USDA Natural Resources
Conservation Service

Ecological site R047XA325UT
Upland Loamy Shale (low sagebrush)

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.

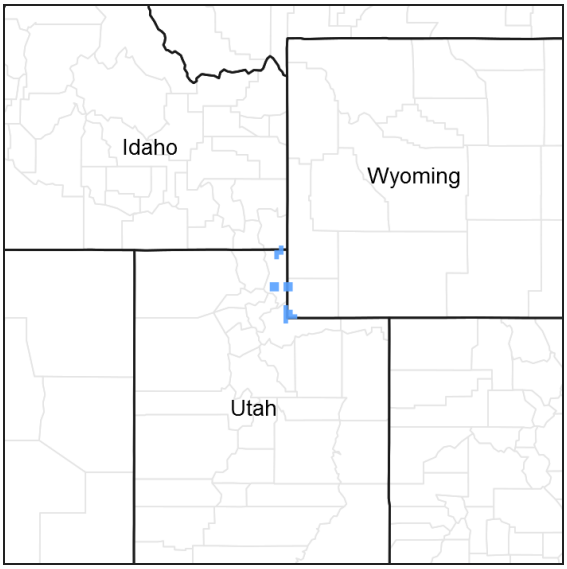

Figure 1. Mapped extent

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. 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. 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 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.
The average precipitation is from 12 to 16 inches in the valleys and can range up to 73 inches in the mountains. Peak precipitation occurs in the winter 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 Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. The soil moisture

regime is typically xeric. The minerology is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

This LRU 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: Ellett SIL – loamy, mixed (calc.), frigid shallow, Xeric Torriorthents

Ecological site concept

The soils of this site formed in colluviuum and slope alluvium derived mostly from shale. Soils are very shallow to shallow and well-drained. Depth to shale ranges from 10 to 20 inches. Small rock fragments may or may not be present on the soil surface. The soil profile usually contains small rock fragments and soft shale fragments. Permeability is moderate. Available water-holding capacity is 1.7 to 2.6 inches. These soils are usually calcareous and have a pH range of 7.9 to 9.0. The soil moisture regime is xeric bordering on aridic and the soil temperature regime is frigid.

The dominant plants on this site are low sagebrush and bluebunch wheatgrass with a mix of low growing forbs.

Associated sites

R047XA320UT	**Upland Shallow Loam (Wyoming big sagebrush)** Sites generally occur adjacent to each other.

Similar sites

R047XA301UT	**Upland Clay Loam (early sagebrush)** Sites have similar floristic characteristics, however this site has less of a shale influence.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula ssp. arbuscula*
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This site occurs on foothills and mountain slopes. Elevation ranges from 6,200 to 7,700 feet. Slopes are mostly between 10 and 30 percent. Runoff is high and flooding and ponding do not affect the site.

Table 2. Representative physiographic features

Landforms	(1) Hillslope (2) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	6,200–7,700 ft
Slope	10–30%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 12 to 16 inches. Effective moisture for plant growth falls in winter and spring. Summer dry periods cause many herbaceous species to enter dormancy. The frost free period ranges from 65 to 80 days, and the freeze free period ranges from 85 to 110 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-16 in
Frost-free period (average)	80 days
Freeze-free period (average)	110 days
Precipitation total (average)	14 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 of this site formed in colluviuum and slope alluvium derived mostly from shale. Soils are very shallow to shallow and well-drained. Depth to shale ranges from 10 to 20 inches. Small rock fragments may or may not be present on the soil surface. The soil profile usually contains small rock fragments and soft shale fragments. Permeability is moderate. Available water-holding capacity is 1.7 to 2.6 inches. These soils are usually calcareous and have a pH range of 7.9 to 9.0. The soil moisture regime is xeric bordering on aridic and the soil temperature regime is frigid.

Table 4. Representative soil features

Parent material	(1) Colluvium–shale (2) Slope alluvium–shale (3) Residuum–shale
Surface texture	(1) Silt loam (2) Gravelly loam
Family particle size	(1) Loamy (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	0–20%
Available water capacity (0-40in)	1.7–2.6 in
Calcium carbonate equivalent (0-40in)	5–30%

Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (0-40in)	10–40%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

It is impossible to determine in any quantitative detail the Historic Climax Plant Community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

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

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

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

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/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

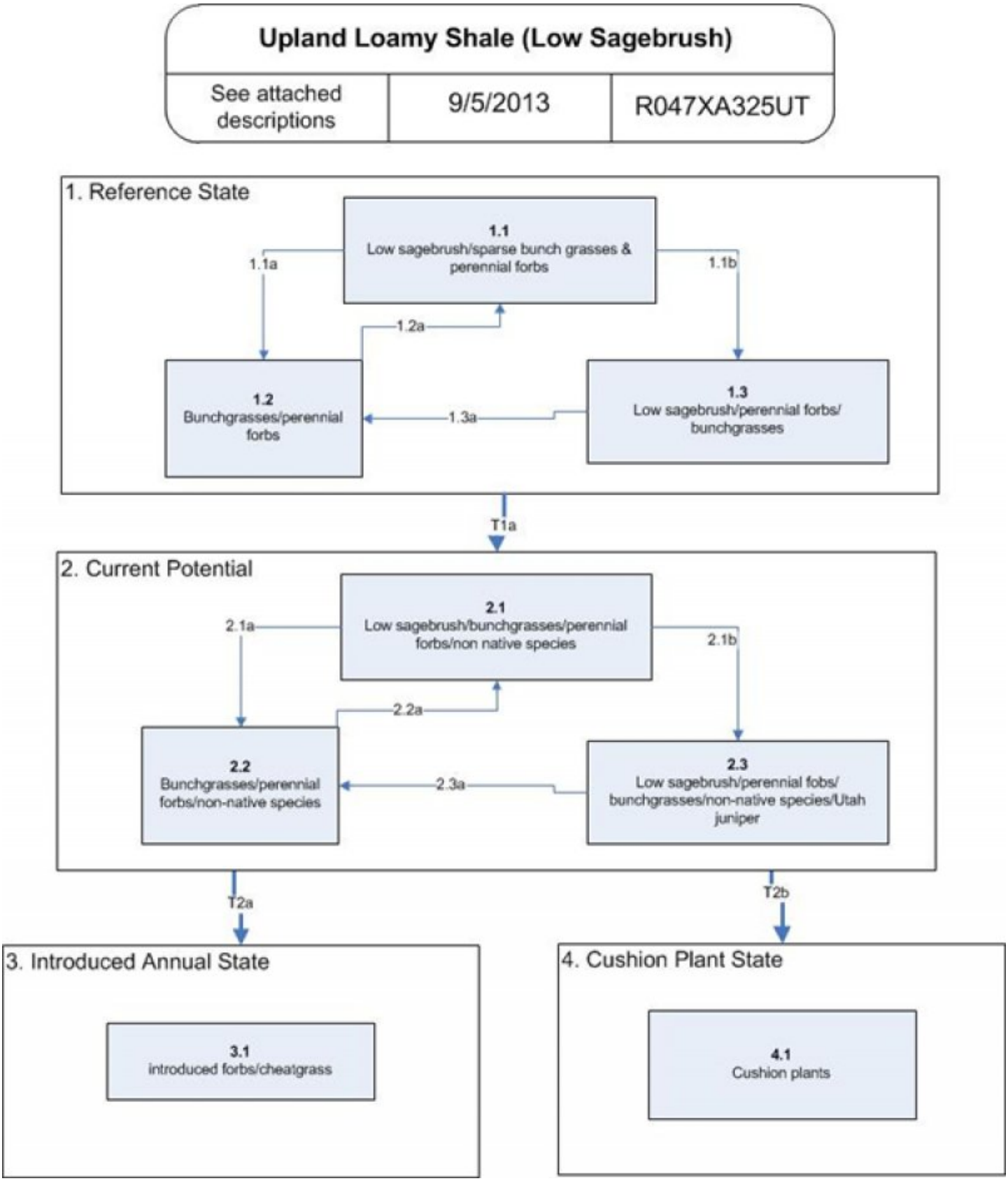

Figure 2. State and Transition Model R047XA325UT

State 1
Reference State

The Reference State is a description of this ecological site 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 (1.1) within the Reference State would have been a low sagebrush (*Artemisia arbuscula* spp. arbuscula) -dominated shrubland with sparse bunchgrasses and native perennial forbs. The understory of the reference plant

community (1.1) would have been dense enough to carry wildfire only rarely (Steinberg 2002). Low sagebrush typically only occurs after wet years or on more mesic sites (Steinberg 2002). Following natural wildfire events (1.1a) the reference plant community would have shifted towards one dominated by mixed grasses (1.2). Low sagebrush would have been much reduced and yellow rabbitbrush (*Chrysothamnus viscidiflorus*) would have increased. In the absence of fire (1.2a) and with a viable shrub seed source, low sagebrush would have increased, and the site would have slowly returned to the reference plant community. Heavy grazing (1.1b) would have created a dominance of low sagebrush with a much reduced understory (1.3). A fire occurring in 1.3 could cause the community to shift back to 1.2 (1.3a), this would have allowed the bunchgrasses and perennial forbs to re-establish, which could then shift the plant community back towards the reference plant community (1.1) from 1.2. 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
Low sagebrush/bunch grasses/perennial forbs

The least modified plant community in the Reference State would have been a low sagebrush-dominated site with scattered bunchgrasses including bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Achnatherum hymenoides*), Sandberg bluegrass (*Poa secunda*), and muttongrass (*Poa fendleriana*). Native perennial forbs would have been present as well.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	248	338	428
Grass/Grasslike	220	300	380
Forb	83	113	143
Total	**551**	**751**	**951**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
Grass/grasslike foliar cover	14-16%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	4-6%
>1 <= 2	–	39-41%	14-16%	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Bunchgrasses/perennial forbs

This plant community would have developed following the removal of low sagebrush by a wildfire event allowing yellow rabbitbrush to temporarily increase. The fire-resistant bunchgrasses remaining in this plant community would have included bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, and muttongrass.

Community 1.3
Low sagebrush/perennial forbs/bunchgrasses

This plant community would have developed following heavy localized grazing by Native American horses, elk, or bison. Utilization would have been mainly on grasses, creating a near monoculture of low sagebrush.

Pathway 1.1a
Community 1.1 to 1.2

Wildfire would have temporarily reduced or removed low sagebrush, shifting the Reference State towards a mixed grass-dominated site.

Pathway 1.1b
Community 1.1 to 1.3

Heavy continuous season-long grazing by elk will convert the plant community to a low sagebrush community with a substantially reduced bunchgrass component.

Pathway 1.2a
Community 1.2 to 1.1

Eventually low sagebrush would have re-established in the plant community, and the species composition would have shifted towards the Reference Plant Community (1.1) in the absence of fire.

Pathway 1.3a
Community 1.3 to 1.2

The perennial bunchgrasses would have recovered and increased after a substantial reduction in herbivory by grazers.

State 2
Low Sagebrush/ Introduced Non-natives State

State 2 is very similar to State 1 in form and function, with the exception of the presence of non-native plants and

animals, possible extinctions of native species, and a different climate. The fire return interval is also altered in State 2. Although fires occur rarely, the ecological sites typically found in association with this site may have longer fire return intervals, allowing Utah juniper to establish within these sites. The juniper is then able to establish within the low sagebrush site (2.3). Utah juniper is found in this state, but is not dominant. State 2 is a description of the ecological site shortly following Euro-American settlement. This State can be regarded as the current potential. This site is typically found with few invasive species. It takes excessive disturbance to move this this site from State 2. This is probably due to the soil characteristics of the site which include high rock content to shallow bedrock. There is not much soil for plants to occupy in this site. Those that do well in this site are typically low growing forbs and bunch grasses. These appear to occupy the soil, making it more difficult for non-native or invasive species to establish.

Community 2.1
Low sagebrush/bunchgrasses/forbs/non-native species

This plant community is characterized by low sagebrush dominance with scattered bunchgrasses including bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, and muttongrass. A few native perennial forbs are also present. The community has some non-native species present, but they do not dominant or control the site.

Community 2.2
Bunchgrasses/perennial forbs/non-native species

This plant community develops following the removal of low sagebrush by a wildfire event, allowing yellow rabbitbrush to temporarily increase. The fire-resistant bunchgrasses that will remain in this plant community include bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, and muttongrass. This community also contains some non-native species but they are not dominant and do not control site dynamics.

Community 2.3
Low sagebrush/perennial forbs/bunchgrasses/non-native species/Utah juniper

R047XA325UT- Upland Loamy Shale (low sagebrush) community phase 2.3- Low sagebrush/perennial forbs/bunchgrasses/non-native

Figure 4. Community Phase 2.3

Figure 5. Ground cover community phase 2.3

This plant community develops following heavy localized grazing by elk, horses, and cattle. Utilization mainly on grasses creates the near monoculture of low sagebrush. There may be a few non-native species present, but they do not dominant the site. Utah juniper may also be within the site. This typically occurs when the associated sagebrush sites adjacent to the low sagebrush site begin to have juniper creep into the site. This increases the likelihood of juniper coming into the low sagebrush site.

Pathway 2.1a
Community 2.1 to 2.2

Wildfire will temporarily reduce or remove low sagebrush, shifting the plant community towards a mixed grass dominated site.

Pathway 2.1b
Community 2.1 to 2.3

Heavy continuous season-long grazing by elk, horses, and cattle will convert the plant community to a low sagebrush community with a substantially reduced bunchgrass component. Also, increasing the fire return interval will allow low sagebrush to increase while decreasing the understory component.

Pathway 2.2a
Community 2.2 to 2.1

Eventually low sagebrush will re-establish in the plant community, and the species composition will shift towards Community Phase 2.1 in the absence of fire.

Pathway 2.3a
Community 2.3 to 2.2

Fire in this community will reduce or temporarily remove the sagebrush.

State 3
Introduced Annuals/ Biennials State

Certain invasive annuals and biennial forbs such as cheatgrass, Russian thistle, and halogeton are favored by soil disturbance. Although there have been some previous attempts to apply tillage and chemicals to improve the composition and productivity at some locations within this ESD (see files in the State Range Conservationist Office for details), the responses are too minor to justify the financial investment. Therefore, currently available manipulations are not recommended.

Community 3.1
Introduced Annuals

Figure 6. Community phase 3.1

Cheatgrasses, Russian thistle and halogeton typcially dominate this community phase. This is typically found next to disturbances such as roads or powerline right of ways.

State 4
Cushion Plants/Eroded State

This is a distrophicated (lacking nutrients) State characterized by a truncated soil profile and impoverished vegetation. Soil organic matter and nutrient stores have been lost due to excessive soil erosion. Only those plants resistant to mechanical impacts and nutrient-depleted soils remain. As with State 3, although there have been some previous attempts to apply tillage and chemicals to improve the composition and productivity at some locations within this ESD (see files in the State Range Conservationist Office for details), the responses are too minor to justify the financial investment. Therefore, currently available manipulations are not recommended.

Community 4.1
Cushion Plants

The plant community is characterized by the few species such as cushion plants (e.g. Phlox spp., Leptodactylon spp., Antennaria spp. and Stenotus spp) which are resistant to severe ground disturbance and soil erosion.

Transition T1a
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, along with 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 not practical.

Transition T2a
State 2 to 3

The Low Sagebrush/ Introduced Non-natives State will transition to the Cushion Plants/Eroded State following severe ground disturbance/mechanical damage caused by excessive foot or wheel traffic, followed by accelerated soil erosion. The approach to this transition is indicated by an increase in exposed bare soil and evidence of soil erosion (i.e. pedestalling of plants and/or surface rock, rilling). This transition is triggered by severe ground disturbance.

Transition T2b
State 2 to 4

The Low Sagebrush/ Introduced Non-natives State will transition to the Cushion Plants/Eroded State following severe ground disturbance/mechanical damage caused by excessive foot or wheel traffic, followed by accelerated soil erosion. The approach to this transition is indicated by an increase in exposed bare soil and evidence of soil erosion (i.e. pedestalling of plants and/or surface rock, rilling). This transition is triggered by severe ground

disturbance.

Transition T3a
State 3 to 4

The Introduced Annuals/Biennials State will transition to the Cushion Plants/Eroded State when the site is exposed to increased soil erosion. The approach to this transition is indicated by an increase in exposed bare soil and evidence of soil erosion (i.e. pedestalling of plants and/or surface rock, rilling) and an increase in species capable of tolerating severe ground disturbance and erosion such as curlytop gumweed (*Grindelia squarrosa*) and cushion plants (e.g. Phlox spp., Leptodactylon spp., *Stenotus acaulis*). The transition is triggered by accelerated soil erosion. Although there have been some previous attempts to apply tillage and chemicals to improve the composition and productivity at some locations within this ESD (see files in the State Range Conservationist Office for details), the responses are too minor to justify the financial investment. Therefore, currently available manipulations are not recommended.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			224–328	
	little sagebrush	ARARA	*Artemisia arbuscula ssp. arbuscula*	120–160	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	24–40	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	24–40	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	24–40	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	16–24	–
3	**Sub-Dominant Shrubs**			56–104	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	24–40	–
	black sagebrush	ARNO4	*Artemisia nova*	8–16	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	8–16	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–16	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–16	–
Grass/Grasslike					
0	**Dominant Grasses**			240–344	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	120–160	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–120	–
	western wheatgrass	PASM	*Pascopyrum smithii*	24–40	–
1	**Sub-Dominant Grasses**			80–144	
	Grass, annual	2GA	*Grass, annual*	24–40	–
	Grass, perennial	2GP	*Grass, perennial*	24–40	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	8–16	–
	squirreltail	ELEL5	*Elymus elymoides*	8–16	–
	muttongrass	POFE	*Poa fendleriana*	8–16	–
	Sandberg bluegrass	POSE	*Poa secunda*	8–16	–

Forb					
0	**Dominant Forbs**			48–80	
	spiny phlox	PHHO	*Phlox hoodii*	24–40	–
2	**Sub-Dominant Forbs**			0–112	
	Forb, annual	2FA	*Forb, annual*	0–8	–
	Forb, perennial	2FP	*Forb, perennial*	0–8	–
	common yarrow	ACMI2	*Achillea millefolium*	0–8	–
	pussytoes	ANTEN	*Antennaria*	0–8	–
	Colorado spiny milkvetch	ASKEC	*Astragalus kentrophyta var. coloradoensis*	0–8	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	0–8	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	0–8	–
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–8	–
	bastard toadflax	COUM	*Comandra umbellata*	0–8	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–8	–
	tufted cryptantha	CRCA7	*Cryptantha caespitosa*	0–8	–
	larkspur	DELPH	*Delphinium*	0–8	–
	Gordon's ivesia	IVGO	*Ivesia gordonii*	0–8	–
	oblongleaf bluebells	MEOB	*Mertensia oblongifolia*	0–8	–
	yellow owl's-clover	ORLU2	*Orthocarpus luteus*	0–8	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–8	–
	low beardtongue	PEHU	*Penstemon humilis*	0–8	–
	tuber starwort	PSJA2	*Pseudostellaria jamesiana*	0–8	–

Animal community

This site does not provide much forage for livestock. Up to 40 percent of the annual production may be attributed to non-forage plants. This site is used by cattle and sheep in spring, summer, and fall.

Wild animals and birds using this site are cottontail, rabbit, coyote, mule deer, elk, sage grouse, and hawk.

Recreational uses

This site is valued for open space. Several species of forbs and shrubs provide varied colored blossoms in the spring. Recreation activities include hiking, hunting, horseback riding and motorbiking.

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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impact]

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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	02/24/2014
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No rills present at low slopes. Very minor rill development may occur as slope increases. If rills are present, they should be widely spaced and not connected. The presence of surface and subsurface rock fragment should reduce rill formation.

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2. **Presence of water flow patterns:** Water flow patterns should not be present.

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3. **Number and height of erosional pedestals or terracettes:** Plants may show minor pedestaling on their down slope side. Terracettes should be few and stable.

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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 – 30%. (Soil surface is typically covered with 50% rock).

5. **Number of gullies and erosion associated with gullies:** No gullies present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very little evidence of active wind generated soil movement. Wind caused blowouts and depositions are not present, but may be present after a fire.

7. **Amount of litter movement (describe size and distance expected to travel):** Some down slope redistribution caused by water. Some litter removal may occur in flow channels with deposition occurring at points of obstruction. Litter movement will increase with slope.

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 rate of 4 under plant canopies and 3 to 4 in the interspaces with an average of 3-4 using a soil stability kit. The presence of surface rock also reduces site erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface varies from 5 to 8 inches. Structure is fine granular. Color typically varies from pale brown (10YR6/3) to dark reddish brown (5YR3/4). Soils are shallow to bedrock.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Bunchgrasses and shrubs are important for increasing infiltration and reducing runoff. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff will increase and infiltration will be reduced.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Soils have bedrock at approximately 10 inches.

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

    Dominant: non sprouting shrubs (low sagebrush) > Perennial bunchgrasses (bluebunch wheatgrass, indian ricegrass)

    Sub-dominant: sprouting shrubs (rabbitbrush) > forbs (slender buckwheat, spiny phlox)

    Other:

    Additional:

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 long fire cycle. Very little mortality in other plants should be apparent.

14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 750 #/acre on an average year

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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, Russian thistle, tumble mustard

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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.
