USDA Natural Resources
Conservation Service

Ecological site R047XA402UT
Mountain Clay (slender wheatgrass)

Last updated: 2/05/2025
Accessed: 05/11/2025

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.

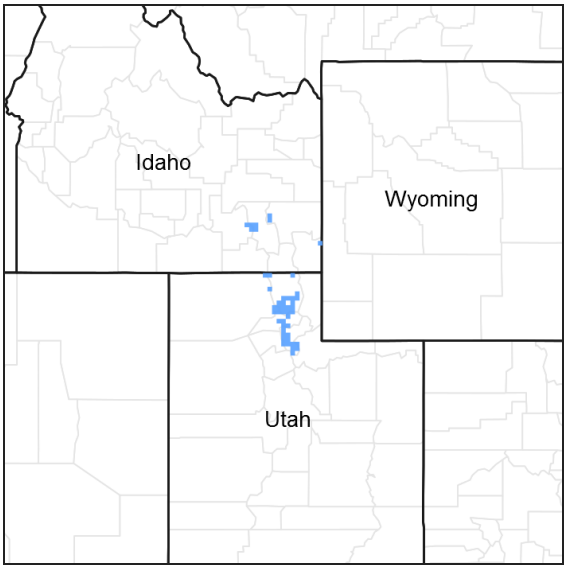

Figure 1. Mapped extent

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 minerology 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: Mondey CL, 8-30% — fine, montmorillonitic, frigid Vertic Argixerolls

Ecological site concept

The soils for this site formed in alluvium and colluvium derived from sandstone, limestone, shale and/or quartzite. They are well drained and greater than 60 inches deep. The surface and subsurface layers are fine-textured silty-clays and clay-loams. Rock fragments may occur in the profile or on the soil surface, but make up less than 35 percent of the soil volume. Soil cracking occurs during the dry summer months, especially where the plant cover has been reduced. Root penetration is somewhat restricted due to the fine textures and reduced depth of moisture penetration. Available water-holding capacity in the upper 40 inches of soil is 5.7 to 7.6 inches. Permeability is slow to very slow. Winter moisture in the form of snow has a better chance of entering these soils than spring rains, especially if the snow melts slowly. Fast melting snow and heavy spring rains contribute to runoff and erosion of these soils. pH ranges from acidic to slightly basic. The soil moisture regime is xeric and the soil temperature regime is frigid.

Associated sites

R047XA473UT	**Mountain Very Steep Stony Loam (browse)**
R047XA474UT	**Mountain Very Steep Stony Loam (mountain big sagebrush)**
R047XA430UT	**Mountain Loam (mountain big sagebrush)**
R047XA461UT	**Mountain Stony Loam (mountain big sagebrush)**
R047XA510UT	**High Mountain Loam (bigtooth maple)** In Cache County, this site is often found near the high mountain clay site on steeper slopes and courser textured soils.

Similar sites

R047XA454UT	**Mountain Stony Clay (slender wheatgrass)** This site has greater than 35 percent rock fragments in the soil volume, greatly reducing the plant available water. It may also have soil between 40 and 60 inches in depth.
R047XA504UT	**High Mountain Clay (slender wheatgrass)** This site recieves more annual precipitation and has a cryic soil temperature regime instead of frigid.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Elymus trachycaulus* (2) *Wyethia amplexicaulis*

Physiographic features

This site occurs on foothill slopes, alluvial fans, mountain slopes and mountain valleys at elevations between 5,000 and 8,000 feet. It is most commonly found on north and east facing slopes, but may be found on other aspects. Slopes are gentle to moderate at 6 to 30 percent. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Alluvial fan (3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	5,000–8,000 ft
Slope	6–30%
Aspect	N, NE, E

Climatic features

The climate of this site is characterized by cold snowy winters and cool dry summers. Annual precipitation ranges from 15 to 22 inches, but typically averages about 18 inches. Distribution of moisture is 55 to 60 percent 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. As snow melts slowly it is allowed to penetrate the dense clay soils characteristic of this site. Heavy rains or quickly melting snow is likely to runoff the soil surface, reducing water intake and storage in the soil for plant use.

Table 3. Representative climatic features

Frost-free period (average)	97 days
Freeze-free period (average)	132 days
Precipitation total (average)	22 in

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 for this site formed in alluvium and colluvium derived from sandstone, limestone, shale and/or quartzite. They are well drained and greater than 60 inches deep. The surface and subsurface layers are fine-textured silty-clays and clay-loams. Rock fragments may occur in the profile or on the soil surface, but make up less than 35 percent of the soil volume. Soil cracking occurs during the dry summer months, especially where the plant cover has been reduced. Root penetration is somewhat restricted due to the fine textures and reduced depth of moisture penetration. Available water-holding capacity in the upper 40 inches of soil is 5.7 to 7.6 inches. Permeability is slow

to very slow. Winter moisture in the form of snow has a better chance of entering these soils than spring rains, especially if the snow melts slowly. Fast melting snow and heavy spring rains contribute to runoff and erosion of these soils. pH ranges from acidic to slightly basic. The soil moisture regime is xeric and the soil temperature regime is frigid.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone, sandstone, and shale (2) Colluvium–limestone, sandstone, and shale
Surface texture	(1) Silty clay (2) Clay loam (3) Gravelly clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to very slow
Soil depth	60 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	5.7–7.6 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–12%
Subsurface fragment volume >3" (Depth not specified)	0–1%

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 as the proportion of browse 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 & 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

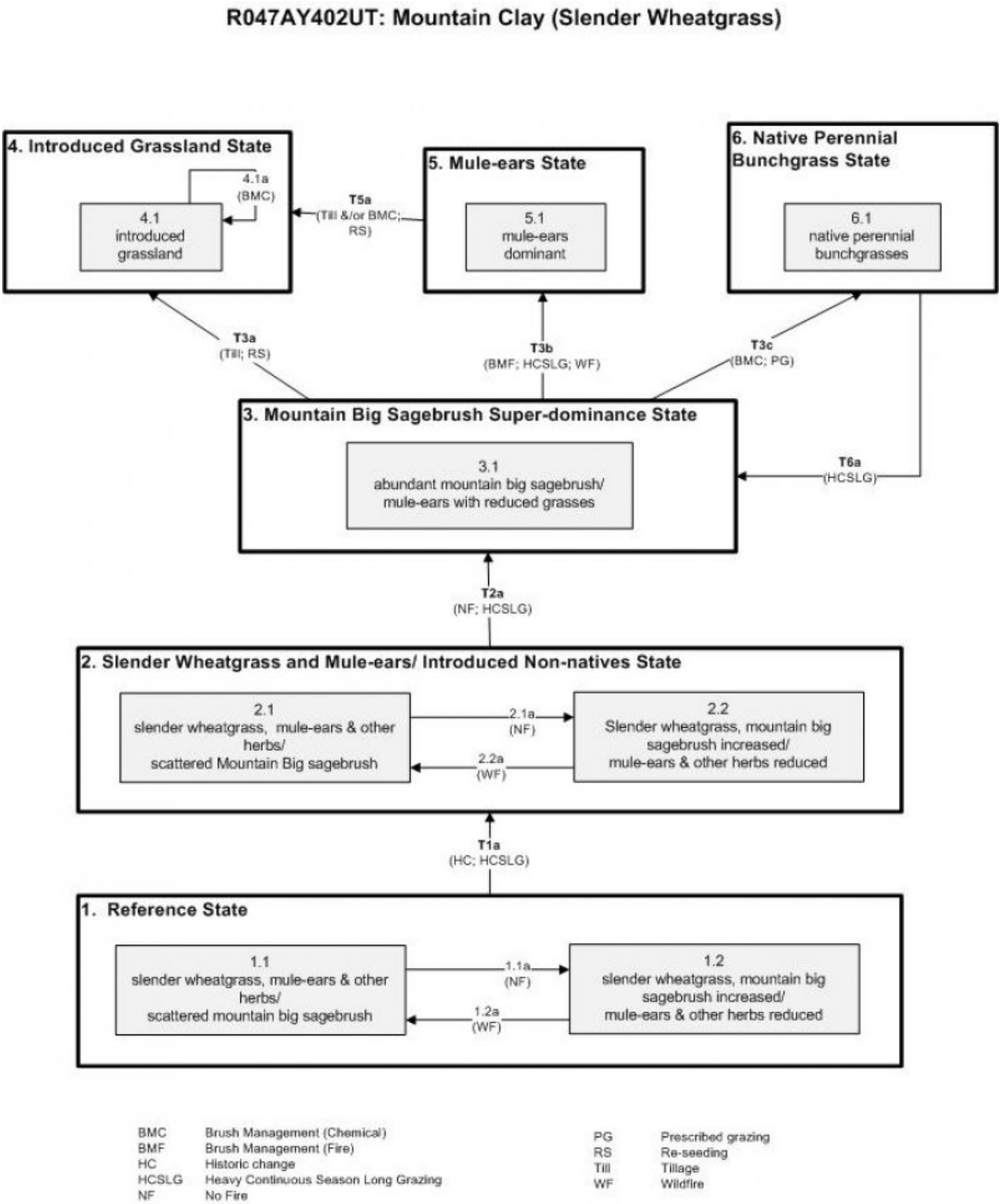

Figure 4. State and Transition Model

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 slender wheatgrass (*Elymus trachycaulus*) with a mixture of mule-ears

(*Wyethia amplexicaulis*) and bluebunch wheatgrass (*Pseudoroegneria spicata*) and other assorted forbs, along with a scattering of mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) (1.1). As the time since the last wildfire lengthened (1.1a), mountain big sagebrush would have increased with a corresponding decrease in the palatable herbaceous component. The primary disturbance factor prior to colonization would have been wildfire (1.2a), which would have reset the vegetation back to an herbaceous-dominated community (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
Slender Wheatgrass, Mule-ears & Other herbs/ Scattered Mountain Big Sagebrush

This plant community would have been characterized by slender wheatgrass and mule-ears with companion herbs and grasses. Mountain big sagebrush would be relatively sparse relative to recent fire history.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	523	963	1183
Shrub/Vine	380	700	860
Forb	48	88	108
Total	**951**	**1751**	**2151**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	4-6%
Grass/grasslike foliar cover	59-61%
Forb foliar cover	9-11%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	–
>1 <= 2	–	–	59-61%	9-11%
>2 <= 4.5	–	4-6%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Mountain Big Sagebrush Increased/ Mule-ears & other herbs Reduced

This plant community would have been dominated by mountain big sagebrush with a relatively reduced understory of slender wheatgrass, mule-ears and other herbs.

Pathway 1.1a
Community 1.1 to 1.2

The absence of fire would have allowed shrubs, primarily mountain big sagebrush, to increase, while the herbaceous component would have diminished proportionally.

Pathway 1.2a
Community 1.2 to 1.1

This plant community would have been dominated by mountain big sagebrush with a relatively reduced understory of slender wheatgrass, mule-ears and other herbs.

State 2
Slender Wheatgrass and Mule-ears/ Introduced Non-natives State

State 2 is a description of the ecological site shortly following Euro-American settlement, which has been influenced by the introduction of several non-native plants and animals, possible extinctions of native species, and a different climate. This state can be regarded as the current potential. Areas of concentrated livestock grazing may have reduced many of the palatable species that were previously abundant. As with State 1, this state is also driven by fire return interval. Mule-ears, slender wheatgrass, and other herbs will be dominant (2.1) just following a fire event (2.2a), but as time since last fire lengthens (2.1a) an increase in mountain big sagebrush will be evident (2.2). A key factor influencing state resiliency on this site is the shrink-swell soils that limit the invasion of woody species. This state will remain stable when livestock grazing, especially during the growing season, is reduced. Alternatively, continued heavy grazing, especially during the growing season will reduce state stability.

Community 2.1
Slender Wheatgrass, Mule-ears & other Herbs/ Scattered Mountain Big Sagebrush

This plant community is dominated by slender wheatgrass, though unpalatable mule-ears is abundant, with some companion herbs and grasses. Mountain big sagebrush is temporarily reduced due to recent fire history.

Community 2.2
Mountain Big Sagebrush Increased/ Mule-ears & other Herbs Reduced

This plant community is dominated by mountain big sagebrush with a reduced herbaceous component.

Pathway 2.1a
Community 2.1 to 2.2

The absence of fire will allow shrubs, primarily mountain big sagebrush, to increase, while the herbaceous component will diminish.

Pathway 2.2a
Community 2.2 to 2.1

absence of fire would have temporarily removed or reduced the mountain big sagebrush while allowing the herbaceous component to regain in dominance.

State 3
Mountain Big Sagebrush Super-dominance State

In the absence of fire, but with continued heavy impacts from livestock grazing, the native grasses will markedly decrease, allowing the shrubs, mainly mountain big sagebrush and unpalatable species like mule-ears, to take over the site. The state will maintain stability with reductions in livestock grazing, especially during the growing season. Alternatively, continued heavy livestock grazing will reduce state stability.

Characteristics and indicators. absence of fire, but with continued heavy impacts from livestock grazing

Community 3.1
Abundant Mountain Big Sagebrush/ Mule-ears with Reduced Grasses

This plant community is characterized by a dramatic increase in mountain big sagebrush and mule-ears, with the native bunchgrasses greatly diminished.

State 4
Introduced Grassland State

This state would have some scattered mountain big sagebrush but would be dominated by introduced grasses, such as smooth brome (*Bromus inermis*), orchardgrass (*Dactylis glomerata*), and intermediate wheatgrass (*Thinopyrum intermedium*).

Community 4.1
Introduced Grassland

This is a community dominated by introduced grasses such as, smooth brome, orchardgrass, and intermediate wheatgrass.

State 5
Mule-ears State

This is a state dominated by mule-ears, though some mountain big sage and grasses are evident.

Community 5.1
Mule-ears dominant

This is a state dominated by mule-ears, though some mountain big sage and grasses are evident.

State 6
Native Perennial Bunchgrass State

Native perennial bunchgrasses include western wheatgrass, slender wheatgrass, and Sandberg bluegrass.

Community 6.1
Native Perennial Bunchgrass

Native perennial bunchgrasses include western wheatgrass, slender wheatgrass, and Sandberg bluegrass.

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 caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is impracticable.

Transition T2A
State 2 to 3

Lack of fire and continued heavy livestock grazing during the growing season of grasses will cause a transition into mountain big sagebrush super-dominance (State 3). Key indicators of the approach to this transition are a loss of perennial grass understory, accelerated soil loss, and an increase in shrubs and unpalatable mule-ears relative to grasses. Sustained heavy grazing over the entire growing season triggers this transition. A restoration pathway is impracticable due to a lack of native perennial grass seed source and partial soil loss.

Transition T3A
State 3 to 4

The key indicator of the approach to this transition is an increase in all size-age form classes of sagebrush, and the trigger is continued growing season-long livestock grazing. A restoration pathway is possible with the use of 2, 4-D™ or 3, 4-5T™, which will reduce sagebrush, mule-ears and other forbs. Deferring livestock use will also allow the recovery of grasses.

Transition T3B
State 3 to 5

A key indicator of the approach to this transition is the build up of fuel, and the trigger is fire. A restoration pathway is possible by reseeding desirable species immediately following fire, and the deferment of grazing until they are established. Another alternative would be proactively spraying 2, 4-D™ or 2, 4-5T™ to reduce mule-ears, and then subsequently reseed.

Transition T3C
State 3 to 6

The key indicator of the approach to this transition is a buildup of fuel, and the trigger is fire. A restoration pathway is possible by first using 2, 4-D™ or 2, 4-5T™ to kill the sagebrush and mule-ears (but also other forbs), and then follow with a deferment of cattle grazing until stand establishment.

Transition T5A
State 5 to 4

Tillage and/or brush removal using herbicides, along with re-seeding and grazing deferment will create a monoculture of the introduced species. Key indicators of the approach to this transition are a loss of palatable species, and the dominance of mule-ears and other unpalatable species. The trigger for this transition is a management decision.

Transition T6A
State 6 to 3

Heavy continuous season long grazing will trigger a transition from state 6 to state 3. A key indicator of the approach to this transition is an abundance of mature sagebrush.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			792–1170	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	270–360	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	180–270	–
	sheep fescue	FEOV	*Festuca ovina*	54–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	54–90	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	54–90	–
1	**Sub-Dominant Grasses**			306–612	
	Grass, annual	2GA	*Grass, annual*	90–180	–
	Grass, perennial	2GP	*Grass, perennial*	90–180	–
	California brome	BRCA5	*Bromus carinatus*	18–36	–
	Geyer's sedge	CAGE2	*Carex geyeri*	18–36	–
	squirreltail	ELEL5	*Elymus elymoides*	18–36	–
	basin wildrye	LECI4	*Leymus cinereus*	18–36	–
	oniongrass	MEBU	*Melica bulbosa*	18–36	–
	western wheatgrass	PASM	*Pascopyrum smithii*	18–36	–
	Kentucky bluegrass	POPR	*Poa pratensis*	18–36	–
Forb					
0	**Dominant Forbs**			180–270	
	mule-ears	WYAM	*Wyethia amplexicaulis*	180–270	–
2	**Sub-Dominant Forbs**			342–648	
	Forb, annual	2FA	*Forb, annual*	54–90	–
	Forb, perennial	2FP	*Forb, perennial*	54–90	–
	common yarrow	ACMI2	*Achillea millefolium*	18–36	–
	Brandegee's onion	ALBR	*Allium brandegeei*	18–36	–
	silverleaf milkvetch	ASAR4	*Astragalus argophyllus*	18–36	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	18–36	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	18–36	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	18–36	–
	oneflower helianthella	HEUN	*Helianthella uniflora*	18–36	–
	Nevada pea	LALA3	*Lathyrus lanszwertii*	18–36	–
	Gray's biscuitroot	LOGR	*Lomatium grayi*	18–36	–
	longleaf phlox	PHLO2	*Phlox longifolia*	18–36	–
	lambstongue ragwort	SEIN2	*Senecio integerrimus*	18–36	–

	white checkerbloom	SICA3	*Sidalcea candida*	18–36	–
Shrub/Vine					
3	**Sub-Dominant Shrubs**			180–468	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	54–90	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	18–54	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	18–54	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	18–54	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	18–54	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	18–54	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	18–54	–

Animal community

This site has high forage values primarily for spring and summer use. It has a relatively high yield and numerous species of grasses, forbs and shrubs. The dominant vegetation is grass, so this site has the highest values when grazed by cattle and horses. It is also good for sheep, but best for spring and early summer grazing by them.

This site is a good food producer for wildlife that feed on grasses and seeds, but poor for those requiring forbs or shrubs. It is a poor site for wildlife cover except for small mammals and birds.

Hydrological functions

Soil series in this site are grouped into c and d hydrologic groups. They have moderately high to high runoff potential. When the vegetation is in climax (potential), the hydrologic curves are 76 to 74 for c group soils and 86 to 84 for d group soils. Refer to scs national engineering handbook, section 4 to determine runoff quantities for these curves. Where range condition has declined from climax, field investigation is needed to determine hydrologic curve numbers.

Recreational uses

This site has fair values for open space and natural beauty. It is primarily a grassland and does not have wide variety of plant species. It has good potential for snowmobiling. Recreation potential is fair for hunting.

Wood products

None

Inventory data references

QC completed by EDQS, with the clarification of updates that will be needed at the start of the next processes in moving forward with these ESDs. 06/30/2022

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	11/05/2012
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to very few. Some very minor rill development may occur on steeper slopes (>10%) or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Any rills present should be <1 inch deep, fairly short (<6 feet long) and somewhat widely spaced (8-10 feet). Minor rill development may be observed following major thunderstorm or spring runoff events, but they should heal during the next growing season. Vertical cracking and slickensides are natural components of the soils on this site and should not be mistaken for rills.

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

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3. **Number and height of erosional pedestals or terracettes:** None to Slight. Perennial vegetation shows little evidence

of erosional pedestalling (2 to 3% of individual plants). Plant roots are covered and litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope. Gilgai micro-relief may be evident and is natural on this site.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-25% bare ground. Soil surface is typically covered by < 5% coarse fragments. Bare ground spaces should not be greater than 2 to 3 feet in diameter and should not be connected.

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5. **Number of gullies and erosion associated with gullies:** None to Very Few. A few gullies may be present in landscape settings where they transport runoff from areas of greater water flow such as exposed bedrock. These gullies will be limited to slopes exceeding 20% slope and adjacent to sites where this runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

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

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

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 5 or 6 under the plant canopies, and a rating of 4 to 5 in the interspaces. The average rating should be a 5. Soil surface texture is typically a heavy clay loam or heavy silty clay loam.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Hawkins Soil surface 0-2 inches. Texture is a heavy clay loam; color is very dark grayish brown (10YR 3/2); structure is moderate fine subangular blocky parting to moderate medium granular. Mollic epipedon ranges from 10 to more than 30 inches. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The clay content within the soil profile may limit infiltration during all but the most gentle storms and snowmelt periods. Perennial vegetation provides sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, protect soil surface from splash erosion and encourages a higher rate of infiltration. Good plant spatial distribution will slow runoff, allowing additional time for infiltration. Bare spaces are expected to be small and irregular in shape and are usually not connected. Vegetative structure is usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing time for good infiltration, reducing runoff and erosion. When perennial grasses and shrubs decrease due to natural events, including drought, insect damage, etc., which may reduce ground

cover, runoff is expected to increase and infiltration be reduced.

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Rhizomatous grasses (slender wheatgrass, Western wheatgrass) > Perennial bunchgrasses (bluebunch wheatgrass, Nevada bluegrass) > Perennial Forbs (northern mulesears) > Sprouting shrubs (low sagebrush, mountain snowberry).

    Sub-dominant: Other perennial bunchgrasses and grasslikes (sheep fescue, Geyer sedge)>> Shrubs (bitterbrush) >> Perennial forbs (mountain aster).

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

    Additional: Natural disturbance regimes include fire, drought, and insects. Assumed fire cycle of 40 to 60+ years. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect a functional community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present under average to above average growing conditions with age class expression likely subdued during periods of extended drought. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during periods of extended drought, or insect infestations. In general, a mix of age classes should be expected with some dead and decadent plants present.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 1700 - 1800#/acre on an average year, but could range from 900 to 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: Cheatgrass, Canada thistle, morningglory, Russian thistle, alyssum, & mustard species.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. Green rabbitbrush sprouts vigorously following fire. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species should be present during average and above average growing years.
