USDA Natural Resources Conservation Service

Ecological site R047XA517UT
High Mountain Loam (silver sagebrush)

Last updated: 2/06/2025
Accessed: 03/15/2026

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.

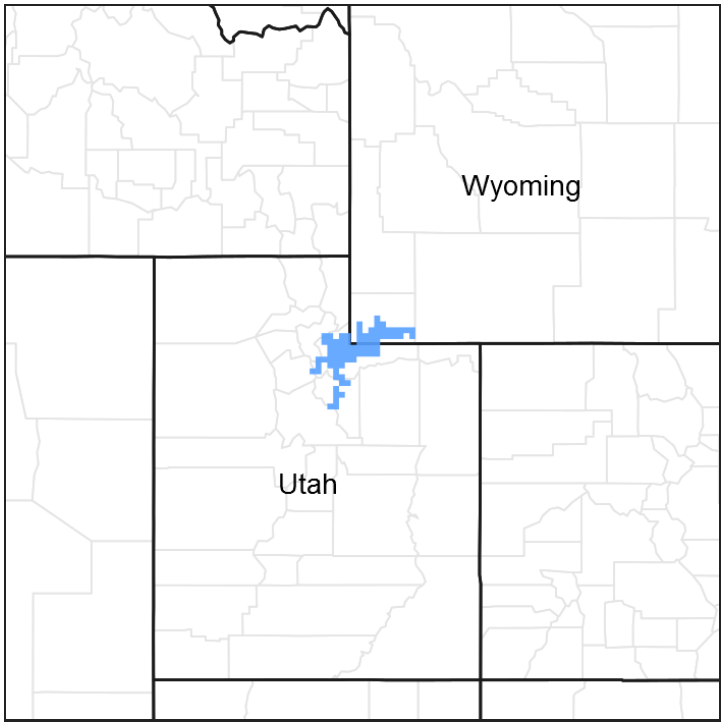


Figure 1. Mapped extent

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: Sessions L, CL, 5-25% — fine, montmorillonitic Argic Cryoborolls

Ecological site concept

The soils of this site formed in glacial till derived from sandstone, quartzite, and shale. Surface layers are dark grayish-brown with loam or clay loam textures. Clay content increases with increasing depth. These soils are deep and well-drained with moderately-slow permeability. They are non-calcareous with neutral pH. Limited rock fragments may be present on the soil surface and throughout the profile, but make up less than 25 percent of the soil volume. Available water holding capacity ranges from 4.8 to 7.0 inches in the upper 40 inches of soil. The soil moisture regime is udic and the soil temperature regime is cryic.

Associated sites

R047XA504UT	**High Mountain Clay (slender wheatgrass)**
F047XA508UT	**High Mountain Loam (quaking aspen)**

Similar sites

R047XA516UT	**High Mountain Loam (mountain big sagebrush)** This site is dominated by Mountain big sagebrush. It typically has coarser subsoils and was formed in colluvium rather than glacial deposits.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia cana*
Herbaceous	(1) *Elymus trachycaulus*

Physiographic features

This site is found on previously glaciated areas on till plains, ground moraines and lateral moraines. Slopes range from 2 to 15 percent. This site is found on all aspects at elevations between 6,100 and 10,600 feet. Runoff is medium and flooding and ponding do not occur on the site.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Ground moraine (3) Lateral moraine
Flooding frequency	None
Ponding frequency	None
Elevation	1,859–3,231 m
Slope	2–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by cool, dry summers and cold snowy winters. The average annual precipitation ranges from 25 to 35 inches. Most of the effective moisture for plant growth comes as winter snow and spring rain. The high elevation results in a short frost-free period for this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	635-889 mm
Frost-free period (average)	60 days
Freeze-free period (average)	
Precipitation total (average)	

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed in glacial till derived from sandstone, quartzite, and shale. Surface layers are dark grayish-brown with loam or clay loam textures. Clay content increases with increasing depth. These soils are deep and well-drained with moderately-slow permeability. They are non-calcareous with neutral pH. Limited rock fragments may be present on the soil surface and throughout the profile, but make up less than 25

percent of the soil volume. Available water holding capacity ranges from 4.8 to 7.0 inches in the upper 40 inches of soil. The soil moisture regime is udic and the soil temperature regime is cryic.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	152 cm
Surface fragment cover <=3"	5–13%
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	12.19–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	10–15%
Subsurface fragment volume >3" (Depth not specified)	0–8%

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.

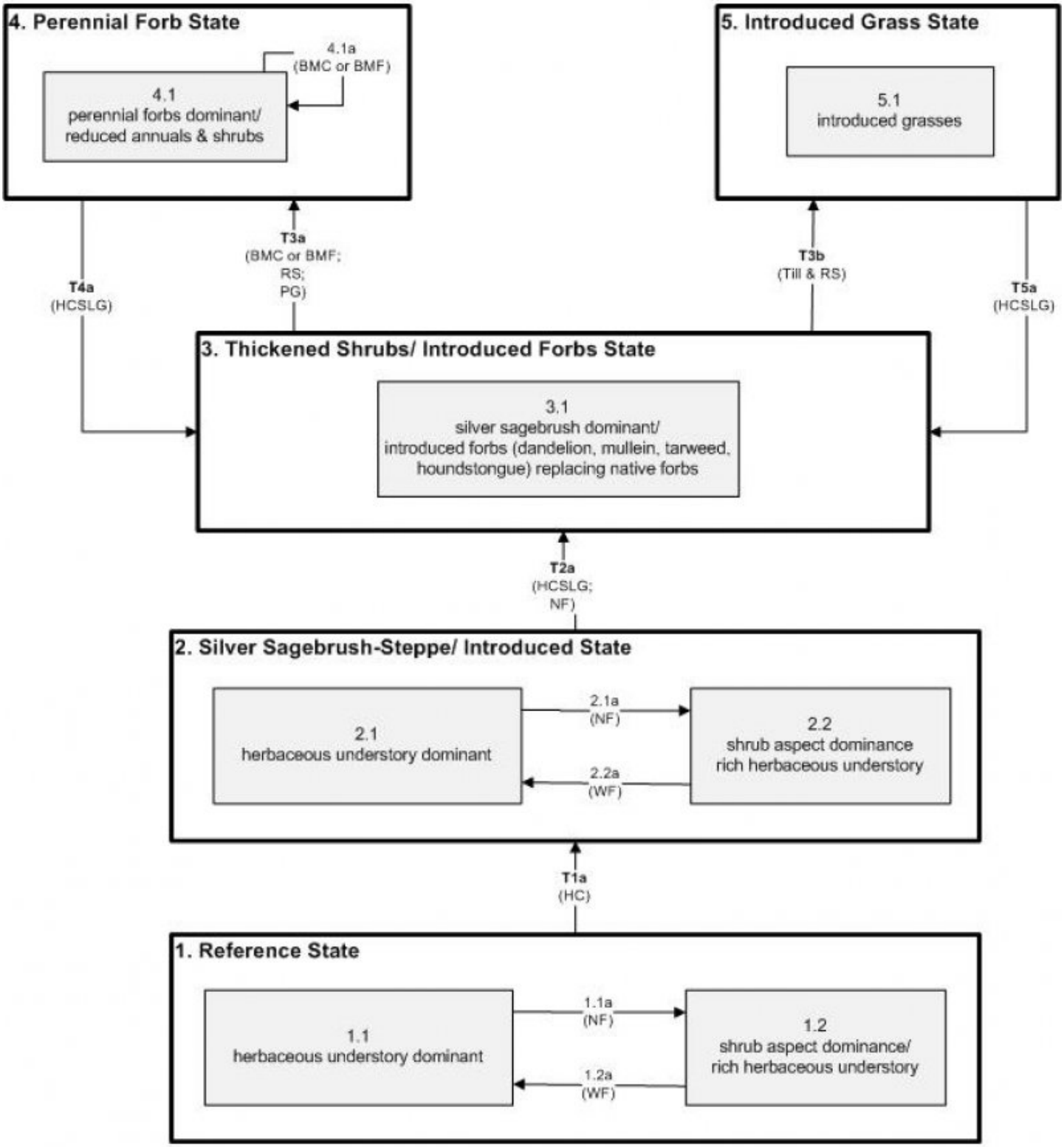
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the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

R047AY517UT: High Mountain Loam (Silver Sagebrush)



BMC	Brush Management Chemical
BMF	Brush Management Fire
HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire
PG	Prescribe Grazing
RS	Re-seed
Till	Tillage
WF	Wildfire

Figure 2. State and Transition Model

State 1
Reference State

The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The Reference State vegetation would have been a shrub steppe. Dominant shrubs included silver sagebrush (*Artemisia cana*) and mountain snowberry (*Symphoricarpos oreophilus*). Snowfield sagebrush (Artemisia spiciformis) may have also been found here. The understory would have been composed of grasses including slender wheatgrass (*Elymus trachycaulus*), mountain brome (*Bromus marginatus*), and bluegrass (Poa spp.). Forbs such as sticky purple geranium (*Geranium viscosissimum*), Nevada pea (*Lathyrus lanszwertii*), slender cinquefoil (*Potentilla gracilis*), and buckwheats (Eriogonum spp.) among many others persisted. The average fire return interval would have ranged from 30 to 50 years, which would have been the driving factor behind changes in abundance of shrubs relative to the associated understory. One community phase would have been an herbaceous-dominant phase (1.1) that would have been found following recent wildfire events (1.2a). As the time since fire increased (1.1a), both the shrubs and herbaceous understory would have increased (1.2). 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

This plant community would have been dominated by herbaceous species such as slender wheatgrass, mountain brome, and bluegrass, along with many forb species such as sticky purple geranium, Nevada pea, slender cinquefoil, and buckwheat species.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1018	1203	1326
Forb	463	547	603
Shrub/Vine	370	437	482
Total	**1851**	**2187**	**2411**

Table 6. Ground cover

Tree foliar cover	0%

Shrub/vine/liana foliar cover	19-21%
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 (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	–	–	14-16%
>0.6 <= 1.4	–	19-21%	39-41%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
shrub aspect dominance/ rich herbaceous understory

This phase would have been characterized by thickened silver sagebrush and a rich herbaceous understory.

Pathway 1.1a
Community 1.1 to 1.2

As the time since the last fire increased, the shrubs would have re-established, along with an increase in their herbaceous companions.

Pathway 1.2a
Community 1.2 to 1.1

Wildfire would temporarily reduce the shrub dominance allowing the native perennial grasses and forbs to dominate.

State 2
Silver Sagebrush-Steppe/ 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 some native species, and a different climate. Nevertheless, a shrub steppe persisted that should be considered the current potential. State 2 is a description of the ecological site shortly following Euro-American settlement. Primary shrubs are silver sagebrush and mountain snowberry. Snowfield sagebrush may also be found here. Grasses include slender wheatgrass, mountain brome, and bluegrass. Forbs include sticky purple geranium, Nevada pea, slender cinquefoil, and buckwheats. A small component of non-native species may also be present such as cheatgrass (*Bromus tectorum*), common dandelion (*Taraxacum officinale*), common mullein (*Verbascum thapsus*), mountain tarweed (*Madia glomerata*), and houndstongue (*Cynoglossum officinale*).

Community 2.1
herbaceous understory dominant

This plant community is dominated by herbaceous species such as slender wheatgrass, mountain brome, and bluegrass, along with many forb species such as sticky purple geranium, Nevada pea, slender cinquefoil, and buckwheats.

Community 2.2
Shrub aspect dominance/ Rich herbaceous understory

This phase is characterized by an increased dominance of silver sagebrush and a rich herbaceous understory.

Pathway 2.1a
Community 2.1 to 2.2

As the length of time elapsed since last fire return lengthens, shrubs re-establish along with their herbaceous companions.

Pathway 2.2a
Community 2.2 to 2.1

Wildfire will temporarily reduce the shrub dominance allowing the native perennial grasses

and forbs to dominate.

State 3
Thickened Shrubs/ Introduced Forbs State

A thickening of shrubs, particularly of silver sagebrush and snowberry, and a reduction of native forbs was seen following a near-century long period of heavy livestock grazing during growing season of herbs. Introduced forbs such as common dandelion, common mullein, mountain tarweed, houndstongue, and snakeweed (*Gutierrezia sarothrae*) became abundant in the understory.

Community 3.1
silver sagebrush dominant/ introduced forbs

This plant community is characterized by silver sagebrush dominance. Some introduced forbs such as common dandelion, common mullein, mountain tarweed, and houndstongue have replaced the native forbs.

State 4
Perennial Forb State

This state is dominated by perennial forbs (4.1). Shrubs will re-sprout following fire or chemical applications; annuals could be replaced by perennials. If keeping the shrubs back is desirable, re-treatment using fire or chemicals may be necessary (4.1a)

Community 4.1
perennial forbs dominant/ reduced annuals & shrubs

This state is characterized by a dominance of perennial forbs with reduced annuals and shrubs. Periodic re-treatment of brush invasion by either chemical or prescribed fire will be required to maintain the introduced perennial grassland state.

State 5
Introduced Grass State

Intermediate wheatgrass, orchard grass, or smooth brome monocultures can result when plowing and seeding has taken place to increase herbage production.

Community 5.1
Introduced Grasses

This phase is characterized by monocultures of introduced grasses, 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 between the 1860s and the 1950s, along with fire exclusion policies saw an increase in shrubs and a replacement of the native forb component with introduced forb species. Reduction in cover leads to accelerated soil erosion, lowering of stream channels and thus xerification and distrophication. While this site is not riparian, it is near enough to streams that it is sub-irrigated at the time of snow pack melt-off. This makes it more resilient than the adjacent uplands. If this site is to remain a productive shrub steppe, the vegetation cover should remain extensive enough so as to prevent accelerated soil erosion.

Transition T3a
State 3 to 4

Brush removal by either chemical means (2,4-D), or prescribed fire, and grazing deferment, will convert State 3 into a perennial forb-dominated state.

Transition T3b
State 3 to 5

Plowing and drill seeding on gentler slopes will increase forage production potential by conversion to introduced grasslands (e.g. intermediate wheatgrass (*Thinopyrum intermedium*), smooth brome (*Bromus inermis*), and orchardgrass (*Dactylis glomerata*)).

Transition T4a
State 4 to 3

Heavy, continuous season-long grazing will return this State 5 to State 3, a thickened shrub and introduced forbs state.

Transition T5a
State 5 to 3

Heavy, continuous season-long grazing will return this State 5 to State 3, a thickened shrub and introduced forbs state.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			448–785	
	silver sagebrush	ARCA13	*Artemisia cana*	336–560	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	112–224	–
3	**Sub-Dominant Shrubs**			135–247	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	67–112	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	22–45	–
	creeping barberry	MARE11	*Mahonia repens*	22–45	–
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	22–45	–
Grass/Grasslike					
0	**Dominant Grasses**			673–1009	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	448–560	–
	wood bluegrass	PONE	*Poa nemoralis*	112–224	–
	California brome	BRCA5	*Bromus carinatus*	112–224	–
1	**Sub-Dominant Grasses**			179–897	
	Grass, annual	2GA	*Grass, annual*	22–112	–
	Grass, perennial	2GP	*Grass, perennial*	22–112	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	22–112	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	22–112	–
	Geyer's sedge	CAGE2	*Carex geyeri*	22–112	–
	sheep fescue	FEOV	*Festuca ovina*	22–112	–
	oniongrass	MEBU	*Melica bulbosa*	22–112	–
	nodding bluegrass	PORE	*Poa reflexa*	22–112	–

	bluegrass				
Forb					
0	**Dominant Forbs**			179–336	
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	112–224	–
	Nevada pea	LALA3	*Lathyrus lanszwertii*	67–112	–
2	**Sub-Dominant Forbs**			493–986	
	Forb, annual	2FA	*Forb, annual*	22–45	–
	Forb, perennial	2FP	*Forb, perennial*	22–45	–
	common yarrow	ACMI2	*Achillea millefolium*	22–45	–
	pale agoseris	AGGL	*Agoseris glauca*	22–45	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	22–45	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	22–45	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	22–45	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	22–45	–
	tall mountain larkspur	DESC	*Delphinium scaposum*	22–45	–
	darkthroat shootingstar	DOPU	*Dodecatheon pulchellum*	22–45	–
	shortstem buckwheat	ERBR5	*Eriogonum brevicaule*	22–45	–
	Eaton's fleabane	EREA	*Erigeron eatonii*	22–45	–
	woodland strawberry	FRVE	*Fragaria vesca*	22–45	–
	common sneezeweed	HEAU	*Helenium autumnale*	22–45	–
	Tolmie's owl's-clover	ORTO	*Orthocarpus tolmiei*	22–45	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	22–45	–
	low beardtongue	PEHU	*Penstemon humilis*	22–45	–
	slender cinquefoil	POGR9	*Potentilla gracilis*	22–45	–

	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	22–45	–
	Parry's clover	TRPA5	*Trifolium parryi*	22–45	–
	American vetch	VIAM	*Vicia americana*	22–45	–

Animal community

This site has moderately high values for summer use by cattle, sheep and horses. It provides green forage after lower elevations have dried out. Sufficient livestock water is usually close by.

It is good summer habitat for elk, mule deer, and moose. This site is good all around habitat for songbirds, blue grouse, golden eagles, bald eagles, hawks, squirrels, snowshoe hare, coyote, cougar, bobcat, and black bear.

Recreational uses

This site has is valued for aesthetics and open space. Wild flowers bloom from early summer through fall. Hunting is fair and fishing is opportune on streams, lakes, and reservoirs through and adjacent to this site.

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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Web Soil Survey, Official Soil Series Descriptions. Available at: http://soils.usda.gov/technical/classification/osd/index.html. Accessed 19 May 2009.

Contributors

Unknown
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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%.

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.

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 30% coarse fragments. Bare ground openings should not be greater than 1 foot in diameter and should normally not be connected.

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.

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.

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.

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):** (Sessions) Soil surface 0-3 inches. Texture is a clay loam; color is very dark grayish brown (10YR 4/2); and structure weak fine granular. Mollic epipedon ranges from 11 to 15 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 should not be mistaken for a compaction pan. Natural textural variation is common within this sites soil profile.

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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), = > Sprouting shrubs (Silver sagebrush, mountain snowberry).

    Sub-dominant: Perennial forbs (sticky purple germanium).

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.

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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 2 to 3 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 1900 - 2000 #/acre on an average year but could range from 1600 - 2200 #/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: Smooth brome, cheatgrass, mustard species, Canada thistle, black medic, Utah or rocky mountain juniper.

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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 is present during average and above average growing years.
