

Ecological site R047XA469UT

Mountain Very Steep Shallow Loam (mountain 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): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. The southern half is in the High Plateaus of the Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south, and the Uinta Mountains, which trend east and west. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area. The Uinta Mountains have a broad, gently arching, elongated shape. Structurally, they consist of a broadly folded anticline that has an erosion-resistant quartzite core. The Wasatch and Uinta Mountains have an elevation of 4,900 to about 13,500 feet (1,495 to 4,115 meters). The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments, but Precambrian rocks are exposed in the Uinta Mountains. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east. The southern Wasatch Mountains consist of Tertiary volcanic rocks occurring as extrusive lava and intrusive crystalline rocks. The average precipitation is from 8 to 16 inches (203 to 406 mm) in the valleys and can range up to 73 inches (1854 mm) in the mountains. In the northern and western portions of the MLRA, peak precipitation occurs in the winter months. The southern and eastern portions have a greater incidence of high-intensity summer thunderstorms; hence, a significant amount of precipitation occurs during the summer months. The average annual temperature is 30 to 50 degrees Fahrenheit (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. Mesic temperature regimes come in on the lower elevations and south facing slopes in the southern portion of this MLRA. The soil moisture regime is typically xeric in the northern part of the MLRA, but grades to ustic in the extreme eastern and southern parts. The mineralogy is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

Major Land Resource Unit 47A is located in the northern half of the Middle Rocky Mountains Province of the Rocky Mountain System. This MLRA includes the Wasatch Mountains which tend to run north and south. These steeply sloping, precipitous mountains have narrow crests and deep valleys. They are primarily fault blocks that have been tilted up. The alluvial fans located at the base of these mountains are important recharge zones for valley aquifers.

Classification relationships

Modal Soil: Agassiz CBV-L, 40-70% — loamy-skeletal, mixed, frigid Lithic Haploxerolls

Ecological site concept

The soils of this site are moderately deep to deep, and well-drained. They formed on steep slopes in colluvium and alluvium derived from limestone, sandstone, and shale. Surface textures are cobbly or channery loams, with rock fragments making up greater than 40 percent of the soil volume. Rock fragments are also visible on the soil surface. Permeability is moderately slow to moderate and available water-holding capacity ranges from 2.5 to 4.0 inches of water in the upper 40 inches of soil. The soil moisture regime is xeric and the soil temperature regime is frigid.

Associated sites

R047XA446UT	Mountain Shallow Loam (mountain big sagebrush)
R047XA430UT	Mountain Loam (mountain big sagebrush)

Similar sites

R047XA446UT	Mountain Shallow Loam (mountain big sagebrush)
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Table 1. Dominant plant species

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

Physiographic features

This site is found on steep to very steep, southeast and southwest-facing slopes at elevations between 5,500 and 8,250 feet. It commonly occurs on alluvial fans, mountain slopes and slump blocks. Runoff is high and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Mountain slope (3) Slump block
Flooding frequency	None
Ponding frequency	None
Elevation	1,680 – 2,520 m
Slope	40 – 80 %
Aspect	SE, SW

Climatic features

Climate of this site is cool and quite humid with cold snowy winters and cool dry summers. The average annual precipitation varies from 16 to 22 inches with an average of around 19. Distribution is 55 to 60 percent during the plant dormant period (October to March). This is the most dependable supply for plant growth. Lower precipitation and high evapo-transpiration rates during July, August, and September causes slowing down in growth of all plant species and dormancy in most of the grasses and forbs.

Table 3 Representative climatic features

Frost-free period (average)	90 days
Freeze-free period (average)	
Precipitation total (average)	640 mm

Influencing water features

Due to its landscape position, this site is not typically influenced by streams or wetlands.

Wetland description

N/A

Soil features

The soils of this site are moderately deep to deep, and well-drained. They formed on steep slopes in colluvium and alluvium derived from limestone, sandstone, and shale. Surface textures are cobbly or channery loams, with rock fragments making up greater than 40 percent of the soil volume. Rock fragments are also visible on the soil surface. Permeability is moderately slow to moderate and available water-holding capacity ranges from 2.5 to 4.0 inches of water in the upper 40 inches of soil. The soil moisture regime is xeric and the soil temperature regime is frigid.

This site is correlated to the Gappmayer soil component (BH) in the Sanpete Valley Area Soil Survey (UT627).

Table 4. Representative soil features

Surface texture	(1) Cobbly loam (2) Channery loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	50 cm
Surface fragment cover <=3"	20 – 50 %
Surface fragment cover >3"	0 – 20 %

Available water capacity (0-101.6cm)	6.35 – 10.16 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	30 – 60 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Ecological dynamics

It is impossible to determine in any quantitative detail the Historic Climax Plant Community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

When available, monitoring data (of various types) were employed to validate more subjective inferences made in this diagram. See the complete files in the office of the State Range Conservationist for more details.

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent

and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range and Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State and transition model

Figure 1. 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	Dominant Shrubs			314-448	
	mountain big sagebrush	ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	224-280	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	56-112	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	34-56	–
3	Sub-Dominant Shrubs			78-146	
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	34-56	–
	Saskatoon serviceberry	AMAL2	<i>Amelanchier alnifolia</i>	11-22	–
	yellow rabbitbrush	CHVIV4	<i>Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus</i>	11-22	–
	slender buckwheat	ERMI4	<i>Eriogonum microthecum</i>	11-22	–
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	11-22	–
Grass/Grasslike					
0	Dominant Grasses			325-504	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	168-224	–
	muttongrass	POFE	<i>Poa fendleriana</i>	56-112	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	34-56	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	34-56	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	34-56	–
1	Sub-Dominant Grasses			202-493	
	Grass, annual	2GA	<i>Grass, annual</i>	56-112	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	56-112	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11-34	–
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	11-34	–
	Geyer's sedge	CAGE2	<i>Carex geyeri</i>	11-34	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	11-34	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	11-34	–
	spike fescue	LEKI2	<i>Leucopoa kingii</i>	11-34	–
	oniongrass	MEBU	<i>Melica bulbosa</i>	11-34	–
Forb					
2	Sub-Dominant Forbs			202-247	
	Forb, annual	2FA	<i>Forb, annual</i>	34-56	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	34-56	–
	common yarrow	ACMI2	<i>Achillea millefolium</i>	11	–
	silverleaf milkvetch	ASAR4	<i>Astragalus argophyllus</i>	11	–
	arrowleaf balsamroot	BASA3	<i>Balsamorhiza sagittata</i>	11	–

	Wyoming Indian paintbrush	CALI4	<i>Castilleja linariifolia</i>	11	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	11	–
	shortstem buckwheat	ERBR5	<i>Eriogonum brevicaule</i>	11	–
	sticky purple geranium	GEVI2	<i>Geranium viscosissimum</i>	11	–
	blue flax	LIPE2	<i>Linum perenne</i>	11	–
	tailcup lupine	LUCAC3	<i>Lupinus caudatus ssp. caudatus</i>	11	–
	Tolmie's owl's-clover	ORTO	<i>Orthocarpus tolmiei</i>	11	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	11	–

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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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 4.1 plant community composition

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

Grazing on this site is limited because of steep slopes. The plant composition provides balanced nutrition during spring, summer and fall. This site is good habitat for many species of wildlife. This site produces excellent forage for deer and elk.

Hydrological functions

Soil series in this site are grouped mainly into d hydrologic group. They have high runoff potential. When the vegetation is in climax (potential), the hydrologic curves are 76 to 73. Where range condition has declined from climax, field investigation is needed to determine hydrologic curve numbers.

Recreational uses

This site has good values for aesthetics and natural beauty. The degree of slope limits the use of the site for recreation.

Wood products

No values exist for lumber. Some of the shrub species produce enough wood for campfires. Production of wood products for other uses are not of a quantity or quality to be of value.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used.

Other references

Galatowitsch, S.M. 1990. Using the original land survey notes to reconstruct pre-settlement landscapes in the American West. Great Basin Naturalist: 50(2): 181-191. Keywords: [Western U.S., conservation, history, human impact]

Parson, R. E. 1996. A History of Rich County. Utah State Historical Society, County Commission, Rich County, Utah. Keywords: [Rich

County, Utah, Historic land use, European settlements]

USDA-NRCS. 2003. National Range and Pasture Handbook. in USDA, editor, USDA-Natural Resources Conservation Service-Grazing Lands Technology Institute. Keywords: [Western US, Federal guidelines, Range pasture management]

Contributors

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Approval

Kendra Moseley, 2/05/2025

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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Date	11/26/2012
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** Rills are fairly common. Their expression may be less defined where coarse fragments (i.e., gravels and/or channers) dominate the soil surface. Rill occurrence may increase slightly on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Rills should be <1 inches deep, somewhat long (10 to 15 feet) and somewhat widely spaced (8-12 feet). An increase in rill development may be observed immediately following major thunderstorm or spring runoff events.
- 2. Presence of water flow patterns:** Sinuous flow patterns are common and wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat as slopes approach 80%. Water flow patterns are long (20 to 30 feet), somewhat narrow (1 to 2 feet wide), and spaced widely (5 to 10 yards) and more closely spaced (3 to 6 yards) on slopes nearing 70 to 80%.

3. **Number and height of erosional pedestals or terracettes:** Small pedestals will form at the base of plants that occur on the edge of water flow patterns, 2 to 4% of plants show minor exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.
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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20–25%. (Soil surface is typically covered by 30-80% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Bare ground spaces not associated with flow patterns should not be greater than 1 to 2 feet in diameter.
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5. **Number of gullies and erosion associated with gullies:** A few gullies may occur. Any gullies present may extend down the length of the site until they reach a stream or other area where water and sediment is diverted or accumulates. Gullies show slightly more indication of erosion as slopes approach 80%, or where the site occurs adjacent to watershed areas with concentrated flow patterns.
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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Perennial shrubs along with surface coarse fragments on this site help break the wind and reduce the potential for wind erosion.
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7. **Amount of litter movement (describe size and distance expected to travel):** Because of the sites very steep slopes, some litter redistribution downslope caused by water movement is normal. Some litter removal may occur in flow channels with deposition occurring within 3 to 5 feet at points of obstruction. The majority of litter still accumulates at the base of plants. Some grass leaves, stems and small woody twigs may accumulate in soil depressions adjacent to plants. Woody stems are likely to move 1 to 2 feet. A slight increase in litter movement is expected following runoff resulting from heavy spring runoff or thunderstorms.
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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):** This site should have an erosion rating of 4 or 5 under the plant canopies, and a rating of 3 to 4 in the interspaces. The average should be a 4. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Wallburg) Soil surface A horizon is typically 0 to 2 inches deep. Structure is weak medium granular. Color is dark grayish brown (10YR 4/2). A Mollic epipedon extends 12 inches into the soil profile. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.
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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Good spatial distribution of plants and well developed biological soil crusts (where present) intercept raindrops, reducing splash erosion and providing areas of increased surface detention to store water, allowing additional time for infiltration.
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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. Fractured sandstone bedrock occurs at about 12 to 16 inches.
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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: Non-sprouting shrubs (Mountain big sagebrush) > cool season perennial bunch grasses (bluebunch wheatgrass, muttongrass) >> rhizomatous grasses (western wheatgrass).

Sub-dominant: Sprouting shrubs (bitterbrush, green rabbitbrush) > forbs (arrowleaf balsamroot, shortstem wild buckwheat)

Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Biological soil crust is variable in its expression where present 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.

Additional: Factors contributing to temporal variability include insects and other pathogens (mistletoe), drought, extreme precipitation events, etc. Factors contributing to spatial variability include slope, amount of rock fragments, aspect, etc. Following a recent disturbance such as fire, drought or insects, that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions may reflect different functional community phases within the reference state.

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 on shrubs, or grasses. There may be partial mortality on individual bunchgrasses and shrubs during drought periods, and complete mortality of individual plants during severe drought periods.
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14. **Average percent litter cover (%) and depth (in):** Cover should be composed mostly of fine litter. Depth should vary from a 1/2 thickness in the interspaces, to up to 1 under herbaceous canopies, and up to 1 1/2" under shrub canopies. Litter cover may increase to 30% on some years due to increased production of plants.
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15. **Expected annual annual-production** (this is TOTAL above-ground annual-production, not just forage annual-production): Annual production in air-dry herbage should be approximately 800 - 1000#/acre on an average year, but could range from 400 to 1800#/acre during periods of prolonged drought or above average precipitation.
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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: Few invasive species are capable of dominating this site. When invasion does occur, cheatgrass, alyssum, and mustard species are the most likely species to invade.
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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species is present during average and above average growing years.
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