USDA Natural Resources Conservation Service

Ecological site R051XY283CO
Foothills 12-16 PZ

Last updated: 12/11/2024
Accessed: 02/07/2025

General information

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

MLRA notes

Major Land Resource Area (MLRA): 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.

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

It is a grassland site that rolling hills, mountains and basalt mesas where alluvium has covered bedrock, creating soils that are deep. The site occurs on the upper end of the slope, on what is considered the mountain-valley fan. This site is associated with volcanic structures and geology.

Associated sites

R051XY277CO	**Basalt Hill 7-12 PZ** The basalt hills site is on soils that are shallow to very shallow, mostly close to the escarpment, and the foothills site is where soil depth becomes deep.
R051XY278CO	**Valley Bench 8-12 PZ** Along the lower end of the slopes/fans where alluvial soils become very deep the Foothills site grades into the the valley bench.

R051XY317CO	**Foothill Loam** The Foothills Loam site occurs on what is considered the mountain-valley fan. Component landforms include: alluvial fans, fans, fan remnants, and mountain-slopes. Soils are mostly deep loam formed from alluvium from igneous and metamorphic rock.

Similar sites

R051XY317CO	**Foothill Loam** The Foothills Loam site occurs on what is considered the mountain-valley fan. Component landforms include: alluvial fans, fans, fan remnants, and mountain-slopes. Soils are mostly deep loam formed from alluvium from igneous and metamorphic rock.

Table 1. Dominant plant species

Tree	(1) *Pinus edulis* (2) *Juniperus monosperma*
Shrub	(1) *Artemisia tridentata* (2) *Atriplex canescens*
Herbaceous	(1) *Pascopyrum smithii* (2) *Hesperostipa comata*

Physiographic features

This site occupies rolling hills, mountains and basalt mesas. The site occurs on the upper end of the slope, on what is considered the mountain-valley fan. The Foothills site is associated with these volcanic structures and geology.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Mountain
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	7,700–9,100 ft
Slope	1–35%

Climatic features

Average annual precipitation is 12 to 16 inches. Of this, more than half falls between May 1 and September 1, mostly as hard, spotty thundershowers in July and August. May and June are normally dry. Wide seasonal and yearly variations are common. Snow makes up a slightly higher percent of the total than on some of the nearby ecological sites at lower elevations. Major native plants make most of their growth between early May and mid-July, sometimes extending it through most of August. Some plants normally complete growth by mid-June and may make late regrowth.

Mean annual temperature is 40 degrees to 43 degrees F. Average frost-free period is 80 to 105 days, from late May to early June to September. Summer daytime temperatures are frequently in the low 80's, but rarely exceed 90 degrees F, and nights are cool. Temperatures of -20 degrees to -30 degrees F can be expected each year and are common some winters. Parts of the site are slightly warmer, though than lower valley land because of air drainage. Winds that often reach high velocities are common, especially in spring. Relative humidity is often low. Even so, evaporation rates average lower than those of many dry regions because of the cooler climate. There is usually more snow than at lower elevations, and snow is usually present during the coldest weather. However, snow cover is light through much of some winters.

This climate zone does not have a representative climate station in Colorado. The only station is in Questa ,NM in this zone.

Table 3. Representative climatic features

Frost-free period (characteristic range)	80-105 days
Freeze-free period (characteristic range)	60-90 days
Precipitation total (characteristic range)	12-16 in
Frost-free period (actual range)	80-105 days
Freeze-free period (actual range)	60-90 days
Precipitation total (actual range)	12-16 in
Frost-free period (average)	92 days
Freeze-free period (average)	75 days
Precipitation total (average)	14 in

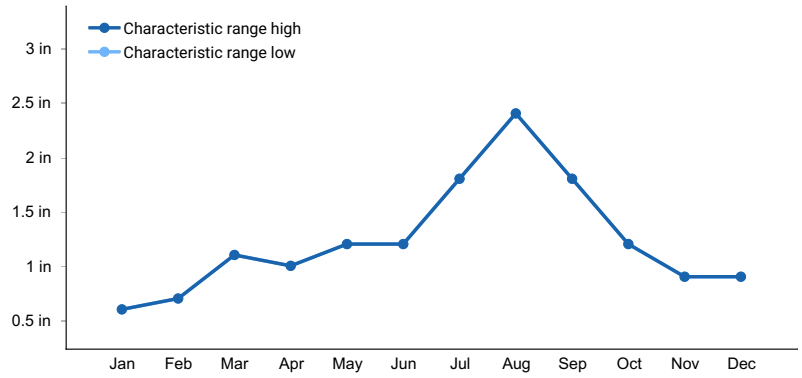


Figure 1. Monthly precipitation range

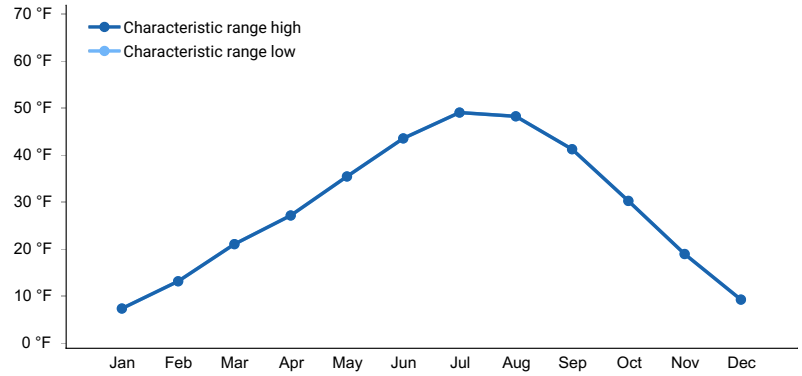


Figure 2. Monthly minimum temperature range

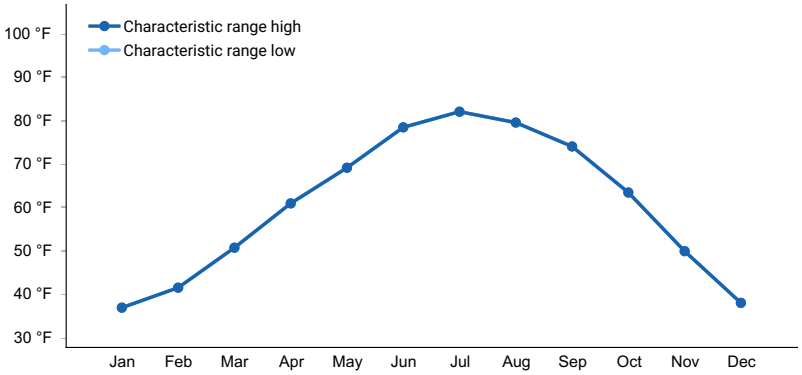


Figure 3. Monthly maximum temperature range

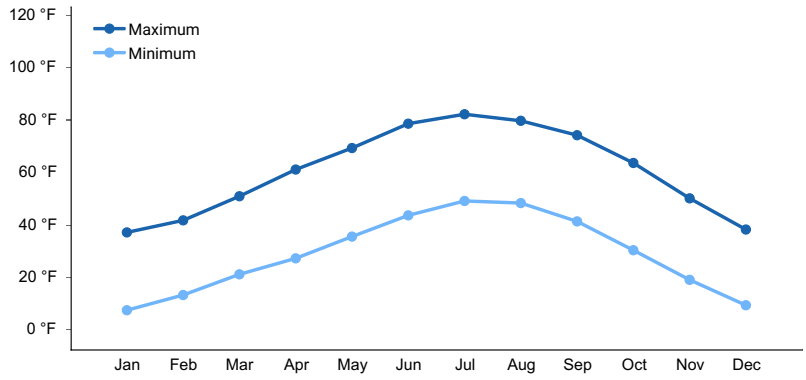


Figure 4. Monthly average minimum and maximum temperature

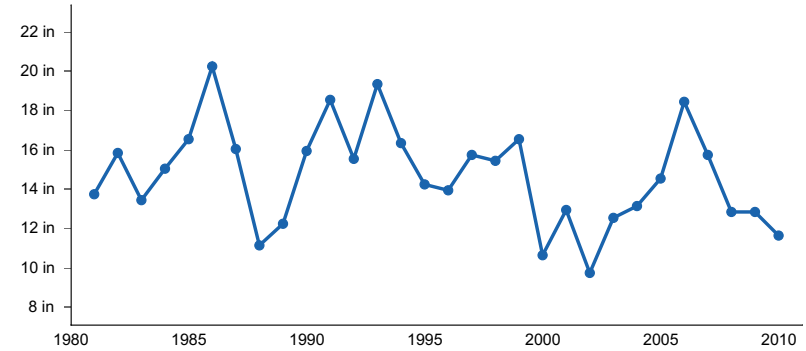


Figure 5. Annual precipitation pattern

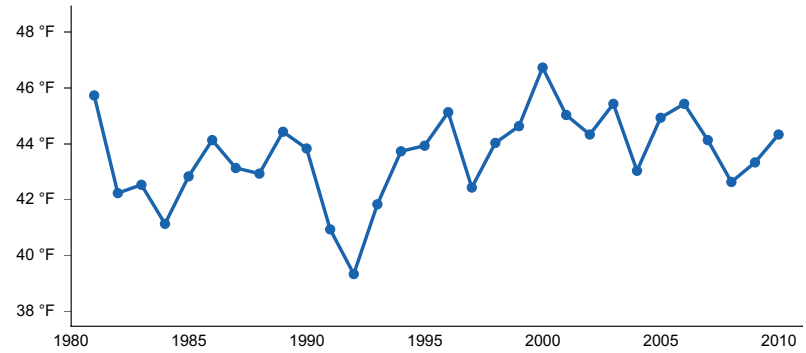


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CERRO [USC00291630], Questa, NM

Influencing water features

This site does not have a water table.

Soil features

The soils are mostly deep loams, occasionally this site will occur on moderately deep soils. The pH is generally 6.6 to 7.8, but in few map units the pH does range from 7.9 to 9.0. Some soils contain varying amounts of gravel and stone through the profile, but not enough to be classified as skeletal. Clay content of the surface layer ranges from 17-25% clay. Soil surface depth ranges from 4 to 15 inches. An argillic horizon starts between 4-15 inches in depth. Typically, the argillic horizon ends around 36 inches.

Potrio series would be a representative soil for this ecological site.

Table 4. Representative soil features

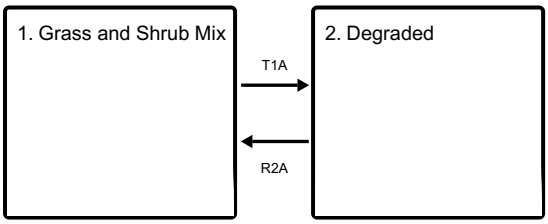
Parent material	(1) Alluvium–basalt (2) Alluvium–volcanic rock
Surface texture	(1) Gravelly silt loam (2) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	40 in
Surface fragment cover <=3"	5–30%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	3.5–5.5 in
Calcium carbonate equivalent (Depth not specified)	0–45%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	5–30%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

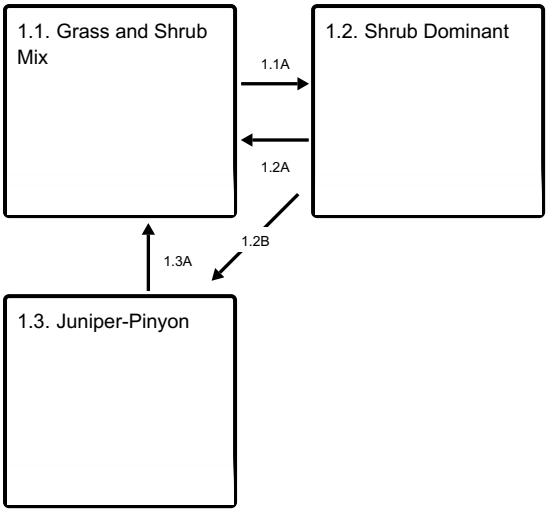
The site is a productive grass-dominated site. The major gradients that affect the biologic variability of this site include: depth to bedrock; texture, slope; aspect; and elevation. As the site grades toward deeper profiles with thicker argillic horizons it trends towards greater percentage of grass and less for shrubs. Cool and wetter conditions on northern and eastern aspects will favor upper montane bunchgrasses such as mountain muhly and Parry oatgrass at the upper elevations of this site. Warmer and dryer conditions (southern and western aspects and lower elevations) will favor lower montane grasses and shrubs such species as western wheatgrass and needleandthread grass and Wyoming big sagebrush.

State and transition model

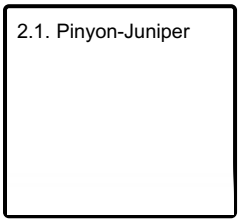
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Grass and Shrub Mix

This site is principally a grassland site with scattered shrubs. Trees are not natural to this site. As the site degrades grasses decrease and big sagebrush becomes more dominant. Blue grama will increase as the site degrades, and it, too becomes sparse under prolonged heavy grazing.

Resilience management. The reference state is most resilient to disturbance. Fire is an important disturbance to keep this site a grassland community. The grasses provide production, cover, annual turnover of fibrous roots and healthy soil microbial communities. Healthy microbial communities improve soil health factors such as water infiltration, retention, and nutrient cycling for plants.

Community 1.1
Grass and Shrub Mix

The reference state is grass dominant with scattered big sagebrush. Cool season grasses such as western wheatgrass, needle-and-thread, muttongrass, and junegrass are common. Minor amounts of forbs and shrubs can be expected. Among them are buckwheats, indian paintbrush, penstemon, lupine, locoweed, prairie sagewort, yellow rabbitbrush, Greene's rabbitbrush, fourwing saltbush, and winterfat. In cooler, wetter areas, mountain muhly and Parry oatgrass are abundant.

Resilience management. Bare ground is minimal and soil health is highest. Resilience to disturbance is greatest with the reference community. To maintain this community, periodic fire must set back the shrubs and trees and rejuvenate the grasses.

Dominant plant species

- western wheatgrass (*Pascopyrum smithii*), grass
- needle and thread (*Hesperostipa comata*), grass

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	525	770	1050
Shrub/Vine	150	220	300
Forb	75	110	150
Total	**750**	**1100**	**1500**

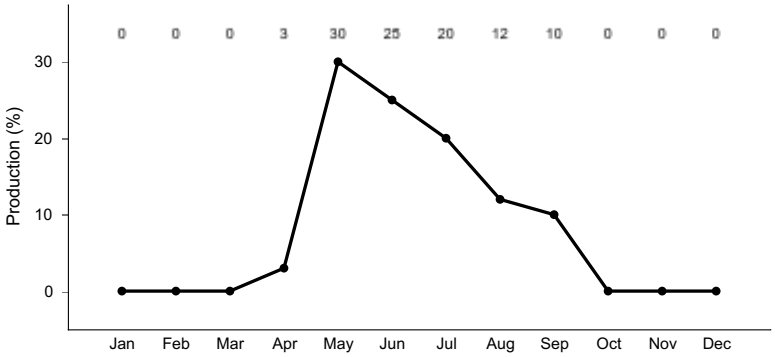


Figure 8. Plant community growth curve (percent production by month). CO5108, Cool-season Dominant Warm-season Subdominant, MLRA 51 Alluvial Fans & fan Remnants. Reference Plant Community for Chico Fan located in LRU 51-5 on fans and fan remnants above valley floor, predominantly in areas surrounding Villa Grove and Saguache, Saguache County..

Community 1.2
Shrub Dominant

Shrubs constitute the greater percentage of composition and cover. Mainly big sagebrush has expanded with decreased grass cover between shrubs.

Resilience management. The more grass cover that is lost, the closer the site moves toward a threshold. Resilience to disturbance has decreased due to loss of soil, a decrease in infiltration, and a decrease in moisture retention.

Community 1.3
Juniper-Pinyon

This plant community has an increase in oneseed juniper and twoneedle pinyon. Over time, the trees spread from nearby shallow soils to the deep soils that this site occurs on. Grasses and shrubs are still mixed into the composition. As conifers increase, the soil becomes droughted.

Resilience management. Over time juniper and pinyon gain a competitive advantage due to extensive root systems that are both lateral and vertical. Periodic fire is needed to take out tree saplings and improve the vigor of grasses. After a certain percentage of cover becomes juniper and pinyon, a threshold is crossed to a tree state (State 2).

Pathway 1.1A
Community 1.1 to 1.2

The main driver is repetitive, high utilization of palatable species during the growing season without adequate periods of recovery where the plants produce flower and seed.. Palatable grass species decrease, bare ground increases, and shrubs gain a competitive advantage. A decrease in fire is another driver. Periodic fire has been an important disturbance to keep shrubs in check while improving ecological processes which favor grasses and forbs.

Pathway 1.2A
Community 1.2 to 1.1

Adding fire as a disturbance to decrease shrubs and open canopy to improve tillering of grasses. If grazing is to be implemented, then using management that allows for critical cool season grasses to grow and seed.

Pathway 1.2B
Community 1.2 to 1.3

Overtime with lack of fire due to a decrease in fuel load, pinyon and juniper saplings have an opportunity to out-compete shrubs and grasses. The main competitive advantage for pinyon and juniper are extensive root systems, both vertical and lateral. They effectively steal the moisture from everything else, and as they increase, the soil becomes droughted.

Pathway 1.3A
Community 1.3 to 1.1

Improving fuel loads through vegetation management and allowing fire to decrease the trees and shrubs, allowing grasses gain the competitive advantage.

State 2
Degraded

Community 2.1
Pinyon-Juniper

The site has become covered by twoneedle pinyon and oneseed juniper with very little understory. Bareground is high and a few remnant grasses, forbs, and shrubs are scattered between trees.

Transition T1A
State 1 to 2

Over time, with low fuel loads causing a lack of fire in the system, pinon and juniper stands expand from the shallow soils to the deep soils. As trees increase, understory decrease causing erosion and a decrease in ecosystem services. Eventually after a dominant percentage of cover becomes trees a threshold is crossed to the degraded pinon-juniper state.

Restoration pathway R2A
State 2 to 1

Important reference conditions of soil and vegetation need to be met to restore the site. This includes setting the trees back through a combination of mechanical treatment and fire. This also includes re-establishing the natural fire regime for long-term maintenance. And last of all, if grazing is implemented, long term management that promotes adequate fuel loads and encourages the colonization of cool season grasses.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				600–1000	
	western wheatgrass	PASM	*Pascopyrum smithii*	300–440	–
	needle and thread	HECO26	*Hesperostipa comata*	75–220	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	75–110	–
	muttongrass	POFE	*Poa fendleriana*	75–110	–
	mountain muhly	MUMO	*Muhlenbergia montana*	0–110	–
	blue grama	BOGR2	*Bouteloua gracilis*	75–110	–

	blue grama	BOGR2	*Bouteloua gracilis*	75–110	–
	Parry's oatgrass	DAPA2	*Danthonia parryi*	0–110	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	75–110	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	–
	spike dropseed	SPCO4	*Sporobolus contractus*	0–10	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–10	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–10	–
	littleseed ricegrass	PIMI	*Piptatheropsis micrantha*	0–10	–
	roughleaf ricegrass	ORAS	*Oryzopsis asperifolia*	0–10	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–5	–
Forb					
2				75–150	
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	0–10	–
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–10	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–10	–
	pingue rubberweed	HYRI	*Hymenoxys richardsonii*	0–10	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	0–10	–
	Colorado four o'clock	MIMU	*Mirabilis multiflora*	0–10	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–10	–
	lupine	LUPIN	*Lupinus*	0–10	–
	locoweed	OXYTR	*Oxytropis*	0–10	–
	beardtongue	PENST	*Penstemon*	0–10	–
Shrub/Vine					
3				175–275	
	big sagebrush	ARTR2	*Artemisia tridentata*	75–110	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–110	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–55	–
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	0–55	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–55	–
	wax currant	RICE	*Ribes cereum*	0–25	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–25	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–25	–
	soapweed yucca	YUGL	*Yucca glauca*	0–10	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	–

Inventory data references

Location of Typical Example of Site:
Open areas on top of Sand Pedro Mesa, just southeast of San Luis, Costilla 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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Approval

Kirt Walstad, 12/11/2024

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)	
Contact for lead author	
Date	09/25/2023
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:**

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

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

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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

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

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):**

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14. **Average percent litter cover (%) and depth (in):**

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

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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:**

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17. **Perennial plant reproductive capability:**
