Season Short Stoloniferous**			13–65	
	buffalograss	BODA2	*Bouteloua dactyloides*	13–65	–
5	**Warm Season Mid-Bunch**			13–33	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	13–39	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–13	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–13	–
6	**Cool Season Annual**			0–13	
	little barley	HOPU	*Hordeum pusillum*	0–13	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–13	–
7	**Miscellaneous Grasses**			13–22	
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–13	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–13	–
8	**Sedges**			13–26	
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	13–26	–
	needleleaf sedge	CADU6	*Carex duriuscula*	0–13	–
9	**Other Native Grasses**			13–39	
	Grass, perennial	2GP	*Grass, perennial*	13–39	–
Forb					
10	**Legumes**			22–77	

	American vetch	VIAM	*Vicia americana*	13–65	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	13–26	–
	white locoweed	OXSE	*Oxytropis sericea*	0–13	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–13	–
	silky sophora	SONU	*Sophora nuttalliana*	0–13	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–13	–
11	**Cool Season**			22–44	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–39	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	13–26	–
	New Mexico groundsel	PANEM	*Packera neomexicana var. mutabilis*	0–13	–
12	**Warm Season**			33–77	
	lacy tansyaster	MAPIP4	*Machaeranthera pinnatifida ssp. pinnatifida var. pinnatifida*	13–26	–
	dotted blazing star	LIPU	*Liatris punctata*	13–26	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	13–26	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	Colorado four o'clock	MIMU	*Mirabilis multiflora*	0–13	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0–13	–
	bahia	PICRA3	*Picradeniopsis*	0–13	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–13	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–13	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–13	–
13	**Annuals**			0–13	
	woolly plantain	PLPA2	*Plantago patagonica*	0–13	–
14	**Other Native Forbs**			26–65	
	Forb, perennial	2FP	*Forb, perennial*	26–65	–
Shrub/Vine					
15	**Shrubs**			66–260	
	fourwing saltbush	ATCA2	*Atriplex canescens*	65–195	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–65	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–13	–
16	**Half-Shrubs**			0–13	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–13	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–13	–
17	**Succulents**			0–13	
	spinystar	ESVIV	*Escobaria vivipara var. vivipara*	0–13	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–13	–
18	**Evergreen**			0–13	
	soapweed yucca	YUGL	*Yucca glauca*	0–13	–
19	**Other Native Shrubs**			13–39	

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–39	–

Animal community

WILDLIFE INTERPRETATIONS:
The variety of grasses, forbs, and shrubs on this ecological site in the various plant communities provides habitat for a wide range of wildlife species. Historic large grazers that influenced these plant communities were bison, elk, and pronghorn. Changes over time have resulted in the loss of bison, the reduction in elk numbers, and pronghorn population swings. Domestic grazers now share these habitats with wildlife. The grassland communities of eastern Colorado are home to many bird species. Changes in the composition of the plant community when moving from the reference plant community to other communities on this ecological site may result in dramatic species shifts in the bird community. Because of a lack of permanent water, fish and many amphibians are not expected on this ecological site. Mule and white-tailed deer may use this ecological site, however the shrub cover is too low to expect more than occasional use. The gray wolf and wild bison used this ecological site in historic times. The wolf is thought to be extirpated from Eastern Colorado. Bison in the area are domesticated.

1.1 Reference Plant Community
Prairie dogs support a high amount of wildlife diversity for their now reduced acreage. Species such as ferruginous hawks, burrowing owls, mountain plovers, western rattlesnake, and black-footed ferret occur in association with prairie dog towns. Pronghorns 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. The loamy soils support many reptile species that may use the site to meet all or parts of their habitat needs. Pollinating insects are attracted to the forbs present in this plant community. Various species of beetles and grasshoppers are also present.

1.2 Community
This community is very similar to the reference community; therefore, the value for wildlife is not significantly different. Wildlife species using this this plant community would be the same.

1.3 Community
The wildlife species found here are similar to those in the reference community.

2.1 Community
This community has reduced wildlife species diversity due to the loss of taller structure grasses and shrubs, and reduced forb diversity. Pronghorn and swift fox continue to use this community. Grassland songbird species that need taller structure like grasshopper sparrows are absent, but short-structure species like horned lark and longspurs are present. If prairie dogs are present, ferruginous hawks, burrowing owls, and mountain plover may be as well.

3.1 Community
The loss of perennial forbs combined with the increase in bare ground results in a change in wildlife species when compared with the reference community. Scaled quail may use this site when adequate cover is available. Grasshoppers are the most common insect, although some pollinators may still be found. Western rattlesnake and other reptiles using the reference community are still found here. Swainson’s hawks continue to be found here as it is easy to spot prey in this community. Black-tailed prairie dogs and their obligate species are also present.

4.1 Community
The wildlife species found here will be similar to the 4.2 community.
Wildlife use of tilled and replanted fields is dependent on the planted seed mix. Many of these sites currently support plains sharp-tailed grouse, greater prairie chicken, lesser prairie chicken, ring-necked pheasant, grasshopper sparrow, and other upland bird species. The purpose of the seeding affects the usability for wildlife. If wildlife use is a primary concern, then seed mixes must be formulated to meet species specific habitat requirements.

GRAZING INTERPRETATIONS:
The following table lists suggested initial stocking rates for an animal unit (1000-pound beef cow) under continuous grazing (yearlong grazing or growing-season-long grazing) based on normal growing conditions. However, continuous grazing is not recommended. These estimates should only be used as preliminary guidelines in the

initial stages of the conservation planning process. Often, the existing plant composition does not entirely match any particular plant community described in this ecological site description. Therefore, field inventories are always recommended to document plant composition, total production, and palatable forage production. Carrying capacity estimates that reflect on-site conditions should be calculated using field inventories.

If the following production estimates are used, they should be adjusted based on animal kind or class and on the specific palatability of the forage plants in the various plant community descriptions. Under a properly stocked, properly applied, prescribed grazing management system that provides adequate recovery periods following each grazing event, improved harvest efficiencies eventually result in increased carrying capacity. See USDA-NRCS Colorado Prescribed Grazing Standard and Specification Guide (528).

The stocking rate calculations are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency divided by 912.5 pounds of ingested air-dry vegetation for an animal unit per month (AUM).

Plant Community (PC) Production (lbs./acre) and Stocking Rate (AUM/acre)

Reference PC - (1300) (0.36)

1.2 PC - (700) (0.19)

2.1 PC - (600) (0.16)

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

Grazing plans should only be developed after an on-site visit.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A and B. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group and 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 to 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

None noted.

Other information

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)

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, percent 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.

Data Source: NRI
Number of Records: 59
Sample Period: 2007-2013
State: CO
Counties: Arapahoe, Baca, Cheyenne, Kiowa, Kit Carson, Larimer, Las Animas, Lincoln, Logan, Morgan, Powers,

Washington, Weld

Data Source: SCS-RANGE-417
Number of Records: 15
Sample Period 1958-1989
State: CO
Counties: Arapahoe, Cheyenne, Elbert, Kiowa, Kit Carson, Las Animas, Lincoln, Morgan, Powers, Washington, Weld

Those involved in developing the 2004 site description include: Harvey Sprock, Rangeland Management Specialist, CO-NRCS; Ben Berlinger, Rangeland Management Specialist, CO-NRCS; Scott Woodall, Rangeland Management Specialist, CO-NRCS; James Borchert, Soil Scientist, CO-NRCS; Dave Sharman, Resource Conservationist, CO-NRCS; Terri Skadeland, Biologist, CO-NRCS; Dave Cook, Rangeland Management Specialist, NE-NRCS; Chuck Ring, Rangeland Management Specialist, WY-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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Kirt Walstad, 12/05/2024

Acknowledgments

Program Support:
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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, Ben Berlinger, Daniel Nosal
Contact for lead author	Harvey Sprock, Area Rangeland Management Specialist, Greeley, CO
Date	11/16/2004
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** Typically none, if present, water flow patterns (on steeper slopes following intense storms) are short and not connected.

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** The site has 3 percent or less bare ground, with bare patches generally less than 2 to 3 inches in diameter. Extended drought can cause bare ground to increase upwards to 10 to 20 percent with bare patches reaching upwards to 6 to 12 inches in diameter.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is minimal and short.

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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 5 to 6 in interspace at soil surface. Soil surface is stabilized by decomposing organic matter. Biological crusts (lichens, algae, cyanobacteria, mosses) may be present on or just below soil surface.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM is 2 to 4 percent. Soils are typically deep to moderately deep. Surface texture ranges from loam to very fine sandy loam. A-horizon ranges from 0 to 5 inches in depth with a dark grayish-brown color and a medium sub-angular blocky 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: Cool-season mid rhizomatous >

Sub-dominant: Warm-season short bunchgrass > cool-season mid bunchgrass/grasslikes > shrubs >

Other: Other shrubs > warm-season short stoloniferous > leguminous forbs > cool- season forbs > warm-season forbs > warm-season mid bunchgrass

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typically minimal. Expect slight short and mid bunchgrass mortality and decadence during and following drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover during and following extended drought ranges from 15 to 25 percent.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 600 lbs./ac. low precip years; 1300 lbs./ac. average precip years; 1800 lbs./ac. above average precip years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 300 – 500 lbs./ac. or more.

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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. Cheatgrass, Russian thistle, burningbush, and other non-native annuals may invade following extended drought or after fire, assuming a seed source is available.

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