Ecological site R047XA460UT
Mountain Stony Loam (browse)

Last updated: 2/05/2025
Accessed: 03/15/2026

General information

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

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.

Ecological site concept

The characteristic soils of this site are shallow to moderately deep and contain greater than 35 percent rock fragments in the soil profile. Permeability is moderately slow to moderately rapid and water holding capacity ranges from 3.5 to 4.4 inches of water in the upper 40 inches of soil. These soils are well- to somewhat excessively drained with loam to sandy loam textures. The soil moisture regime is xeric and the soil temperature regime is frigid.

Associated sites

R047XA473UT	**Mountain Very Steep Stony Loam (browse)**

Similar sites

R047XA456UT	**Mountain Stony Loam (antelope bitterbrush)**

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Artemisia tridentata ssp. vaseyana* (2) *Cercocarpus montanus*
Herbaceous	Not specified

Physiographic features

This site occurs on mountain slopes, spurs and ridges at elevations between 5,300 and 8,600 feet. It is most often found on moderate to steep slopes, but is occaisionally on more gentle terrain. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Spur
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,615–2,621 m
Slope	30–60%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site characterized by cold snowy winters and cool dry summers. Winter snow and spring rain are the most dependable supply of moisture for plant growth. Lower precipitation and high evapotranspiration rates during July and August cause slowing of growth for all plant species and dormancy in most of the herbaceous species.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-100 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	406-559 mm

Influencing water features

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

Wetland description

N/A

Soil features

The characteristic soils of this site are shallow to moderately deep and contain greater than 35 percent rock fragments in the soil profile. Permeability is moderately slow to moderately rapid and water holding capacity ranges from 3.5 to 4.4 inches of water in the upper 40 inches of soil. These soils are well- to somewhat excessively drained with loam to sandy loam textures. The soil moisture regime is xeric and the soil temperature regime is frigid.

Soil Survey Area: Soil Components (Map Units in parentheses)
Box Elder County, Eastern Part (UT602): Broad (BSE, BSG, BTG, BUG, BVG, MJG, SFG);

Cache Valley Area (UT603): Bradshaw (BSG2, DHG);

Carbon Area (UT616): Beje (005), Guben (046), Datino variant (044), Perma (075), Pabbitex (087), Rottulee (116);

Henry's Fork Area (WY638): Bookcliff (107), Chittum (112), Handran (121), Ledgefork (143), Parkay (176);

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone (2) Residuum–limestone and sandstone
Surface texture	(1) Cobbly loam (2) Fine sandy loam (3) Gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	51–102 cm
Soil depth	51–102 cm
Surface fragment cover <=3"	8–16%
Surface fragment cover >3"	0–12%
Available water capacity (0-101.6cm)	8.89–11.18 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%

Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume <=3" (0-101.6cm)	10–32%
Subsurface fragment volume >3" (0-101.6cm)	12–25%

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 detail.

Plant Community Narratives:
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 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 (1.1) within the Reference State would have been a sagebrush-dominated stand with mountain big sagebrush (*Artemisia tridentata* spp. vaseyana), mountain snowberry (*Symphoricarpos oreophilus*) and associated bunch grasses such as bluebunch wheatgrass (Pseudoroegeneria spicata), Nevada bluegrass (*Poa secunda*) and slender wheatgrass (*Elymus trachycaulus*). Forbs such as arrowleaf balsamroot (*Balsamorhiza sagittata*), sticky purple geranium (*Geranium viscosissimum*) and fleabane (Erigeron sp.) would be present. Fire is believed to be the dominant disturbance force in natural big sagebrush communities. The reference plant community (1.1) would have been relatively stable with occasional use by wildlife. Following a natural fire (1.1a) and depending on the severity, would have killed most if not all of the sagebrush favoring the sprouting shrubs and bunchgrasses (1.2). Over time and without any further disturbances (1.2a) sagebrush and other non-sprouting shrubs would slowly come back into the site (1.3), however the sprouting shrubs and bunch grasses would still dominate the site. If there were another fire to occur on the site (1.3a) the site would return to community phase 1.2. If community phase 1.3 continued to experience no disturbances over a longer period of time (1.3b) it would eventually show a co-dominance between mountain big sagebrush and the other shrubs on the site. 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 Phase 1.1 Mountain big sagebrush with perennial grasses and deciduous shrubs.
The least modified plant community within the Reference State would have been a mountain big sagebrush-dominated with associated deciduous shrubs such as mountain snowberry, antelope bitterbrush, serviceberry and associated perennial grasses such as bluebunch wheatgrass and slender wheatgrass. Arrowleaf balsamroot, sticky purple geranium and Erigeron sp. would have been the commonly associated forbs. Percent composition would have been 45 percent shrubs, 45 percent grasses and 15 percent forbs.

Community Pathway 1.1a
A naturally occurring fire would have killed all the non-sprouting shrubs like mountain big sagebrush. As the site recovered, it would be converted to the sprouting shrubs with perennial bunchgrasses community.

Community Phase 1.2 Sprouting shrubs with perennial bunch grasses.
Fire is a naturally occurring disturbance on this site and would have kept shrubs like mountain big sagebrush and antelope bitterbrush less dominant. Sprouting shrubs like mountain snowberry and serviceberry and perennial grasses would have become the dominant aspect of this site.

Community Pathway 1.2a Over time and without the occurrence of a natural disturbance, such as fire, non-sprouting shrubs like mountain big sagebrush, antelope bitterbrush and alderleaf mountain mahogany would become re-established on the site.

Community Phase 1.3 Non-sprouting shrubs start becoming re-established.
Non-sprouting shrubs start becoming re-established from seed over time. Sprouting shrubs and perennial grasses are still the dominant aspect of this site.

Community Pathway 1.3a In the event that there is another natural disturbance, like a fire, the site would return to the sprouting shrubs with perennial bunch grasses community.

Community Pathway 1.3b Over time and with the absence of a natural disturbance, like fire, the non-sprouting shrubs will continue becoming more abundant to a point where they are co-dominant with the sprouting shrubs.

T1a: Transition from State 1 to State 2 (Reference State to Current Potential/ Introduced Non-natives State)
The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with climate change, will cause State 1 to transition to State 2. A return pathway back to State 1 would be impracticable because of these issues.

State 2: Current Potential/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, which can be regarded as the current potential. The least modified plant community (2.1) within State 2 is a sagebrush (*Artemisia tridentata* spp. vaseyana) dominated state with mountain snowberry (*Symphoricarpos oreophilus*) and associated bunch grasses such as bluebunch wheatgrass (Pseudoroegeneria spicata), Nevada bluegrass (*Poa secunda*) and slender wheatgrass (*Elymus trachycaulus*). Forbs such as arrowleaf balsamroot (*Balsamorhiza sagittata*), sticky purple geranium (*Geranium viscosissimum*) and fleabane (Erigeron sp.) would be present. A common non-native

species in this state is cheatgrass. Fire is believed to be the dominant disturbance force in natural big sagebrush communities. Following brush management or fire (2.1a) and depending on the severity, would have killed most if not all of the sagebrush, and other non-sprouting shrubs, favoring the sprouting shrubs and bunchgrasses (2.2). This plant community is relatively stable under mixed use by wildlife and livestock. However, heavy utilization by bison, elk, horses, and domestic cattle on these sites during the growing season (2.1b) would deplete the grasses and deciduous shrubs creating site that is dominated by mountain big sagebrush (2.3). In community 2.2, when management, such as prescribed grazing, can be combined with time (2.2a) to allow the site to recover returning to community 2.1. However if the community continues to be over utilized by both wildlife and domestic livestock, and possibly in combination with a natural or man caused disturbance (2.2b) this community (2.2) can be degraded to community 2.4 which is dominated by rhizomatous grasses with unpalatable sprouting shrubs and forbs. In community 2.3 when management, such as prescribed grazing coupled with time, (2.3a) the sprouting shrubs and perennial grasses can have an opportunity to recover and recolonize the site and return to community 2.1. In community 2.3, when it experiences a disturbance such as brush management or fire, coupled with management like prescribed grazing (2.3b) it can drive the site to a more stable and diverse community 2.2. However, when community 2.3 continues to be over utilized and this is coupled with a disturbance such as brush management or fire (2.3c) it can drive the site to an undesirable community 2.4.

Community Phase 2.1: Mountain big sagebrush with perennial grasses and deciduous shrubs. Introduced annual species present.
The least modified community within the mountain big sagebrush/deciduous shrub/introduced state. This is a mountain big sagebrush dominated community with an abundance of deciduous shrubs such as mountain snowberry, antelope bitterbrush and serviceberry. Community is also characterized by an abundance of native perennial grasses such as, bluebunch wheatgrass, slender wheatgrass and Nevada bluegrass. Associated forbs on this site may consist of arrowleaf balsamroot, sticky purple geranium and erigeron sp. Introduced species likely to occur on this site are cheatgrass, annual forbs, milkweed and stickseed.

Community Pathway 2.1a This pathway is characterized by the implementation of brush management, prescribed or natural fire. This will reduce the abundance of non-sprouting shrubs giving the competitive advantage to sprouting shrubs and native perennial grasses (2.2).

Community Pathway 2.1b Heavy continuous grazing and browsing by wildlife and domestic animals would deplete resources of the deciduous shrubs and native perennial grasses (2.3).

Community Phase 2.2: Sprouting shrubs with perennial grasses with introduced annuals present.
This community represents what the site would look like following brush management or a

natural or prescribed fire. Depending on the severity of the fire/management practice, some or all of the non-sprouting shrubs would be killed. This would open up resources for the sprouting shrubs and native perennial grasses subsequently they would be the dominant aspect of the site.

Community Pathway 2.2a This pathway represents that over time and under normal climatic conditions, along with prescribed grazing, this community would return to the previous community (2.1).

Community Pathway 2.2b This pathway represents when the community experiences heavy continuous grazing and browsing by wildlife and domestic animals. Natural disturbances such as fire could also occur simultaneously in this pathway (2.4).

Community Phase 2.3: Depauperate sagebrush with conifers possibly present.
This community represents what the site would look like following a long period of over grazing and browsing. The more palatable species would be heavily utilized giving a competitive advantage to species such as mountain big sagebrush. Over time sagebrush would be the dominant aspect of the site with a low diversity of the other native species that normally occur on the site.

Community Pathway 2.3a This pathway represents that over time and under normal climatic conditions, along with prescribe grazing, this community would return to the previous community (2.1).

Community Pathway 2.3b This pathway represents that over time and under normal climatic conditions, along with prescribe grazing along with a natural or prescribed fire or brush management mountain big sagebrush/conifers would be killed. This would stimulate the sprouting shrubs and perennial native grasses moving the site to community 2.2.

Community Pathway 2.3c This pathway represents the occurrence when the site continues to be overgrazed and there is a disturbance like a fire. Non-sprouting shrubs and conifers, if present, would be killed. Deciduous shrubs and native perennial grasses are already at low diversity and stressed, giving the competitive advantage to rhizomatous grasses and unpalatable sprouting shrubs like rabbitbrush (2.4).

Community Phase 2.4: Rhizomatous grasses with unpalatable sprouting shrubs and forbs with low growing grasses.
This community represents the site when there has been continued overgrazing/browsing for an extended period of time, followed by a disturbance such as a brush management treatment or natural/prescribed fire. Species diversity was already low (2.3). The over utilization of the desirable native vegetation coupled with the fire has reduced the site to unpalatable sprouting shrubs and forbs along with low growing grasses.

Community Pathway 2.4a This pathway represents that over time, along with prescribed grazing that the sprouting shrubs and native perennial grasses would eventually re-

establish and return the site back to community 2.2.

T2a: Transition from State 2 to State 3 (Current Potential to Seeded State)
When land managers or landowners have made the decision that the herbaceous understory species are so depleted or undesirable, and the biological, hydrological and soil resources are at risk, introduced and native perennial grasses are utilized in a range seeding. This often occurs in combination with a natural/prescribed fire or other brush management treatment.

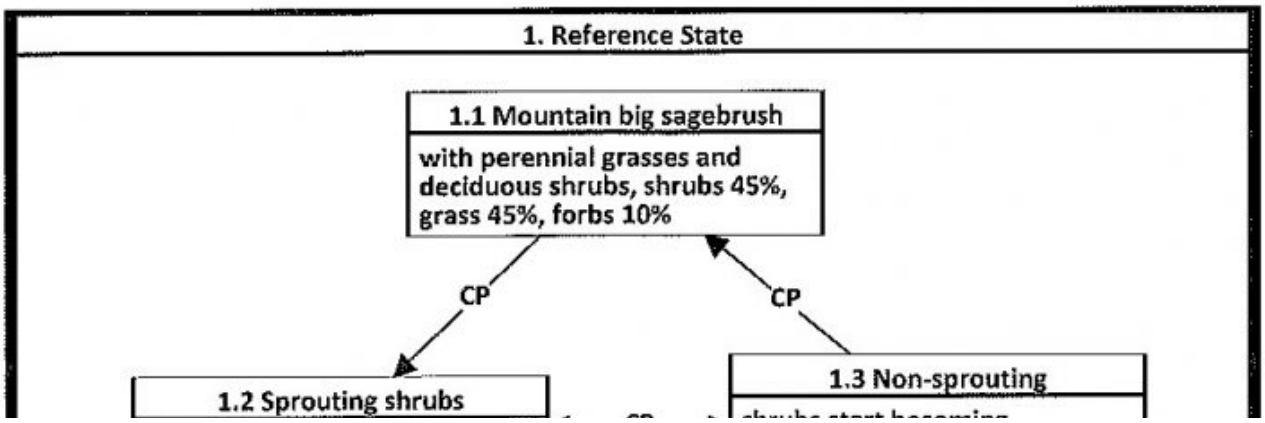
State 3: Seeded State:
This State occurs where historic excessive livestock grazing reduced canopy cover, and in an attempt to prevent any additional excessive erosion it was intentionally seeded with species such as smooth brome and/or crested wheatgrass. Do to the decreased canopy cover and increased erosion, and rangeland seeding is utilized, either rangeland drilled or aerial application with predominately introduced species.

Community Phase 3.1: Range seeding with perennial introduced species.
This community represents a time shortly following a brush management treatment/fire in addition to the range seeding. Non-sprouting shrubs have been greatly reduced and sprouting shrubs have not had adequate time to become re-established. Introduced and native grass species with a few sprouting shrubs dominate the site.

Community Pathway 3.1a Over an extended period of time and in combination with prescribed grazing, the native desirable sprouting shrubs begin to become well established.

Community Phase 3.2: Sprouting shrubs becoming co-dominant with perennial grasses.
This community phase represents the site over a 5 to 10 year period of time under normal climatic conditions. The desirable sprouting shrubs have had adequate time to reestablish and become co-dominant with the perennial grasses. Non-sprouting shrubs have also started to re-establish on the site as well. It is imperative that prescribed grazing must be implemented in order for this community to be persist.

State and transition model



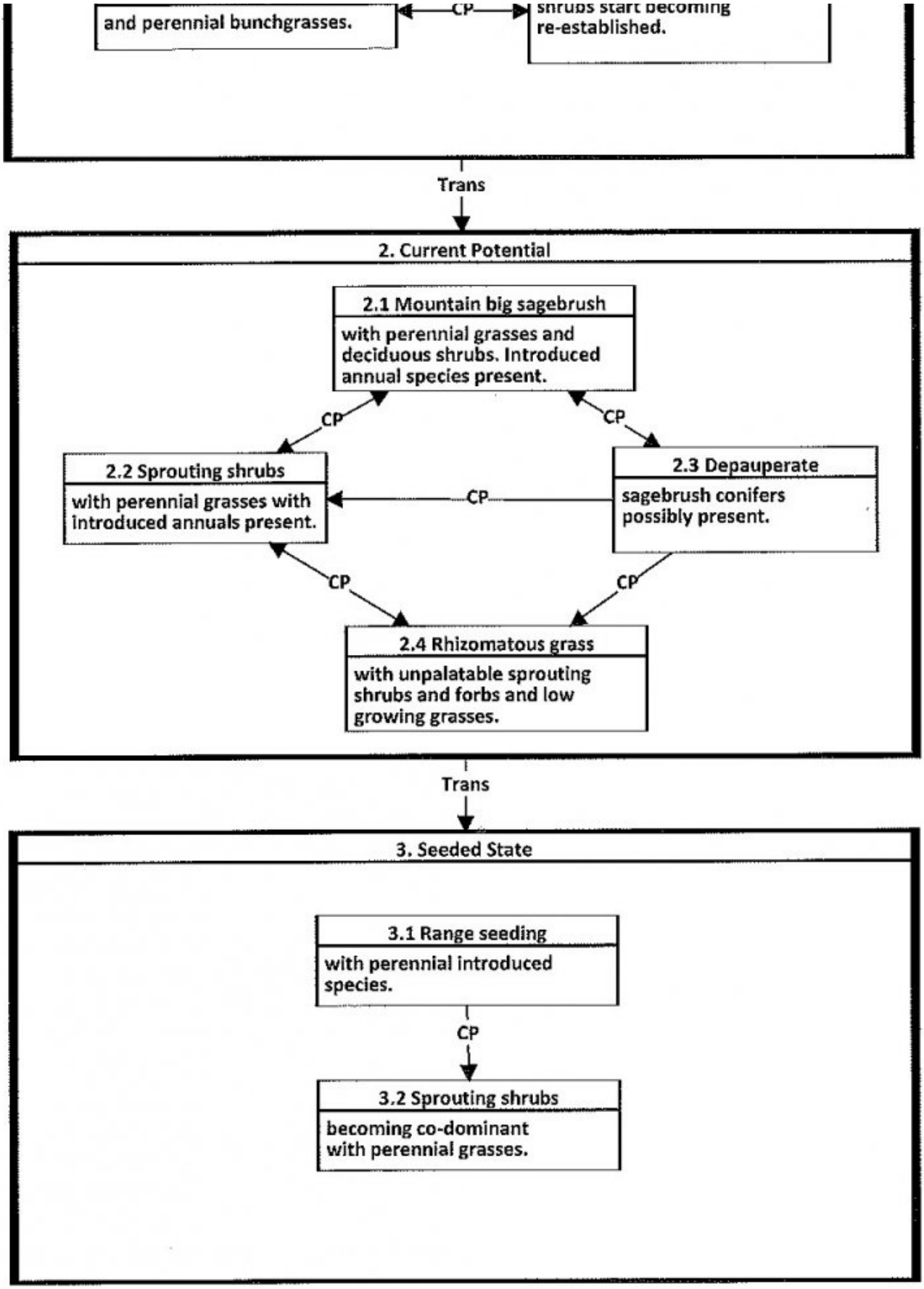

and perennial bunchgrasses.
CP
shrubs start becoming re-established.
Trans
2. Current Potential
2.1 Mountain big sagebrush
with perennial grasses and deciduous shrubs. Introduced annual species present.
CP
CP
2.2 Sprouting shrubs
with perennial grasses with introduced annuals present.
CP
2.3 Depauperate
sagebrush conifers possibly present.
CP
CP
2.4 Rhizomatous grass
with unpalatable sprouting shrubs and forbs and low growing grasses.
Trans
3. Seeded State
3.1 Range seeding
with perennial introduced species.
CP
3.2 Sprouting shrubs
becoming co-dominant with perennial grasses.

Diagram Legend

T 1-2	Introduced species.
T 2-3	Disturbance with range seeding.
CP 1.1-1.2	Natural disturbance such as fire.
CP 1.2-1.3	Time
CP 1.3-1.1	Time and lack of disturbance.
CP 1.3-1.2	Natural disturbance such as fire.
CP 2.1-2.2	Fire or brush management.
CP 2.1-2.3	Historic over grazing/browsing.
CP 2.2-2.1	Time and with prescribed grazing.
CP 2.2-2.4	Over grazing/browsing with a disturbance like fire.
CP 2.3-2.1	Time with prescribed grazing.
CP 2.3-2.2	Disturbance with prescribed grazing.
CP 2.3-2.4	Continued overgrazing and a disturbance like fire.
CP 2.4-2.2	Time with prescribed grazing.
CP 3.1-3.2	Time with prescribed grazing.

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

Dean Stacy

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.

Author(s)/participant(s)	
Contact for lead author	
Date	03/15/2026
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

   _____

2. **Presence of water flow patterns:**

   _____

3. **Number and height of erosional pedestals or terracettes:**

   _____

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

_____

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

_____

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

_____

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:**

_____

17. **Perennial plant reproductive capability:**

_____