

Ecological site R028AY336UT

Upland Claypan (Low 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 (1,493 to 1,859 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.

Ecological site concept

The Upland Claypan (Low Sagebrush) site is located on fan remnants on gentle slopes to steep slopes (3 to 60 percent) between 5,400 and 7,600 feet (1,646 to 2,316 meters). The soil is clayey-skeletal and deep. The soil was formed in alluvium derived from sandstone and quartzite. The precipitation ranges from 11 to 15 inches (279 to 381 mm). The dominant vegetation is low sagebrush (*Artemisia arbuscula*) and bluebunch wheatgrass (*Pseudoroegneria spicata*). Total canopy cover in the reference state is about 50 percent shrubs, 40 percent grasses, and 10 percent forbs.

Associated sites

R028AB306UT	Upland Gravelly Loam (Bonneville big sagebrush) South This site occurs adjacent to the site in loamy textured soils.
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Similar sites

R028AY125NV	GRAVELLY CLAYPAN 14+ P.Z. This site is similar to the Upland Claypan site but was developed in Nevada. The STM was used from this site.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia arbuscula</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i>

Physiographic features

The Upland Claypan (Low Sagebrush) site is located on fan remnants on gentle slopes to steep slopes (3 to 60 percent) between 5,400 and 7,600 feet (1,646 to 2,316 meters).

Table 2. Representative physiographic features

Landforms	(1) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	1,650 – 2,320 m
Slope	0 – 60 %
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by warm, dry summers, cold, snowy winters and moist springs. The average annual precipitation is between 11 and 15 inches. October through May is the wettest part of the year and July to September is the driest, except for summer convective storms that occur. These storms are intermittent and may not occur reliably every year, however they do provide enough summer moisture to alter the plant community with warm season grasses. The effective moisture for plant growth is the portion that falls during the plant dormant period, which wets the soil deeply in the spring and early summer.

Table 3 Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	280-410 mm
Frost-free period (average)	
Freeze-free period (average)	
Precipitation total (average)	330 mm

Influencing water features

Due to landscape position, the Upland Claypan (Low Sagebrush) site is not typically influenced by streams or wetlands. It can sometimes be influenced by overland flow during heavy thunder storms and/or during wetter spring runoff periods.

Soil features

The soils are deep and well to somewhat excessively drained. They formed in alluvium derived from igneous and sedimentary rock. The surface layer is very cobbly loam with over 35 percent rock fragments. The subsoil has over 35 percent rock fragments. Available water capacity ranges from 3 to 4 inches in the upper 40 inches of soil. A layer of clay accumulation is usually within 40 inches of the surface. The soil moisture regime is xeric and the soil temperature regime is frigid.

Soil Map Units that may contain this site:

Soil Survey Area: Soil Components (Map units in parentheses)

Tooele Area, Utah-Tooele County and Parts of Box Elder, Davis and Juab Counties (UT611): Yeates Hollow (72)

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Very cobbly loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	150 cm
Surface fragment cover <=3"	20 %

Surface fragment cover >3"	20 %
Available water capacity (Depth not specified)	8.64 – 11.18 cm
Soil reaction (1:1 water) (Depth not specified)	6.1 – 7.3
Subsurface fragment volume <=3" (Depth not specified)	30 %
Subsurface fragment volume >3" (Depth not specified)	30 %

Ecological dynamics

The Upland Claypan (Low Sagebrush) site is found in the Great Salt Lake Area of the Basin and Range Ecological Province. It developed under the natural ecological conditions found there, including the normal influences of native wildlife herbivory, fire, and climate.

Low sagebrush is the dominant shrub with bluebunch wheatgrass as the dominant herbaceous plant in this ecological site. Low sagebrush is typically found in soil that has a clay pan or a rocky layer within 8 to 13 inches of the soil surface (Steinberg 2002). Soils with claypans may develop a perched water table or higher soil moisture in the spring and winter, which will exclude other sagebrush types.

Low sagebrush communities are often low productivity sites compared to big sagebrush sites. This is thought to be due to the high clay in subsurface horizons that may restrict root growth.

As vegetative communities respond to changes caused by natural or human caused events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on the present biotic and abiotic features and the desired results.

Fire Ecology:

Low sagebrush is not tolerant of fire and will not sprout (Steinberg 2002).

Livestock/Wildlife Grazing Interpretations:

Low sagebrush can tolerate and increase with disturbance by grazing (Steinberg 2002). Low sagebrush is considered a good browse plant during the spring, fall, and winter months (Monsen and Shaw 1986) if not covered with snow.

Three possible alternative stable states have been hypothesized for this ecological site. This site is similar to 028AY125NV developed in Nevada. The state and transition model and narratives used from site 0125NV and applied to Upland Claypan (Low Sagebrush) (Stringham et al. 2015). The Reference State contains three community phases, shrub/grass dominated, shrub dominated, grass dominated, and a fire tolerant phase. The primary drivers in this state are fire, drought, and/or insect or disease. The Current Potential State is like the Reference State; however, non-native species have been introduced in the system which alters the resilience and resistance of the state. The Shrub State occurs when shrubs become much more dominant in the plant community, out-competing grasses in the understory. Specific community phases and transitions will be described in the narratives below.

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 (%)
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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 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 3.1 plant community composition

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

Location 1: Tooele County, UT	
Township/Range/Section	T12 S. R19 W. S16
General legal description	Fifteen miles south of Ibapah, Utah. 200 feet east and 1600 feet south of the northwest corner of section 16 in T. 12 S. R. 19 W.
Location 2: Tooele County, UT	
Township/Range/Section	T12 S. R19 W. S16
General legal description	Fifteen miles south of Ibapah, Utah. 200 feet east and 1600 feet south of the northwest corner of section 16 in T. 12 S. R. 19 W.

Other references

Monsen, Stephen B.; Shaw, Nancy L. 1986. Response of an alkali sagebrush/fescue site to restoration treatments. In: McArthur, E. Durant; Welch, Bruce L., compilers. Proceedings--symposium on the biology of Artemisia and Chrysothamnus; 1984 July 9-13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 126-133.

Steinberg, Peter D. 2002. Artemisia arbuscula. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <https://www.fs.fed.us/database/feis/plants/shrub/artarb/all.html> [2018, August 16].

Contributors

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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.

Author(s)/participant(s)	
Contact for lead author	
Date	09/01/2026
Approved by	
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):

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:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

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

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

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:

17. Perennial plant reproductive capability:
