USDA Natural Resources Conservation Service

Ecological site R051XY294CO
Valley Sand

Last updated: 9/07/2023
Accessed: 07/17/2024

General information

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

MLRA notes

Major Land Resource Area (MLRA): 051X–High Intermountain Valleys

This MLRA encompasses the San Luis Valley in south central Colorado and the Taos Plateau and Taos alluvial fans of north central New Mexico. As part of the northern portion of the Rio Grande Rift, the MLRA consists of large, alluvium filled basins washed down from adjacent mountain ranges. The Rio Grande River flows through this MLRA, continuing its long function of carrying mountain sediment down to the basin. Cenozoic volcanism is an extensive characteristic of the MLRA where large basalt flows with volcanic hills and domes are abundant. Ancient Lake Alamosa is a large feature within the MLRA..

LRU notes

The Valley Sand Ecological Site occurs on the alluvial flat portion of the basin floor within the San Luis Valley. It is mostly comprised of Holocene age portions of the alluvial flat but may overlap and merge with relic, Pleistocene aged, surfaces. Where rivers and large drainages have cut across the alluvial flat it may appear on low terraces and abandoned floodplains. On the leeward side of large tributaries, soils will have formed in wind-blown sandy alluvium, scoured out of the drainages.

Classification relationships

NRCS:
Major Land Resource Area 51, High Intermountain Valleys (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
331J – Northern Rio Grande Basin M331Ic > 331Ja - San Luis Valley, 331Jb - San Luis Hills and 331C - Mogotes

EPA:
22 - Arizona/New Mexico Plateau > 22a - San Luis Shrublands and Hills ; 22b -San Luis Alluvial Flats and Wetlands ; 22c - Salt Flats; 22e - Sand Dunes and Sand Sheets and 22f -Taos Plateau (Griffith, 2006).

USGS:
Southern Rocky Mountain Province

Ecological site concept

Soils are deep to very deep and range from sandy to course-loamy in the particle size-control section.

The vegetation is made up of both grasses that thrive in sandy soils and deep-rooted, salt tolerant brush species. Much of this site has been irrigated and planted to crops such as potatoes, barley, oats, and alfalfa.

Associated sites

R051XY315CO	**Wet Meadow 6-10 PZ** This site has a shallow to moderately deep water table. Soil textures are loamy to clayey.
R051XY263CO	**Salt Flats** The Salt Flats also occupy the alluvial flat of the basin floor but have finer textured soils and slick spot areas where clays and salts have accumulated.
R051XY263CO	**Salt Flats** The sandy bench is similar but occurs on the Piedmont slope, is not derived from re-worked, Holocene aged alluvium and does not have a water table.
R051XY275CO	**Deep Sands 7-9 PZ** The Deep Sands site is part of the sand sheet that surrounds the active dune field. Soils are deep and sandy but not skeletal nor on the mountain front alluvial fan.
R051XY317CO	**Foothill Loam** The Foothill Loam site does not have the eolian influence and textures are not as course.

Similar sites

R051XY275CO	**Deep Sands 7-9 PZ** The Deep Sands site is part of the sand sheet that surrounds the active dune field. Soils are deep and sandy but not skeletal nor on the mountain front alluvial fan.
R051XY312CO	**Sand Hummocks** This site exists in the lowest reaches of this closed basin. It is intermingled with the alkali overfow site and is correlated to the playa dunes component of the basin floor. Because the soils were developed from coarse, wind-blown material on the leeward side of a playa and erosion and deposition are a constant issue, this site can develop "hummocks" and the plant community exists as a sparse, uneven cover of grass and shrubs.
R051XY273CO	**Sandy Bench** The sandy bench is similar but occurs on the Piedmont slope, is not derived from re-worked, Holocene aged alluvium and does not have a water table.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Hesperostipa comata*

Physiographic features

This site occupies low sand bars and ridges within the San Luis Valley and localized areas around the edges of the Valley where there is evidence of a deep water table. Topography is almost level along fans.

Figure 3. The geographic zones, or positions, in which the major landforms of bolsons commonly occur. The upper piedmont zone comprises *mountain-valley fans* within the bounding mountains *(M)*, *alluvial fans (A)*, and *ballenas (B)* (shown as a group of parallel ballenas would occur, others may occur individually, cf., Fig. 5 and 6). The middle piedmont zone comprises the *fan piedmont (P)*, and the lower zone the *fan skirt (S)*. The bolson floor comprises an *alluvial flat (F)*, *playa (Y)*, and possibly other major landforms such as beach plains.

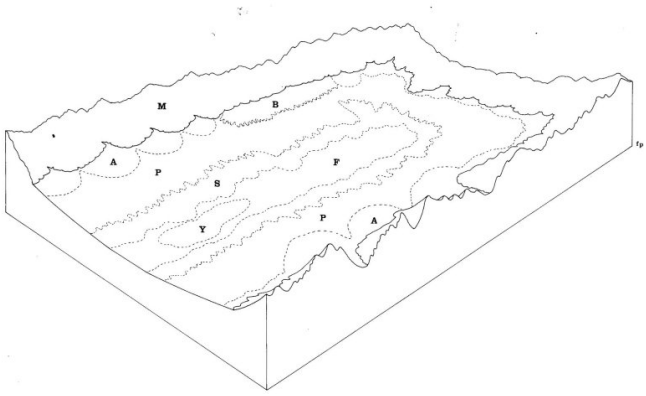


Figure 1. Basin landform diagram by Peterson (Peterson, 1981).

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan (3) Valley floor
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	2,286–2,438 m
Slope	0–3%
Aspect	Aspect is not a significant factor

Climatic features

The climate that typifies the High Intermountain Valley, ranges from arid to semi-arid, and is characterized by cold winters, moderate summers, and much sunshine. Average annual precipitation ranges from 6 to 10 inches along the valley floor and throughout most of the resource area. Approximately 55-60 percent of the annual precipitation falls between May 1 and September 1. May and June are normally dry. Precipitation comes mostly from short duration high intensity thundershowers in July and August. Wide seasonal and yearly variations are common. The San Juan mountain range to the west and the Sangre de Cristo Mountains to the east intercept much of the precipitation causing a two-way rain shadow effect.

Cold air from the encompassing mountain ranges drain into the valley and settle. This phenomena results in long cold winters and moderate summer temperatures. Mean average annual temperature ranges between 42 to 44 degrees F. July is the hottest month and January is the coldest. Summer temperatures range from highs in the upper 70’s and low 80’s and occasionally reach to the mid 90 degrees F. Summer nights are cool. Average frost-free period is 90-115 days, from late May or early June to September. There is a 50% probability that the first frost in the fall will occur near September 16, and the last frost in the spring on about June 9. Most major plant species initiate growth between mid May and late July, but growth may extend into September. Some cool season plants begin growth earlier and complete growth by mid June. There may be late re-growth on some of the plants.

Wind speeds average 7 miles per hour annually. Wind that often reaches high velocities are common, especially in the spring. Relative humidity is usually low. Even so, evaporation rates average lower than those of many dry regions because of the cooler climate. Snow cover is often light and is sometimes lacking through much of the winter. There is usually some snow, though, during the coldest weather.

Table 3. Representative climatic features

Frost-free period (characteristic range)	74-87 days

Freeze-free period (characteristic range)	95-115 days
Precipitation total (characteristic range)	152-254 mm
Frost-free period (actual range)	70-91 days
Freeze-free period (actual range)	93-122 days
Precipitation total (actual range)	152-254 mm
Frost-free period (average)	81 days
Freeze-free period (average)	106 days
Precipitation total (average)	203 mm

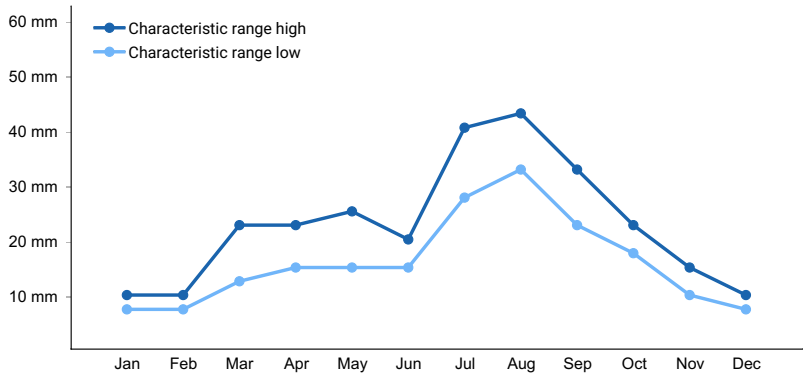


Figure 2. Monthly precipitation range

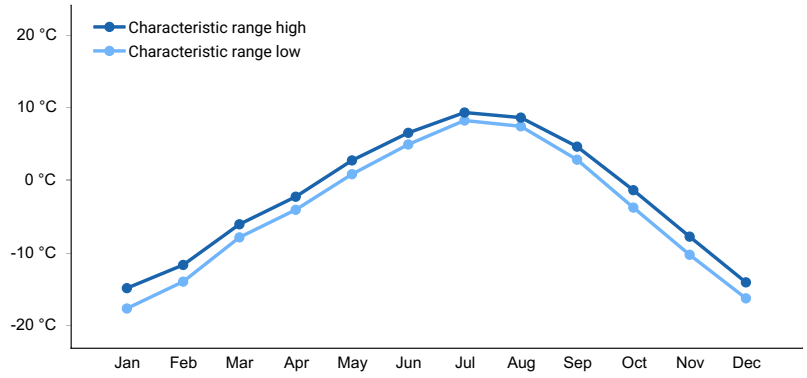


Figure 3. Monthly minimum temperature range

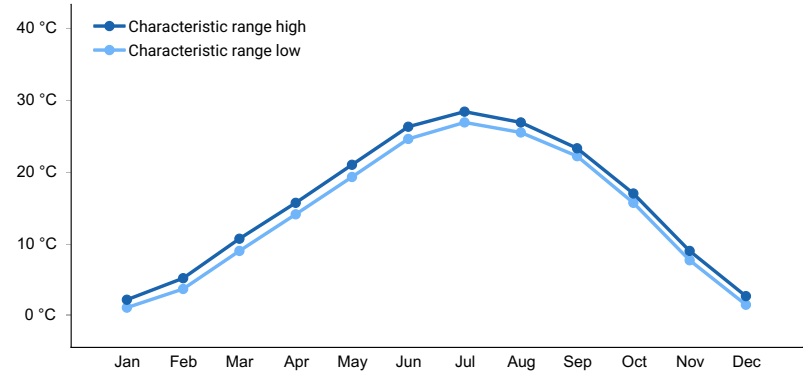


Figure 4. Monthly maximum temperature range

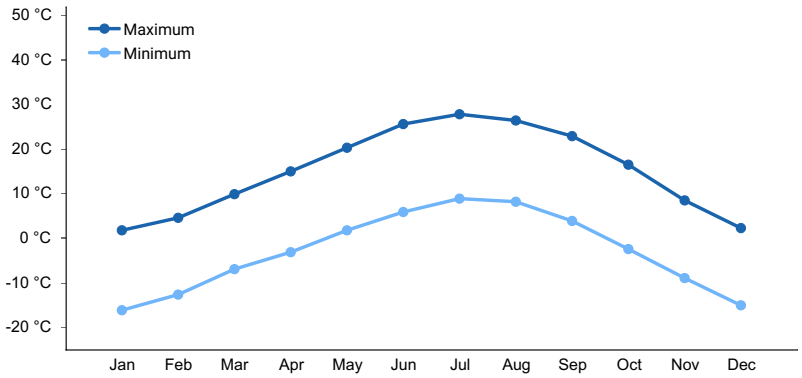


Figure 5. Monthly average minimum and maximum temperature

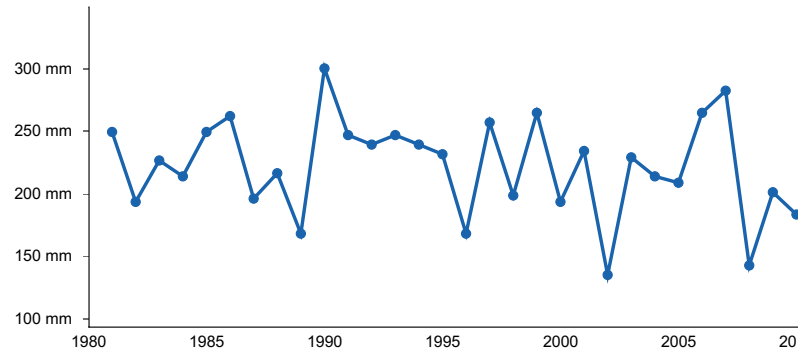


Figure 6. Annual precipitation pattern

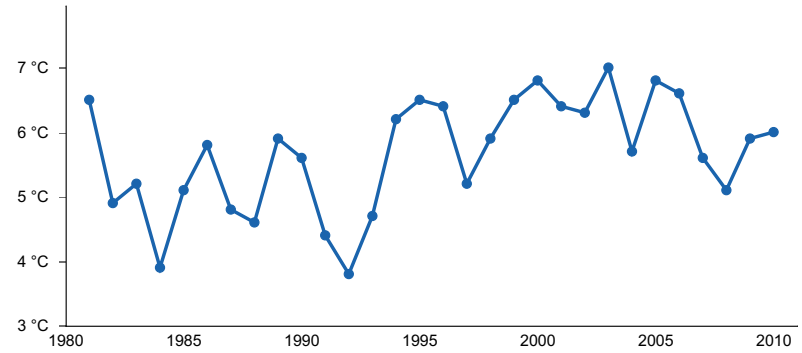


Figure 7. Annual average temperature pattern

Climate stations used

- (1) ALAMOSA SAN LUIS AP [USW00023061], Alamosa, CO
- (2) BLANCA 4 NW [USC00050776], Blanca, CO
- (3) CENTER 4 SSW [USC00051458], Center, CO

Influencing water features

A deep water table often exists within reach of deep-rooted shrubs (>60"). This water table is too deep to have any effect on grass production.

Soil features

Surface soils are sandy, porous and relatively free of salts and alkali, but alkali at lower depths will have an effect on the vegetation. Subsoils, are generally sandy, too. Soils are deep to very deep, somewhat excessively drained, and formed in wind reworked alluvium with mixed mineralogy.

Typical soil correlated to this site is Space City.

Table 4. Representative soil features

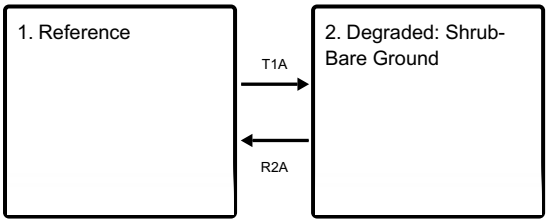
Parent material	(1) Alluvium–basalt (2) Alluvium (3) Eolian sands (4) Alluvium–igneous rock
Surface texture	(1) Loamy sand
Family particle size	(1) Not used (2) Coarse-loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	152–305 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	5.08–10.16 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–25
Soil reaction (1:1 water) (Depth not specified)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

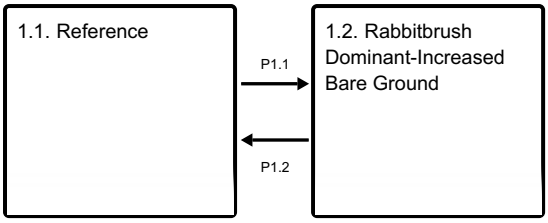
The Valley Sand Ecological Site has a mix of grasses that take advantage of course-textured soils, along with deep-rooted shrubs which can reach down to the water table. Erosion is an issue when plant cover is reduced and bare soil is exposed. Sandy surface horizons are prone to blow when cover is lost. A loss of plant cover exposing more of the soil surface to wind and sun aggravates an already droughty site. Drought is always a factor of disturbance within the San Luis Valley.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference

Figure 8. Mix of grasses and shrubs

The reference state has a mix of cool and warm season grasses and shrubs. Species diversity helps stabilize the site during times of drought, which are frequent in the San Luis Valley. A diversity of root systems help reach deep to a water table during times of drought as well as take advantage of precipitation events during the growing season.

Resilience management. The reference state is most sustainable and able to be resilient with disturbance. Disturbance such as drought, fire, and herbivory are common on this site and the diversity, production, and litter cover of the reference state provides stability.

Community 1.1
Reference

Figure 9. Reference Community Phase

Figure 10. Cool season bunchgrasses

The vegetation is made up of both sandy land grasses and deep-rooted salt tolerant brush species. The dominant grasses are Indian ricegrass, needleandthread, blue grama, alkali sacaton, western wheatgrass, creeping wildrye, and some patches of saltgrass. Fourwing saltbush and small amounts of winterfat are important browse plants. Deep-rooted four-wing saltbush, greasewood, and rubber rabbitbrush are the most prominent shrubs.

Resilience management. The reference community phase is most resilient to disturbance. Deep rooted shrubs reach down into the groundwater to anchor the site through drought. Grasses with fibrous root systems take advantage of timely moisture events during the summer growing season. Cover helps hold the soil in place and adds to decomposition and healthy microbial communities.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- greasewood (*Sarcobatus vermiculatus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass
- blue grama (*Bouteloua gracilis*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	504	673	841
Shrub/Vine	135	179	224
Forb	34	45	56
Total	**673**	**897**	**1121**

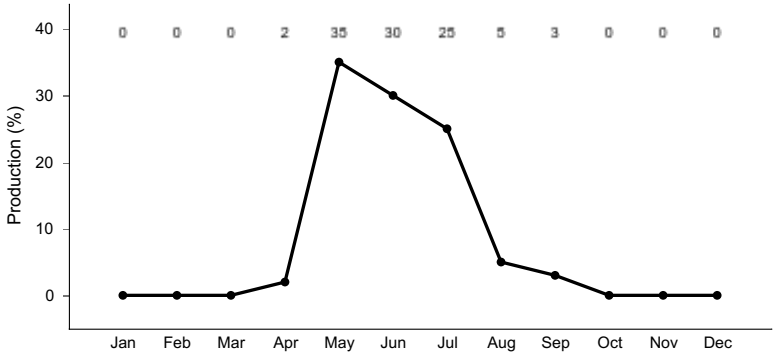


Figure 12. Plant community growth curve (percent production by month). CO5109, Cool-season/Warm-season co-dominant, coarse textured soils, alluvial fans and benches. Located in LRU 51-5 on fans and fan remnants above valley floor, pre-dominantly in Saguache County, Villa Grove and Saguache area..

Community 1.2
Rabbitbrush Dominant-Increased Bare Ground

Figure 13. Shrubs make up the bulk of the composition and cover. Bare ground is more prominent.

This is an "at-risk" community phase to crossing a threshold to a degraded state. Bare ground has increased and cool-season bunchgrasses have decreased. Deep-rooted greasewood and rubber rabbitbrush are the dominant shrubs. Greasewood and rubber rabbitbrush are taking advantage of soil moisture deep in the water table. Salt tolerant plants such as saltgrass and alkali sacaton make up a sizable percentage of the community.

Resilience management. Drivers have decreased the site's resilience to disturbance. Biomass from shoots and roots of grasses have decreased with this community phase exposing the site to further degradation and the crossing of a threshold when drought strikes.

Pathway P1.1
Community 1.1 to 1.2

Reference

Rabbitbrush Dominant-Increased Bare Ground

Long term, repetitive defoliation at high utilization of key reference species with little rest or recovery during the growing season, will, over time, decrease preferred species, such as Indian ricegrass. Species with physical or chemical defenses to herbivory will increase in composition. Litter is reduced causing a decrease in moisture retention and an increase in erosion.

Pathway P1.2
Community 1.2 to 1.1

Rabbitbrush Dominant-Increased Bare Ground

Reference

Where grazing is implemented, it is recommended that intensity, frequency, and opportunity for regrowth is closely monitored. Grasses should be given an opportunity to produce an inflorescence which leads to further colonization throughout the site. Cover, including litter is monitored, as greater ground cover leads toward healthier soil and plant processes.

State 2
Degraded: Shrub-Bare Ground

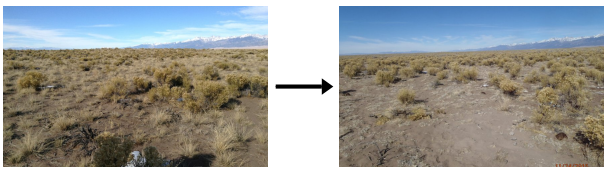
Figure 14. The site has lost most of its grass cover and has large areas of bare soil.

Figure 15. Alkali sacton colonization is important for restoration of the degraded state.

This is a degraded state where areas of bare soil are dominant. Shrub species such as rubber rabbitbrush, Greene's rabbitbrush, and greasewood dominate the vegetative composition as they can send tap roots to capture moisture deep in the profile or to the water table. Grass species that are still present include alkali sacaton, saltgrass, sand dropseed, and threeawn. Prickly pear cactus is also scattered throughout.

Resilience management. This is a degraded state and poorly resilient to disturbance. Drought especially takes its toll in this state as the site has lost hydrologic function and grass species struggle to maintain moisture and colonize. Erosion exacerbates the degrading feedback loops as soil binding agents are minimal to non-existent and cover is weak.

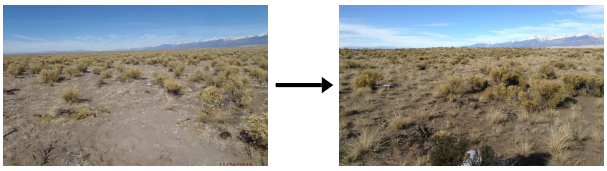
Transition T1A
State 1 to 2



Reference **Degraded: Shrub-Bare Ground**

The main driver is repetitive defoliation and high utilization of palatable species over multiple years during the growing season and especially during drought. This decreases the health and vigor of important plants and eventually leads to a decline in soil health and hydrologic function. Drought is the common trigger event, killing off most shallow rooted, low-vigor grass species and leaving deep-rooted shrubs.

Restoration pathway R2A
State 2 to 1



Degraded: Shrub-Bare Ground | Reference

The degraded state often has grasses hidden within and around shrub species. Alkali sacaton is an important species for re-colonization of the site as it often lingers, even in the degraded state. Long term management, with monitoring to allow recovery of all plants is needed. To promote a mix of warm and cool season plants, rest during critical growing seasons is important. Allowing time for plants to recover after being bitten is important as well. Eventually, with alkali sacaton leading the way, plant diversity, cover, and biomass will recover on this sandy site.

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	**Grasses**			560–785	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	202–336	–
	blue grama	BOGR2	*Bouteloua gracilis*	202–336	–
	western wheatgrass	PASM	*Pascopyrum smithii*	67–112	–
	alkali sacaton	SPAI	*Sporobolus airoides*	67–112	–
	alkali cordgrass	SPGR	*Spartina gracilis*	34–56	–
	needle and thread	HECO26	*Hesperostipa comata*	34–56	–
	alkali wildrye	LESI5	*Leymus simplex*	34–56	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	20–34	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	20–34	–
	beardless wildrye	LETR5	*Leymus triticoides*	20–34	–
	saltgrass	DISP	*Distichlis spicata*	20–34	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	20–34	–
	sedge	CAREX	*Carex*	10–17	–
	blowout grass	REFL	*Redfieldia flexuosa*	10–17	–
	arctic rush	JUAR2	*Juncus arcticus*	0–10	–
Forb					
2	**Forbs**			34–56	
	snowball sand verbena	ABFR2	*Abronia fragrans*	0–20	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–20	–
	tanseyleaf tansyaster	MATA2	*Machaeranthera tanacetifolia*	0–20	–
	bractless blazingstar	MENU	*Mentzelia nuda*	0–20	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0–20	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–20	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–20	–
Shrub/Vine					
2	**Shrubs**			140–224	
	fourwing saltbush	ATCA2	*Atriplex canescens*	67–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	34–56	–
	rubber rabbitbrush	ERNAC2	*Ericameria nauseosa ssp. consimilis*	34–56	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	34–56	–
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	17–28	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	17–28	–

Animal community

Grazing:
This site has a high value rating for cattle and sheep, and a medium value rating for horses.

Hydrological functions

NA

Recreational uses

This site has a low value rating for recreation and natural beauty.

Wood products

NA

Inventory data references

Location of Typical Example of the Site:
Along Highway 160, 4 miles NW of Alamosa

Field Offices in Colorado Where Site Occurs:
Alamosa and Center

References

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Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections andSubsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington,DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored.

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Contributors

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Approval

Kirt Walstad, 9/07/2023

Acknowledgments

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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 51 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.

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Contact for lead author	Rachel Meade, CO NRCS State Rangeland Management Specialist
Date	12/15/2004
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** Very slight and short, if at all

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3. **Number and height of erosional pedestals or terracettes:** Pedestalled plants are common at or near wind scoured areas.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30% or less bare ground, with bare patches ranging from 5-10 inches in diameter. Prolonged drought or wildfire events will cause bare ground to increase upwards to 15-30% with bare patches ranging from 10-20 inches in diameter.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scouring is inherent to this site. Soil movement can intensify with disturbances such as wildfire, wildlife, or extended drought.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter will move on this site. Interspaces can be void of litter. Litter collects around base of established vegetation.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating anticipated to be 2-3 in interspace at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soils are usually a loamy fine sand. The A-horizon averages 0-8 inches in depth with a brown to a grayish brown or brownish gray color. Single grain to a weak fine granular structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community composition has a moderate effect on infiltration and runoff on this site. Infiltration rates are high. These soils have a low water holding capacity and moderately rapid to rapid permeability.

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

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

    Dominant: cool season bunchgrass = shrubs >

    Sub-dominant: warm season bunchgrass > cool season rhizomatous grass = shrubs = forbs

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal. Decadence will exist on areas inaccessible to grazing animals.

14. **Average percent litter cover (%) and depth (in):** 20-30% litter cover at 0.25 inch depth. Litter cover during and following drought can range from 10-15% and 5-10% following wildfire.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

production): 400 lbs./ac. low precipitation years; 800 lbs./ac. average precipitation years; 1,000 lbs./ac. high precipitation years. After extended drought, production will be reduced to 200 – 400 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.

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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.
