

Ecological site R028AY208UT

Semidesert Bouldery Loam (Wyoming Big 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 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.

Ecological site concept

The Semidesert Bouldery Loam (Wyoming Big Sagebrush) site occurs on hillsides and ridges of ancient basalt flows, fan remnants, and alluvial fans. The amount of boulders on this site make it unique from other Wyoming sagebrush sites. This site has lower shrubs and grass production than similar sites, such as Semidesert Shallow Loam (Wyoming sagebrush) or Semidesert Loam (Wyoming sagebrush).

Associated sites

R028AY124UT	Desert Loam (Shadscale) This site will occur on finer textured soils and is dominated by shadscale.
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Similar sites

R028AY220UT	Semidesert Loam (Wyoming Big Sagebrush) This site occurs on lake terraces and fan remnants on soils that are loamy that have less than 15% rock fragments in the soil profile, it does not contain boulder size rock fragments. The dominant shrub is Wyoming big sagebrush.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i>
Herbaceous	Not specified

Physiographic features

The Semidesert Bouldery Loam (Wyoming Big Sagebrush) site occurs on hillsides and ridges of ancient basalt flows, fan remnants and alluvial fans.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Fan remnant (4) Alluvial fan
Elevation	1,370 – 1,940 m
Slope	10 – 50 %

Climatic features

The climate is semi-arid and characterized by cold snowy winters and warm dry summers. The average annual precipitation is about 12 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.

Table 3 Representative climatic features

Frost-free period (characteristic range)	90 days
Freeze-free period (characteristic range)	120 days
Precipitation total (characteristic range)	310 mm
Frost-free period (actual range)	90 days

Freeze-free period (actual range)	120 days
Precipitation total (actual range)	310 mm
Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	310 mm

- (1) ROSETTE [USC00427408], Park Valley, UT

Influencing water features

Soil features

The characteristic soils are 10 to 20 inches deep over basalt and well drained. The soils formed in colluvium and residuum derived mainly from igneous parent materials. The surface horizon is extremely bouldery silt loam textures and 3 inches thick. About 60 percent of the soil surface is covered by rock fragments. The volume of rock fragments in the soil profile is 35 to 80 percent.

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Slope alluvium (3) Residuum (4) Basalt (5) Igneous rock
Surface texture	(1) Very cobbly sandy loam (2) Extremely bouldery silt loam
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	30 – 50 cm
Surface fragment cover <=3"	20 %
Surface fragment cover >3"	20 – 60 %

Available water capacity (0-101.6cm)	2.54 – 10.41 cm
Calcium carbonate equivalent (Depth not specified)	0 – 40 %
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	7.9 – 10
Subsurface fragment volume <=3" (Depth not specified)	30 – 40 %
Subsurface fragment volume >3" (Depth not specified)	20 – 30 %

Ecological dynamics

The Semidesert Bouldery Loam (Wyoming Big Sagebrush) site is dominated by shrubs with few grasses and forbs in the understory. The dominant identifying characteristics are the boulders on the soil surface. This site has two states, the Reference State and Current Potential. The Reference State has two community phases, both dominated by shrubs, but fewer grasses in community phase 1.2. A biotic transition occurs with non-native invasive species come into the plant community. This represents an irreversible transition as it has not been documented that invasive species can be removed. Cheatgrass (*Bromus tectorum*) is the most common invasive species present in this site. The Current Potential State is similar to the Reference State, with the exception of the presence of non-native species in state two. There is potential for Utah juniper (*Juniperus osteosperma*) to invade the site where it is adjacent to a Utah juniper ecological site. No documentation exists of this occurring other than observation of aerial photography where the site has been correlated to a soil mapunit. Field verification of this community phase is needed before adding it to the state and transition model.

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			372-510	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	256-328	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	73-110	–
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	22-37	–

	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	22-37	—
3	Secondary Shrubs			22-37	
Grass/Grasslike					
0	Primary Grasses			110-183	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	73-110	—
	squirreltail	ELEL5	<i>Elymus elymoides</i>	37-73	—
1	Secondary Grasses			22-37	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	22-37	—
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	22-37	—
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	22-37	—
Forb					
2	Forbs			22-37	
	Utah milkvetch	ASUT	<i>Astragalus utahensis</i>	8-22	—
	quill cryptantha	CRAF	<i>Cryptantha affinis</i>	8-22	—
	western tansymustard	DEPI	<i>Descurainia pinnata</i>	8-22	—
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	8-22	—

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 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

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

The Semidesert Bouldery Loam (Wyoming Big Sagebrush) site is suited for sheep and cattle grazing during fall, 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 D with runoff curves ranging from 80 to 89 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	T12N R12W S36
General legal description	Southwest of Kelton, UT. NE ¼ Section 36, Township 12N, Range 12W.
Location 2: Box Elder County, UT	
Township/Range/Section	T11N R11W S6
General legal description	Center of Section 6, Township 11N, Range 11W.

Contributors

David J. Somorville

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)	Jack Alexander, Range Specialist, Synergy Resource Solutions, Inc. Julia Kluck, Soil Scientist, Synergy Resource Solutions, Inc. Shane Green, State Range Specialist, Utah NRCS
Contact for lead author	Shane Green, Shane.Green@ut.usda.gov
Date	02/08/2010
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Some rills present. 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 other sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop).

2. **Presence of water flow patterns:** Water flow patterns are common. Some are long (15-20'). They are generally very widely spaced (about 20-30' apart). Flow patterns occur in low places associated with microtopography commonly occurring on this site.

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.

5. **Number of gullies and erosion associated with gullies:** No gullies present.

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.

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. On steep slopes (>30%), litter will move downhill to next obstruction.

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).

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** This description is based on the modal soil (Saxby BYX-SiL, soil survey area: 601, West Box Elder). This site has 2 correlated soils, resulting in variation of each of these attributes. Unless working on a location with the modal soil, it is critical to supplement this description with the soil-specific information from the published soil survey. Soil surface horizon is typically 4 to 10 inches deep. Structure is typically weak fine granular. Color is typically brownish gray (10YR 6/2) dark grayish brown (10YR 4/2) 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 an 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.

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.
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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. Some soils have lithic contact at 18". 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: Wyoming big sagebrush

Sub-dominant: perennial grasses (Indian ricegrass> squirreltail

Other: other grasses = other shrubs > forbs

Additional: Functional /structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. crested wheatgrass and Russian wildrye may substitute for mid stature cool season perennial native bunchgrasses.). Biological soil crust is variable in its expression on this site and is measured as a component of ground cover. 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. 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): 625#/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.

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: Annual grasses and annual forbs

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.
