USDA Natural Resources
Conservation Service

# Ecological site R047XA469UT
# Mountain Very Steep Shallow Loam (mountain big sagebrush)

Last updated: 2/05/2025
Accessed: 02/26/2025

## 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.

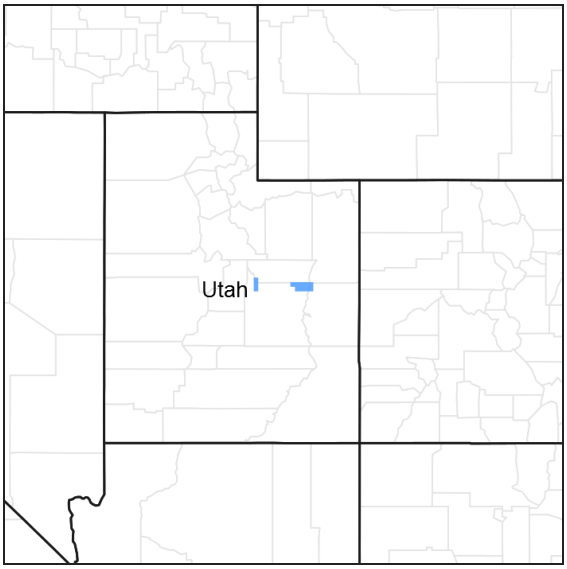



**Figure 1. Mapped extent**

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

## 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)** |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Artemisia tridentata ssp. vaseyana* |
| Herbaceous | (1) *Pseudoroegneria spicata* |

## 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<br>(2) Mountain slope<br>(3) Slump block |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 5,500–8,250 ft |
| Slope | 35–80% |
| 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) | 25 in |

## 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<br>(2) Channery loam |
| Family particle size | (1) Loamy |
| Drainage class | Well drained |
| Permeability class | Moderately slow to moderate |
| Soil depth | 20 in |
| Surface fragment cover <=3" | 15–50% |

| | |
|---|---|
| Surface fragment cover >3" | 3–15% |
| Available water capacity (0-40in) | 2.5–4 in |
| Calcium carbonate equivalent (0-40in) | 0% |
| Electrical conductivity (0-40in) | 0–2 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0 |
| Soil reaction (1:1 water) (0-40in) | 6.6–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 27–59% |
| Subsurface fragment volume >3" (Depth not specified) | 0–29% |

## 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.

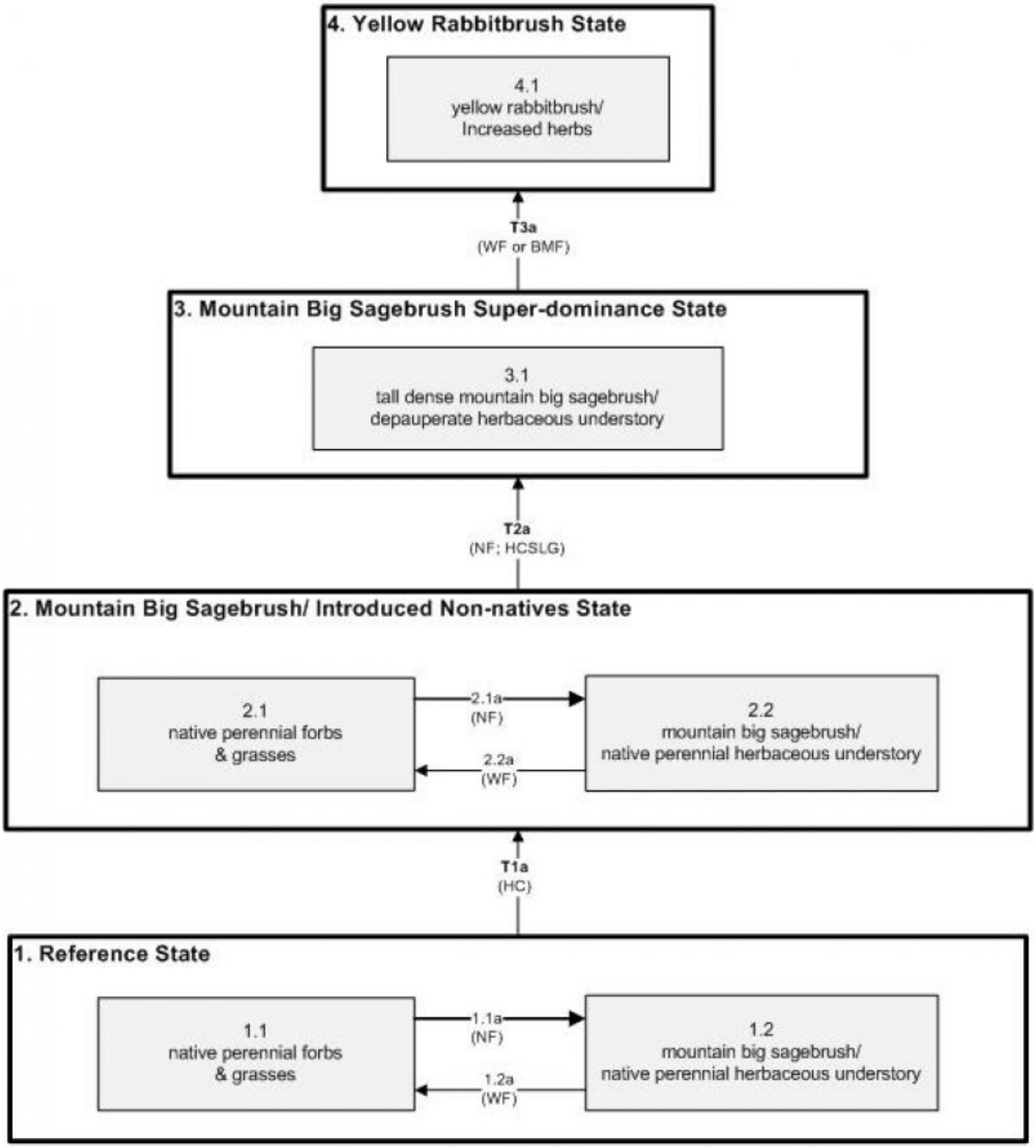
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the 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

# R047AY469UT: Mountain Very Steep Shallow Loam (Mountain Big Sagebrush)




| | |
|---|---|
| BMF | Brush Management (fire) |
| HC | Historic Change |
| HCSLG | Heavy Continuous Season Long Grazing |
| NF | No Fire |
| WF | Wildfire |

**Figure 2. State and Transition Model**

## 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 dominant plant communities found on these sites would have depended on the time since last wildfire. The fire return interval on these sites averaged between 30 and 40 years. Immediately following wildfire (1.2a) herbaceous species would have been dominant with a mixture of native perennial forbs and grasses. Forbs would have included tapertip hawksbeard (*Crepis acuminata*), arrowleaf balsamroot (*Balsamorhiza sagittata*), sticky purple geranium (*Geranium viscosissimum*), and shortstem buckwheat (*Eriogonum brevicaule*), and grasses would have included bluebunch wheatgrass (*Pseudoroegneria spicata*), muttongrass (*Poa fendleriana*), and slender wheatgrass (*Elymus trachycaulus*) (1.1). With increased time since the last wildfire (1.1a), mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) would have ultimately regained its dominance on the site (1.2). Several mountain shrub species would have also been present including antelope bitterbrush (*Purshia tridentata*) and mountain snowberry (*Symphoricarpos oreophilus*). The native perennial herbaceous understory of these sites would have had increased productivity and richness at higher elevations, resembling more of a sagebrush-steppe environment. A more complete list of species by lifeform for the Reference State is available in the accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document.

## Community 1.1
## native perennial forbs & grasses

This plant community would have been dominated by a mixture of native perennial forbs and grasses following wildfire. Dominant forbs would have included tapertip hawksbeard, arrowleaf balsamroot, sticky purple geranium, and shortstem buckwheat. Grasses would have included bluebunch wheatgrass, muttongrass, and slender wheatgrass.

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 225 | 450 | 750 |
| Shrub/Vine | 203 | 405 | 675 |
| Forb | 23 | 45 | 75 |
| **Total** | **451** | **900** | **1500** |

**Table 6. Ground cover**

| | |
|---|---|
| Tree foliar cover | 0% |
| Shrub/vine/liana foliar cover | 39-41% |
| Grass/grasslike foliar cover | 39-41% |
| Forb foliar cover | 4-6% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 0% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 0% |

**Table 7. Canopy structure (% cover)**

| Height Above Ground (Ft) | Tree | Shrub/Vine | Grass/ Grasslike | Forb |
|---|---|---|---|---|
| <0.5 | – | – | – | – |
| >0.5 <= 1 | – | – | – | 4-6% |
| >1 <= 2 | – | – | 39-41% | – |
| >2 <= 4.5 | – | 39-41% | – | – |
| >4.5 <= 13 | – | – | – | – |
| >13 <= 40 | – | – | – | – |
| >40 <= 80 | – | – | – | – |
| >80 <= 120 | – | – | – | – |
| >120 | – | – | – | – |

### Community 1.2
### mountain big sagebrush/ native perennial herbaceous understory

Mountain big sagebrush would have re-established on the site after approximately a 30 to 40 year time period without fire. The plant community would have retained much of its perennial native herbaceous understory.

### Pathway 1.1a
### Community 1.1 to 1.2

As time since last wildfire increased, mountain big sagebrush would have slowly reclaimed its dominance on these sites.

### Pathway 1.2a
### Community 1.2 to 1.1

Wildfire would have removed the sagebrush, returning the plant community to an herb-dominated phase.

## State 2
## Mountain Big 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. The balance between shrubs and herbs would be dependent upon the length of time elapsed since the last wildfire. Immediately following fire (2.2a), the site will be in an herb-dominated phase (2.1). Following a period without fire (2.1a) mountain big sagebrush will become dominant, with a mixture of native perennial forbs and grasses in the understory (2.2). The shrub-steppe variety tends to occur at higher elevations. Dominant grasses are bluebunch wheatgrass, muttongrass, and slender wheatgrass. Forbs include tapertip hawksbeard, arrowleaf balsamroot, and sticky purple geranium, among others. Some non-native species may be present. This State is maintained by periodic wildfire and by a healthy, productive, and diverse plant community that can provide native seed sources and promotes soil stability, water infiltration, and soil moisture retention. The resiliency of this State will be maintained by a reduction in livestock grazing pressure. Conversely, continued heavy season-long livestock grazing will negatively impact the resiliency of this State.

### Community 2.1
### native perennial forbs & grasses

This plant community is dominated by a mixture of native perennial forbs and grasses following wildfire. Dominant grasses are bluebunch wheatgrass, muttongrass, and slender wheatgrass. Dominant forbs include tapertip hawksbeard, arrowleaf balsamroot, sticky purple geranium, and shortstem buckwheat, among others.

### Community 2.2
### mountain big sagebrush/ native perennial herbaceous understory

Mountain big sagebrush will re-establish on the site following a 30 to 40 year period without fire. Native perennial forbs and grasses are also present in the understory, increasing in productivity and richness at higher elevations.

### Pathway 2.1a
### Community 2.1 to 2.2

Absence of fire will allow the mountain big sagebrush to reclaim its dominance at the site.

### Pathway 2.2a
### Community 2.2 to 2.1

Wildfire will remove the sagebrush, bringing the plant community back to an herbaceous phase.

### State 3
### Mountain Big Sagebrush Super-dominance State

In the absence of fire, and with continued heavy impacts from livestock grazing, the native herbaceous understory will markedly decrease, allowing the shrubs, mainly mountain big sagebrush, to become super-dominant and take over the site (3.1). This State is maintained by the abundance of seed source for mountain big sagebrush and a corresponding lack of native perennial seed source for herbaceous species. The resiliency of this State can be maintained by deferring livestock grazing pressure during the growing season. Conversely, the resiliency of this State will be negatively impacted by continued season-long heavy livestock grazing. This State may also experience accelerated soil erosion, which will negatively impact the resiliency of this State.

### Community 3.1
### tall dense mountain big sagebrush/ depauperate herbaceous understory

This plant community is characterized by a dramatic increase in mountain big sagebrush and a corresponding reduction in the perennial herbaceous understory compared to State 2.

### State 4
### Yellow Rabbitbrush State

Yellow rabbitbrush and some common disturbance-following herbaceous species such as houndstongue (Cynoglossum spp.), tarweed (Madia spp.), and cheatgrass (*Bromus tectorum*) will increase following fire (4.1), whether prescribed or wild, while the mountain big sagebrush will be lost. This State could be maintained by periodic fire.

### Community 4.1
### yellow rabbitbrush/ increased herbs

This plant community is dominated by yellow rabbitbrush and a suite of hearty herbaceous disturbance-followers such as such as houndstongue, tarweed, and cheatgrass.

### Transition T1a
### State 1 to 2

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.

### Transition T2a
### State 2 to 3

Lack of fire and continued heavy livestock grazing during the growing season of grasses will cause a transition into the Mountain Big Sagebrush Super-dominance State. During the time period between 1860 and 1950, most of these sites experienced heavy grazing pressure and have therefore transitioned to the Mountain Big Sagebrush Super-dominance State. The approach to this transition is indicated by a loss of perennial grasses and forbs in the understory and an increase in the shrub component relative to the grasses and forbs. This transition is triggered by sustained heavy grazing, which has often occurred since Euro-American settlement.

### Transition T3a
### State 3 to 4

Wildfire or prescribed fire will temporarily remove the mountain big sagebrush. However, an increase in yellow rabbitbrush (*Chrysothamnus viscidiflorus*) will follow the removal of sagebrush in most circumstances. The herbaceous component may also increase after fire. The approach to this transition is indicated by a drastic decrease in forage species and increased fuel loads. The trigger causing this transition is fire.

## Additional community tables

**Table 8. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Shrub/Vine** | | | | | |
| 0 | **Dominant Shrubs** | | | 280–400 | |
| | mountain big sagebrush | ARTRV | *Artemisia tridentata ssp. vaseyana* | 200–250 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 50–100 | – |
| | mountain snowberry | SYOR2 | *Symphoricarpos oreophilus* | 30–50 | – |
| 3 | **Sub-Dominant Shrubs** | | | 70–130 | |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 30–50 | – |
| | Saskatoon serviceberry | AMAL2 | *Amelanchier alnifolia* | 10–20 | – |
| | yellow rabbitbrush | CHVIV4 | *Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus* | 10–20 | – |
| | slender buckwheat | ERMI4 | *Eriogonum microthecum* | 10–20 | – |
| | spineless horsebrush | TECA2 | *Tetradymia canescens* | 10–20 | – |
| **Grass/Grasslike** | | | | | |
| 0 | **Dominant Grasses** | | | 290–450 | |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 150–200 | – |
| | muttongrass | POFE | *Poa fendleriana* | 50–100 | – |
| | Columbia needlegrass | ACNE9 | *Achnatherum nelsonii* | 30–50 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 30–50 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 30–50 | – |
| 1 | **Sub-Dominant Grasses** | | | 180–440 | |
| | Grass, annual | 2GA | *Grass, annual* | 50–100 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 50–100 | – |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 10–30 | – |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 10–30 | – |
| | Geyer's sedge | CAGE2 | *Carex geyeri* | 10–30 | – |
| | prairie junegrass | KOMA | *Koeleria macrantha* | 10–30 | |

| | | | | | |
|---|---|---|---|---|---|
| | prairie junegrass | KOMA | *Koeleria macrantha* | 10–30 | – |
| | basin wildrye | LECI4 | *Leymus cinereus* | 10–30 | – |
| | spike fescue | LEKI2 | *Leucopoa kingii* | 10–30 | – |
| | oniongrass | MEBU | *Melica bulbosa* | 10–30 | – |
| **Forb** | | | | | |
| 2 | **Sub-Dominant Forbs** | | | 180–220 | |
| | Forb, annual | 2FA | *Forb, annual* | 30–50 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 30–50 | – |
| | common yarrow | ACMI2 | *Achillea millefolium* | 10 | – |
| | silverleaf milkvetch | ASAR4 | *Astragalus argophyllus* | 10 | – |
| | arrowleaf balsamroot | BASA3 | *Balsamorhiza sagittata* | 10 | – |
| | Wyoming Indian paintbrush | CALI4 | *Castilleja linariifolia* | 10 | – |
| | tapertip hawksbeard | CRAC2 | *Crepis acuminata* | 10 | – |
| | shortstem buckwheat | ERBR5 | *Eriogonum brevicaule* | 10 | – |
| | sticky purple geranium | GEVI2 | *Geranium viscosissimum* | 10 | – |
| | blue flax | LIPE2 | *Linum perenne* | 10 | – |
| | tailcup lupine | LUCAC3 | *Lupinus caudatus ssp. caudatus* | 10 | – |
| | Tolmie's owl's-clover | ORTO | *Orthocarpus tolmiei* | 10 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 10 | – |

## 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

Darryl Trickler, David Somerville

## 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.

| | |
|---|---|
| Author(s)/participant(s) | V. Keith Wadman (NRCS Retired). |
| Contact for lead author | shane.green@ut.usda.gov |
| Date | 11/26/2012 |
| Approved by | Kendra Moseley |
| 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.

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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%.

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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.

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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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