USDA Natural Resources Conservation Service

Ecological site R049XB210CO
Sandy Foothill

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 049X–Southern Rocky Mountain Foothills

MLRA 49 is in Colorado (58 percent), Wyoming (27 percent), and New Mexico (15 percent). It makes up about 11,130 square miles (28,845 square kilometers). The major cities in or adjacent to this MLRA are Laramie, Wyoming; Fort Collins, Boulder, Denver, Colorado Springs, and Pueblo, Colorado; and Santa Fe and Las Vegas, New Mexico. Interstates 25, 70, and 80 cross the MLRA. Part of the Medicine Bow National Forest is in the northern tip of this area, in Wyoming; parts of the Roosevelt, Pike, and San Isabel National Forests are in this area in Colorado; and part of the Santa Fe National Forest is in the southern end of this area, in New Mexico. The Rocky Flats Nuclear Arsenal, Peterson Air Force Base, most of the Air Force Academy grounds, and part of the Fort Carson Military Reservation are in the part of this area in Colorado.

Almost half of this area is in the Southern Rocky Mountains and Wyoming Basin Provinces in the Rocky Mountain System. The rest is in the Colorado Pediment, Raton, and High Plains Sections of the Great Plains Province of the Interior Plains. The northern part of the MLRA consists of the Laramie Mountains. The central and southern parts generally are bounded on the east by the Great Plains and on the west by the Southern Rocky Mountains. Elevation ranges from 5,000 feet (1,525 meters) to 8,000 feet (2,440 meters) in most of the MLRA, but small mountains in the area are as high as 10,000 feet (3,050 meters). The Laramie and North Platte Rivers and their associated tributaries are the principal streams in the Wyoming portion of the MLRA. The Cache La Poudre, Big Thompson, Saint Vrain, South Platte, Arkansas, Saint Charles, Huerfano, Cucharas, and Purgatoire Rivers, Clear Creek, Fountain Creek, and their associated tributaries are the principal streams in the Colorado portion. The Vermejo, Cimarron, Pecos, and Mora Rivers and their associated tributaries are the principal streams in the New Mexico portion.

This area has been impacted by the geologic processes of uplift, folding, and faulting and by subsequent erosion and deposition. The Southern Rocky Mountains were uplifted 50 to 70 million years ago during the Laramide uplift. Most of this MLRA is adjacent to this uplift and was also affected. The uplift induced erosion of the relatively soft Late Pennsylvanian to Cretaceous sedimentary rocks from the uplands and dissected the underlying crystalline Precambrian rocks. The relief of the area was reduced by a combination of erosion of uplands and alluvial filling. Approximately 7 million years ago, a large portion of the area was uplifted again to elevations of 14,000 feet (4,270 meters) or more at the core of the Laramide uplift. Since then, precipitation occurring as both rain and snow led to the renewal of erosion and subsequent alluvial fills. The Wyoming portion of the MLRA, the Laramie Mountains, consists primarily of Precambrian plutonic rocks with Pennsylvanian and Permian sedimentary rocks folded and faulted at the margin of the range. The Colorado and New Mexico portions of the area consist primarily of remnants of the uplifted and folded Pennsylvanian through Cretaceous sedimentary rocks forming hogbacks, ridges, and hills, the ranges of which trend in a general north-south direction, parallel to the uplifted Southern Rocky Mountains. Tertiary volcanic flows filled valleys in some areas. After extensive erosion, these more resistant volcanic rocks now form prominent mesas, such as North and South Table Mountains near Golden, Colorado, and Fishers Peak Mesa near the Colorado-New Mexico border. Stream erosion from the eastern front of the Southern Rocky Mountains fostered the creation of a sequence of large alluvial fan remnants, pediments, and terrace deposits in this MLRA.

The average annual precipitation is 12 to 25 inches (305 to 635 millimeters) in most of this area, but it ranges from 10 to 35 inches (255 to 890 millimeters), generally increasing with elevation. The highest precipitation occurs in the Laramie Mountains, in Wyoming, and the lowest precipitation occurs in the Arkansas River Valley, above Salida, Colorado. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. Winter precipitation occurs as snow. The average annual temperature is 36 to 54 degrees F (2 to 12 degrees C). The freeze-free period averages 140 days and ranges from 90 to 195 days, decreasing in length with elevation and from south to north.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the Colorado and New Mexico portions of the MLRA dominantly have a frigid or mesic soil temperature regime. Those in the Wyoming portion have a frigid or cryic soil temperature regime. A few of the higher peaks and some north aspects have a cryic soil temperature regime. Most of the soils in the area have an ustic soil moisture regime, but those on the higher peaks and on some north aspects have a udic soil moisture regime. The soils in the area dominantly have smectitic or mixed mineralogy. They are very shallow to very deep and are dominantly well drained. The texture is dominantly loamy in soils that formed in material weathered from igneous and metamorphic rocks and is dominantly loamy or clayey in soils that formed in material weathered from sedimentary rocks. Some of the most extensive and representative great groups are Haplustolls (Baller series), Argiustolls (Nederland, Nunn, Santa Fe, and Enmedio series), Haplustalfs (Fort Collins, Stoneham, and Dargol series), Haplustepts (Stout series), Ustorthents (Lorencito and Saruche series), and Paleustolls (Flatirons series). (USDA-NRCS, 2006)

Classification relationships

NRCS:
Major Land Resource Area 49, Southern Rocky Mountain Foothills (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
M331Ib – North Front Range; M331Ic – North Laramie Mountains; M331Id – South Laramie Mountains; and M331Ii – Northern Arkansas Granitics – 39 mile Mountain M331I – Northern Parks and Ranges M331 - Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331Fb – Wet Mountains; M331Fc – Wet Mountain Valley; M331Ff – Raton Basin; M331Fg – Sangre de Cristo Mountains Woodland; and M331Fh – Sangre de Cristo Mountains Coniferous Forest M331F – Southern Parks and Rocky Mountain Range M331 - Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

331If – Arkansas Valley Tablelands; 331Ig- Arkansas Valley High Tablelands; 331Ih – Black Forest; and 331Ii – Southern Front Range Foothills < 331I – Arkansas Tablelands < 331 Great Plains – Palouse Dry Steppe

331Ha – Southern Denver-Julesburg Basin; 331Hc – Eastern Central High Plains; 331He – Northern Front Range Foothills and 331Hf – Denver-Julesburg Basin < 331H – Central High Plains < 331 Great Plains – Palouse Dry Steppe

EPA:
21b – Crystalline Subalpine Forests, 21c – Crystalline Mid-Elevations Forests, 21d -Foothill Shrublands, 21e – Sedimentary Subalpine Forests, and 21f – Sedimentary Mid-Elevation Forests, 21j – Grassland Parks < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006).

25c – Moderate Relief Plains, 25d – Flat to Rolling Plains, and 25l – Front Range Fans < 25 High Plains < 9.4 South Central Semi-Arid Prairies < 9 Great Plains (Griffith, 2006).

26e – Piedmont Plains and Tablelands, 26f- Mesa de Maya/Black Mesa, 26h- Pinyon-Juniper Woodlands and Savannas, 26i – Pine-Oak Woodlands, 26j – Foothills Grasslands, 26k – Sandsheets, and 26l – Upper Canadian Plateau < 26 Southwestern Tablelands < 9.4 South Central Semi-arid Prairies < 9 Great Plains (Griffith, 2006).

USGS:
Southern Rocky Mountain Province, Colorado Piedmont and Raton

Ecological site concept

R049XB210CO Sandy Foothill occurs on gently sloping to rolling hills and uplands. Slopes is between 0 to 10%. Soils are greater than 40 inches. Soils are derived from alluvium, eolian deposits, eolian sands, and residuum primarily from arkosic sedimentary rock and sandstone. Soil surface texture is loamy sand, sandy loam or fine sandy loam. Family particle size is coarse-loamy or sandy. It is a Big Bluestem– Prairie Sandreed community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.

Associated sites

R049XB208CO	**Clayey Foothill** This site occurs on undulating hills to gently sloping uplands. Slopes is between 0 to 15%. Soils are moderately deep to deep (20 to 60 inches). Soils are derived from alluvium from basalt, and/or calcareous shale; or residuum from clayey shale, sandstone, calcareous shale and/or shale. Soil surface texture is clay loam or silty clay loam and it may or may not have cobbles, stone, or gravels (up to 15%). Family particle size is fine. It is a Western Wheatgrass – Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 17 inches.
R049XY036CO	**Overflow** This site occurs on flood plains, terraces, valley floor and stream terraces. Slopes is between 0 to 9%. Soils are greater than 60 inches in depth. Soils are derived from slopes alluvium from sandstone and shale. Soil surface texture is loam or fine sandy loam. Family particle size is fine-loamy. It is a Western Wheatgrass– Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 11 to 18 inches.
R049XY214CO	**Gravelly Foothill** This site occurs on gently rolling and sloping uplands. Slopes is between 0 to 35%. Soils are deep and greater than 60 inches in depth. Soils are derived from slopes alluvium, alluvium and colluvium from arkose or igneous and metamorphic rocks. Soil surface texture is gravelly, sandy loam, cobbly sandy loam, gravelly loam or very gravelly loam. Family particle size is sandy-skeletal, loamy-skeletal or fine-loamy over sandy-skeletal. It is a Little Bluestem – Needle-and-Thread community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.
EX049X01X202	**Loamy Foothill Palmer Divide** This site occurs on fans, fan remnants, hills, hillslopes, and valley sides. Slopes is between 0 to 20%. Soils are moderately deep to very deep with depths of greater than 20 inches. Soils are derived from alluvium and residuum from sedimentary rocks (sandstone, siltstone and shale). Soil surface texture is loam, silt loam or very fine sandy loam. Family particle size is loamy. It is a Winterfat – Four-wing saltbush – Western wheatgrass – Blue grama plant community. It has a typic ustic moisture regime. The effective precipitation ranges from 14 to 19 inches.

Similar sites

R049XY216CO	**Sandy Divide** This site occurs on alluvial fans, hills, valley sides, hillsides, flats, mesa and plateaus. Slopes is between 1 to 25%. Soils are moderately deep to very deep in depth (20 to 100 inches). Soils are derived from alluvium from arkose or sedimentary rock; and/or residuum from arkose or sedimentary rock or sandstone and shale. Soil surface texture is sandy loam, loamy sand or gravelly sandy loam. Family particle size is coarse-loamy or fine-loamy. It is a Mountain Muhly– Little Bluestem community. It has an typic ustic moisture regime. The effective precipitation ranges from 16 to 19 inches.
R049XY031CO	**Sandy Bottomland** This site occurs on flood plains and stream terraces. Slopes is between 0 to 4%. Soils are greater than 60 inches in depth. Soils are derived from alluvium from arkose. Soil surface texture is loamy coarse sand. Family particle size is sandy. It is a Switchgrass– Sand Bluestem community. It has a typic ustic moisture regime. The effective precipitation ranges from 14 to 19 inches.
R049XB204CO	**Shallow Foothill** This site occurs on ridges, hog-backs, and steep slopes. Slopes is between 0 to 35%. Soils are shallow (< 20 inches). Soils are derived from residuum from basalt, sandstone, shale, granite, gneiss and/or limestone; slope alluvium from basalt, sandstone and/or limestone. Soil surface texture is loam or sandy loam and it may have cobbles, stone, gravels or channers in it. It is a Mountain Mahogany – Big Bluestem – Little Bluestem community. It has an aridic ustic moisture regime. The effective precipitation ranges from 13 to 17 inches.

R049XY214CO	**Gravelly Foothill** This site occurs on gently rolling and sloping uplands. Slopes is between 0 to 35%. Soils are deep and greater than 60 inches in depth. Soils are derived from slopes alluvium, alluvium and colluvium from arkose or igneous and metamorphic rocks. Soil surface texture is gravelly, sandy loam, cobbly sandy loam, gravelly loam or very gravelly loam. Family particle size is sandy-skeletal, loamy-skeletal or fine-loamy over sandy-skeletal. It is a Little Bluestem – Needle-and-Thread community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Calamovilfa longifolia*

Physiographic features

This site is commonly found on gently sloping to rolling hills and uplands. It is usually on slopes that vary from nearly level to 10%; but can range up to 25%. Elevation ranges from 5,500 to 7,000 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Flat (3) Stream terrace (4) Alluvial fan (5) Hillslope (6) Terrace (7) Drainageway
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,134 m
Slope	0–25%

Climatic features

Annual precipitation ranges from 12 to 16 inches. About 75% of the precipitation occurs between the months of March through September. Much of this precipitation is in the form of snowfall during the months of March, April and May. Intense summer thundershowers that produce hail and localized flooding are common in June and July. December and January are typically the driest months of the year. The average annual temperature is about 49 degrees F.

The optimum growing season for the major forage species is early spring and summer. Cool season plants usually begin growth around April 1 while warm season plants usually initiate growth May 1 and after.

Table 3. Representative climatic features

Frost-free period (characteristic range)	83-109 days
Freeze-free period (characteristic range)	118-135 days
Precipitation total (characteristic range)	330-381 mm
Frost-free period (actual range)	70-112 days
Freeze-free period (actual range)	114-136 days
Precipitation total (actual range)	305-406 mm

Frost-free period (average)	95 days
Freeze-free period (average)	126 days
Precipitation total (average)	356 mm

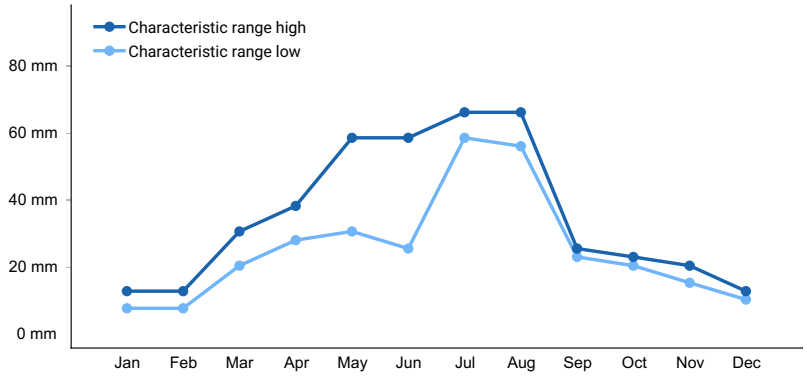


Figure 1. Monthly precipitation range

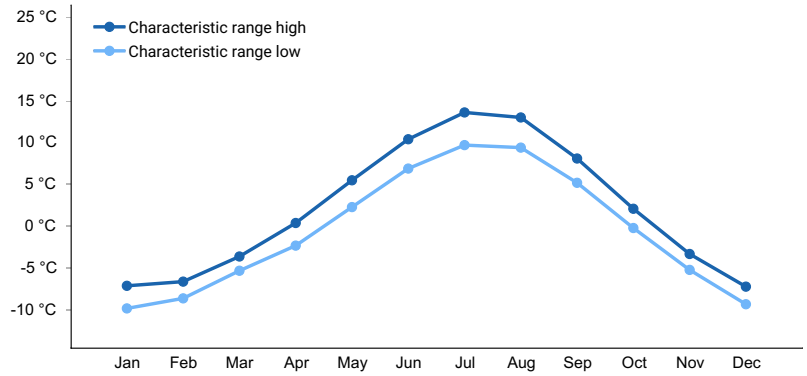


Figure 2. Monthly minimum temperature range

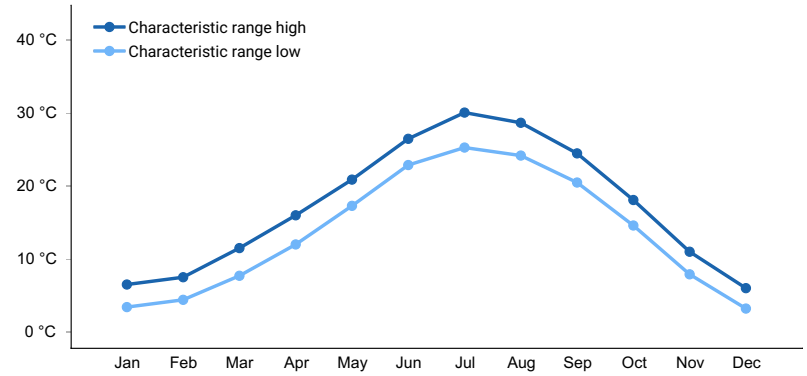


Figure 3. Monthly maximum temperature range

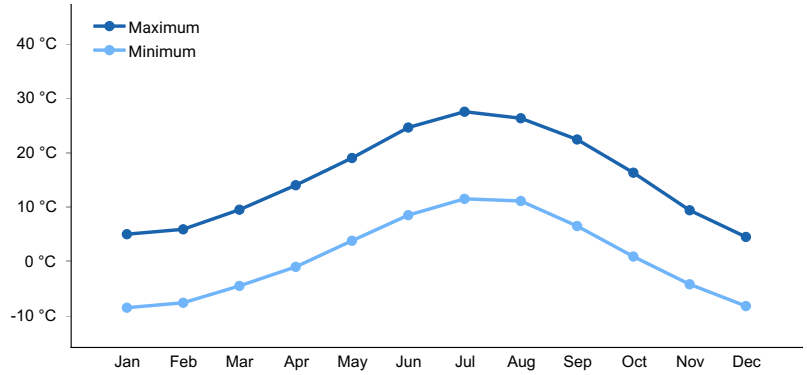


Figure 4. Monthly average minimum and maximum temperature

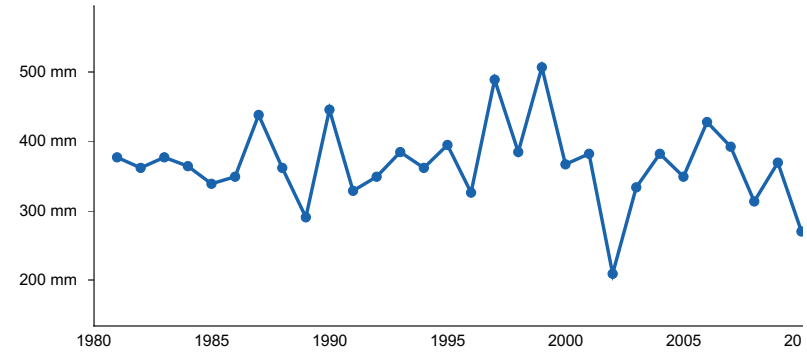


Figure 5. Annual precipitation pattern

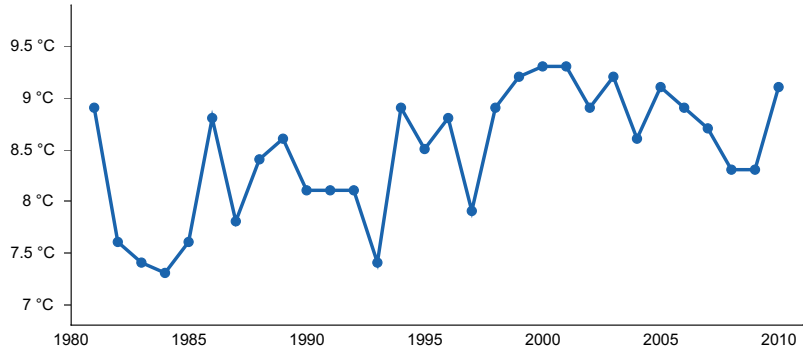


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PARKER 6 E [USC00056326], Parker, CO
- (2) RUSH 1N [USC00057287], Rush, CO
- (3) SHEEP MTN [USC00057572], Gardner, CO
- (4) RED WING 1 WSW [USC00056977], Gardner, CO

Influencing water features

None

Soil features

The soils of this site are deep, well drained and occur on gently sloping uplands to ridges including benches, terraces, and side slopes. For the most part, these soils are formed in alluvium and residuum weather from arkosic sedimentary rock. The Terry soils are formed in calcareous residuum materials. The surface soils are sandy loam and loamy sands. The subsoil varies from a loamy sand as in the Blakeland soils to s sandy clay loam texture for the Bresser soils. The substratum ranges from a sandy loam to coarse sand as found in the Blakeland soils. The reaction of these soils varies from slightly acidic to mildly alkaline.

Permeability is moderate to rapid with a moderate available water holding capacity. Surface runoff is slow and the water erosion hazard is moderate. However, if the vegetation is depleted accelerated erosion can be expected especially on the steeper slopes.

Major soils associated with this site:

Blakeland, Blendon, Otero, Stapleton, Terry and Truckton.

Table 4. Representative soil features

Parent material	(1) Alluvium–arkose (2) Eolian deposits (3) Eolian sands (4) Residuum–arkose (5) Residuum–sandstone (6) Alluvium (7) Alluvium–sedimentary rock (8) Eolian deposits–sedimentary rock (9) Eolian deposits–arkose (10) Alluvium
Surface texture	(1) Loamy sand (2) Sandy loam (3) Fine sandy loam
Family particle size	(1) Coarse-loamy (2) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	102 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–2%
Available water capacity (Depth not specified)	6.35–11.43 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Clay content (Depth not specified)	6–15%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–4%

Ecological dynamics

The information in this ESD, including the state-and-transition model diagram (STM), was developed using historical data, and professional experience. 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/time-controlled grazing strategies, and historical accounts.

The Sandy Foothill ecological site is characterized by four states: Reference, Shortgrass Dominated, Increased *Bare Ground*, and Invaded States. The Reference State is characterized by dominant warm-season tallgrass (big bluestem, prairie sandreed), and secondary cool-season midgrass (needle and thread, western wheatgrass). The Shortgrass State is characterized by a warm-season short bunchgrass (blue grama). The Increased *Bare Ground* State is characterized by early successional warm-season bunchgrass (Fendler threeawn), cool-season short bunchgrass (squirreltail), annual grasses, annual forbs, and soapweed yucca. The Invaded State has been disturbed by equipment and includes early successional annual plants as well as invasive species (knapweeds, yellow toadflax).

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 and elk, along with 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.

Historically, it is believed, grazing patterns by herds of large ungulates was 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, to increase water infiltration.

The soil moisture regime is favorable to the production of mid and tallgrass species giving this range site a rolling, mixed prairie aspect. The plant community is about 75 to 85% grasses and grass-like plants, 10 to 15% forbs and 5 to 10% shrubs (air-dry weight). Big bluestem, little bluestem, prairie sandreed, switchgrass, needleandthread and sideoats grama make up most of the plant community and provide about 60-75% of the total production. Grasses such as blue grama, western wheatgrass and prairie junegrass are secondary in the plant community. Small amounts of sand dropseed, sun sedge, purple prairieclover, spreading eriogonum and Louisiana sagewort are scattered throughout the plant community.

This site developed with occasional fires being part of the ecological processes. Historic fire frequency (pre-industrial), is estimated at 10-12 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season.
Dendroecological reconstructions of fire history showed that fires burned during years of extreme drought (2011. Schoennagel, Sherriff, Veblen).

Early human inhabitants were also likely to start fires for various reasons (deliberately or accidentally). Both of these types of fire events likely impacted the site by leaving mosaic vegetation patterns. The impact of fire over the past 50 years has been relatively insignificant due to wildfire suppression and the lack of acceptance of prescribed fire as a management tool. However, prolonged drought, coupled with fire suppression has increased the frequency and intensity of periodic wildfires in the area.

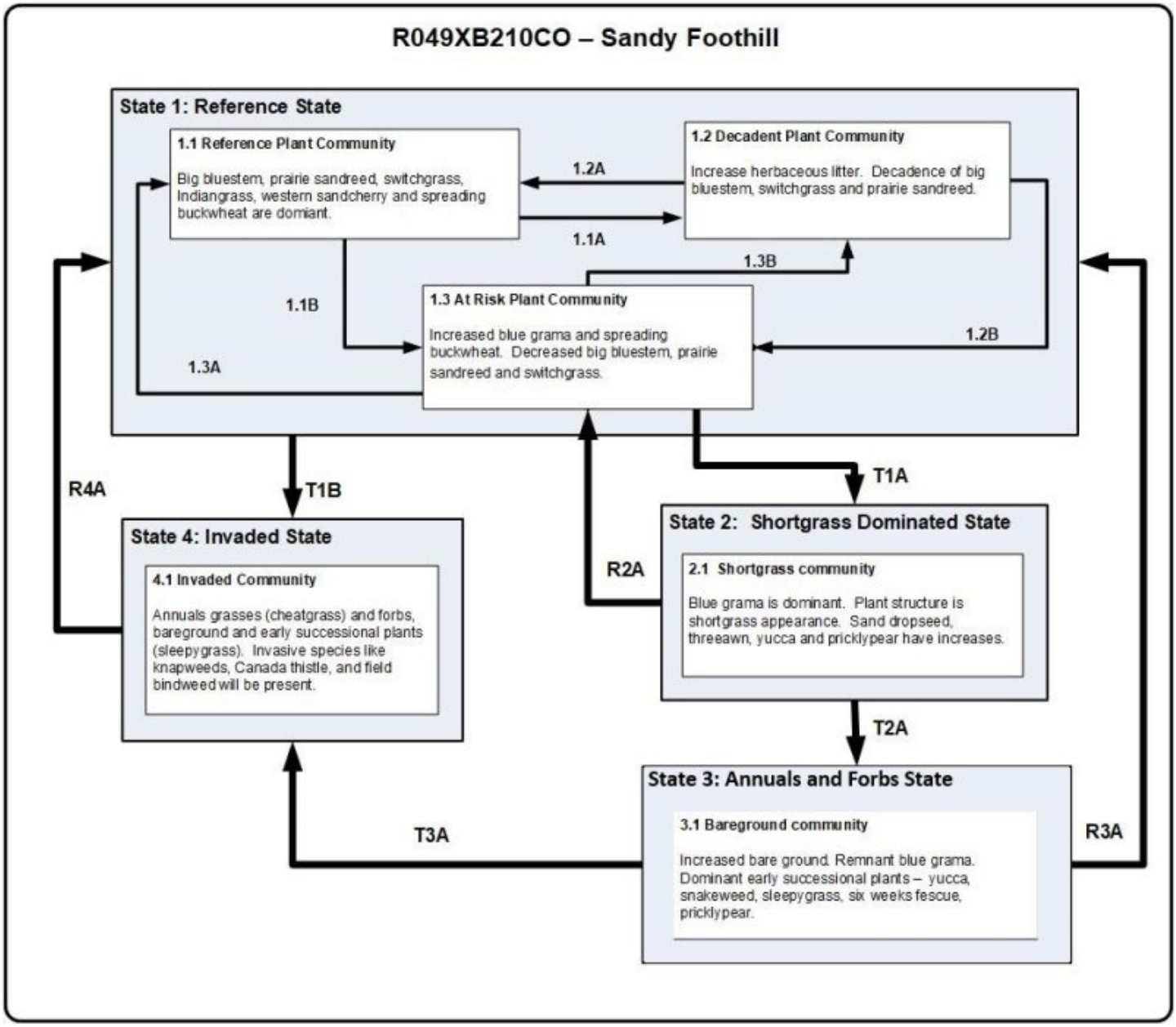
Deterioration of this site, due to continuous grazing without adequate recovery periods following each grazing occurrence and/or overstocking, will cause blue grama to increase. Cool-season grasses such as needle and thread and western wheatgrass will decrease. Warm-season grasses such as big bluestem, and palatable forbs such as purple prairie clover will also decrease. Fendler threeawn, annuals and bare ground increase under heavy continuous grazing. Lack of grazing and lack of fire initially causes increased herbaceous litter. Decadence of bunchgrasses, such as needle and thread and Indian ricegrass, and lower vigor vegetation is expected to occur with non-use and lack of fire. This also allows invasive species like diffuse knapweed, spotted knapweed, cheatgrass, toadflax and other similar vegetation to establish. Grazing which allows adequate recovery periods following each grazing event and proper stocking will maintain the palatable plants.

Drought and/or early killing frost cycles have historically impacted the vegetation. Changes in species composition will vary depending upon the duration and severity of the drought and/or frost cycle.

Some of this ecological site has been tilled and used for crop production. Today, much of this site is urban/suburban residence and small acreage development. Residential development leads to fire suppression. This is an important site for livestock grazing, especially beef cattle. Today the management of livestock grazing 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.

The following diagram illustrates the common plant communities that can occur on the site and the pathways (arrows) among communities. Bold lines surrounding each plant community or communities represent ecological thresholds and a plant community state. Community phase pathways in the reference state represent shifts in the plant community within the natural range of variability. Transition and Restoration pathways represent the plant community crossing an ecological threshold between states. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model



Legend

1.1A. 1.3B – lack of grazing, lack of fire, time without disturbance
1.2A – fire, proper grazing
1.2B – proper grazing with recovery time, fire
1.3A – proper grazing, wetter climatic periods, normal fire frequency
1.1B – repeated herbivory without recovery time, over stocking, drought, reduced fire frequency
T1A – continuous grazing and/or high stocking rates, extended drought
R2A, R3A – long-term prescribed grazing and proper stocking rates over lengthy time frame, wetter climatic cycles
T2A – long term heavy continuous grazing without adequate recovery time
T1B – heavy continuous grazing, lack of fire, time without disturbance, invasive species introduction
R4A – very long term prescribed grazing, insect/disease, vegetation manipulation (invasive species management)
T3A – long-term continuous grazing, mechanical disturbance

State 1
Reference State

The Reference State is characterized by three distinct plant community phases- the Reference Plant Community, an At-Risk Plant Community, and a Decadent Community. The plant communities, and various successional stages between them, represent the natural range of variability due to the disturbance regimes applicable to the site. The soil moisture regime is favorable to the production of mid and tall grass species giving this ecological site a rolling, mixed prairie aspect. Big bluestem, prairie sandreed, switchgrass, needle and thread and sideoats grama make up most of the total production and provide 60-75 percent of the total production. Grasses such as blue grama, western wheatgrass and prairie junegrass are secondary in the plant community. Small amounts of sand dropseed, sun sedge, purple prairie clover, spreading buckwheat and white sagebrush are scattered throughout the plant community.

Community 1.1
Reference Plant Community

This is the interpretive plant community. This plant 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 75-85% grasses and grass-like plants, 10-15% forbs, and 5-10% shrubs (air-dry weight). The major grasses in the Reference Plant Community include big bluestem, prairie sandreed, switchgrass, and blue grama. Needle and thread and western wheatgrass are major cool-season midgrasses in this plant community and are valuable forage plant in late spring and/or early summer. Sub-dominant grasses include little bluestem, sideoats grama, and sand dropseed. Major forbs include purple prairieclover, upright prairie coneflower, scarlet globemallow, and dotted gayfeather. A minor amount of shrubs such as western sandcherry, spreading buckwheat and soapweed yucca 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, and wildlife use by many species, livestock use, and is aesthetically pleasing. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. This community is resistant to disturbances except continuous moderate to heavy grazing, tillage, and/or development into urban or other uses. Total annual production ranges from 900 to 2300 pounds of air-dry vegetation per acre and will average 1600 pounds during an average year. Of this production, 5 to 10% will likely be unpalatable out of reach of grazing animals. 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. Resilience management. Grazing management that provides for proper stocking and adequate recovery opportunity will maintain this plant community and provide sustainable ecosystem goods and services from the plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	807	1435	2062
Forb	151	269	387
Shrub/Vine	50	90	129
Total	**1008**	**1794**	**2578**

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				1121–1793	
	big bluestem	ANGE	*Andropogon gerardii*	269–448	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	269–448	–
	switchgrass	PAVI2	*Panicum virgatum*	179–269	–

	blue grama	BOGR2	*Bouteloua gracilis*	90–179	–
	little bluestem	SCSC	*Schizachyrium scoparium*	90–179	–
	needle and thread	HECO26	*Hesperostipa comata*	72–143	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	72–143	–
	western wheatgrass	PASM	*Pascopyrum smithii*	72–143	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	36–90	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	18–90	–
	Indiangrass	SONU2	*Sorghastrum nutans*	18–90	–
	mountain muhly	MUMO	*Muhlenbergia montana*	18–90	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–90	–
	Grass, native	2GN	*Grass, native*	0–90	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	1–54	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–54	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–36	–
Forb					
2				112–420	
	purple prairie clover	DAPU5	*Dalea purpurea*	54–90	–
	Forb, native	2FN	*Forb, native*	0–54	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	18–36	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	1–36	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	1–36	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	1–36	–
	dotted blazing star	LIPU	*Liatris punctata*	1–18	–
	western wallflower	ERAS2	*Erysimum asperum*	1–18	–
	common starlily	LEMO4	*Leucocrinum montanum*	1–18	–
	white locoweed	OXSE	*Oxytropis sericea*	1–18	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	1–18	–
	grassy deathcamas	ZIVEG	*Zigadenus venenosus var. gramineus*	1–18	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	1–18	–
	sand lupine	LUAM	*Lupinus ammophilus*	1–18	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	1–18	–
Shrub/Vine					
3				56–135	
	prairie sagewort	ARFR4	*Artemisia frigida*	36–90	–
	spreading buckwheat	EREF	*Eriogonum effusum*	18–90	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	1–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	1–54	–
	soapweed yucca	YUGL	*Yucca glauca*	18–36	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–18	–

Animal community

Livestock Grazing:

This site provides excellent spring and summer forage for cattle, horses, sheep, pronghorn, deer, and small mammals.

The animal forage preferences changes as the growing season progresses. This coupled with the fact that this site has a good complement of cool and warm season plants, make it important that planned deferment and rotation be scheduled. This level of grazing management will ensure maximum utilization of the available forage while maintaining the desirable plants.

Cool season plants such as needle and thread, prairie junegrass, sun sedge, and western wheatgrass are very nutritious during the early spring. Therefore, it is necessary to periodically defer grazing in the spring so that these cool season grasses are not grazed out and replaced by less desirable species. Warm season plants such as blue grama, big bluestem, prairie sandreed, sideoats grama, and purple prairieclover will benefit by deferment from grazing in the late spring and early summer months.

Vegetative palatability will influence proper use considerations. The season of use, kind of grazing animal, past grazing use, and the plant composition will directly influence animal preference and performance.

Guide to Initial Stocking Rates (Stocking rates recommendations from site concept circa 1989 and based on estimated plant community succession).

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

Plant Community (PC)/ Production (lbs./acre)/Stocking Rate (AUM/acre)
Reference PC/ 1600/ 0.44
Increased Litter/Decadence PC/ 750/ 0.21
At Risk PC/ 1000/ 0.27
Shortgrass Dominated PC/ 650/ 0.18
Bare Ground PC/ 350/ 0.10
Invaded PC/ */ *
* Highly variable; stocking rate needs to be determined on site.

Adjustments to the initial stocking rate should be made as needed to obtain proper use. With specialized grazing systems, large livestock breeds, uncontrolled ungulates, inaccessibility, dormant season use, presence of introduced forage species, seeded rangeland, etc., stocking rate adjustments will be required.

Major Poisonous Plants to Livestock

Plant Common Name/Livestock Affected/Type of poisoning/Season serious

Silky crazyweed/ chiefly horses also cattle and sheep/selenium, affects are slow animals can become addicted/ all seasons when other forage is scarce.

Nuttall larkspur/cattle, horses & occasionally sheep/toxic alkaloids new growth especially dangerous/spring, early summer, other forage scarce.

grassy deathcamas/ sheep, can affect cattle & horses/toxic alkaloids 1/2 lb will poison sheep/ spring, early summer, other forage scarce.

Wildlife

This site has high value for wildlife because of the excellent habitat produced. This is due to the amount of cover and protection afforded by the taller grasses, and the abundance of forbs produced. This site provides habitat for pronghorn, deer, cottontail, jackrabbit, small mammals, non-game birds, quail and doves. If range condition declines from over grazing with cattle, pronghorn and mule deer will be reduced due to lack of quality forage. Other small mammals, quail and cottontail will also decline in numbers.

Species of concern listed by Colorado Parks and Wildlife include:
Plains Sharp-Tailed Grouse; Tympanuchus phasianellus jamesii; State Endangered
Lesser Prairie-Chicken; Tympanuchus pallidicinctus; State Threatened
Both of these species are associated with this ecological site.

Hydrological functions

Soils in this site are grouped into "A" and "B" hydrologic group, as outlined in the Soils of Colorado Loss Factors and Erodibility Hydrologic Groupings 1979 Handbook. Field investigations are needed to determine hydrologic cover conditions and hydrologic curve numbers. Refer to NRCS National Engineering Handbook, Section 4, and Peak Flows in Colorado Handbook for more information.

Recreational uses

This site has good to excellent aesthetic appeal and natural beauty due to the numerous forbs and shrubs that bloom from spring to early summer. The recreation provided through hunting for pronghorn is generally good on this site.

Wood products

No potential production

Inventory data references

Location of typical examples of the site:

Vernon R. Miller Ranch, 6 miles north and 1 mile west of Elizabeth in Elbert County.
Cemetery site located in the NW1/4, Section 14, T.10S., T61W in Elbert County.

Counties in which this ecological site occurs:
Arapahoe, Boulder, Douglas, Elbert, El Paso, Fremont, Huerfano, Jefferson, Larimer, and Las Animas.

Other references

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Approval

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--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data are required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 49 must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

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)	
Contact for lead author	
Date	04/30/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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

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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):**

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

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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):**

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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:

    Sub-dominant:

    Other:

    Additional:

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

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):**

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:**

17. **Perennial plant reproductive capability:**