USDA Natural Resources
Conservation Service

Ecological site R047XA456UT
Mountain Stony Loam (antelope bitterbrush)

Last updated: 2/05/2025
Accessed: 05/20/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

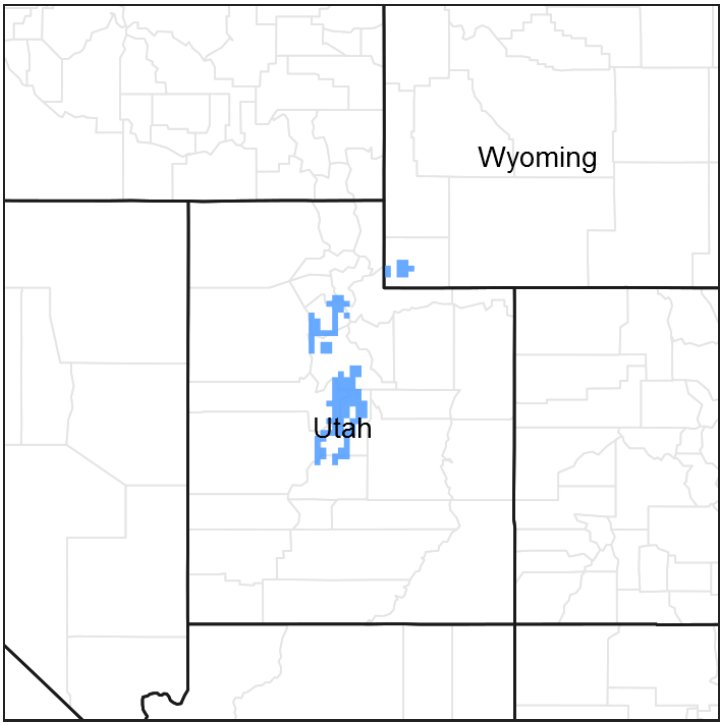


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square

kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. The southern half is in the High Plateaus of the Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south, and the Uinta Mountains, which trend east and west. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area. The Uinta Mountains have a broad, gently arching, elongated shape. Structurally, they consist of a broadly folded anticline that has an erosion-resistant quartzite core. The Wasatch and Uinta Mountains have an elevation of 4,900 to about 13,500 feet (1,495 to 4,115 meters).

The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments, but Precambrian rocks are exposed in the Uinta Mountains. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east. The southern Wasatch Mountains consist of Tertiary volcanic rocks occurring as extrusive lava and intrusive crystalline rocks.

The average precipitation is from 8 to 16 inches (203 to 406 mm) in the valleys and can range up to 73 inches (1854 mm) in the mountains. In the northern and western portions of the MLRA, peak precipitation occurs in the winter months. The southern and eastern portions have a greater incidence of high-intensity summer thunderstorms; hence, a significant amount of precipitation occurs during the summer months. The average annual temperature is 30 to 50 degrees Fahrenheit (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols, Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. Mesic temperature regimes come in on the lower elevations and south facing slopes in the southern portion of this MLRA. The soil moisture regime is typically xeric in the northern part of the MLRA, but grades to ustic in the extreme eastern and southern parts. The mineralogy is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

Major Land Resource Unit 47A is located in the northern half of the Middle Rocky Mountains Province of the Rocky Mountain System. This MLRA includes the Wasatch Mountains which tend to run north and south. These steeply sloping, precipitous mountains have narrow crests and deep valleys. They are primarily fault blocks that have been tilted up. The alluvial fans located at the base of these mountains are important recharge zones for valley aquifers.

Classification relationships

Modal Soil: Hoskin CB-L, 30-70% — loamy-skeletal, mixed, frigid Typic Argixerolls

Ecological site concept

The soils of this site formed in alluvium, colluvium and residuum derived from various sedimentary and igneous rocks. Rock fragments are visible on the soil surface and throughout the profile, and make up more that 35 percent of the soil volume. These soils are well-drained and moderately deep to deep. Permeability is moderate and water-holding capacity ranges from 1.4 to 4.1 inches of water in the upper 40 inches of soil. The soil moisture regime is xeric and the soil temperature regime is frigid.

Associated sites

R047XA461UT	**Mountain Stony Loam (mountain big sagebrush)** Sites often occur adjacent to each other.

Similar sites

R047XA460UT	**Mountain Stony Loam (browse)** This site has a greater diversity of browse shrubs including serviceberry, choke cherry, and gambel oak.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Purshia tridentata*
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This site occurs on mountain slopes, ridges, and alluvial fans at elevations between 5,000 and 8,500 feet. It is found on all aspects with slopes ranging from 20 to 70 percent. Runoff is medium to high and flooding and ponding do not occur on the site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Alluvial fan
Runoff class	Medium to high
Flooding frequency	None

Ponding frequency	None
Elevation	1,524–2,591 m
Slope	20–70%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by cold snowy winters and cool dry summers. Total annual precipitation ranges from 22 to 30 inches. The distribution of precipitation is 55 to 60 percent during the plant dormant period (October to March). This is the most dependable supply of moisture for plant growth. Lower precipitation and high evapotranspiration rates during July and August cause a reduction in growth of all plant species and dormancy in many grasses and forbs.

Table 3. Representative climatic features

Frost-free period (average)	167 days
Freeze-free period (average)	205 days
Precipitation total (average)	762 mm

Influencing water features

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

Soil features

The soils of this site formed in alluvium, colluvium and residuum derived from various sedimentary and igneous rocks. Rock fragments are visible on the soil surface and throughout the profile, and make up more than 35 percent of the soil volume. These soils are well-drained and moderately deep to deep. Permeability is moderate and water-holding capacity ranges from 1.4 to 4.1 inches of water in the upper 40 inches of soil. The soil moisture regime is xeric and the soil temperature regime is frigid.

Table 4. Representative soil features

Surface texture	(1) Very cobbly loam (2) Very stony loam (3) Extremely stony loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate

Soil depth	51 cm
Surface fragment cover <=3"	16–18%
Surface fragment cover >3"	22–23%
Available water capacity (0-101.6cm)	3.56–10.41 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	17–26%
Subsurface fragment volume >3" (Depth not specified)	14–21%

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 with sheep as the browse component increased.

Below is a State and Transition Model diagram that illustrates the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

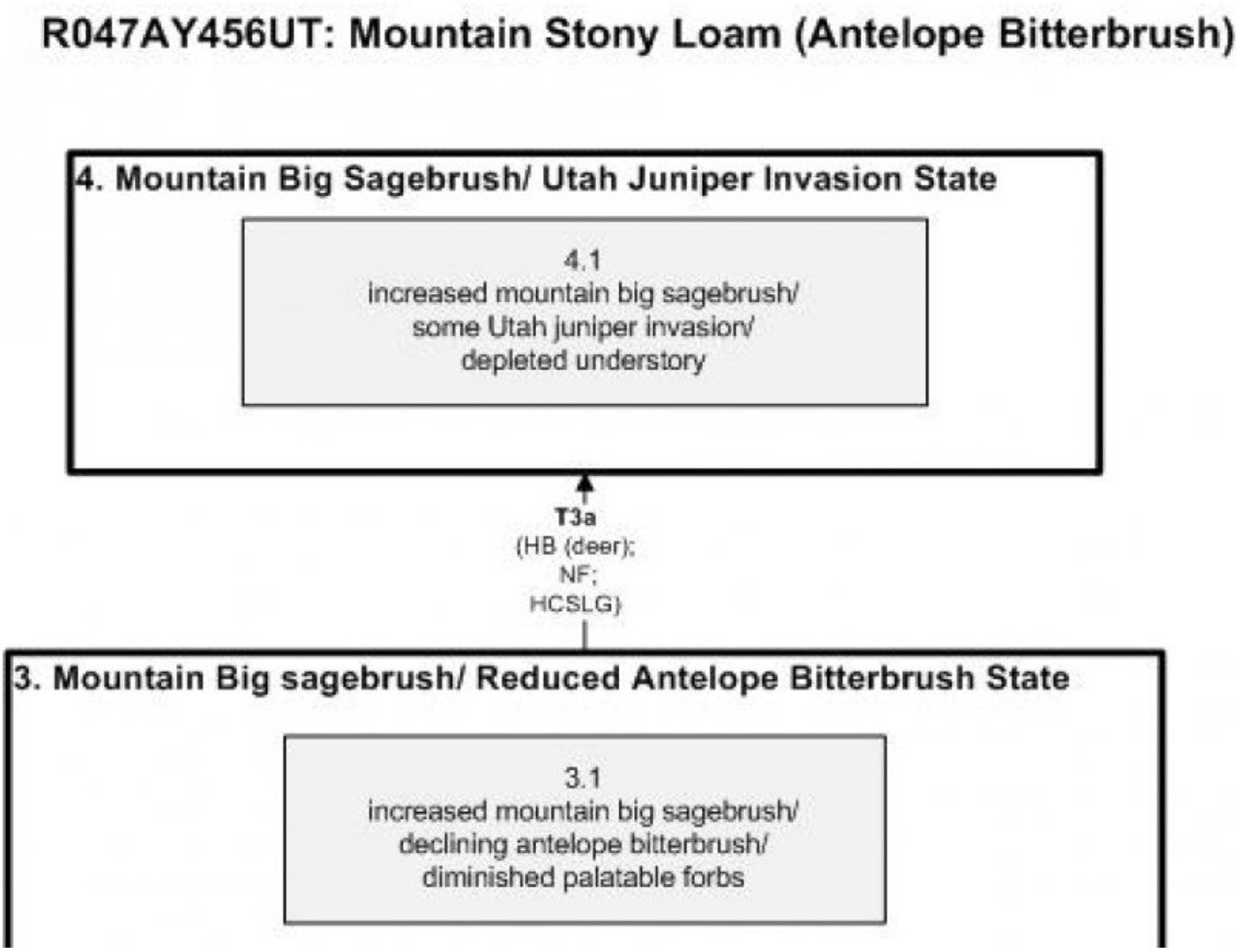
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the

bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

When available, monitoring data (of various types) were employed to validate more subjective inferences made in this diagram. See the complete files in the office of the State Range Conservationist for more details.

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range and Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State and transition model



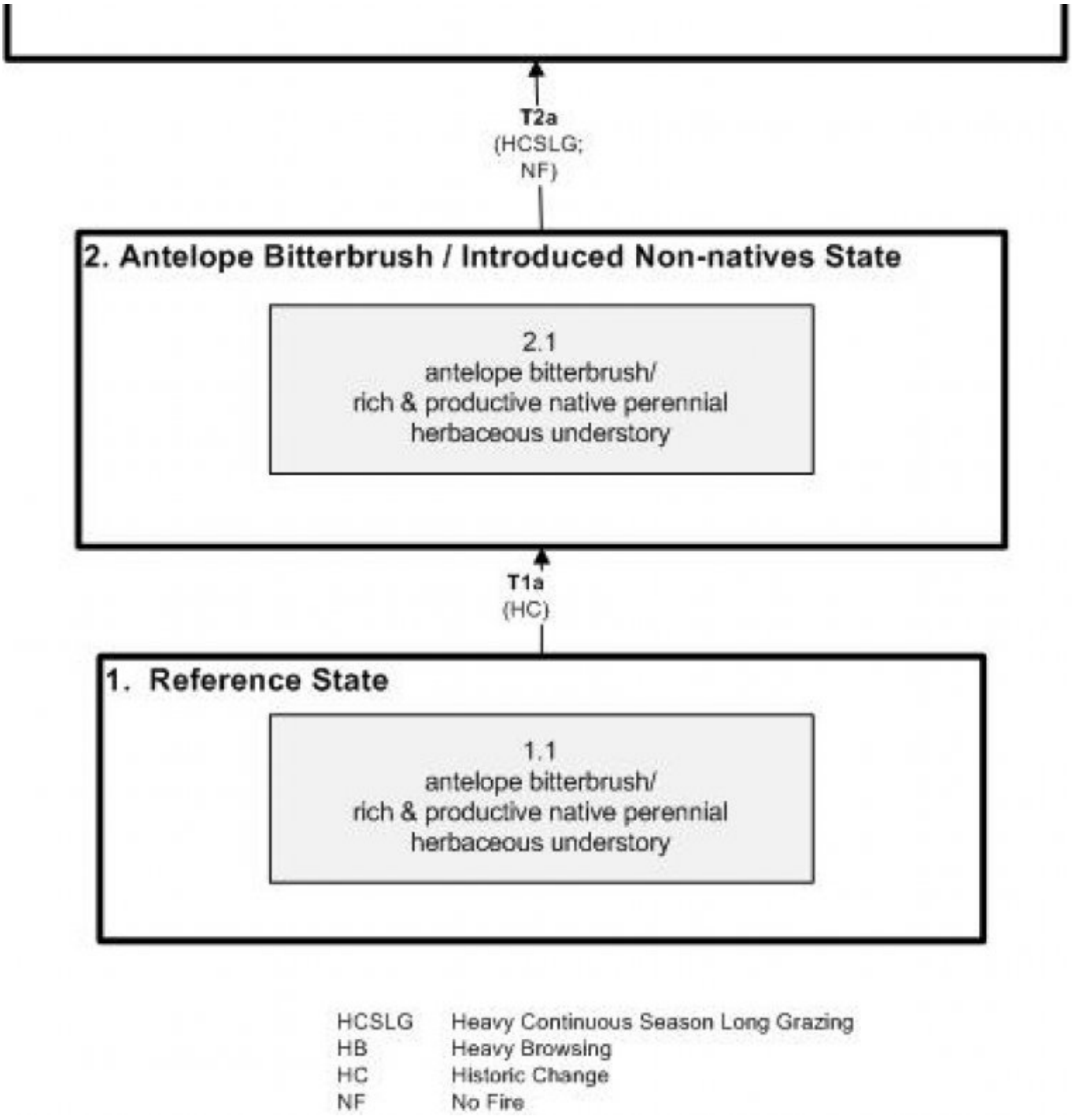


Figure 4. State and Transition Model

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 antelope bitterbrush (*Purshia tridentata*), primarily occurring on south-facing slopes, with a rich and productive native perennial herbaceous understory. Mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) and birch-leaf mountain mahogany (*Cercocarpus montanus*) would have been common shrub associates. The majority of the grass component would have been bluebunch wheatgrass

(*Pseudoroegneria spicata*), and forbs would have included a mixture of common yarrow (*Achillea millefolium*), Wyoming Indian paintbrush (*Castilleja linariifolia*), western stoneseed (*Lithospermum ruderale*), and buckwheats (Eriogonum spp.), among others (1.1). 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 document.

Community 1.1
antelope bitterbrush / rich and productive native perennial herbaceous understory

This plant community would have been characterized by antelope bitterbrush occurring primarily on southerly aspects with a rich and productive native perennial understory.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	404	631	857
Grass/Grasslike	404	732	857
Forb	90	163	191
Total	**898**	**1526**	**1905**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	19-21%
Grass/grasslike foliar cover	39-41%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	4-6%
>0.3 <= 0.6	–	–	39-41%	–
>0.6 <= 1.4	–	19-21%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Antelope Bittebrush/ Introduced Non-natives State

State 2 is identical to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement. This state can be regarded as the current potential. Antelope bitterbrush is the dominant shrub with a mixture of predominately native perennial herbaceous species. Grasses include a slightly diminished bluebunch wheatgrass, slender wheatgrass (*Elymus trachycaulus*), and Letterman's needlegrass (*Achnatherum lettermanii*). Forbs include common yarrow, Wyoming Indian paintbrush, western stoneseed, and buckwheats, among others (2.1). Key indicators of the approach to this transition are the loss of perennial grass understory and an increase in the shrub component relative to grasses. Sustained heavy grazing and fire exclusion over time (decades) will trigger this transition.

Community 2.1
antelope bitterbrush / rich and productive native perennial herbaceous understory

This plant community is dominated by antelope bitterbrush with a diverse and productive native perennial understory. A small component of introduced non-native species may also be present, such as cheatgrass (*Bromus tectorum*).

State 3
Mountain Big Sagebrush/ Reduced Antelope Bitterbrush State

In the absence of fire, but with continued heavy impacts from livestock grazing, the native herbaceous understory will markedly decrease, allowing the certain shrubs, mainly mountain big sagebrush, to gain in dominance (3.1). Antelope bitterbrush will also decline

because of heavy use by sheep as well as big game. The root-sprouting ability of bitterbrush is a key factor affecting the resiliency of this state. Stability of this state will be maintained by reducing livestock and wildlife ungulate use, while continued heavy use by livestock and wildlife will reduce state stability.

Community 3.1
increased mountain big sagebrush/ declining antelope bitterbrush/ diminished palatable forbs

This plant community is characterized by a dramatic increase in mountain big sagebrush and a reduction in the perennial herbaceous understory.

State 4
Mountain Big Sagebrush/ Utah Juniper Invasion State

Due to heavy browsing impacts from local mule deer populations, antelope bitterbrush suffers immensely, and Utah juniper will invade. The herbaceous understory will also be depleted due to continued heavy livestock grazing.

Community 4.1
increased mountain big sagebrush / Utah juniper invasion/ depleted understory

This plant community is dominated by mountain big sagebrush and Utah juniper in higher elevations. The herbaceous understory is relatively lacking.

Transition T1A
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, and climate change has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

Transition T2A
State 2 to 3

Lack of fire and continued heavy livestock grazing during the growing season of grasses, throughout the 1860s to the 1950s, caused a transition into a Mountain Big Sagebrush/ Reduced Antelope Bitterbrush State.

Transition T3A
State 3 to 4

During the period between the 1940s and the 1950s a dramatic increase was seen in local mule deer populations. The impacts from their heavy browsing particularly on the antelope bitterbrush, combined with continued fire suppression, further reduced the bitterbrush to its near removal on some sites, allowing both mountain big sagebrush and Utah juniper to take over the site. Key indicators of the approach to this transition are the loss of vigor in bitterbrush and an increase in sagebrush and juniper reproduction and establishment. Excessive big game use triggers this transition.

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**			269–588	
	antelope bitterbrush	PUTR2	*Purshia tridentata*	168–420	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	50–84	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	50–84	–
3	**Sub-Dominant Shrubs**			168–504	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	84–168	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	17–67	–
	feather fingergrass	CHVI4	*Chloris virgata*	17–67	–
	creeping barberry	MARE11	*Mahonia repens*	17–67	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	17–67	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	17–67	–
Grass/Grasslike					
0	**Dominant Grasses**			488–673	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	336–420	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	50–84	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	50–84	–
1	**Sub-Dominant Grasses**			336–841	
	Grass, annual	2GA	*Grass, annual*	84–168	–
	Grass, perennial	2GP	*Grass, perennial*	84–168	–

	Geyer's sedge	CAGE2	*Carex geyeri*	17–50	–
	squirreltail	ELEL5	*Elymus elymoides*	17–50	–
	sheep fescue	FEOV	*Festuca ovina*	17–50	–
	needle and thread	HECO26	*Hesperostipa comata*	17–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	17–50	–
	basin wildrye	LECI4	*Leymus cinereus*	17–50	–
	spike fescue	LEKI2	*Leucopoa kingii*	17–50	–
	oniongrass	MEBU	*Melica bulbosa*	17–50	–
	muttongrass	POFE	*Poa fendleriana*	17–50	–
	Sandberg bluegrass	POSE	*Poa secunda*	17–50	–
Forb					
2	**Sub-Dominant Forbs**			454–1362	
	Forb, annual	2FA	*Forb, annual*	84–252	–
	Forb, perennial	2FP	*Forb, perennial*	84–252	–
	common yarrow	ACMI2	*Achillea millefolium*	17–50	–
	tapertip onion	ALAC4	*Allium acuminatum*	17–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–50	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	17–50	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	17–50	–
	bastard toadflax	COUM	*Comandra umbellata*	17–50	–
	shortstem buckwheat	ERBR5	*Eriogonum brevicaule*	17–50	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	17–50	–
	showy goldeneye	HEMU3	*Heliomeris multiflora*	17–50	–
	oneflower helianthella	HEUN	*Helianthella uniflora*	17–50	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	17–50	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	17–50	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	17–50	–
	Tolmie's owl's-clover	ORTO	*Orthocarpus tolmiei*	17–50	–
	low beardtongue	PEHU	*Penstemon humilis*	17–50	–
	Munro's	SPMU2	*Sphaeralcea*	17–50	–

	globemallow		*munroana*		

Animal community

This site is suited for use by cattle, sheep, and horses in spring, summer, and fall. It has diverse grasses, forbs, and shrubs that provide balanced nutrition for livestock and wildlife. This site is good habitat for songbirds, chukars, quail, sage grouse, squirrels, snowshoe hare, coyotes, wildcats, cougars, mule deer, antelope, and elk.

Recreational uses

This site has values for open space and aesthetics. It has a variety of grasses, forbs, and shrubs in bloom throughout the growing season. Hunting for upland game birds, deer and elk is good to excellent. Hiking and horseback riding are good on this site as well.

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

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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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Contact for lead author	shane.green@ut.usda.gov
Date	11/13/2012
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rare to Slight. Slight rill development may occur 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 (4-8 feet), < 1 inch deep and somewhat widely spaced (5-10 feet). Minor rill development may be observed on all slopes following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Slight. Some minor evidence of water flow patterns may be found winding around perennial plant bases. They show little evidence of current erosion.

They are expected to be short (3-6 feet), stable, sinuous and normally not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat on slopes > 20%.

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3. **Number and height of erosional pedestals or terracettes:** Perennial vegetation shows little evidence of erosional pedestalling (1 to 2% of individual plants). Plant roots are covered and most litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 20% - 25%. Soil surface may be covered by 20 to 70% 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 basin/range environments. Where landscape gullies are present, they should be stable, partially vegetated on their sides and bottoms, with no evidence of head-cutting. Some slight increase in disturbance may be evident following significant weather events or when gullies convey considerable runoff from higher elevation rocky or naturally eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of wind generated soil movement is present. Wind caused blowouts and deposition are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow channels with deposition occurring within 1 to 2 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes >20% and/or increased runoff resulting from heavy thunderstorms.

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

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Horrocks) Soil surface 0-5 inches. Texture is a very cobbly sandy clay loam; color is very dark grayish brown (10YR 3/2); and structure is weak medium granular. Mollic epipedon ranges to 14 inches. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial vegetation produces sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, also protect the soil surface from splash erosion and encourage higher infiltration. Bare spaces are expected to be small and irregular in shape and usually not connected. Vegetative structure and distribution are usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing maximum time for infiltration, and reducing runoff and erosion in all but the most extreme storm events. When perennial grasses and shrubs decrease due to natural events such as long-term drought, insect damage, etc., runoff is likely to increase and infiltration be reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. 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: Sprouting shrubs (bitterbrush, alderleaf mountain mahogany) > Non-sprouting shrub (mountain big sagebrush) = > Perennial bunchgrasses (bluebunch wheatgrass, Letterman needlegrass) > Rhizomatous Grasses (slender wheatgrass).

Sub-dominant: Perennial forbs (arrowleaf balsamroot)

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

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

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

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14. **Average percent litter cover (%) and depth (in):** Litter cover will be heavier under plants. Most litter will be herbaceous and depths of 1 to 2 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 1400 - 1500 #/acre on an average year but could range from 750 - 1750 #/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, alyssum, mustard species, Canada thistle, black medic, Utah juniper, Gamble oak.

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