USDA Natural Resources Conservation Service

Ecological site R047XA458UT
Mountain Stony Loam (quaking aspen thicket)

Last updated: 2/05/2025
Accessed: 05/10/2025

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.

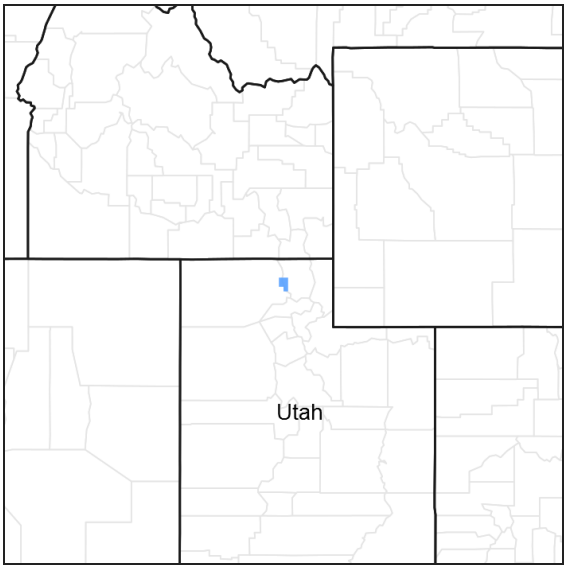

Figure 1. Mapped extent

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: Poleline GR-L 30-70% — loamy-skeletal, mixed Pachic Cryoborolls

Ecological site concept

The soils of this site are moderately deep to deep and formed from colluvium derived primarily from sandstone. The surface texture is gravelly loam and may or may not have rock fragments visible on the soil surface. A dark brown surface layer 2 to 3 feet thick makes up a distinct mollic epipedon. Rock fragments tend to increase with soil depth. These soils are well-drained and permeability is moderate to rapid. Available water-holding capacity ranges from 3.6 to 4.5 inches of water in the upper 40 inches of soil. The soil temperature regime is frigid and the soil moisture regime is ustic.

Associated sites

R047XA430UT	**Mountain Loam (mountain big sagebrush)**

Similar sites

R047XA430UT	**Mountain Loam (mountain big sagebrush)**
F047XA508UT	**High Mountain Loam (quaking aspen)**

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides*
Shrub	Not specified
Herbaceous	(1) *Bromus carinatus*

Physiographic features

This site occurs on steep to very steep mountain slopes at elevations between 7,000 and 9,000 feet. Slopes range from 30 to 70 percent and aspects are typically northward. Runoff is low to moderate. This site provides a cool, moist environment for plant growth because of the elevation and steep northerly exposure where it occurs.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	7,000–9,000 ft
Slope	30–70%
Aspect	NW, N, NE

Climatic features

The climate of this site is cold and snowy in the winter and cool and dry in the summer. Approximately 70 percent of the precipitation falls as snow from December through February. Heavy snow accumulation on this site persists late into spring and early summer. Snow slowly melting during this period is added to the soil moisture supply and is available to plants during the growing season. On the average July, August and September are the driest months of the year on this site, and January, February and March are the wettest months.

Table 3. Representative climatic features

Frost-free period (average)	75 days
Freeze-free period (average)	90 days
Precipitation total (average)	30 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 formed from colluvium derived primarily from sandstone. The surface texture is gravelly loam and may or may not have rock fragments visible on the soil surface. A dark brown surface layer 2 to 3 feet thick makes up a distinct mollic epipedon. Rock fragments tend to increase with soil depth. These soils are well-drained and permeability is moderate to rapid. Available water-holding capacity ranges from 3.6 to 4.5 inches of water in the upper 40 inches of soil. The soil temperature regime is frigid and the soil moisture regime is ustic.

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

Cache Valley Area (UT603) \ Poleline (PSG2, SUG);

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone
Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to rapid

Soil depth	40–60 in
Surface fragment cover <=3"	0–24%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3.6–4.5 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	33%
Subsurface fragment volume >3" (Depth not specified)	0–2%

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

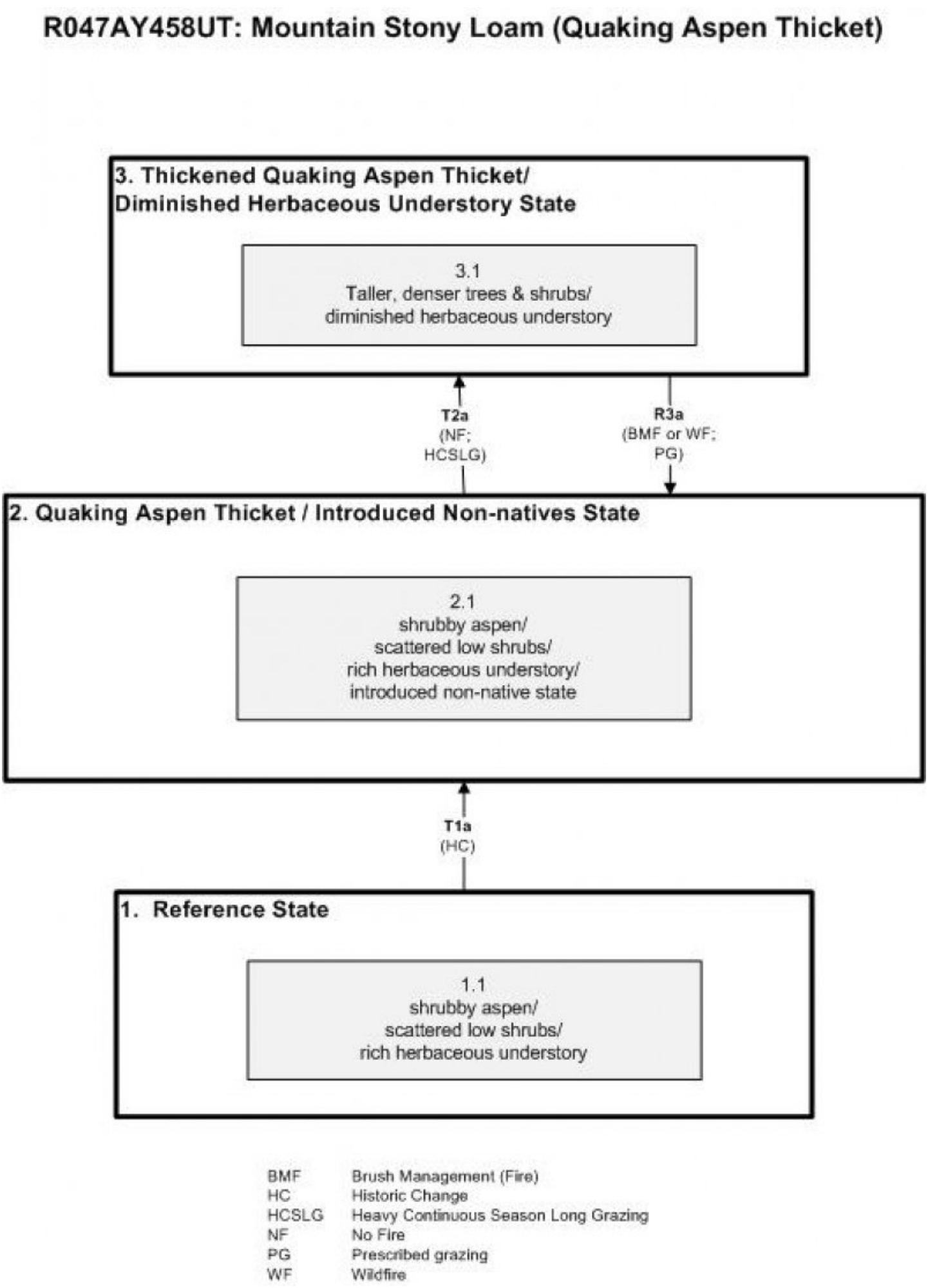

Figure 2. State and Transition Model

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. Along the lee sides of ridges in areas where snow accumulates, these linear-shaped copses would have been dominated by quaking aspen (*Populus tremuloides*), with a scattering of low shrubs, and a rich and productive native perennial herbaceous understory. Mountain snowberry (*Symphoricarpos oreophilus*), chokecherry (*Prunus virginiana*), and Woods' rose (*Rosa woodsii*), among others would have been common shrub associates. The major grasses/grass-likes would have been Mountain brome (*Bromus marginatus*), slender wheatgrass (*Elymus trachycaulus*), and Ross' sedge (*Carex rossii*). Forbs would have included a mixture of Fendler's meadow-rue (*Thalictrum fendleri*), Gray's biscuitroot (*Lomatium grayi*), and lambstongue ragwort (*Senecio integerrimus*) (1.1). These sites would have typically had fire return intervals every 80 to 100 years. 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
shrubby aspen/ scattered low shrubs/ rich herbaceous understory

This plant community would have been characterized by a shrubby form of quaking aspen, with a scattering of low shrubs and a rich and productive native perennial herbaceous understory.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	653	990	1328
Forb	435	660	885
Shrub/Vine	363	550	738
Tree	145	220	295
Total	**1596**	**2420**	**3246**

Table 6. Ground cover

Tree foliar cover	69-71%
Shrub/vine/liana foliar cover	14-16%
Grass/grasslike foliar cover	29-31%
Forb foliar cover	19-21%
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	–	–	–	–
>1 <= 2	–	–	29-31%	19-21%
>2 <= 4.5	–	14-16%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	69-71%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

State 2
Quaking Aspen Thicket/ 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 site is dominated by a shrubby form of quaking aspen along with a suite of mountain shrub species such as mountain snowberry, chokecherry, and woods' rose. The native perennial herbaceous understory species include grasses and grass-likes such as mountain brome, slender wheatgrass, and Ross' sedge, and forbs including Fendler's meadow-rue, Gray's biscuitroot, lambstongue, ragwort, and hound's tongue (Cynoglossum spp.), among others (2.1). Some non-native species may be present. Since this ecological site usually occurs on sheltered topography (e.g. in lee of ridges with extra snowdrift, hollows, north slopes), it is more productive and responsive to management than other sites in this zone. It is however, very important to mule deer fawning and neo-tropical migrant birds. 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. Periodic cool season (spring or fall) prescribed fire may also serve to maintain the balance between woody and herbaceous species in these sites. These sites tend to be particularly resilient due to their location in mesic (moist) micro-sites that are usually covered by snow for about half of the year. The resiliency of this State can be maintained by reducing livestock and big game use and by occasional fire. Conversely, excessive livestock and big game use and fire suppression will negatively impact the resiliency of this State.

Community 2.1
shrubby aspen/ scattered low shrubs/ rich herbaceous understory

This plant community is characterized by a shrubby form of quaking aspen, with a scattering of low shrubs and a rich and productive native perennial herbaceous understory. A small component of introduced non-native species may also be present such as orchardgrass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), or Kentucky bluegrass (*Poa pratensis*).

State 3
Thickened Quaking Aspen Thicket/ Diminished Herbaceous Understory State

In the absence of fire, and with continued heavy impacts from livestock grazing, the native herbaceous understory will markedly decrease. Fire exclusion promotes the thickening of the aspen and other woody species at the expense of the herbaceous understory. The stability of this State is maintained by lack of wildfire and continued impacts to the herbaceous species by livestock.

Community 3.1
taller, denser trees & shrubs/ diminished herbaceous understory

This plant community is characterized by a thickening of the aspen and shrubby understory. The native perennial herbaceous understory, especially the desirable forages, is greatly diminished.

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 throughout the 1860s to the 1950s caused many of these sites to transition into a Thickened Aspen Thicket/ Diminished Herbaceous Understory State. The approach to this transition is indicated by a decrease in the most desirable forage species and an increase in less desirable species. This transition is triggered by sustained heavy grazing and by fire exclusion occurring since Euro-American settlement.

Restoration pathway R3A
State 3 to 2

With prescribed fire or wildfire, followed by a reduction in livestock grazing levels, it may be possible to restore the aspen and some of the more desirable forage species, as aspen will readily re-sprout following fire. However, re-treatment may be required every 40 to 50 years to maintain the appropriate balance of woody and herbaceous components.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			1125–2250	
	quaking aspen	POTR5	*Populus tremuloides*	1125–2250	–
Shrub/Vine					
0	**Dominant Shrubs**			1800–3375	
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	1125–2250	–
	chokecherry	PRVI	*Prunus virginiana*	675–1125	–
3	**Sub-Dominant Shrubs**			2025–8775	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	225–3375	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	225–675	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	225–675	–
	snowbrush ceanothus	CEVE	*Ceanothus velutinus*	225–675	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	225–675	–
	creeping barberry	MARE11	*Mahonia repens*	225–675	–
	sticky currant	RIVI3	*Ribes viscosissimum*	225–675	–
	Woods' rose	ROWO	*Rosa woodsii*	225–675	–
	Scouler's willow	SASC	*Salix scouleriana*	225–675	–
Grass/Grasslike					
0	**Dominant Grasses**			4275–7875	
	California brome	BRCA5	*Bromus carinatus*	1152–2250	–

	slender wheatgrass	ELTR7	*Elymus trachycaulus*	1152–2250	–
	Ross' sedge	CARO5	*Carex rossii*	675–1125	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	675–1125	–
1	**Sub-Dominant Grasses**			3600–8550	
	Grass, annual	2GA	*Grass, annual*	1125–2250	–
	Grass, perennial	2GP	*Grass, perennial*	1125–2250	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	225–675	–
	squirreltail	ELEL5	*Elymus elymoides*	225–675	–
	blue wildrye	ELGL	*Elymus glaucus*	225–675	–
	sheep fescue	FEOV	*Festuca ovina*	225–675	–
	oniongrass	MEBU	*Melica bulbosa*	225–675	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	225–675	–
Forb					
0				2025–3375	
	Gray's biscuitroot	LOGR	*Lomatium grayi*	675–1125	–
	lambstongue ragwort	SEIN2	*Senecio integerrimus*	675–1125	–
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	675–1125	–
2	**Sub-Dominant Forbs**			5625–13725	
	Forb, annual	2FA	*Forb, annual*	1125–2250	–
	Forb, perennial	2FP	*Forb, perennial*	1125–2250	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	675–1125	–
	oblongleaf bluebells	MEOB	*Mertensia oblongifolia*	225–675	–
	slender cinquefoil	POGR9	*Potentilla gracilis*	225–675	–
	yellow salsify	TRDU	*Tragopogon dubius*	225–675	–
	hookedspur violet	VIAD	*Viola adunca*	225–675	–
	common yarrow	ACMI2	*Achillea millefolium*	225–675	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	225–675	–
	heartleaf arnica	ARCO9	*Arnica cordifolia*	225–675	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	225–675	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	225–675	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	225–675	–
	Richardson's geranium	GERI	*Geranium richardsonii*	225–675	–

Animal community

This site is of minor importance for livestock grazing because of steepness of slope.
This site provides food and cover for wildlife.
Wildlife using this site include rabbit, coyote, sage grouse, and mule deer.

Hydrological functions

The hydrologic group for the poleline soil series is b. The hydrologic curve number is 61 when the vegetation is in good condition.

Recreational uses

Hunting and Hiking

Wood products

Poles and firewood

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

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)	
Contact for lead author	
Date	05/10/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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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):**

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

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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:**

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17. **Perennial plant reproductive capability:**
