USDA Natural Resources
Conservation Service

Ecological site R047XA528UT
High Mountain Stony Clay (slender wheatgrass)

Last updated: 2/06/2025
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.

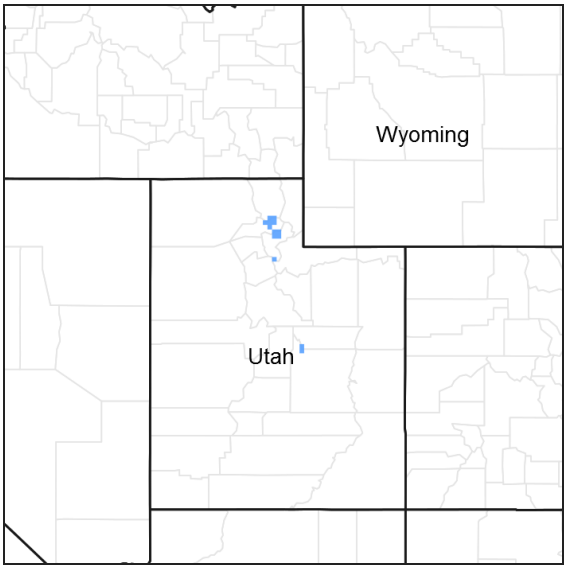

Figure 1. Mapped extent

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: Herd CB-CL, 3-25% — fine, montmorillonitic Mollic cryboralfs

Ecological site concept

The soils of this site formed in a variety of parent materials. Stones and gravels are visible on the soil surface and make up 35 to 65 percent of the soil volume. Surface textures are often loamy, and clay content increases with increasing soil depth. Bedrock may be encountered at depths greater than 20 inches. These soils are well-drained, have moderately slow to moderate permeability, and are penetrated easily by plant roots. They have a neutral pH and are non-calcareous. Available water capacity ranges from 3.1 to 4.9 inches in the upper 40 inches of soil, but these values may be lower in soils less than 40 inches deep. The soil moisture regime is udic, and the soil temperature regime is cryic.

Associated sites

R047XA504UT	**High Mountain Clay (slender wheatgrass)**
R047XA516UT	**High Mountain Loam (mountain big sagebrush)**
F047XA508UT	**High Mountain Loam (quaking aspen)**

Similar sites

R047XA504UT	**High Mountain Clay (slender wheatgrass)** This site has less than 35 percent rock fragments and greater total annual production than the high mountain stony clay site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Elymus trachycaulus* (2) *Bromus carinatus*

Physiographic features

This site is found on mountain slopes, ridges and plateaus at elevations of 7,600 to 10,300 feet. Flooding and ponding do not occur on the site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Plateau
Flooding frequency	None
Ponding frequency	None
Elevation	7,600–10,300 ft
Slope	3–25%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by cold, snowy winters and cool summers. Average annual precipitation varies from 25 to 35 inches. Much of the effective moisture for plant growth occurs from snowmelt and spring precipitation.

Table 3. Representative climatic features

Frost-free period (average)	65 days
Freeze-free period (average)	
Precipitation total (average)	35 in

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed in a variety of parent materials. Stones and gravels are visible on the soil surface and make up 35 to 65 percent of the soil volume. Surface textures are often loamy, and clay content increases with increasing soil depth. Bedrock may be encountered at depths greater than 20 inches. These soils are well-drained, have moderately slow to moderate permeability, and are penetrated easily by plant roots. They have a neutral pH and are non-calcareous. Available water capacity ranges from 3.1 to 4.9 inches in the upper 40 inches of soil, but these values may be lower in soils less than 40 inches deep. The soil moisture regime is udic, and the soil temperature regime is cryic.

Table 4. Representative soil features

Surface texture	(1) Very cobbly loam (2) Very stony loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to moderate

Soil depth	20–60 in
Surface fragment cover <=3"	9–25%
Surface fragment cover >3"	30–37%
Available water capacity (0-40in)	3.1–4.9 in
Calcium carbonate equivalent (0-40in)	0–4%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	9–26%
Subsurface fragment volume >3" (Depth not specified)	28–38%

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 and transition model

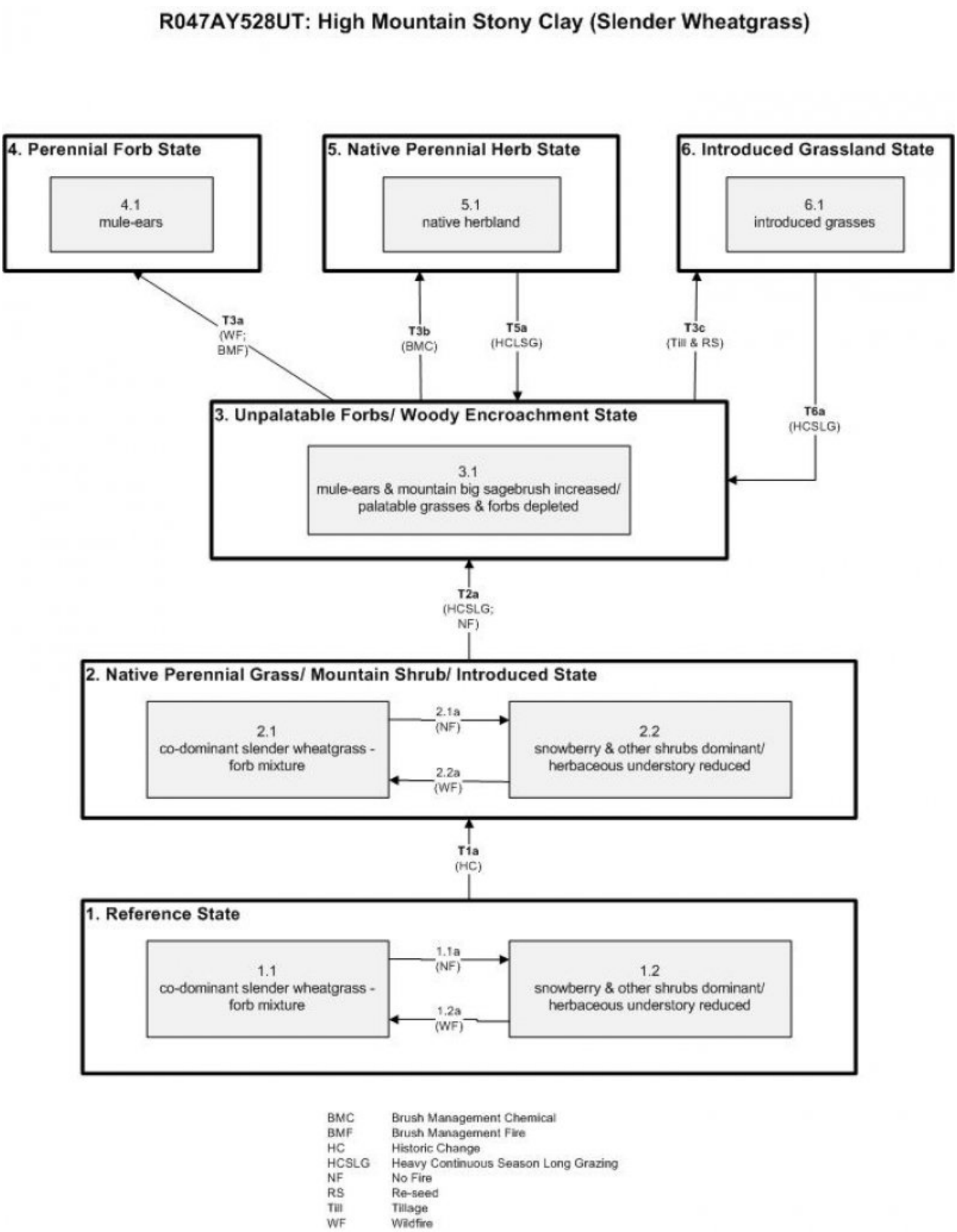

Figure 2. State and Transition Model

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. Vegetation in the reference state would have varied from grassland to shrub steppe depending primarily on time since the last wildfire. Following recent fires (1.2a), a co-dominant mixture of grasses and forbs with scattered shrubs would have been prevalent (1.1). As the time elapsed since last fire increased (fire return intervals averaged approximately every 30 to 50 years) (1.1a), the shrubs would have increased in dominance and the herbaceous understory lessened. The dominant shrub would have been mountain snowberry (*Symphoricarpos oreophilus*), while slender wheatgrass (*Elymus trachycaulus*), cutleaf balsamroot (*Balsamorhiza macrophylla*), and mule-ears (*Wyethia amplexicaulis*) would have been the primary understory species. A more complete list of species by lifeform for the Reference State is available in accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this ESD document.

Community 1.1
co-dominant slender wheatgrass - forb mixture

This plant community would have been characterized by a co-dominance of grass and forb species. Grasses would have included slender wheatgrass, mountain brome (*Bromus marginatus*), basin wildrye (*Leymus cinereus*), sheep fescue (*Festuca ovina*), Columbia needlegrass (*Achnatherum nelsonii*), and Letterman's needlegrass (*Achnatherum lettermanii*). Forb species would have included cutleaf balsamroot, mule-ears, western mountain aster (*Symphyotrichum spathulatum* var. spathulatum), tailcup lupine (*Lupinus caudatus* spp. caudatus), and American bistort (*Polygonum bistortoides*), among others.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	510	780	1050
Forb	170	260	350
Shrub/Vine	170	260	350
Total	**850**	**1300**	**1750**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	19-21%
Grass/grasslike foliar cover	39-41%
Forb foliar cover	9-11%
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	–	–	–	9-11%
>1 <= 2	–	–	39-41%	–
>2 <= 4.5	–	19-21%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
snowberry and other shrubs dominant/ herbaceous understory reduced

This shrub-dominant phase would have been characterized by increased amounts of snowberry, antelope bitterbrush (*Purshia tridentata*), and mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana).

Pathway 1.1a
Community 1.1 to 1.2

As the time lengthened since the last wildfire, the shrubs, particularly snowberry, would have increased.

Pathway 1.2a
Community 1.2 to 1.1

Wildfire would temporarily remove some of the shrub component allowing the native perennial grasses and forbs to dominate.

State 2
Native Perennial Grass/ Mountain Shrub/ Introduced State

State 2 is very similar 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. Vegetation in this Reference State would have varied from grassland to shrub steppe depending primarily on time since the last fire.

Community 2.1
co-dominant slender wheatgrass – forb mixture

This plant community is characterized by a co-dominance of grass and forb species. Grasses include slender wheatgrass, mountain brome, basin wildrye, sheep fescue, Columbia needlegrass, and Letterman's needlegrass. Forb species include cutleaf balsamroot, mule-ears, western mountain aster, tailcup lupine, and American bistort, among others. A small component of non-native herb species may also be present.

Community 2.2
snowberry and other shrubs dominant/ herbaceous understory reduced

This shrub-dominant phase is characterized by increased amounts of snowberry, antelope bitterbrush, and mountain big sagebrush. A small component of native and introduced herbs may also be present.

Pathway 2.1a
Community 2.1 to 2.2

As the length of time elapsed since last fire increases (i.e. approaching 30 to 50 years), the shrubs, particularly snowberry, will increase.

Pathway 2.2a
Community 2.2 to 2.1

Wildfire would temporarily remove some of the shrub component allowing the native perennial grasses and forbs to dominate.

State 3
Unpalatable Forbs/ Woody Encroachment State

The combined effects of heavy continuous season-long grazing by livestock and the prevention of wildfire has resulted in an increase of unpalatable species particularly mule-ears and native woody species such as snowberry, mountain big sagebrush, silver sagebrush (*Artemisia cana*), and snowfield sagebrush (Artemisia spiciformis) at the expense of the palatable herbaceous species.

Community 3.1
mule-ears and mountain big sagebrush increased/ palatable grasses and forbs depleted

This plant community is characterized by a relative increase in unpalatable forbs, particularly mule-ears, and certain native woody species such as mountain big sagebrush and silver sagebrush. Palatable native herbaceous perennials are depleted. Both native and introduced annual herbs such as Douglas' knotweed (*Polygonum douglasii*) and mountain tarweed (*Madia glomerata*) will increase.

State 4
Perennial Forb State

Wildfire, whether natural or prescribed, will remove the shrub component from these sites, leaving only the fire-tolerant herbaceous species, namely mule-ears.

Community 4.1
mule-ears

This plant community is characterized by the fire-tolerant herbaceous species mule-ears. While herbicidal reduction of mule-ears is possible, it is costly and requires reseeding and grazing deferment.

State 5
Native Perennial Herb State

Chemical manipulation to reduce the unpalatable native shrubs and forbs will restore the site to a native perennial grass and forb state, provided the seed source for species are available. These include slender wheatgrass, mountain brome, basin wildrye, sheep fescue, Columbia needlegrass, and Letterman's needlegrass.

Community 5.1
native perennial herbland

Provided a seed source is available, the native perennial grassland may include slender wheatgrass, mountain brome, basin wildrye, sheep fescue, Columbia needlegrass, or Letterman's needlegrass.

State 6
Introduced Grassland State

Intermediate wheatgrass, orchardgrass, or smooth brome monocultures may be present where plowing and seeding has taken place to increase herbage production. Various phases should be added, depending on the seeded species chosen.

Community 6.1
introduced grasses

This community is dominated by introduced grass species. These may include intermediate wheatgrass, orchardgrass, or smooth brome.

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

Heavy continuous season-long grazing by livestock and the prevention of wildfire will cause State 2 to transition to State 3. While these stony soils are somewhat resistant to soil erosion, significant decrease in plant and litter cover due to excessive season long livestock grazing can accelerate soil erosion, xerification, and eutrophication. Moderation of livestock grazing will reverse these trends.

Transition T3a
State 3 to 4

Wildfire or prescribed burning will remove the woody component, but will leave the fire-tolerant mule-ears (State 4).

Transition T3b
State 3 to 5

The use of chemicals, namely 2,4-D, will remove both the woody and forb components leaving stand of native herbs (State 5).

Transition T3c
State 3 to 6

Through tillage and seeding of introduced perennial grass such as intermediate wheatgrass (*Thinopyrum intermedium*), smooth brome (*Bromus inermis*), or orchardgrass (*Dactylis glomerata*), herbage production can be increased in some locations, if this is the desired objective.

Transition T5a
State 5 to 3

Following heavy, continuous season-long grazing the native perennial herbland will return to the Unpalatable Forbs/Woody Encroachment State (State 3).

Transition T6a
State 6 to 3

Heavy continuous season-long grazing may reduce the seeded grasses to the point where only unpalatable species are able to persist. This returns State 6 to an Unpalatable Forbs/Woody Encroachment state (State 3).

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**			68–135	
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	68–135	–
3	**Sub-Dominant Shrubs**			138–340	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	68–135	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	14–41	–
	silver sagebrush	ARCA13	*Artemisia cana*	14–41	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	14–41	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	14–41	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	14–41	–
Grass/Grasslike					
0	**Sub-Dominant Grasses**			529–744	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	338–405	–
	California brome	BRCA5	*Bromus carinatus*	68–135	–
	sheep fescue	FEOV	*Festuca ovina*	41–68	–
	basin wildrye	LECI4	*Leymus cinereus*	41–68	–
	muttongrass	POFE	*Poa fendleriana*	41–68	–
1	**Sub-Dominant Grasses**			220–652	
	Grass, annual	2GA	*Grass, annual*	68–135	–
	Grass, perennial	2GP	*Grass, perennial*	68–135	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	14–27	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	14–27	–
	nodding brome	BRAN	*Bromus anomalus*	14–27	–
	Geyer's sedge	CAGE2	*Carex geyeri*	14–27	–
	oniongrass	MEBU	*Melica bulbosa*	14–27	–
	spike trisetum	TRSP2	*Trisetum spicatum*	14–27	–
Forb					
0	**Dominant Forbs**			104–203	
	cutleaf balsamroot	BAMA4	*Balsamorhiza macrophylla*	68–135	–
	mule-ears	WYAM	*Wyethia amplexicaulis*	41–68	–
2	**Sub-Dominant Forbs**			318–803	
	Forb, annual	2FA	*Forb, annual*	68–135	–
	Forb, perennial	2FP	*Forb, perennial*	68–135	–
	common yarrow	ACMI2	*Achillea millefolium*	14–41	–
	Fendler's sandwort	ARFE3	*Arenaria fendleri*	14–41	–
	heartleaf milkweed	ASCO	*Asclepias cordifolia*	14–41	–
	meadow thistle	CISC2	*Cirsium scariosum*	14–41	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	14–41	–
	Eaton's fleabane	EREA	*Erigeron eatonii*	14–41	–
	yellow avalanche-lily	ERGR9	*Erythronium grandiflorum*	14–41	–

	lily				
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	14–41	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	14–41	–
	longleaf phlox	PHLO2	*Phlox longifolia*	14–41	–
	American bistort	POBI6	*Polygonum bistortoides*	14–41	–
	slender cinquefoil	POGR9	*Potentilla gracilis*	14–41	–
	lambstongue ragwort	SEIN2	*Senecio integerrimus*	14–41	–

Animal community

This site is predominantly grasses but has enough forbs and shrubs to supply a fairly good balance of nutritious feed. It is adapted for summer and fall use for horses, cattle, and sheep. It has plants which remain green until frost, so it maintains animal gains throughout the grazing period.

This site supports songbirds, golden eagles, bald eagles, snowshoe hare, small rodents, coyotes, mule deer, elk, cougars, and black bear, for at least part of each year.

Hydrological functions

These soils are in hydrologic group c. The curve number is 74 when the vegetation is in good condition.

Recreational uses

This site has excellent values for aesthetics and open space. It is good for elk and mule deer hunting. Hiking, horseback riding, snowshoeing and snowmobiling are potential recreational activities. Cover is limited for camping and picnics.

Wood products

None

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]

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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.

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Date	11/09/2012
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to very few. Some very minor rill development may occur on steeper slopes (>10%) or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Any rills present should be <1 inch deep, fairly short (<6 feet long) and somewhat widely spaced (8-10 feet). Minor rill development may be observed following major thunderstorm or spring runoff events, but they should heal during the next growing season.

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2. **Presence of water flow patterns:** Slight. Some very minor evidence of water flow patterns may be found around perennial plant bases. They show little evidence of current erosion. They are expected to be somewhat short (3-6 feet), stable, sinuous and not connected. There may also be very minor evidence of deposition. Evidence of water flow may increase somewhat with slope.

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3. **Number and height of erosional pedestals or terracettes:** None to Slight. Perennial vegetation shows little evidence of erosional pedestalling (2 to 3% of individual plants). Plant roots are covered and litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope.

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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% bare ground. Soil surface is typically covered by 35 to 70% coarse fragments. Bare ground spaces should not be greater than 2 to 3 feet in diameter and should not be connected.

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5. **Number of gullies and erosion associated with gullies:** None to Very Few. A few gullies may be present in landscape settings where they transport runoff from areas of greater water flow such as exposed bedrock. These gullies

will be limited to slopes exceeding 20% slope and adjacent to sites where this runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of wind generated soil movement is expected. No blowouts or depositional materials are present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow channels with deposition occurring within 1 to 2 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes > 10% and/or increased runoff resulting from heavy 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 a soil stability rating of 5 or 6 under the plant canopies, and a rating of 4 to 5 in the interspaces. The average rating should be a 5. Soil surface texture is typically a silty clay.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Yence) Soil surface 0-2 inches. Texture is a stony loam; color is brown (7.5 YR 4/4); structure is weak medium subangular parting to weak fine granular. Mollic epipedon ranges from 2 to 9 inches. 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:** The clay content within the soil profile may limit infiltration during all but the most gentle storms and snowmelt periods. Perennial vegetation provides sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, protect soil surface from splash erosion and encourages a higher rate of infiltration. Good plant spatial distribution will slow runoff, allowing additional time for infiltration. Bare spaces are expected to be small and irregular in shape and are usually not connected. Vegetative structure is usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing time for good infiltration, reducing runoff and erosion. When perennial grasses and shrubs decrease due to natural events, including drought, insect damage, etc., which may reduce ground cover, runoff is expected to increase and infiltration be reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Some soils may have natural textural variability within their profiles, including changes in clay content, these should not be mistaken for a compaction pan.

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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: Rhizomatous grasses (slender wheatgrass) > Sprouting shrubs (silver sagebrush, mountain snowberry), > Perennial bunchgrasses (mountain brome, basin wildrye)

Sub-dominant: Perennial forbs (northern mulesears).

Other: Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: Natural disturbance regimes include fire, drought, and insects. Assumed fire cycle of 40 to 60+ years. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect a functional community phase 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):** All age classes of perennial grasses should be present under average to above average growing conditions with age class expression likely subdued during periods of extended drought. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during periods of extended drought, or insect infestations. In general, a mix of age classes should be expected with some dead and decadent plants present.

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14. **Average percent litter cover (%) and depth (in):** Litter cover will be heavier under plants. Most litter will be herbaceous and depths of 1 to 2.5 inches would be considered normal. Perennial vegetation should be well distributed on the site.

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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 1250 - 1350#/acre on an average year, but could range from 800 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:** Cheatgrass, Canada thistle, morningglory, Russian thistle, alyssum, dock & mustard species.

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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. Green rabbitbrush sprouts vigorously following fire. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species should be present during average and above average growing years.
