USDA Natural Resources Conservation Service

# Ecological site R051XY273CO
# Sandy Bench

Last updated: 7/19/2021
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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): 051X–High Intermountain Valleys

This MLRA encompasses the San Luis Valley in south central Colorado and the Taos Plateau and Taos alluvial piedmonts 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.

## 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

The soils are derived from mountain alluvium eroded down into the basin. The source of this alluvium is mostly course grain geologies such as calcareous sandstone and granite, which form soils that have a course-loamy particle size class. The soils mostly have accumulated carbonates in the B horizon. Dominant grasses in the plant community are Indian ricegrass, needleandthread, blue grama, sand dropseed and squirreltail.

## Associated sites

| | |
|---|---|
| R051XY281CO | **Mountain Outwash**<br>The landforms are the same but Mountain Outwash have skeletal loamy soils, and often do not have a calcic diagnostic horizon. |

| | |
|---|---|
| R051XY276CO | **Limy Bench**<br>Limy bench are sometimes skeletal and have a fine-loamy particle size class vs the course-loamy sandy bench. |
| R051XY312CO | **Sand Hummocks**<br>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. |

## Similar sites

| | |
|---|---|
| R051XY294CO | **Valley Sand**<br>The Valley Sand is similar but appears on the basin floor where a water table may be within reach of deep-rooted shrubs. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Achnatherum hymenoides*<br>(2) *Bouteloua gracilis* |

## Physiographic features

This site occurs on almost level to gently sloping fans. The topography is almost level to gently sloping.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Fan remnant<br>(2) Alluvial fan<br>(3) Alluvial flat<br>(4) Outwash plain<br>(5) Outwash fan<br>(6) Outwash terrace |
| Runoff class | Very low to low |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 2,286–2,591 m |
| Slope | 0–9% |
| 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 7 to 10 inches along the valley floor and throughout most of the resource area. Upper elevations and southern reaches range from 11 to 13 inches. Precipitation extremes vary from 3 to 20 inches per year depending on location. 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. Approximately 60 to 65 percent of the annual precipitation falls between May 1 and October 1, mostly from short duration high intensity thundershowers in July and August. Snowfall averages 34 inches annually; snow cover is light or patchy throughout much of the winter. Wind speeds average 7 miles per hour annually. High wind velocities are common in the spring.

Cold air from the encompassing mountain ranges drain into the valley and settle. This phenomena results in long cold winters and moderate summer temperatures. 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 90o F. Summer nights are cool, with lows averaging in the mid 40’s. Temperatures of -20oF to -40oF can be expected each year and are common during some winters. Higher elevations can receive a dusting of snow as early as September 1. 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. The average length of the growing season is 119 days and varies from 94 to 143 days. Summer humidity is low. Evaporation rates average lower than those of dry regions because of the cool climate.

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.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 74-77 days |
| Freeze-free period (characteristic range) | 97-102 days |
| Precipitation total (characteristic range) | 152-305 mm |
| Frost-free period (actual range) | 73-78 days |
| Freeze-free period (actual range) | 96-103 days |
| Precipitation total (actual range) | 152-305 mm |
| Frost-free period (average) | 76 days |
| Freeze-free period (average) | 100 days |
| Precipitation total (average) | 229 mm |

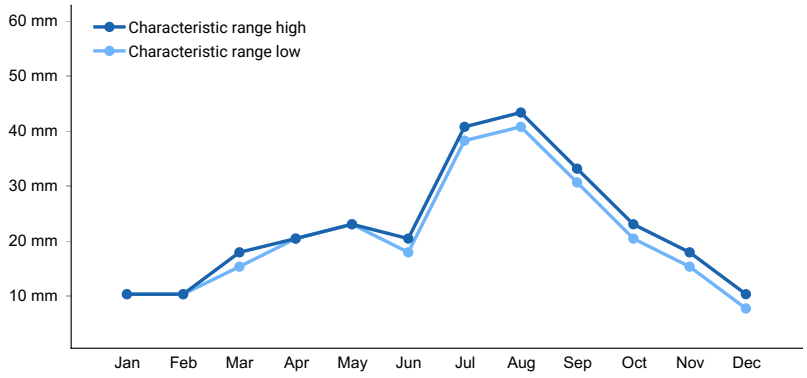



**Figure 1. Monthly precipitation range**

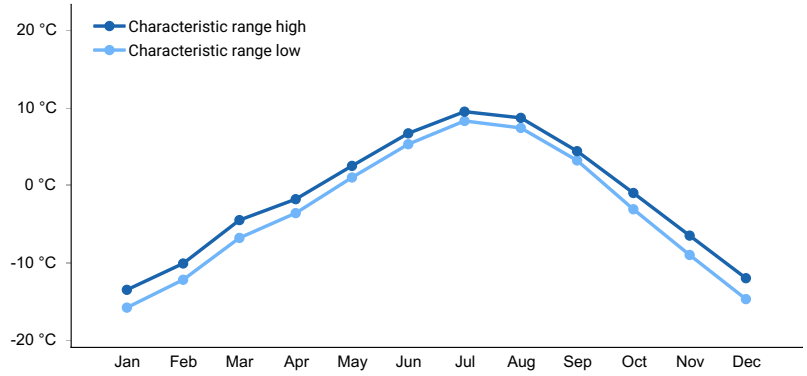



**Figure 2. Monthly minimum temperature range**

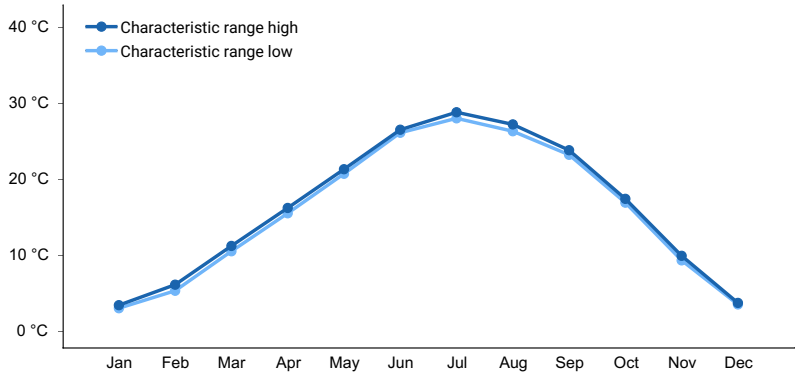



**Figure 3. Monthly maximum temperature range**

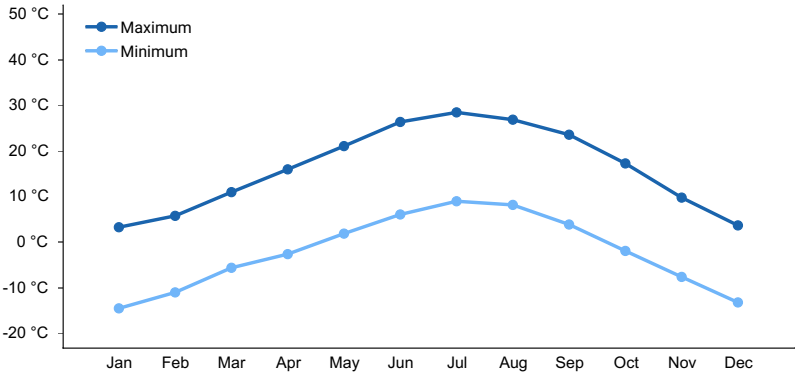



**Figure 4. Monthly average minimum and maximum temperature**

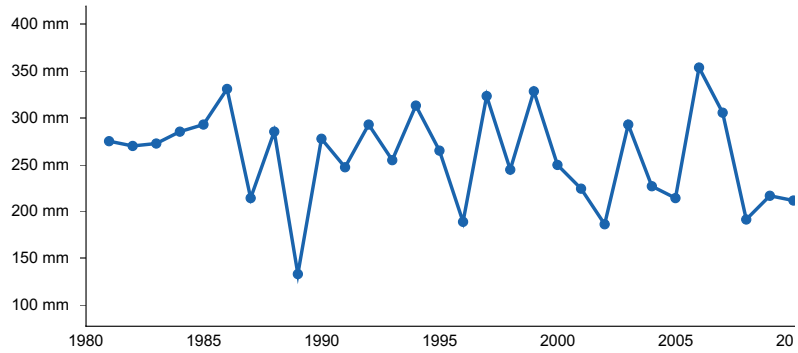



**Figure 5. Annual precipitation pattern**

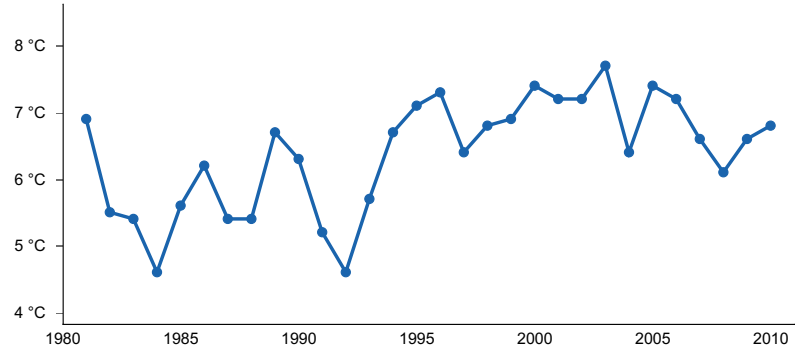



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) BLANCA 4 NW [USC00050776], Blanca, CO
- (2) SAN LUIS 1 S [USC00057430], San Luis, CO

## Influencing water features

This site does not have a water table.

## Soil features

The soils are coarse in texture and very deep. The soil absorbs moisture readily and has a good capacity for storage where depth is not limited. The textures throughout the profile range from loamy sand to fine sandy loam. Soil surface texture clay content ranges from 5 to 16% clay. The soils are easily eroded by wind and water once the cover is removed or destroyed. Parent material is alluvium derived from calcareous sandstone; granite, gneiss, and mica schist; or basalt.

Typical soils correlated to this site are:
Blanfort, Cososa, McGinty, Ryan Park and Space City.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Alluvium–calcareous sandstone<br>(2) Alluvium–igneous and metamorphic rock<br>(3) Not specified |
| Surface texture | (1) Loamy sand<br>(2) Fine sandy loam<br>(3) Sandy loam |
| Family particle size | (1) Coarse-loamy |
| Drainage class | Well drained to somewhat excessively drained |
| Permeability class | Moderate to rapid |
| Soil depth | 152 cm |
| Surface fragment cover <=3" | 0–10% |
| Surface fragment cover >3" | 0% |
| Available water capacity (Depth not specified) | 7.62–15.24 cm |
| Calcium carbonate equivalent (Depth not specified) | 0–5% |
| Electrical conductivity (Depth not specified) | 0–2 mmhos/cm |
| Sodium adsorption ratio (Depth not specified) | 0–4 |
| Soil reaction (1:1 water) (Depth not specified) | 6.6–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–15% |
| Subsurface fragment volume >3" (Depth not specified) | 0–2% |

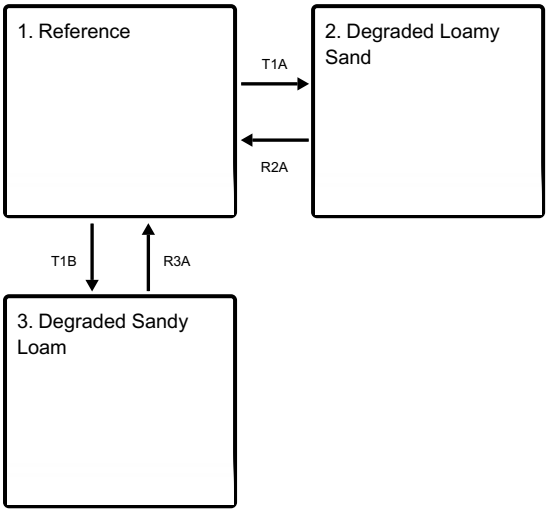
## Ecological dynamics

This site has sandy soils which affect ecological processes and plant community composition. When in reference condition soils are stable and they have a diversity of plants and root systems which take advantage of seasonal drought and flash precipitation events. Sandy soils absorb moisture readily and can store moisture deep in the profile, allowing deep rooted plants an opportunity to sustain drought. Sandy soils also release moisture easily, allowing plants to take advantage of flash precipitation events which improves recovery rates from past degradation. Even though a sandy site may recover more quickly from degradation, it may also fall into degradation more quickly if ecological processes and range health break down.

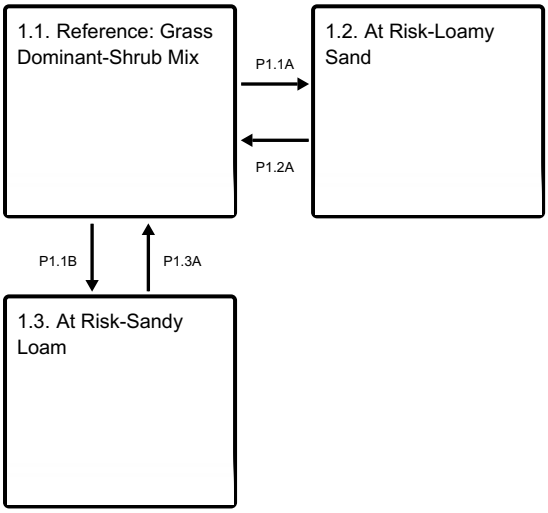
The sandy bench site has a mix of cool and warm season plants. Dominant grasses in the plant community are Indian ricegrass, needle-and-thread, spike dropseed, and western wheatgrass. Smaller amounts of blue grama, sand dropseed, squirreltail, and slimstem muhly, may also be found. Forbs and shrubby plants such as scarlet globemallow, yarrow, buckwheat, prairie sagewort, prickly pear, yucca, skunkbrush, apache plume, currant, winterfat and Greene's rabbitbrush are scattered in small amounts throughout the plant community. The site has a gradient of surface texture from sandy loam to loamy sand. Response to disturbance is affected by this gradient as coarser soils show a greater composition of shrubs.

## State and transition model

**Ecosystem states**




**State 1 submodel, plant communities**




## State 1
## Reference

**Figure 7. Reference Shrub Dominant**

The reference state has a mix of cool and warm season grasses, forbs, and shrubs. Bare ground is minimal and ecological processes are most functional. The state can be variable from grass dominant to shrub dominant. Dominant grasses include Indian ricegrass, needle-and-thread, spike dropseed, and western wheatgrass. Smaller amounts of blue grama, sand dropseed, squirreltail, and slimstem muhly, may also be found. Forbs and shrubby plants such as scarlet globemallow, buckwheat, prairie sagewort, prickly pear, yucca, skunkbrush sumac, apache plume, wax currant, winterfat and Greene's rabbitbrush are scattered in small amounts throughout the plant community.

**Resilience management.** The reference state is the most resilient to disturbance. Bare ground is minimal and a mix of structural-functional groups provide the most ecosystem services. Shrubs with deep tap roots help anchor the site and can withstand drought by drawing moisture from deep in the sandy profile. Grasses with fibrous root systems add organic matter to the soil which eventually cycles back to plant nutrients through mineralization. The microbial community secretes exudates which help bond soil particles providing aggregate stability. This intern improves soil stability and water storage. Overall range health is at its healthiest in the reference state.

## Community 1.1
## Reference: Grass Dominant-Shrub Mix

The reference community phase is a grass-shrub-forb mix with minimal bare ground. Grasses are the most dominant structural-functional group with a mix of cool and warm season grasses throughout. Shrubs are secondary in composition but play an important role in drawing moisture from deep in the profile.

**Resilience management.** The reference community is the most resilient to disturbance. It has the greatest diversity of plants, root systems, and microbial communities. This community has the most stable soils, and the greatest amount of water retention and annual production.

### Dominant plant species

- winterfat (*Krascheninnikovia lanata*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass

**Table 5. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 583 | 729 | 874 |
| Forb | 224 | 280 | 336 |
| Shrub/Vine | 90 | 112 | 135 |
| **Total** | **897** | **1121** | **1345** |

## Community 1.2

### At Risk-Loamy Sand

**Figure 9. Shrub-Grass Mix**

Shrubs are the major structural-functional group. This is an at-risk community as shrubs and bare ground have increased and grasses have decreased. Shrubs such as rabbitbrush, prairie sagewort, and snakeweed have all increased in composition.

**Resilience management.** Long term drivers have decreased the site's resilience to disturbance. Diversity and production of grasses have decreased while disturbance oriented shrubs have increased.

## Community 1.3
## At Risk-Sandy Loam

**Figure 10. Grass dominated**

Grasses with natural resistance to grazing have gained a competitive advantage. This includes blue grama, sand dropseed, threeawn, and squirreltail. This site is "at-risk" as a few ecologically important species such as Indian ricegrass and needleandthread have decreased in production. Shrubs have decreased as well due to disturbance.

**Resilience management.** This community is at risk to crossing a threshold. As bare ground increases, erosion increases, and a threshold can be crossed to a degraded state.

## Pathway P1.1A
## Community 1.1 to 1.2

The main driver is grazing continuously over multiple years often with high utilization where preferred species eventually are reduced to protected areas among shrubs. A slow decline in hydrologic function due to accelerated erosion has given shrubs, with deeper tap roots, a competitive advantage. Coarser soils such as loamy sand may also help shrubs have a competitive advantage over grasses.

### Pathway P1.1B
### Community 1.1 to 1.3

Long term, repetitive defoliation throughout the growing season without sufficient recovery and monitoring of utilization where both palatable grasses and shrubs species have decreased. This could also be accelerated by a disturbance to the shrubs.

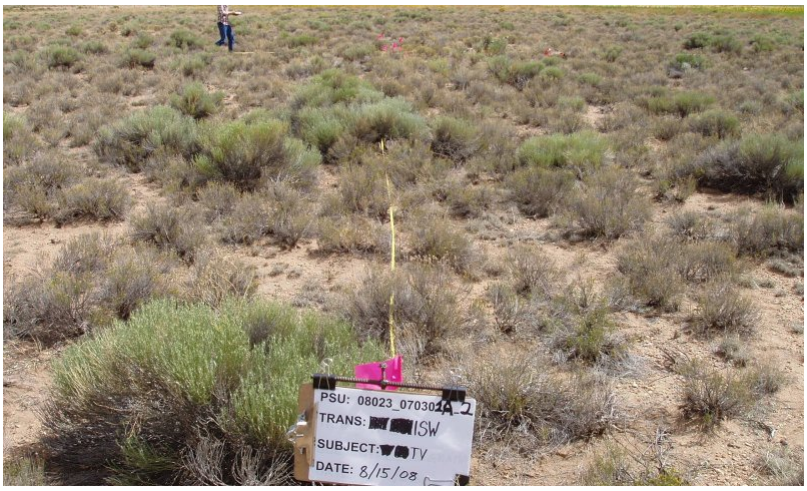
### Pathway P1.2A
### Community 1.2 to 1.1

In theory, a disturbance to set the shrubs back and management to encourage the colonization of grasses. Fire may play a role in the process. Grazing management allowing for appropriate recovery periods and utilization rates may also be a part of the recovery.

### Pathway P1.3A
### Community 1.3 to 1.1

Long term management allowing the diversity of grasses, forbs, and shrubs to re-establish. Grazing management will be an important component with a critical eye toward monitoring and adaptive management.

## State 2
## Degraded Loamy Sand



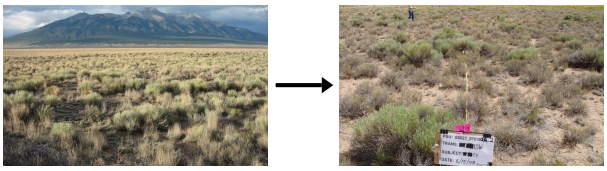

This site has crossed a threshold to a shrub dominated state with active soil erosion. The topsoil has eroded, degrading the site to coppice dunes. Soil textures are loamy sand to sand with high erosion and deposition. The plant community is mostly rabbitbrush with some annuals such as Russian thistle and lambs quarter.

## State 3
## Degraded Sandy Loam

Where the site is sandy loam in texture the eroded state primarily consists of bare ground with sporadic grass cover and annuals. Grass species with natural defenses to grazing such as blue grama, threeawn, squirreltail and sand dropseed may be present.

**Resilience management.** This site is not very resilient to disturbance as hydrologic function is very low.

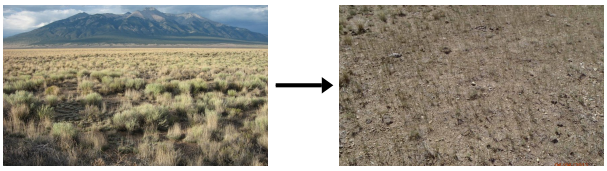
### Transition T1A
### State 1 to 2



Reference | Degraded Loamy Sand

Where the site has coarser textured soils, drivers such as long-term repetitive defoliation at high utilization rates that does not allow for preferred species to recover and will lead toward a state change. Repeated, high utilization on both preferred grasses and shrubs during drought will help speed the degradation. Once excessive erosion starts to occur, only deep rooted, disturbance-driven basal sprouters such as rabbitbrush will survive.

### Transition T1B
### State 1 to 3



Reference | Degraded Sandy Loam

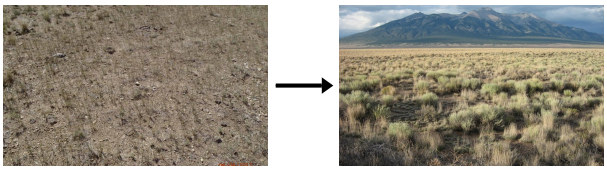
Preferred species of grass and shrubs have been reduced to where bare ground is dominant. Long term grazing without adequate rest and often with high utilization has driven the site to a threshold. High utilization during drought is often a trigger.

### Restoration pathway R2A
### State 2 to 1

Degraded Loamy Sand | Reference

Restoration starts with the stabilization of soil. This means managing to promote colonization by a diversity of plants, promoting the accumulation of litter, and allowing for plant growth following precipitation events.

### Restoration pathway R3A
### State 3 to 1



Degraded Sandy Loam | Reference

Long term management where key species begin to colonize, bare ground is reduced, and production increases.

## 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** | | | 560–841 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 359–538 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 224–336 | – |
| | needle and thread | HECO26 | *Hesperostipa comata* | 135–202 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 90–135 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 90–135 | – |
| | spike dropseed | SPCO4 | *Sporobolus contractus* | 90–135 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 45–67 | – |
| | alkali wildrye | LESI5 | *Leymus simplex* | 45–67 | – |
| | squirreltail | ELELE | *Elymus elymoides ssp. elymoides* | 45–67 | – |
| | purple threeawn | ARPU9 | *Aristida purpurea* | 22–34 | – |
| | sandhill muhly | MUPU2 | *Muhlenbergia pungens* | 22–34 | – |
| | blowout grass | REFL | *Redfieldia flexuosa* | 11–17 | – |
| **Forb** | | | | | |
| 2 | **Forbs** | | | 224–336 | |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 28–84 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 28–84 | – |
| | annual buckwheat | ERAN4 | *Eriogonum annuum* | 6–28 | – |
| | rush skeletonplant | LYJU | *Lygodesmia juncea* | 0–13 | – |
| | tenpetal blazingstar | MEDE2 | *Mentzelia decapetala* | 0–13 | – |
| | lemon scurfpea | PSLA3 | *Psoralidium lanceolatum* | 0–13 | – |
| | broom-like ragwort | SESP3 | *Senecio spartioides* | 0–13 | – |
| | aster | ASTER | *Aster* | 0–13 | – |
| | western tansymustard | DEPI | *Descurainia pinnata* | 0–13 | – |
| | snowball sand verbena | ABFR2 | *Abronia fragrans* | 0–13 | – |
| **Shrub/Vine** | | | | | |
| 3 | **Shurbs** | | | 84–168 | |
| | fourwing saltbush | ATCA2 | *Atriplex canescens* | 84–140 | – |
| | skunkbush sumac | RHTR | *Rhus trilobata* | 28–112 | – |
| | wax currant | RICE | *Ribes cereum* | 28–84 | – |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 28–84 | – |
| | Greene's rabbitbrush | CHGR6 | *Chrysothamnus greenei* | 22–34 | – |
| | rubber rabbitbrush | ERNAB2 | *Ericameria nauseosa ssp. nauseosa var. bigelovii* | 22–34 | – |
| | Apache plume | FAPA | *Fallugia paradoxa* | 11–17 | – |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 11–17 | – |
| | soapweed yucca | YUGL | *Yucca glauca* | 11–17 | – |

| | | | | | |
|---|---|---|---|---|---|
| | soapweed yucca | YUGL | *Yucca glauca* | 11–17 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 11–17 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | – | – |

## Inventory data references

Location of Typical Example of the Site:
Along Highway 160 near the Alamosa-Costilla County line. Shellabarger Ranch on Rito Alto Creek in Saguache County.

Field Offices in Colorado where the site occurs:
Alamosa, Center, and San Luis

## References

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## Other 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

Curtis Talbot, 7/19/2021

## 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.

| | |
|---|---|
| Author(s)/participant(s) | S. Woodall, C. Villa, D. Sparks, H. Garcia |
| Contact for lead author | |
| Date | 12/16/2004 |
| Approved by | Curtis Talbot |
| 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:** None

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3. **Number and height of erosional pedestals or terracettes:** Minor pedestalling may be evident 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):** A fair amount of gravel and cobble stones are scattered about the soil surface. Approximately 15% or less bare ground, with bare patches ranging from 2-3 inches in diameter. Prolonged drought or wildfire events will cause bare ground to increase upwards to 15-20% with bare patches ranging from 3-5 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:** Some minor wind scouring is inherent to this site. Surface gravels provide surface roughness. Soil movement can intensify with disturbances such as wildfire, wildlife, or extended drought.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement on this site is minor.

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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 anticipated to be 3-4 in interspace at soil surface.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soils are most commonly loamy sand, fine sandy loam or sandy loam. The A-horizon ranges from 2-15 inches in depth. Surface horizon structure is usually weak fine granular structure.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Plant community composition has a minor effect on infiltration and runoff on this site. Infiltration rates are high due to soil texture.

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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 bunchgrass >

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

    Other: forbs

    Additional:

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

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14. **Average percent litter cover (%) and depth ( in):** 25-35% litter cover at 0.25 inch depth. Litter cover during and following drought can range from 10-15% and 5-10% following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 800 lbs./ac. low precipitation years; 1000 lbs./ac. average precipitation years; 1200 lbs./ac. high precipitation years. After extended drought, production will be reduced to 400 – 600 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.

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