USDA Natural Resources Conservation Service

Ecological site R047XA525UT
High Mountain Shallow Loam (low sagebrush)

Last updated: 2/06/2025
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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.

Ecological site concept

The soils of this site formed mostly in colluvium over residuum from quartzite. Surface soils are very gravelly loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and can make up more than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderate permeability. pH is slightly acidic to slightly alkaline. Available water-holding capacity ranges from 1.0 to 2.4 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly xeric and the soil temperature regime is cryic. Precipitation ranges from 22 to 45 inches annually.

Associated sites

R047XA528UT	**High Mountain Stony Clay (slender wheatgrass)** Sites often occur adjacent to each other.

Similar sites

R047XA476UT	**Mountain Windswept Ridge (low sagebrush)** These sites have similar floral characteristics and landscape position. This site however occurs in the mountain ecological zone.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula*
Herbaceous	Not specified

Physiographic features

This ecological site typically occurs on mountain slopes and ridges. Slopes normally range from 10 to 45 percent but may occasionally be steeper. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 6,400 to 9,700 feet in elevation.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,951–2,957 m
Slope	10–45%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 22-45 inches. October thru April, are typically the wettest months with June thru August being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are less reliable sources of moisture to support vegetative growth on this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-60 days

Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	559-1,143 mm

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed mostly in colluvium over residuum from quartzite. Surface soils are very gravelly loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and can make up more than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderate permeability. pH is slightly acidic to slightly alkaline. Available water-holding capacity ranges from 1.0 to 2.4 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly xeric and the soil temperature regime is cryic. Precipitation ranges from 22-45 inches annually.

Table 4. Representative soil features

Parent material	(1) Colluvium–quartzite (2) Residuum–quartzite
Surface texture	(1) Very gravelly loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	25–51 cm
Soil depth	25–51 cm
Surface fragment cover <=3"	40%
Available water capacity (0-50.8cm)	2.54–6.1 cm
Calcium carbonate equivalent (0-50.8cm)	0%
Electrical conductivity (0-50.8cm)	0 mmhos/cm
Sodium adsorption ratio (0-50.8cm)	0
Soil reaction (1:1 water) (0-50.8cm)	6.3–7.4
Subsurface fragment volume <=3" (Depth not specified)	40%
Subsurface fragment volume >3" (Depth not specified)	15%

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 that illustrates 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 1: Reference State
The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The least modified plant community would have been dominated by sparsely scattered stands of low sagebrush (*Artemisia arbuscula*). The herbaceous understory would also have been relatively sparse on these shallow soils, with grass species including bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread (*Hesperostipa comata*), and muttongrass (*Poa fendleriana*), and forbs including spiny phlox (*Phlox hoodii*) and Torrey's cryptantha (*Cryptantha torreyana*), and rock goldenrod (*Petradoria pumila*) (1.1). These sites would have had wildfire return intervals approximately every 100 years.

Community Phase 1.1: sparsely scattered low sagebrush/ scattered bunchgrasses and forbs
This plant community would have been characterized by sparsely scattered stands of low sagebrush. Some mountain shrubs may also have been present, but would have been very scarce. These would have included mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana), mountain snowberry (*Symphoricarpos oreophilus*), and slender buckwheat (*Eriogonum microthecum*). The perennial herbaceous understory would have included a scattering of forbs such as spiny phlox and rock goldenrod, and grasses such as bluebunch wheatgrass and needle and thread.

Transition T1a: from State 1 to State 2 (Reference State to Low Sagebrush/ Introduced Non-natives State)
The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, and climate change has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

State 2: Low Sagebrush/ Introduced Non-natives State
State 2 is identical to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, and a different climate. State 2 is a description of the ecological site

shortly following Euro-American settlement. This state can be regarded as the current potential. This plant community is characterized by scattered stands of low sagebrush and possibly mountain browse associates. The native perennial herbaceous understory is still intact, but a small component of non-native species will also be present. This should be considered the current potential. The soils on this site are considered self-armoring, thus stabilizing this state from the effects of erosion. The stability of this state is maintained by a reduction in ungulate use. Alternatively, this state will lose resiliency with heavy ungulate use.

Community Phase 2.1: sparsely scattered low sagebrush/ scattered bunchgrasses and forbs
This plant community is characterized by sparsely scattered stands of low sagebrush and possibly mountain browse associates such as mountain big sagebrush, mountain snowberry, and slender buckwheat. The perennial herbaceous understory includes a scattering of forbs such as spiny phlox and rock goldenrod, and grasses such as bluebunch wheatgrass and needle and thread.

Transition T2a: from State 2 to State 3 (Low Sagebrush/ Introduced Non-natives State to Depauperate Low Sagebrush State)
Heavy continuous season-long livestock grazing will convert the low sagebrush/ introduced non-natives state to a more depauperate condition. Key indicators of the approach to this transition are a loss of perennial grass understory, an increase in the shrub component relative to grasses, and bare ground between shrubs. The transition is triggered by sustained heavy grazing in the growing season by livestock, and by deer and elk in winter.

State 3: Depauperate Low Sagebrush State
Following long periods with heavy livestock grazing, and where fire has been excluded, low sagebrush will be taller and denser. This will also be the case where deer and elk use is excessive. In this state the herbaceous understory species are greatly reduced (3.1). Subsequent wildfire (3.1a) will remove the older low sagebrush which will be replaced by yellow rabbitbrush (*Chrysothamnus viscidiflorus*) (3.2).

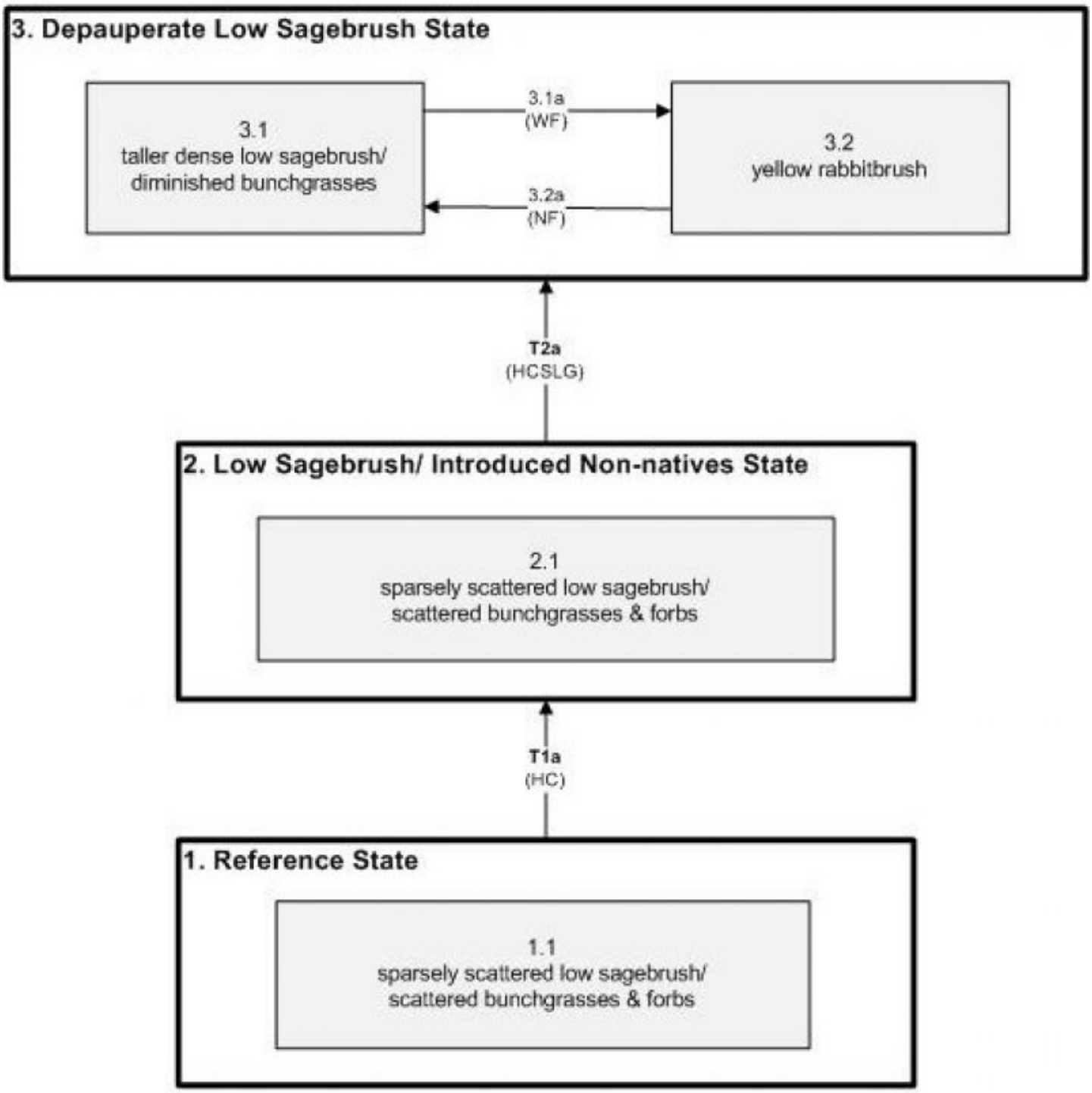
Community Phase 3.1: taller dense low sagebrush/ diminished bunchgrasses
This plant community is characterized by an increase in low sagebrush both in height and density. The native perennial bunchgrasses will be substantially reduced.

Community Pathway 3.1a:
Wildfire will remove the older low sagebrush and replace it with yellow rabbitbrush.

Community Phase 3.2: yellow rabbitbrush
Wildfire will cause the plant community to change favoring more fire-tolerant species such as yellow rabbitbrush, which will remain temporarily dominant. Other introduced annuals and biennials may also appear in the understory at this time.

Community Pathway 3.2a:
As the time since last fire increases, low sagebrush will slowly return to the site provided there is an available seed source.

State and transition model



HC	Historic change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire
WF	Wildfire

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, 2/06/2025

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	05/13/2025
Approved by	Kendra Moseley
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:

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17. **Perennial plant reproductive capability:**
