USDA Natural Resources
Conservation Service

Ecological site R047XA446UT
Mountain 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.

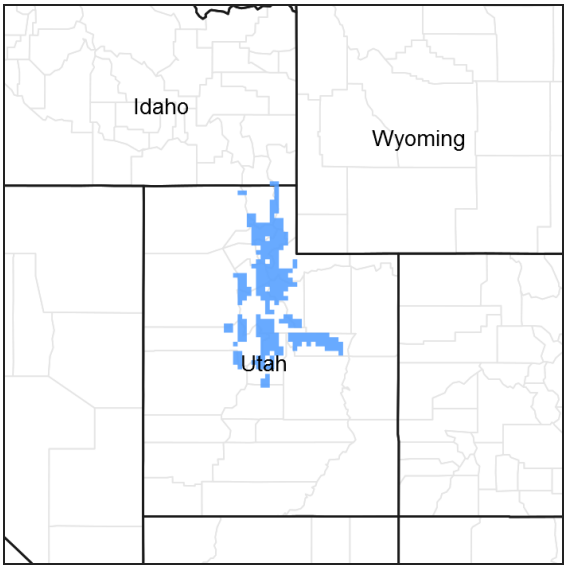

Figure 1. Mapped extent

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 VCB-L, 8-25% — loamy-skeletal, mixed, frigid Lithic Haploxerolls

Ecological site concept

The soils in this site were formed from colluvium and residuum that weathered from various parent materials including sandstone, limestone, shale, quartzite and igneous rock. These soils typically formed on steep slopes. They are dark in color and shallow, with bedrock 10 to 20 inches from the soil surface. In most cases the soils in this site are stony or cobbly and are well to somewhat excessively drained. Roots penetrate the soil material readily above the bedrock and into rock fractures, but are restricted where bedrock is solid. Waterholding capacity is low due to the shallow depth and high rock fragment content of the profile. It ranges from 1.0 to 2.5 inches with a water supplying capacity of 5 to 8 inches. Runoff will occur on these soils because soil depth limits water storage capacity. The soil temperature regime is frigid and the soil moisture regime is xeric.

Associated sites

R047XA442UT	**Mountain Shallow Loam (low sagebrush)**
R047XA469UT	**Mountain Very Steep Shallow Loam (mountain big sagebrush)**
R047XA430UT	**Mountain Loam (mountain big sagebrush)** This site is often adjacent to the mountain shallow loam (Mountain big sagebrush) site where soils are deeper. Thus total annual production is greater on this site than on the site with shallow soils.

Similar sites

R047XA476UT	**Mountain Windswept Ridge (low sagebrush)** This site will be dominated by Low sagebrush rather than Mounatin big sagebrush. It will always be located on a ridgetop.
R047XA442UT	**Mountain Shallow Loam (low sagebrush)** This site will be dominated by Low sagebrush rather than Mountain big sagebrush.
R047XA438UT	**Mountain Shallow Loam (black sagebrush)** This site will be dominated by Black sagebrush rather than Mountain big sagebrush.
R047XA469UT	**Mountain Very Steep Shallow Loam (mountain big sagebrush)**

R047XA461UT	**Mountain Stony 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 almost exclusively on mountainsides with gentle to very steep slopes, but can also occur on ridge tops and hills. The site occurs on all aspects, however it is commonly found on relatively dry, south and west facing exposures. Runoff is moderate to very high and elevation ranges from 5200 to 8500 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Hill
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	5,200–8,500 ft
Slope	3–70%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is cool and quite humid with cold snowy winters and cool dry summers. The average precipitation ranges from 17 to 24 inches annually with 55 to 60 percent coming during the plant dormant period (October to March). Much of the precipitation comes as snow that acts as a reservoir for water until the growing season begins. This winter moisture is the most dependable supply of water for plant growth. Lower precipitation and higher evapo-transpiration rates during July, August, and September cause a reduction in plant growth for all species and dormancy in many of the grasses and forbs.

Table 3. Representative climatic features

Frost-free period (average)	160 days
Freeze-free period (average)	194 days
Precipitation total (average)	24 in

Influencing water features

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

Wetland description

N/A

Soil features

The soils in this site were formed from colluvium and residuum that weathered from various parent materials including sandstone, limestone, shale, quartzite and igneous rock. These soils typically formed on steep slopes.

They are dark in color and shallow, with bedrock 10 to 20 inches from the soil surface. In most cases the soils in this site are stony or cobbly and are well to somewhat excessively drained. Roots penetrate the soil material readily above the bedrock and into rock fractures, but are restricted where bedrock is solid. Waterholding capacity is low due to the shallow depth and high rock fragment content of the profile. It ranges from 1.0 to 2.5 inches with a water supplying capacity of 5 to 8 inches. Runoff will occur on these soils because soil depth limits water storage capacity. The soil temperature regime is frigid and the soil moisture regime is xeric.

Soils Associated With This Site:
Soil Survey Area: Soil Components (Map Units in parentheses)
Box Elder County, Eastern Part (UT602): Agassiz (AGG, EMF)
Cache Valley Area (UT603): Curtis Creek (CSE, CSG, SCG)
Rich County (UT604): Foxol (FFF, FGE)
Fairfield-Nephi Area (UT608): Agassiz (AaF, AbF, CbF); Wallsburg (RoF, WcF, WdE, WdF)
Morgan Area (UT609): Agassiz (AaG, AGG, GcG); Choptie (CeG); Foxol (FdG, FrG); Lithic Haploxerolls (LHG); Redcan (RaG, RcG); Wallsburg (CrG)
Salt Lake Area (UT612): Agassiz (AGG, BEG); Brad (BCG); Little pole (HXF); Van Wagoner (VGG, VRG); Wallsburg (GGG, HGG, WAG)
Summit Area (UT613): Agassiz (101, 136, 143); Melling (107, 108, 124, 125, 158)

Table 4. Representative soil features

Parent material	(1) Colluvium–igneous, metamorphic and sedimentary rock (2) Residuum–igneous, metamorphic and sedimentary rock
Surface texture	(1) Very cobbly loam (2) Very stony loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderate
Soil depth	10–20 in
Surface fragment cover <=3"	8–25%
Surface fragment cover >3"	5–28%
Available water capacity (0-40in)	1–2.5 in
Calcium carbonate equivalent (0-40in)	0–3%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	7–29%
Subsurface fragment volume >3" (Depth not specified)	5–30%

Ecological dynamics

It is impossible to determine in any quantitative detail the Historic Climax Plant Community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs

(Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant 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

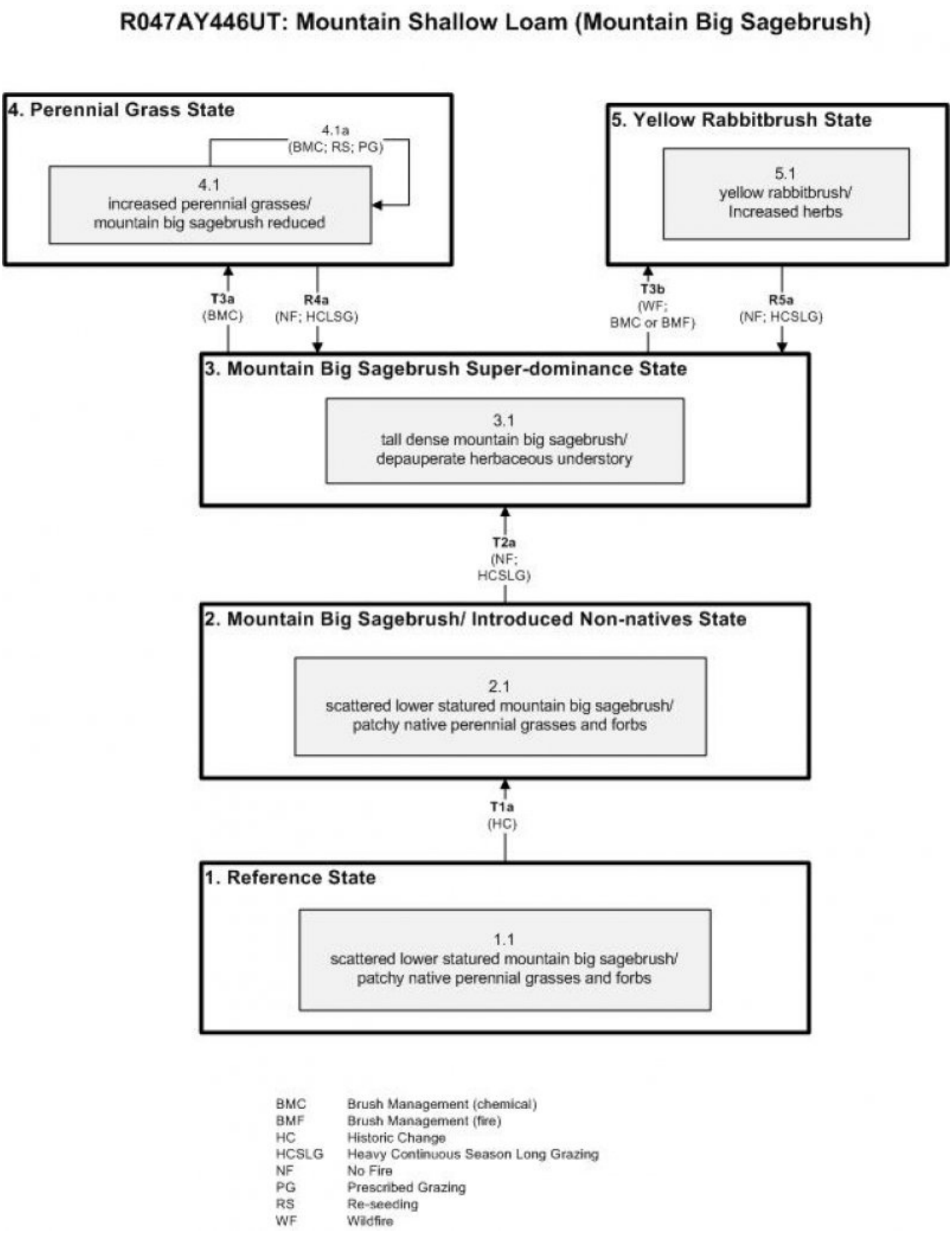

Figure 4. State and Transition Model

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 least modified plant community would have been dominated by a scattering of lower-statured mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) and a mixture of relatively patchy herbaceous species. Antelope bitterbrush (*Purshia tridentata*) and mountain snowberry (*Symphoricarpos oreophilus*) would have been present but less common shrub associates. Dominant grasses would have included bluebunch wheatgrass (*Pseudoroegneria spicata*), muttongrass (*Poa fendleriana*), and Columbia needlegrass (*Achnatherum nelsonii*), and forbs would have included tapertip hawksbeard (*Crepis acuminata*), arrowleaf balsamroot (*Balsamorhiza sagittata*), sticky purple geranium (*Geranium viscosissimum*), and shortstem buckwheat (*Eriogonum brevicaule*), among others (1.1). 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
scattered lower statured mountain big sagebrush/patchy native perennial grasses and forbs

This plant community would have been characterized by a scattering of lower-statured mountain big sagebrush and a relatively patchy herbaceous understory.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	525	825
Shrub/Vine	248	473	743
Forb	28	53	83
Total	**551**	**1051**	**1651**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	19-21%
Grass/grasslike foliar cover	29-31%
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	–	–	29-31%	–
>2 <= 4.5	–	19-21%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

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. This state is characterized by somewhat scattered mountain big sagebrush, antelope bitterbrush, and other minor shrubs with a mixture of herbaceous species. Dominant grasses are western wheatgrass (*Pascopyrum smithii*), with bluebunch wheatgrass, muttongrass, and Columbia needlegrass being slightly diminished from the Reference State. Forbs include tapertip hawksbeard, arrowleaf balsamroot, and sticky purple geranium, among others (2.1). A small component of non-natives will also be present. The resiliency of this State is maintained by a healthy, productive, and diverse plant community that can provide native seed sources and promotes soil stability, water infiltration, and soil moisture retention. Wildfire may also play a role in maintaining the balance between shrubs and herbs. The resiliency of this State will be maintained by a reduction in livestock numbers and season of use. Conversely, heavy continuous season long livestock and/or big game grazing will negatively impact the resiliency of this State.

Community 2.1
scattered lower-statured mountain big sagebrush/ patchy native perennial grasses and forbs

This plant community is characterized by a scattering of lower-statured mountain big sagebrush and a relatively patchy herbaceous understory.

State 3
Mountain big sagebrush Superdominance State

In the absence of fire, but 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). The stability of this State is maintained by the abundance of seed source for sagebrush and other shrubs, and the lack of seed source for native perennial herbs, and possibly by soil erosion. The resiliency of this State can be maintained by reductions in animal numbers and seasons of use as long as soils are largely intact. Conversely, heavy season-long grazing by livestock and big game 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 having tall, dense mountain big sagebrush with a dramatically reduced perennial herbaceous understory.

State 4
Perennial Grass State

Perennial grasses will temporarily dominate the site (4.1) if chemicals (e.g. 2, 4-D, spike) are used to reduce the

shrub component. This grass-dominated plant community can be sustained by re-application of chemical, re-seeding when necessary, and moderating the grazing by livestock during the growing season (4.1a). Fire control combined with continuous heavy season-long grazing will allow the site to eventually return to State 3.

Community 4.1
Increased perennial grasses/ mountain big sagebrush reduced

This plant community is dominated by perennial grasses, which increase following the chemical reduction of mountain big sagebrush. Periodic shrub control will be necessary to maintain grass dominance by re-application of chemicals, provided any livestock grazing is sustainable as shown by monitoring.

State 5
Yellow rabbitbrush State

Yellow rabbitbrush and some herbaceous species such as bluebunch wheatgrass, muttongrass, western wheatgrass and squirreltail (*Elymus elymoides*) (5.1) will increase following fire, whether prescribed or wild, or chemical removal of mountain big sagebrush. This State will be maintained by the recurrence of wildfire at short intervals, assuming that soils are largely intact. Fire control combined with continuous heavy season-long grazing will allow the site to eventually return to State 3.

Community 5.1
Yellow rabbitbrush/ Increased herbs

This plant community is dominated by yellow rabbitbrush and a suite of hearty herbaceous-disturbance followers such as squirreltail, prairie Junegrass (*Koeleria macrantha*), Nevada/Sandberg bluegrass (*Poa secunda*), hawksbeard (Crepis spp.), blue flax (*Linum perenne*), and common yarrow (*Achillea millefolium*).

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 can cause a transition into Mountain Big Sagebrush Super-dominance State. The approach to this transition is indicated by a loss of the perennial grass understory, an increase in the shrub component relative to the grasses, and an increase in bare soil exposed between the perennials. This transition is triggered by sustained heavy grazing in the growing season by livestock and big game use in winter.

Transition T3A
State 3 to 4

With the application of 2, 4-D or spike, it may be possible to reduce the shrub layer and allow the perennial grasses to re-establish.

Transition T3B
State 3 to 5

Wildfire or brush management, either by mechanical means 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 or brush beating. The approach to this transition is indicated by the loss of desirable perennial species and a build up of fuel loads. This transition is triggered by wildfire or brush removal by mechanical or pyric (fire) means.

Restoration pathway R4A
State 4 to 3

Fire control and heavy grazing will allow sagebrush to eventually re-establish, allowing the plant community to return to State 3.

Restoration pathway R5A
State 5 to 3

Fire control and heavy grazing will allow sagebrush to eventually re-establish, allowing the plant community to return to 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**			308–440	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	165–220	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	110–165	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	33–55	–
3	**Sub-Dominant Shrubs**			88–165	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	33–55	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	11–22	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	11–22	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	11–22	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	11–22	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	11–22	–
Grass/Grasslike					
0	**Dominant Grasses**			319–495	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	165–220	–
	muttongrass	POFE	*Poa fendleriana*	55–110	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	33–55	–
	squirreltail	ELEL5	*Elymus elymoides*	33–55	–
	western wheatgrass	PASM	*Pascopyrum smithii*	33–55	–
1	**Sub-Dominant Grasses**			209–517	
	Grass, annual	2GA	*Grass, annual*	55–110	–
	Grass, perennial	2GP	*Grass, perennial*	55–110	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	11–33	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	11–33	–
	Geyer's sedge	CAGE2	*Carex geyeri*	11–33	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–33	–

	basin wildrye	LECI4	*Leymus cinereus*	11–33	–
	spike fescue	LEKI2	*Leucopoa kingii*	11–33	–
	oniongrass	MEBU	*Melica bulbosa*	11–33	–
	Sandberg bluegrass	POSE	*Poa secunda*	11–33	–
Forb					
2	**Sub-Dominant Forbs**			220–264	
	Forb, annual	2FA	*Forb, annual*	33–55	–
	Forb, perennial	2FP	*Forb, perennial*	33–55	–
	common yarrow	ACMI2	*Achillea millefolium*	11	–
	silverleaf milkvetch	ASAR4	*Astragalus argophyllus*	11	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	11	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	11	–
	meadow thistle	CISC2	*Cirsium scariosum*	11	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	11	–
	shortstem buckwheat	ERBR5	*Eriogonum brevicaule*	11	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	11	–
	spotted stickseed	HAPA	*Hackelia patens*	11	–
	blue flax	LIPE2	*Linum perenne*	11	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	11	–
	Tolmie's owl's-clover	ORTO	*Orthocarpus tolmiei*	11	–
	spiny phlox	PHHO	*Phlox hoodii*	11	–

Animal community

This site has a large amount of grasses and shrubs (about equal amounts by total air-dry production). Diverse species of forbs are found on this site, but make up a relatively small proportion of the total annual production. With this composition, good forage and balanced animal nutrition is provided during spring, summer, and fall. Cattle, sheep, goats, and horses graze this site to good advantage.

This site produces excellent forage for deer and elk and is preferred habitat for these species from late fall through early spring.

This site is fair habitat for mule deer and other wildlife.

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 esthetic value and is good for open space, hiking, and horseback riding. Motorized recreation is dependent on road access. Many forbs and shrubs are in bloom from early spring through the summer and often into the fall. Hunting upland game birds, elk and mule deer may be good to excellent on this site.

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

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Contributors

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Approval

Kendra Moseley, 2/05/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	11/16/2012
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to Slight. Slight rill development may occur in exposed areas, on steeper slopes (> 20%) and/or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Where rills are present, they should be fairly short (4-8 feet), < 1 inch deep and somewhat widely spaced (5-10 feet). Minor rill development may be observed on all slopes following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Slight. Some minor evidence of water flow patterns may be found winding around perennial plant bases. They show little evidence of current erosion. They are expected to be short (3-6 feet), stable, sinuous and normally not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat on slopes > 20%.

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3. **Number and height of erosional pedestals or terracettes:** Perennial vegetation shows little evidence of erosional pedestalling (1 to 2% of individual plants). Plant roots are covered and most 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):** Bare ground ranges from 30% - 35%. Soil surface may be covered by <20% coarse fragments. Bare ground openings should not be greater than 1 to 2 feet in diameter and should normally not be connected.

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5. **Number of gullies and erosion associated with gullies:** None to Rare at site level. Scattered landscape level gully channels, however, are a normal component of basin/range environments. Where landscape gullies are present, they should be stable, partially vegetated on their sides and bottoms, with no evidence of head-cutting. Some slight increase in disturbance may be evident following significant weather events or when gullies convey considerable runoff from higher elevation rocky or naturally eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of wind generated soil movement is present. Wind caused blowouts and deposition are not 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 >20% 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 textures are typically loams, very fine sandy loams and silt loams.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Curtis Creek) Soil surface 0-8 inches. Texture is a loam; color is dark brown (7.5YR 4/3); and structure is moderate fine granular. Mollic epipedon ranges from 8 to 16 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:** Perennial vegetation produces sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, also protect the soil surface from splash erosion and encourage higher infiltration. Bare spaces are expected to be small and irregular in shape and usually not connected. Vegetative structure and distribution are usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing maximum time for infiltration, and reducing runoff and erosion in all but the most extreme storm events. When perennial grasses and shrubs decrease due to natural events such as long-term drought, insect damage, etc., runoff is likely 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. Fractured bedrock occurs between 18 and 26 inches. 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: Non-sprouting shrub (mountain big sagebrush) > Sprouting shrubs (bitterbrush, mountain snowberry) > = Perennial bunchgrasses (bluebunch wheatgrass, muttongrass) > = Rhizomatous Grasses (western wheatgrass).

    Sub-dominant: Perennial forbs (arrowleaf balsamroot).

    Other: A wide variety of other perennial grasses and both perennial and annual forbs can be expected to occur in the plant community.

    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. 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 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):** 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 1/2 to 1 inches would be considered normal. Perennial vegetation should be well distributed on the site.

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 1000 - 1100 #/acre on an average year but could range from 500 - 1700 #/acre during periods of prolonged drought or above average precipitation.

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, alyssum, mustard species, Canada thistle, black medic, Utah juniper, Gamble oak.

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 is expected to be present during average and above average growing years.