

Ecological site R028AB227UT

Semidesert Gravelly Sandy Loam (Black Sagebrush)

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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): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82 percent), Nevada (16 percent), and Idaho (2 percent). 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. The soils are generally well drained, loamy or loamy-skeletal, and very deep.

LRU notes

The Basin and Range South LRU has mountain ranges that are about 40 percent sedimentary/metasedimentary (limestone/quartzite dominant) and about 40 percent Tertiary volcanics. The basin floors are generally higher in the southern LRU than in the north LRU between 4,900 and 6,100 feet (1493 to 1859 meters) in elevation. The Basin and Range South LRU also exhibits patterns of summers with a greater relative amount of precipitation in July and August coming from convective storms (ustic trending pattern). Pinyon and juniper ecological sites have a great percentage of pinyon pine (*Pinus edulis* or *monophylla*) than Utah juniper (*Juniperus osteosperma*), with pinyon pine up to 50 percent of the tree composition in the semidesert zones and more than 50 percent in upland zones. Warm season grasses, such as James' galleta (*Pleuraphis jamesii*) or blue grama (*Bouteloua gracilis*), are present within the plant community, and can make up a large portion of the subdominant grass composition. Bristlecone pine (*Pinus longaeva*) and cliffrose (*Purshia* sp.) are also present and dominant on some ecological sites in the southern LRU, while they are sparse or absent in the northern LRU.

Classification relationships

MLRA: 28A Great Salt Lake Area LRU: Basin and Range South Ecological Zone: Semidesert Ecological Site Semidesert Gravelly Sandy Loam (Black Sagebrush) EPA Ecoregions: North American Desert Cold Deserts Central Basin and Range Shadscale-Dominated Saline Basins Sagebrush Basins and Slopes, Woodland-and Shrub-Covered Low Mountains

Ecological site concept

The Semidesert Gravelly Sandy Loam (Black Sagebrush) site is found on alluvial fans on lake terraces. The soil is typically a deep well drained gravelly sandy loam. Black sagebrush (*Artemisia nova*) is the dominant shrub and Indian ricegrass (*Achnatherum hymenoides*) is the dominant understory species, blue grama (*Bouteloua gracilis*) is a common bunchgrass. The similar site in the Basin and Range North LRU is R028AY227UT, all of the soils are currently correlated to the site in the north. Field work is needed to separate out the soils

correlated to this site.

Associated sites

R028AY226UT	Semidesert Sandy Loam (Wyoming Big Sagebrush) Located adjacent to the site on soil that has fewer coarse fragments in the soil.
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Similar sites

R028AY227UT	Semidesert Gravelly Sandy Loam (Black Sagebrush) North Similar site that occurs in the Basin and Range North LRU. This site has either no or occasional warm season grasses.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia nova</i>
Herbaceous	Not specified

Physiographic features

The Semidesert Gravelly Sandy Loam (Black Sagebrush) site occurs on alluvial fans. It is found between 4500 and 6500 feet on slopes between 8 and 15 percent. There is no flooding or ponding on this site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan
Flooding frequency	None
Ponding frequency	None
Elevation	1,370 – 1,980 m
Slope	10 – 20 %
Aspect	Aspect is not a significant factor

Climatic features

The climate is semi-arid and characterized by cold snowy winters and warm summers influence by summer thunderstorms. The average annual precipitation is 8 inches.

The southern portion of the MLRA receives significant summer thunderstorms generated from monsoonal moisture pushed up from the

Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).

Table 3 Representative climatic features

Frost-free period (characteristic range)	90-100 days
Freeze-free period (characteristic range)	120-130 days
Precipitation total (characteristic range)	180-200 mm
Frost-free period (actual range)	90-110 days
Freeze-free period (actual range)	110-140 days
Precipitation total (actual range)	180-200 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	200 mm

- (1) CALLAO [USC00421144], Wendover, UT
- (2) MARYSVALE [USC00425477], Marysvale, UT

Influencing water features

Soil features

The characteristic soils are over 60 inches deep and well drained. They formed in alluvium derived mainly from limestone, sandstone, and shale parent materials. The surface horizon is gravelly sandy loam textures and 3 inches thick. About 15 percent of the soil surface is covered by rock fragments; the volume of rock fragments in the soil profile is 5 to 15 percent.

The soils contain a calcic horizon, which extend from about 10 to 38 inches. The available water capacity is 2 to 6 inches. The permeability is moderate. Runoff is slow with a slight erosion hazard. The cementation is the limiting soil factor affecting plant growth on this site, allowing black sagebrush to dominate the site instead of a big sagebrush species.

This site is correlated to the following soil component:
Beaver County Area (UT628) - Arapien

Table 4. Representative soil features

Parent material	(1) Alluvium – limestone and sandstone (2) Beach sand – shale (3) Granite (4) Rhyolite
Surface texture	(1) Gravelly sandy loam (2) Fine sandy loam
Drainage class	Well drained
Permeability class	Slow to moderately rapid
Soil depth	150 cm
Surface fragment cover <=3"	10 – 20 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	4.32 – 15.75 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 40 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 10
Subsurface fragment volume <=3" (Depth not specified)	10 %

Subsurface fragment volume >3" (Depth not specified)	10 %
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Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass (*Achnatherum hymenoides*), needle and thread (*Hesperostipa comata*), and globemallow (*Sphaeralcea coccinea*) decrease while rabbitbrush (*Chrysothamnus viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) increase.

When the potential natural plant community is burned, Indian ricegrass and black sagebrush (*Artemisia nova*) decrease while rabbitbrush and horsebrush (*Tetradymia nuttallii*) increase.

Cheatgrass (*Bromus tectorum*) and annual forbs are most likely to invade this site.

State and transition model

Figure 7. STM R028AB227UT

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			173-275	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	8-24	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	8-24	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	8-24	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	8-24	–
3	Secondary Shrubs			24-39	
Grass/Grasslike					
0	Primary Grasses			230-471	
	littleleaf pussytoes	ANMI3	<i>Antennaria microphylla</i>	8-24	–
	Utah milkvetch	ASUT	<i>Astragalus utahensis</i>	8-24	–
	Searls' prairie clover	DASE3	<i>Dalea searlsiae</i>	8-24	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	8-24	–
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	8-24	–
	largeflower skeletonplant	LYGR	<i>Lygodesmia grandiflora</i>	8-24	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	8-24	–
1	Secondary Grasses			24-39	
Forb					
0	Primary Forbs			16-39	
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	8-24	–
	matted buckwheat	ERCA8	<i>Eriogonum caespitosum</i>	8-24	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	8-24	–
	Watson's prickly phlox	LIWA4	<i>Linanthus watsonii</i>	8-24	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	8-24	–
2	Secondary Forbs			39-78	

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 12. Community 2.4 plant community composition

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

The Semidesert Gravelly Sandy Loam (Black Sagebrush) site is suited for cattle and sheep grazing during winter and spring. Wildlife using this site include rabbit, coyote, fox, badger, pronghorn antelope, mule deer, and dove. 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 horseback riding.

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Box Elder County, UT	
General legal description	Box Elder County, Utah, East fan of Pilot Mountains.

Other references

Shultz, L.M. 2009. Monograph of Artemisia subgenus Tridentatae (Asteraceae-Anthemideae). Systematic Botany Monographs, pp.1-131.

West, N.E. 2000. Synecology and disturbance regimes of sagebrush steppe ecosystems. In Proceedings of the sagebrush steppe

Approval

Kendra Moseley, 6/12/2025

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.

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Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** No rills present. Very minor rill development may occur in sparsely vegetated areas. If rills are present, they should be widely spaced and not connected. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run inflow enters site from adjacent sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop). Site is essentially level and rills do not form.

- 2. Presence of water flow patterns:** Water flow patterns will be short (2-5'), narrow (<1'), and meandering; interrupted by plants and exposed rocks. Slight to no evidence of erosion or deposition associated with flow patterns.

- 3. Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (1-3") where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (1-3") and show little sign of

active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal. Well-developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-35% bare ground (soil with no protection from raindrop impact). Herbaceous communities are most likely to have lower values. As species composition by shrubs increases, bare ground is likely to increase. Poorly developed biological soil crust that is susceptible to raindrop splash erosion should be recorded as bare ground. Very few if any bare spaces of greater than 1 square foot.
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5. **Number of gullies and erosion associated with gullies:** No gullies present.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust. Gravel or desert pavement protects the site from wind scour.
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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water and wind movement. Very minor litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. The majority of litter accumulates at the base of plants. Some leaves, stems, and small twigs may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move.
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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):** Soil surface is moderately stable (average soil stability score of 3.5 -5).
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** This description is based on a combination of the 3 correlated soils for this site. This results in variation of each of these attributes. Due to the natural variability of soil attributes, it is critical to supplement this description with the soil-specific information from the published soil survey. Soil surface horizon is typically 6 to 10 inches deep. Structure is typically weak thin or medium platy. Color is typically light brownish gray (10YR 6/2), dark grayish brown (10YR 3/2) (moist) or light brown (7.5 YR 6/3) brown (7.5YR 5/3) moist. An ochric horizon extends to a depth of 10 inches. An ochric horizon typically extends to a depth of 2 to 10 inches. The ochric horizon is a surface horizon lacking fine stratification and which is either light colored, or thin, or has a low organic carbon content, or is massive and (very) hard when dry. The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Bunchgrasses and shrubs equally important for increasing infiltration and reducing runoff. Litter plays a role in increasing infiltration and decreasing runoff. Plants provide microhabitat for seedlings, catch litter and soil, and slow raindrops and runoff. Vascular plants and/or well-developed biological soil crusts (where present) will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well-developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and any well-developed biological soil crusts (where present) may serve as water flow patterns during episodic runoff events, with natural erosion expected in

severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced. Shrubs catch snow, slow wind evaporation, and provide microhabitat for seedling establishment.

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): None. Naturally occurring soil horizons may be harder than the surface because of an accumulation of calcium carbonate and should not be considered as compaction layers.
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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: Indian ricegrass

Sub-dominant: needle and thread, black sagebrush

Other: other grasses > other shrubs > forbs

Additional: In the northern portion of the MLRA cool-season perennial grasses (Indian ricegrass, needle and thread) dominate. In the southernmost portion of the MLRA warm-season perennial grasses (galleta, sand dropseed) dominate. The two groups share dominance in the middle portion of the MLRA.

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. Some mortality of bunchgrass and other shrubs may occur during very severe (long-term) droughts. There may be partial mortality of individual bunchgrasses and shrubs during less severe drought. Long-lived species dominate site. Open spaces from disturbance are quickly filled by new plants through seedlings and reproductive reproduction (tillering).
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14. Average percent litter cover (%) and depth (in): Litter cover includes litter under plants. Most litter will be fine litter. Depth should be 1-2 leaf thickness in the interspaces and up to 1/2" under canopies. Litter cover may increase to 15-25% following years with favorable growing conditions. Excess litter may accumulate in absence of disturbance. Vegetative production may be reduced if litter cover exceeds 40%.
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15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): 675#/acre. Even the most stable communities exhibit a range of production values. Production will vary between communities and across the MRLA. Refer to the community descriptions in the ESD. Production will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context.
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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: Cheatgrass and annual forbs
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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually, except in drought years. Density of plants indicates that plants reproduce at level sufficient to fill available resource. Within capability of site there are no restrictions on seed or vegetative reproductive capacity.
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