USDA Natural Resources
Conservation Service

Ecological site R047XA516UT
High Mountain 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.

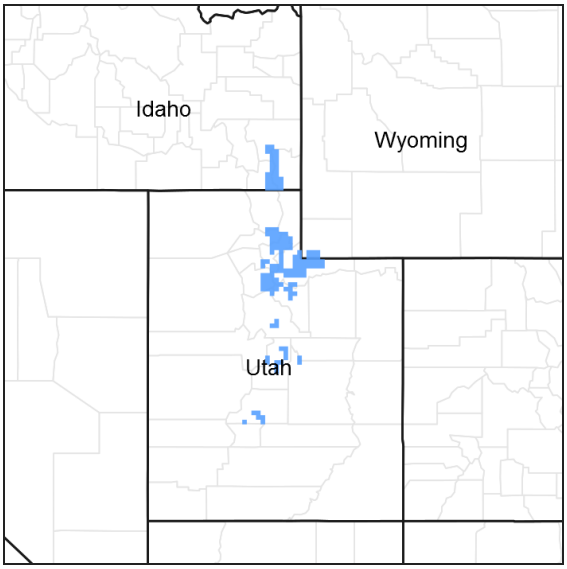

Figure 1. Mapped extent

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 F (-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: Hourglass L, 15-35% — fine-loamy, mixed Argic Cryoborolls

Ecological site concept

The soils of this site formed in colluvium, alluvium, residuum weathered from conglomerate rock, sandstone, shale, limestone, quartzite and various igneous rocks. They are well-drained and can be shallow or deep. The upper soil layer is a dark, mollic epipedon, and may be pachic if greater than 40 cm thick. Roots penetrate the soil readily. These soils have a high range in water holding capacity depending on soil depth. Shallow soils hold as little as 2 inches of water, while deeper soils can hold over 6 inches of water in the upper 40 inches of soil. Rock fragments can be found throughout the soil profile but are not always present. The soil temperature regime is cryic and the soil moisture regime is udic, sometimes bordering on xeric.

Associated sites

R047XA504UT	**High Mountain Clay (slender wheatgrass)**
F047XA508UT	**High Mountain Loam (quaking aspen)** This is an Aspen site.
F047XA512UT	**High Mountain Loam (Douglas-fir)**
R047XA528UT	**High Mountain Stony Clay (slender wheatgrass)**

Similar sites

R047XA560UT	**High Mountain Gravelly Loam (mountain big sagebrush)** This site is different from the High Mountain Loam site because of the high gravel content of the soil.
R047XA517UT	**High Mountain Loam (silver sagebrush)** This is a Silver sagebrush site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. vaseyana*

Herbaceous	(1) *Elymus trachycaulus* (2) *Bromus carinatus*

Physiographic features

This site is found on gently sloping to very steep mountain sides, plateaus, elevated stream terraces and alluvial fans. It occurs on all aspects at elevations between 6,000 and 11,200 feet. Runoff varies greatly depending on the slope and flooding rarely occurs on low-lying areas of the site extent.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Plateau (3) Alluvial fan
Flooding frequency	None to rare
Ponding frequency	None
Elevation	6,000–11,200 ft
Slope	6–70%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by cold, snowy winters and cool, dry summers. The annual precipitation varies greatly throughout the spatial extent of this ecological site. At elevations below 7,500 feet, annual precipitation ranges between 39 and 58 inches. At elevations greater than 7,500 feet, this site may receive as much as 60 inches of annual precipitation (*need to do a PRISM analysis of climate*). About 75 percent of the moisture comes as snow between October and May. This snow pack provides the most reliable source of moisture for plant growth on the site and is also a source of moisture for lower-lying areas in the watershed.

Table 3. Representative climatic features

Frost-free period (average)	75 days
Freeze-free period (average)	99 days
Precipitation total (average)	49 in

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed in colluvium, alluvium, residuum weathered from conglomerate rock, sandstone, shale, limestone, quartzite and various igneous rocks. They are well-drained and can be shallow or deep. The upper soil layer is a dark, mollic epipedon, and may be pachic if greater than 40 cm thick. Roots penetrate the soil readily. These soils have a high range in water holding capacity depending on soil depth. Shallow soils hold as little as 2 inches of water, while deeper soils can hold over 6 inches of water in the upper 40 inches of soil. Rock fragments can be found throughout the soil profile but are not always present. The soil temperature regime is cryic and the soil moisture regime is udic, sometimes bordering on xeric.

Soils where this site may be present:

Morgan Area (UT609) Yeljack (YeD, YeE); Charcol (ChG)
Summit Area (UT613) Millcreek (147); Starley (113, 114, 165)
Heber Valley (UT622) Buell (BVC, BVD, BVF); Clayburn (CBB, CBC, CBD, CCD, CDE)
Sanpete Valley (UT627) Adel (ADG); Gothic (GOF2); Toze (TVD, ZTE); Zeesix (ZSE, ZTE)

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone, sandstone, and shale (2) Colluvium–limestone, sandstone, and shale (3) Residuum–limestone, sandstone, and shale
Surface texture	(1) Gravelly fine sandy loam (2) Loam (3) Very cobbly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	10–60 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–25%
Available water capacity (0-40in)	2–6 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)	0–44%
Subsurface fragment volume >3" (Depth not specified)	0–31%

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

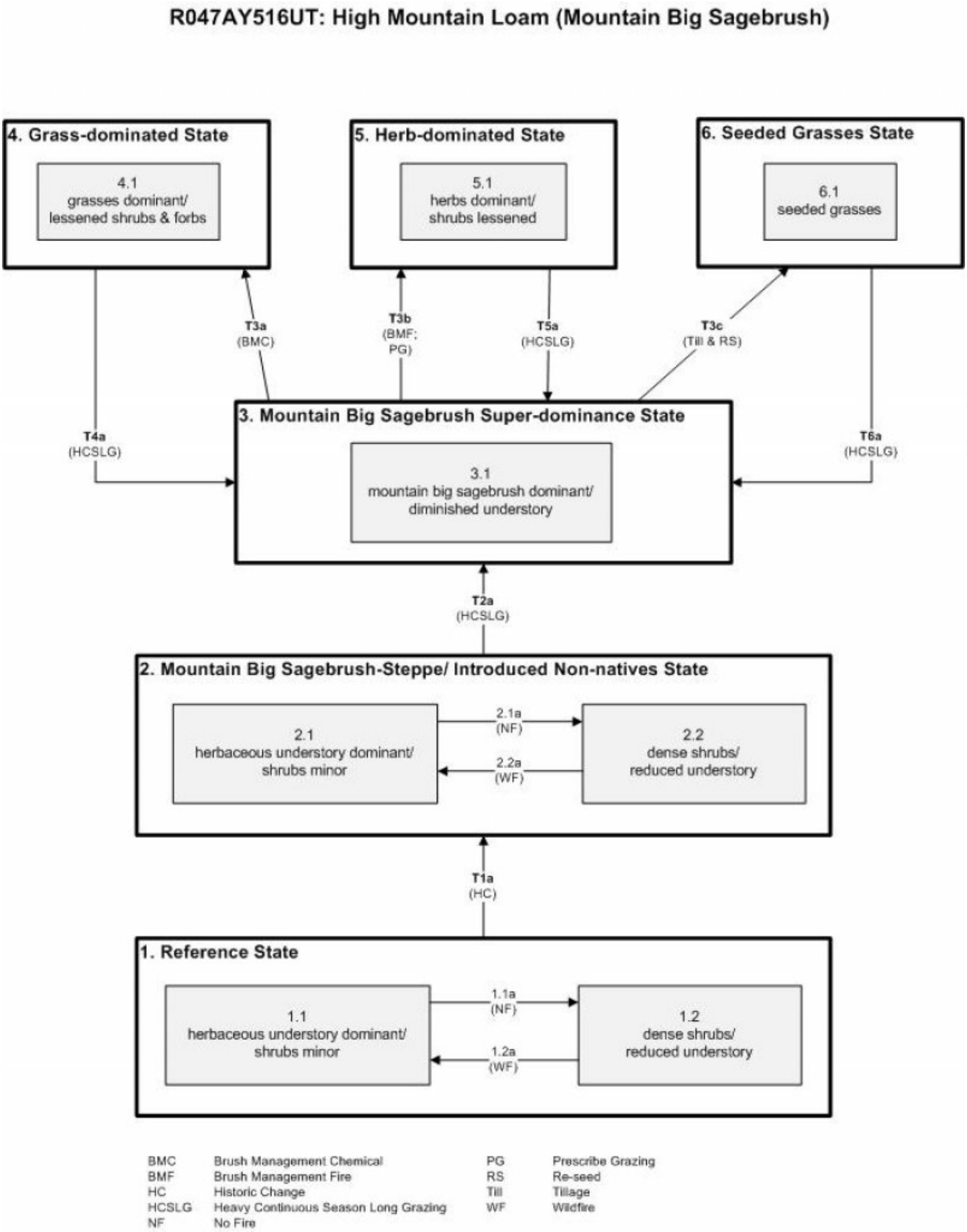

Figure 6. State and Transition Model

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 pre-settlement vegetation here would have varied from a herbland (1.1) to a shrub steppe (1.2) primarily depending on when a wildfire last occurred. Dominant shrubs would have included mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) and mountain snowberry (*Symphoricarpos oreophilus*) with an understory of native perennial grasses such as slender wheatgrass (*Elymus trachycaulus*), mountain brome (*Bromus marginatus*), Columbia needlegrass (*Achnatherum nelsonii*), sheep fescue (*Festuca ovina*), and oniongrass (*Melica bulbosa*). The forb component would have included sticky purple geranium (*Geranium viscosissimum*), Nevada pea (*Lathyrus lanszwertii*), and buckwheats (Eriogonum spp.) among several others. The driving factor behind changes in relative abundance and shrubs and the associated understory would have been time since last fire event. An herbaceous understory with only a minor amount of shrubs (1.1) would have been found following a recent wildfire (1.2a). Shrubs would have increased, crowding out herbaceous understory (1.2) as the time since the last fire lengthened (1.1a). A fire return of interval of 25 to 35 years was probable. 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
herbaceous understory dominant/ shrubs minor

This plant community would have been characterized by a dominance of herbaceous species including sticky purple geranium and buckwheat. Shrubs would have been minimal.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1073	1593	1918
Shrub/Vine	330	490	590
Forb	248	368	443
Total	**1651**	**2451**	**2951**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	9-11%
Grass/grasslike foliar cover	39-41%
Forb foliar cover	14-16%
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	–	–	–	14-16%
>1 <= 2	–	–	39-41%	–
>2 <= 4.5	–	9-11%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
dense shrubs/ reduced understory

This phase would have been characterized by increased mountain big sagebrush and snowberry with a reciprocal reduction in understory components.

Pathway 1.1a
Community 1.1 to 1.2

As time since the last fire lengthened, the mountain big sagebrush and snowberry would have slowly returned to dominance while the understory diminished.

Pathway 1.2a
Community 1.2 to 1.1

Wildfire would temporarily reduce the fire-intolerant shrubs allowing the native perennial grasses and forbs to re-establish.

State 2
Mountain big sagebrush-Steppe/ Introduced non-natives 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 some native species, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement. This sagebrush steppe, including some exotics, should be considered the current potential. Like the Reference State, the length of time elapsed since the last fire would have influenced the relative abundances of shrubs and herbs in this State.

Community 2.1
herbaceous understory dominant/ shrubs minor

This plant community is characterized by a dominance of herbaceous species including sticky purple geranium, Nevada pea, and buckwheat. Shrubs are minimal. A small component of non-native species may also be present such as cheatgrass (*Bromus tectorum*) or bulbous bluegrass (*Poa bulbosa*).

Community 2.2
dense shrubs/ reduced understory

This phase is characterized by increased mountain big sagebrush and snowberry with a reciprocal reduction in understory components.

Pathway 2.1a

Community 2.1 to 2.2

As the length of time elapsed since last fire increases, the mountain big sagebrush and snowberry will slowly return to dominate the site while the understory diminishes.

Pathway 2.2a
Community 2.2 to 2.1

Wildfire will temporarily reduce the fire-intolerant shrubs allowing the native perennial grasses and forbs to re-establish.

State 3
Mountain Big Sagebrush Super-Dominance State

Effects from heavy continuous season-long livestock grazing include an increase in shrub canopy and reduction in herbaceous understory components. If accelerated soil erosion has ensued, introduced species are favored because of xerification and eutrophication of the site. Excessive grazing and fire exclusion will reduce the stability of this state. Moderating the grazing will allow fire to resume its role and diversify the vegetation.

Community 3.1
mountain big sagebrush dominant/ diminished understory

This community is dominated by mountain big sagebrush with a diminished understory.

State 4
Grass-dominated State

As a result of brush management by chemical means, the site will become grass-dominated. Forbs and shrubs will have a minor presence. Grasses will include slender wheatgrass, mountain brome, Columbia fescue and Letterman’s needlegrass.

Community 4.1
grasses dominant/ lessened shrubs and forbs

This phase is characterized by a dominance of grasses, such as slender wheatgrass, mountain brome, Columbia needlegrass, and sheep fescue. Mountain big sagebrush and associated forbs have a minor presence.

State 5
Herb-dominated State

As a result of brush management by fire, this site will become dominated by a mixture of grasses and forbs. Shrubs will constitute a minor component.

Community 5.1
herbs dominant/ shrubs lessened

This phase is characterized by a dominance of grasses and forbs with a minor component of shrubs.

State 6
Seeded Grasses State

On more gentle slopes, where plowing and seeding is feasible, slender wheatgrass or mountain brome can be seeded. If introduced grasses such as intermediate wheatgrass, orchardgrass, and smooth brome have already been seeded, then these aggressive exotic grasses will dominate. In recent trials, native grasses have been planted much more successfully.

Community 6.1

seeded grasses

This phase is characterized by seeded grasses such native slender wheatgrass or mountain brome, or aggressive introduced species such as 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 (which was prevalent between the 1860s and 1950s), will cause State 2 to transition to State 3.

Transition T3a
State 3 to 4

Brush management by chemical means (2,4-D, tebuthiron) will reduce the shrub component.

Transition T3b
State 3 to 5

Brush management by prescribed fire combined with a period of grazing deferment will reduce fire-intolerant shrub species and allow the herbaceous component and native grasses to re-establish.

Transition T3c
State 3 to 6

On gentler slopes, some locations may be plowed and seeded with native mountain brome or slender wheatgrass. In the past intermediate wheatgrass (*Thinopyrum intermedium*), orchardgrass (*Dactylis glomerata*), or smooth brome (*Bromus inermis*) has been planted, but establishment of native species will have greater success.

Transition T4a
State 4 to 3

Heavy, continuous, season-long grazing will return State 4 to State 3, a mountain big sagebrush dominated state.

Transition T5a
State 5 to 3

Heavy, continuous, season-long grazing will return State 5 to State 3, a mountain big sagebrush dominated state.

Transition T6a
State 6 to 3

Heavy, continuous, season-long grazing will return State 6 to State 3, a mountain big sagebrush dominated state.

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 Shrub**			125–250	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	125–250	–
3	**Sub-Dominant Shrubs**			300–600	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	125–250	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	25–50	–
	creeping barberry	MARE11	*Mahonia repens*	25–50	–
	chokecherry	PRVI	*Prunus virginiana*	25–50	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	25–50	–
	whitestem gooseberry	RIIN2	*Ribes inerme*	25–50	–
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	25–50	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	25–50	–
Grass/Grasslike					
0	**Dominant Grasses**			1375–1875	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	625–750	–
	sheep fescue	FEOV	*Festuca ovina*	250–375	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	250–375	–
	California brome	BRCA5	*Bromus carinatus*	250–375	–
1	**Sub-Dominant Grasses**			450–900	
	Grass, annual	2GA	*Grass, annual*	125–250	–
	Grass, perennial	2GP	*Grass, perennial*	125–250	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	25–50	–
	nodding brome	BRAN	*Bromus anomalus*	25–50	–
	Geyer's sedge	CAGE2	*Carex geyeri*	25–50	–
	blue wildrye	ELGL	*Elymus glaucus*	25–50	–
	basin wildrye	LECI4	*Leymus cinereus*	25–50	–
	spike fescue	LEKI2	*Leucopoa kingii*	25–50	–
	oniongrass	MEBU	*Melica bulbosa*	25–50	–
	nodding bluegrass	PORE	*Poa reflexa*	25–50	–
Forb					
2	**Sub-Dominant Forbs**			1675–2850	
	Forb, annual	2FA	*Forb, annual*	500–750	–
	Forb, perennial	2FP	*Forb, perennial*	500–750	–
	common yarrow	ACMI2	*Achillea millefolium*	25–50	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	25–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–50	–
	silverleaf milkvetch	ASAR4	*Astragalus argophyllus*	25–50	–
	white marsh marigold	CALE4	*Caltha leptosepala*	25–50	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	25–50	–

	hawksbeard				
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	25–50	–
	tall mountain larkspur	DESC	*Delphinium scaposum*	25–50	–
	shortstem buckwheat	ERBR5	*Eriogonum brevicaule*	25–50	–
	Eaton's fleabane	EREA	*Erigeron eatonii*	25–50	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	25–50	–
	spotted stickseed	HAPA	*Hackelia patens*	25–50	–
	common sneezeweed	HEAU	*Helenium autumnale*	25–50	–
	oneflower helianthella	HEUN	*Helianthella uniflora*	25–50	–
	Nevada pea	LALA3	*Lathyrus lanszwertii*	25–50	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	25–50	–
	desertparsley	LOMAT	*Lomatium*	25–50	–
	prairie bluebells	MELAL2	*Mertensia lanceolata var. lanceolata*	25–50	–
	western sweetroot	OSOC	*Osmorhiza occidentalis*	25–50	–
	beardtongue	PENST	*Penstemon*	25–50	–
	towering Jacob's-ladder	POFO	*Polemonium foliosissimum*	25–50	–
	western coneflower	RUOC2	*Rudbeckia occidentalis*	25–50	–
	tall ragwort	SESE2	*Senecio serra*	25–50	–
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	25–50	–
	Parry's clover	TRPA5	*Trifolium parryi*	25–50	–
	mountain deathcamas	ZIEL2	*Zigadenus elegans*	25–50	–

Animal community

Livestock:
This site Has high value for summer season use by cattle, sheep and horses. It provides an abundance of green forage when sites at lower elevations have matured and are drying out. It is normally located in areas with sufficient livestock water.

Wildlife considerations:
This site is good habitat for sage grouse, blue grouse, sharptail grouse, ruffed grouse, song birds, wild turkey, golden eagles, bald eagles, squirrels, snowshoe hare, ground squirrels, coyotes, badgers, bobcats, cougars,mule deer, and elk. Moose and black bear may occasionally be seen on the site.

Hydrological functions

Soil series in this site have moderately low to moderately high runoff potential (hydrologic soil groups b and c). Where the vegetation is in climax (potential), the site condition is good. Hydrologic curve numbers are 62 to 60 for hydrologic soil group b and 75 to 72 for group c. Where range conditions have declined from climax, field investigation is needed to determine site condition and hydrologic curve number.

Recreational uses

This site has aesthetic values and provides open space. A large number of forbs and shrubs are in bloom throughout the summer and into the fall. It has a combination of grasses, forbs, small shrubs, and large shrubs that

may be suitable for camping and picnic areas where shade is nearby. Hunting for upland game birds, snowshoe hare, elk, and mule deer is good to excellent on this site. Fishing may be possible on nearby streams, lakes and reservoirs adjacent to this site. Snowmobiling, snowshoeing and skiing are potential winter recreational uses for the site.

Wood products

No values exist for lumber. Production of wood products is low but some values exist for firewood for campfires.

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

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.

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Date	11/05/2012
Approved by	Kendra Moseley
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to Rare. Some minor rill development may occur on steeper slopes (> 20%) or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Where these rills are present, they should be fairly short (3-6 feet), < 1 inch deep and somewhat widely spaced (4-8 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:** Rare. Some very 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 in 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 20% - 30%. Soil surface may be covered by 0 to 20% coarse fragments. Bare ground openings should not be greater than 1 foot 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 mountain 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):** (Clayburn) Soil surface 0-2 inches. Texture is a sandy clay loam; color is very dark grayish brown (10YR 3/2); and structure weak fine granular. Mollic epipedon ranges from 16 to 42 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 protects soil from splash erosion and encourages a higher rate of infiltration. Plant spatial distribution should 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 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 including drought, insect damage, etc., which reduce ground cover and increase bare ground, runoff is expected to increase and associated infiltration 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 have an argillic horizon that could 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) > Perennial bunchgrasses (Mountain brome, Colombia needlegrass), = > Non-sprouting shrub (mountain big sagebrush)

    Sub-dominant: Sprouting shrub (bitterbrush) > Perennial forbs (thickleaf peavine)

    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 30 to 40+ 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):** 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.

14. **Average percent litter cover (%) and depth (in):** Litter cover will be heavier under plants. Most litter will be herbaceous and depths of 2 to 3 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 2400 - 2500 #/acre on an average year but could range from 1600 - 3000 #/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:** Smooth brome, cheatgrass, mustard species, Canada thistle, black medic, Utah juniper.

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 present during average and above average growing years.