

Ecological site R028AY120UT

Desert Gravelly Loam (Shadscale)

Last updated: 5/02/2025
Accessed: 09/16/2026

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): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It encompasses approximately 36,775 square miles (95,246 square kilometers). A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 feet (1,204 to 2000 meters) in the basins and from 6,560 to 11,150 feet (1996 to 3398 meters) in the mountains. Much of the MLRA has alluvial valley fill and playa lakebed deposits at the surface from pluvial Lake Bonneville, which dominated this MLRA 13,000 years ago. A level line of remnant lake terraces on some mountain slopes indicates the former extent of this glacial lake. The Great Salt Lake is what remains of the pluvial lake. Mountains in the interior of this MLRA consist of tilted blocks of marine sediments from Cambrian to Mississippian age with scattered outcrops of Tertiary continental sediments and volcanic rocks. The average annual precipitation is 5 to 12 inches (13 to 30 cm) in the valleys and ranges up to 49 inches (124 cm) in the mountains. Most of the rainfall in the southern LRU occurs as high-intensity, convective thunderstorms during the growing season (April through September). The driest period is from midsummer to early autumn in the northern LRU. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F (4 to 12 °C). The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with increasing elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. Soils are dominantly in the mesic or frigid soil temperature regime, aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

LRU notes

The Basin and Range North LRU exhibits dry summer with stronger xeric patterns than the Basin and Range South LRU. Ranges in the north LRU are about 50 percent Paleozoic sedimentary/metasedimentary (limestone/quartzite dominant) and about 10 percent Tertiary volcanics. The basin floors are between 4,200 and 5,100 feet (1280 to 1554 meters) in elevation. Pinyon and juniper sites have a greater percentage of Utah juniper (*Juniperus osteosperma*) in the plant community than pinyon pine (*Pinus edulis* or *monophylla*). The Basin and Range North have few semidesert ecological sites with Utah juniper. Cool season grasses, such as bluebunch wheatgrass (*Pseudoroegneria spicata*), are dominant in the plant community, while warm season grasses are largely absent or a small component of the plant community.

Classification relationships

MLRA 28A, LRU A, northern desert zone

Ecological site concept

This site occurs on alluvial fans, fan remnants or terraces. It can be found on slopes between 0 and 15 percent in gravelly moam soils. Shadscale is typically dominant in reference condition.

Associated sites

R028AY215UT	Semidesert Gravelly Loam (Wyoming Big Sagebrush) North This site occurs upslope and on shallow soils.
R028AY138UT	Desert Shallow Loam (Shadscale) This site occurs on shallow soils.

Similar sites

R028AY012NV	LOAMY 5-8 P.Z. This site is similar in soil characteristics and vegetation.
-------------	--

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on broad, nearly level hilltops, alluvial fans, fan remnants, terraces and lake terraces. It occurs between 4300 to 6000 feet on slopes between 0 to 15 percent. This site does not flood or pond water.

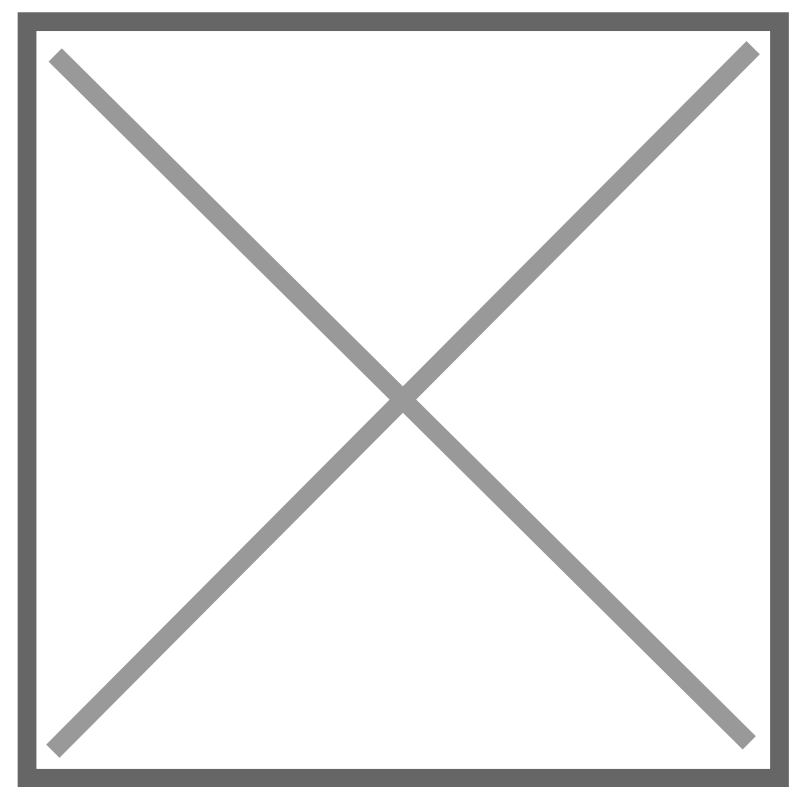


Figure 1.

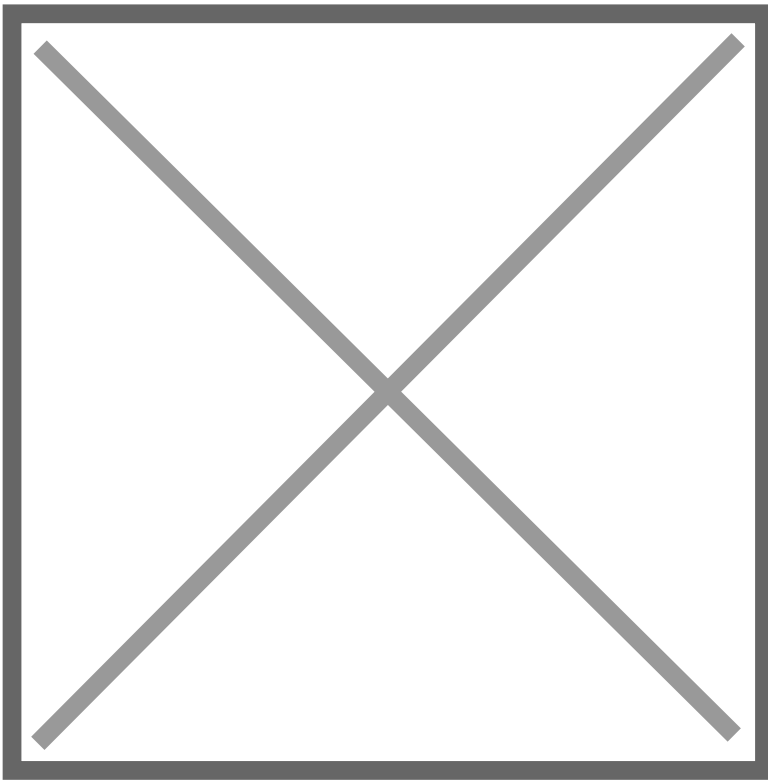


Figure 2.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant (3) Lake terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,310 – 1,830 m
Slope	0 – 20 %

Climatic features

The climate is cold and snowy in the winter and warm and dry in the summer. The average annual precipitation is 5 to 8 inches. Approximately 70 percent comes as rain from March through October. On the average, June through September are the driest months and March through May are the wettest months.

Mean Annual Air Temperature: 46-53

Mean Annual Soil Temperature: 50-56

Table 3 Representative climatic features

Frost-free period (average)	110 days
-----------------------------	----------

Freeze-free period (average)	140 days
Precipitation total (average)	150 mm

- (1) CALLAO [USC00421144], Wendover, UT
- (2) WENDOVER AP AWOS [USW00024193], Wendover, UT

Influencing water features

Water does not flood or pond on this site.

Soil features

Characteristic soils in this site are 60 inches deep and well to somewhat excessively drained. They formed in alluvium underlain by coarser sediments deposited by waves of the ancient lake derived mainly from limestone and calcareous sandstone parent materials. The surface horizon is moderately coarse textures and 6 inches thick. About 50 percent of the soil surface is covered by rock fragments. The volume of rock fragments in the soil profile is 35 to 70 percent.

These soils are calcareous throughout and have moderately rapid permeability. They are non-saline to slightly saline. The available water capacity is 2 to 3.5 inches.

Natural geologic erosion in potential is approximately 0.5 tons/acre/year.

This site is correlated to the following soil components (Soil Survey, Component, mapunit):

UT601: Cliffdown (16, 17)

UT611: Cliffdown (12, 28)

UT617: Dera (15, 16, 17, 19, 29, 30, 41, 52), Papoose (45, 51, 52, 53)

UT623: Stent (86, 94, 175, EJA)

UT632: Bluewing (BLC2), Hiko Springs (HKC2), Hiko Springs variant (HLC)

Table 4. Representative soil features

Parent material	(1) Alluvium – limestone and sandstone
Surface texture	(1) Gravelly loam (2) Gravelly sandy loam (3) Gravelly fine sandy loam
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid
Soil depth	150 cm
Surface fragment cover <=3"	20 – 30 %
Surface fragment cover >3"	0 – 10 %

Available water capacity (0-101.6cm)	5.33 – 8.89 cm
Calcium carbonate equivalent (0-101.6cm)	10 – 50 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 60
Soil reaction (1:1 water) (0-101.6cm)	7.9 – 10
Subsurface fragment volume <=3" (Depth not specified)	20 – 40 %
Subsurface fragment volume >3" (Depth not specified)	0 – 10 %

Ecological dynamics

As ecological condition deteriorates due to overgrazing, galleta, Indian ricegrass, and winterfat decrease while shadscale, rabbitbrush, horsebrush and snakeweed increase.

When the potential natural plant community is burned, galleta, Indian ricegrass, winterfat, and shadscale decrease while rabbitbrush and native annual forbs increase.

Halogeton and cheatgrass are most likely to invade this site.

This site is similar to Nevada's 028AY012NV site. The state and transition model developed by Stringham et al. (2015) is used for the Utah ESD.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
0	Primary Shrubs			152-247	
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	67-90	–
	bud sagebrush	PIDE4	<i>Picrothamnus desertorum</i>	22-45	–

	Nuttall's horsebrush	TENU2	<i>Tetradymia nuttallii</i>	22-45	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	22-45	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	13-22	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	13-22	–
3	Secondary Shrubs			13-22	
	pygmy sagebrush	ARPY2	<i>Artemisia pygmaea</i>	4-13	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	4-13	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	4-13	–
	desert polygala	POAC2	<i>Polygala acanthoclada</i>	4-13	–
Grass/Grasslike					
0	Primary Grasses			148-202	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	90-112	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	45-67	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	13-22	–
1	Seconary Grasses			13-22	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	4-13	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	4-13	–
	saline wildrye	LESAS	<i>Leymus salinus ssp. salinus</i>	4-13	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	4-13	–
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	4-13	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	4-13	–
Forb					
2	Forbs			22-45	
	Torrey's milkvetch	ASCA9	<i>Astragalus calycosus</i>	13-22	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	13-22	–
	low beardtongue	PEHU	<i>Penstemon humilis</i>	13-22	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	13-22	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	13-22	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
-------	-------------	--------	-----------------	----------------------	------------------

Animal community

This site is suited for sheep and cattle grazing during spring, fall, and winter. Wildlife using this site include rabbit, coyote, fox, pronghorn antelope, and mule deer (seasonal). This is a short list of the more common species found. Many other species are present as well and migratory birds are present at times.

Hydrological functions

The soils are in hydrologic group B with runoff curves ranging from 61 to 79 depending on hydrologic condition.

Recreational uses

Resources that have special aesthetic and landscape value are wildflowers. Some recreation uses of this site are hiking and hunting..

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Box Elder County, UT	
Township/Range/Section	T10N R14W S34
General legal description	Western part of Box Elder County at Red Dome NW ¼, NW ¼ Section 34, Township 10N, Range 14W. South of Fish Springs Juab County, Utah. Tooele Army Depot, South Rush Valley, Utah.

Other references

Stringham, T.K., P. Novak-Echenique, P. Blackburn, C. Coombs, D. Snyder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and Transition Models, Major Land Resource Area 28A and 28B Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-01. p. 1524.

Contributors

Patti Novak Echenique
Tamzen Stringham
David J. Somorville
DJS

Approval

Jamin Johanson, 5/02/2025

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)	V. Keith Wadman (NRCS Ret.), Shane A. Green (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	01/10/2009
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** Very minor rill development may be evident in the reference community following significant storm or snow melt events. The presence of rills may be more apparent where run-on from adjacent upland sites or exposed bedrock concentrate flows. Any rill development will be short (< 3') and widely spaced (10' – 15'). Evidence of rills will decrease in the months following major weather events as they heal. Potential rill development may be masked by significant concentrations (35 - 60%) of coarse fragments on the soil surface.

- 2. Presence of water flow patterns:** Some evidence of stable overland water flow is apparent in the reference community; increased flow activity may be observed immediately following significant weather events. Flow patterns are normally <20 feet long, follow natural contours, and are typically spaced 10 to 15 feet apart.

- 3. Number and height of erosional pedestals or terracettes:** Pedestals or terracettes caused by accelerated water erosion are not typically evident in the reference community. 1 – 2 inches of depositional mounding in perennial grass clumps and under Shadscale canopies is normal and may not be water erosion caused.

- 4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 10% - 20% in the reference community. Ground cover (the inverse of bare ground) typically includes: rock fragments – 35% to 60%; plant canopy – 20% to 30%; litter – 10% to 20%.

- 5. Number of gullies and erosion associated with gullies:** Few. Some gully channels are a normal component of desert environments. Gullies associated with reference areas will typically have stable, partially vegetated sides and bottoms with no evidence of head-cutting. Some evidence of disturbance may be evident following significant weather events or when gullies convey runoff from higher elevation

rocky or naturally eroding areas.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Evidence of wind generated soil movement is rare in reference communities. Slight depositional mounding in perennial grass bunches and under Shadscale canopies is a normal characteristic of this site.
-
7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place within or under plant canopies. Some movement of the finest material (< 1/8" or less) may move (1' – 2') in the direction of prevailing winds or down slope if being transported by water. Little accumulation is observed behind obstructions.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 4 to 5. Surface textures are typically sandy loams containing 35 to 60% rock fragments.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 3 - 4 inches deep and structure varies from weak, thin to medium platy. The A-horizon color is typically 10YR 6/2. Soils have an Ochric epipedon that extends 3 – 4 inches into the soil profile. The A horizon is normally deeper and better developed under plant canopies. Where surface soil is lost, increased clay and silt percentages are common in the remaining soil material.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The presence of perennial grasses and Shadscale in the reference community provides for the best infiltration and least runoff from storm events and snow melt. As perennial vegetation decreases and bare ground increases, runoff increases and soil loss is accelerated. Rock fragments armor the soil surface and slowing infiltration.
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Soils are deep to very deep. Increases in clay or silt content in subsoil layers could be mistaken for compaction.
-
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:** Dominant: Non-sprouting shrubs (e.g. Shadscale and Bud sage) 20 – 30%, > warm season perennial grasses (e.g. James galleta and Sand dropseed) 10 – 20%, > tall cool season grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 5 – 15%.
- Sub-dominant:** Sub-dominant: Sprouting shrubs (e.g. Nuttall horsebrush, Nevada jointfir and Winterfat) 5 - 10% > short Cool season grasses (e.g. Bottlebrush squirreltail, Sandberg and Nevada bluegrasses) 3 - 5%.
- Other:** Others: Shrubs (e.g. Low rabbitbrush and Four-wing saltbush) 1-3%, perennial forbs (e.g. Scarlet globemallow and Carpet phlox) 3-5%, biological crusts (e.g. lichens, mosses, cyanobacteria) trace%.
- Additional:** Moss and lichen communities will normally be found under plant canopies while the cyanobacteria will be found throughout the site. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native

species in the reference state. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought or insect infestations up to 80% of the shadscale may die. There may be partial mortality of individual bunchgrasses and other shrubs during severe drought.
-

14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 10 to 20% with a spike when Bud Sage and Shadscale drops its leaves. Depth varies from $\frac{1}{4}$ - $\frac{3}{4}$ inch with depth increasing near plant canopies.
-

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350 – 400 pounds on an average year.
-

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: Broom snakeweed, Russian thistle, Redstem storksbill, annual bromes and Halogeton are likely to increase in or invade this site.
-

17. **Perennial plant reproductive capability:** All perennial plant species have the ability to reproduce in most years except drought years.
-