

Ecological site R034AA207UT Semi-desert Shallow Loam (Black sagebrush)

Last updated: 9/07/2023
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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): 034A–Cool Central Desertic Basins and Plateaus

Major Land Resource Area (MLRA) 34A, Cool Central Desertic Basins and Plateaus, consists of approximately 21 million acres in Wyoming, Colorado and Utah, it consists of 11 Land Resource Units (LRU). These units are divisions of the MLRA based on geology, landscape, common soils, water resources and plant community potentials. The elevation spans from approximately 5600 feet (1700 m) along the Green River in UT and CO to approximately 9500 feet (2900 m) near Jeffrey City, WY. Annual precipitation ranges from 7 to 16 inches (177 to 406 mm), with the driest areas in the Green River and Great Divide Basins and the wettest areas in northern Carbon County, Southeast Fremont County and Albany County. There is a seasonal weather pattern that trends west to east, with more winter precipitation in the west and more spring/summer in the east, illustrated by diminishing amounts of Big Sagebrush in the eastern part of the MLRA.

LRU notes

The Bear River Valley LRU is located on the far western side of MLRA 34A between the Bear River Divide and the Monte Cristo Range, from Woodruff, Utah at the southern end to Cokeville, Wyoming at the northern end. The total area of the LRU is approximately 340,000 acres. It shares a boundary with MLRA 47, 43B and 46 (proposed). This LRU differs from the others in its geology, which is comprised mostly of alluvium and colluvium from the Stump Formation. Its weather patterns are such that the soil moisture is xeric, there is a slight peak in winter precipitation in this LRU, with typical yearly precipitation between 9 to 15 inches (230 to 380 mm). The soil temperature regime of this LRU is frigid with mean annual soil temperatures ranging from 44 to 48 degrees Fahrenheit (6.7 to 8.8°C). The elevation range is from 5700 to 7000 feet (1730 to 2130 m). The soils in the Bear River Valley are dominated by young aged very deep soils developed from sandstone and shale parent material re-worked with recent alluvium. Soils are dominated by Alfisols with young argillic horizons and by Fluvents in more recent alluvium. The Bear River runs through this LRU, allowing for ample amounts of irrigation water used in the lowland areas to produce hay. Smaller tributaries originating from the neighboring mountains.

Ecological site concept

- This site does not receive any additional water.
- These soils:
 - o are not saline or saline-sodic
 - o are shallow
 - o are skeletal within 20" of the soil surface; and have greater than 35 percent rock fragments in the soil subsurface
 - o are strongly or violently effervescent in the surface mineral layer (within top 10")
 - o have surface textures that usually range from silt loam to loam in surface mineral layer (4")
- have slopes less than 30 percent
- clay content is not greater than 35% in mineral soil surface layer (1-2")

Associated sites

R034AA205UT	Semi-desert Stony Loam (Black sagebrush)
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Similar sites

R034AY262WY	Shallow Loamy Foothills and Basins West (SwLy)
R034BY227UT	Semidesert Shallow Loam (Black Sagebrush)

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia nova</i>
Herbaceous	Not specified

Physiographic features

This site is located on foothills, valley sides, mountain sides, and ridges at elevations between 5,700 and 7,000 feet. It occurs on all aspects on slopes ranging from 3 to 50 percent. Runoff is medium to high and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Valley side (2) Mountain slope (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	5,700–7,000 ft
Slope	3–50%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by warm, dry summers and cold, snowy winters. This climate is modified by local topographic conditions. The mountains appreciably modify both the precipitation and temperature patterns. April, May, September, and October are the wettest months; December, January, February and July are the wettest.

Table 3. Representative climatic features

Frost-free period (average)	79 days
Freeze-free period (average)	112 days
Precipitation total (average)	13 in

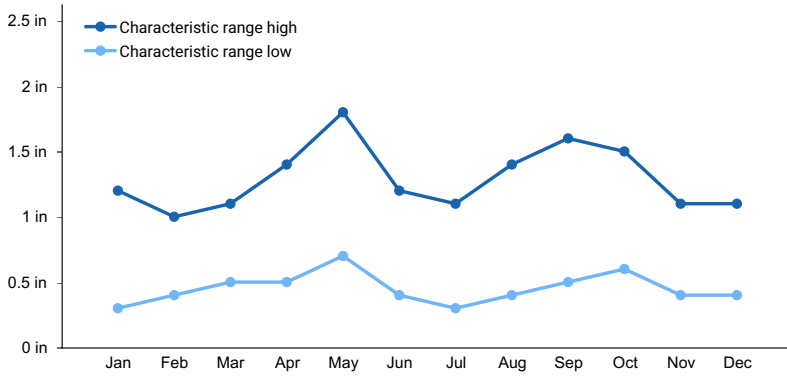


Figure 1. Monthly precipitation range

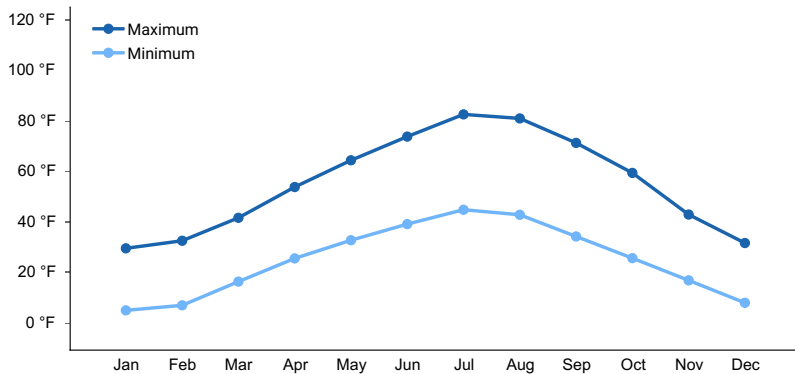


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

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

Soil features

These soils are shallow to very shallow and formed in residuum and colluvium derived primarily from limestone. Surface and subsurface textures are loams or silt loams and usually contain rock fragments. The subsurface can contain up to 90 percent rock fragments by volume. These soils are well- to somewhat excessively well-drained and have moderately slow to moderate permeability. Available water-holding capacity ranges from 1 to 3 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) Loam (2) Silt loam (3) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderate
Soil depth	5–20 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	1–3 in
Soil reaction (1:1 water) (0-40in)	7.4–9

Subsurface fragment volume <=3" (Depth not specified)	0–90%
Subsurface fragment volume >3" (Depth not specified)	0–15%

Ecological dynamics

It is impossible to determine in any quantitative detail the Reference Plant Community 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

R034AY207UT: Semi-desert Shallow Loam (Black Sagebrush)

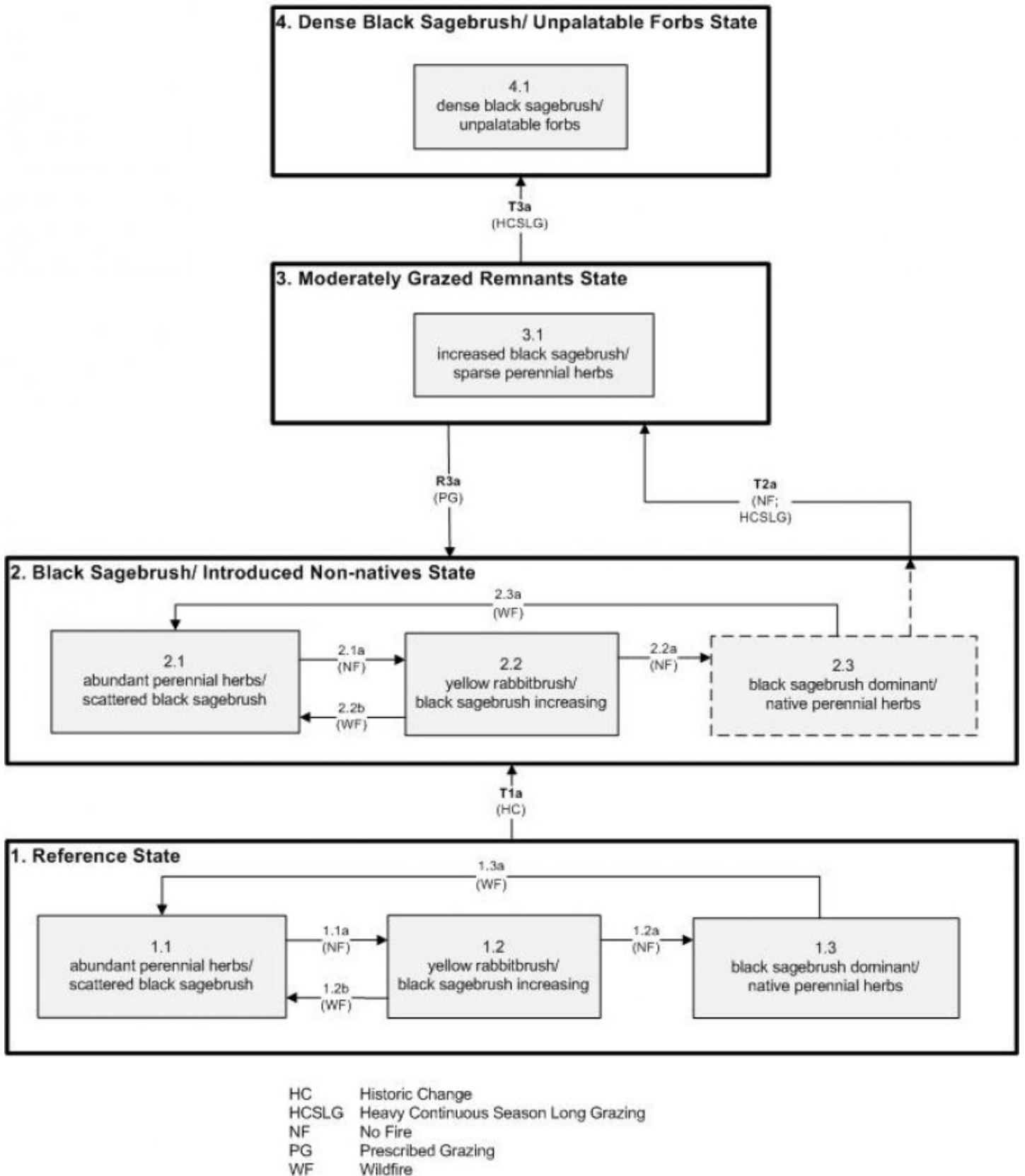


Figure 3. State and Transition Model

**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. Before Euro-American settlement, the Reference plant community (1.1) would have been characterized by scattered black sagebrush (*Artemisia nova*) and abundant perennial herbs. The major grasses would have included Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread (*Hesperostipa comata*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and Western wheatgrass (*Pascopyrum smithii*). Primary forbs would have included cushion buckwheat (*Eriogonum ovalifolium*), scarlet globemallow (*Sphaeralcea coccinea*), longleaf phlox (*Phlox longifolia*), and several possible species of milkvetch or locoweed (*Astragalus* spp). 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. The productivity would have been relatively lower than the similar, but stonier loam sites (e.g. R034AY2qqUT Semi-desert Stony Loam Ecological Site) because of the Inverse Texture Principle (Noy-Meir, 1973). In deserts and semi-deserts, finer textured soils are effectively drier and thus typically have lower production potential than coarser textured soils. The phases of this State would have depended on the time since last fire, starting with a perennial herb-dominated phase (1.1) immediately following fire (1.3a, 1.2b), with yellow rabbitbrush (*Chrysothamnus viscidiflorus*) becoming temporarily dominant (1.2) approximately 5 to 15 years post-fire (1.1a), and finally the re-establishment of black sagebrush (1.3) approximately 20 to 30 years post-fire (1.2a).

Community 1.1

Abundant perennial herbs/ scattered black sagebrush

Community Phase 1.1: abundant perennial herbs/ scattered black sagebrush This plant community would have been characterized by the temporary dominance of assorted native perennial bunchgrasses, primarily Indian ricegrass, but also including needle-and-thread, bluebunch wheatgrass, and Western wheatgrass, and a scattering of black sagebrush. Primary forbs would have included scarlet globemallow, longleaf phlox, and several species of milkvetch/locoweed. This community would have existed for approximately 1 to 5 years following the most recent fire event.

Community 1.2

Yellow rabbitbrush/ black sagebrush increasing

Community Phase 1.2: yellow rabbitbrush/ black sagebrush increasing This plant community would have existed approximately 5 to 20 years post-wildfire, and would have had yellow rabbitbrush as the dominant species, and a slight increase in black sagebrush.

Community 1.3

Black sagebrush dominant/ native perennial herbs

Community Phase 1.3: black sagebrush dominant/ native perennial herbs The balance between black sagebrush, native perennial forbs (primarily locoweeds/milkvetches and longleaf phlox), and grasses would have returned following at least a 40 year period since the last wildfire.

Pathway CP 1.1A

Community 1.1 to 1.2

Community Pathway 1.1a: As time increased since the last wildfire, yellow rabbitbrush and black sagebrush would have increased.

Pathway CP 1.2B

Community 1.2 to 1.1

Community Pathway 1.2b: Wildfire would have reset the successional clock back to a graminoid dominated site, temporarily removing most of the shrubs.

Pathway CP 1.2A

Community 1.2 to 1.3

Community Pathway 1.2a: As length of time increased since the last wildfire, (i.e. greater than 30 years) the

balance between black sagebrush and the native perennial understory would have slowly returned.

Pathway CP 1.3A

Community 1.3 to 1.1

Community Pathway 1.3a Wildfire would have reset the successional clock back to a graminoid dominated site, removing the majority of the sagebrush and allowing the native perennial bunchgrasses to increase and be temporarily dominant.

State 2

Black 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. State 2 is a description of the ecological site immediately following Euro-American settlement, and is considered the current potential for this site. The phases of this State vary between a native bunchgrass dominated phase (2.1), to a yellow rabbitbrush/ black sagebrush invaded phase (2.2), to a black sagebrush with native perennial understory phase (2.3), which develop according to the time since last wildfire (2.3a or 2.2b, 2.1a, 2.2a, respectively). The resiliency of this state is maintained by the availability of native seed sources for both the herbaceous species and for black sagebrush, and by wildfire. The resiliency of this State can be negatively impacted by heavy livestock and big game grazing.

Community 2.1

Black Sagebrush/ Introduced Non-natives State

Community Phase 2.1: abundant perennial herbs/ scattered black sagebrush This plant community is characterized by the temporary dominance of assorted native perennial bunchgrasses, primarily Indian ricegrass, along with needle-and-thread, and a scattering of black sagebrush. Common forb species include locoweeds/milkvetches, longleaf phlox, and scarlet globemallow. A small component of introduced species will also be present. This community is typically found to occur within the first 1 to 5 years following wildfire.

Community 2.2

Yellow rabbitbrush/ black sagebrush increasing

Community Phase 2.2: yellow rabbitbrush/ black sagebrush increasing This plant community is typical approximately 20 to 30 years post-wildfire, where yellow rabbitbrush will be the current dominant species, and a slight increase in black sagebrush.

Community 2.3

Black sagebrush dominant/ native perennial herbs

Community Phase 2.3: black sagebrush dominant/ native perennial herbs The balance between black sagebrush and the native perennial herbs will return following at least a 30 year period since the last wildfire. A small component of introduced species will also be present.

Pathway CP 2.1A

Community 2.1 to 2.2

Community Pathway 2.1a: As time increases since the last wildfire, yellow rabbitbrush and black sagebrush will increase.

Pathway CP 2.2B

Community 2.2 to 2.1

Community Pathway 2.2b: Wildfire will reset the successional clock back to a graminoid dominated site, temporarily removing most of shrubs.

Pathway CP 2.2A

Community 2.2 to 2.3

Community Pathway 2.2a: After approximately 20 to 30 years since the last wildfire, a balance between black sagebrush and the native perennial herbs will return.

Pathway CP 2.3A

Community 2.3 to 2.1

Community Pathway 2.3a Wildfire will reset the successional clock back to a graminoid dominated phase, removing the majority of the sagebrush and allowing the native perennial bunchgrass to increase and be temporarily dominant.

State 3

Moderately Grazed Remnants State

A prolonged absence of fire and continuous heavy grazing during the growing season will moderately reduce the perennial herbaceous understory, allowing black sagebrush to increase (3.1). Employing more conservative grazing practices by avoiding the growing season of the herbaceous component (R3a), may help to restore this plant community back the Black Sagebrush/ Introduced Non-natives State. Increases in grazing, especially during the spring growth period, will reduce the resiliency of this State.

Community 3.1

Moderately Grazed Remnants State

Community Phase 3.1: increased black sagebrush/ sparse perennial herbs This plant community will have a greater abundance of black sagebrush with a sparse understory of perennial herbs.

State 4

Dense Black Sagebrush/ Unpalatable Forbs State

Black sagebrush and unpalatable forbs such as granite prickly phlox (*Linanthus pungens*) and/or poisonous locoweed/milkvetch species (4.1) will increase on sites where heavy continuous season-long grazing has taken place. The resiliency of this State can be maintained through a reduction in livestock grazing; increases in livestock grazing will reduce the resiliency of this State. Mechanical and chemical treatments are not recommended at these sites because the low responses by native perennial herbs after reseeding make them economically inadvisable. Additionally, these soils are too shallow for successful conversion to crested wheatgrass.

Community 4.1

Dense black sagebrush/ unpalatable perennial herbs

Community Phase 4.1: dense black sagebrush/ unpalatable perennial herbs Black sagebrush and unpalatable forbs will increase following heavy continuous season-long grazing by cattle during the growing season.

Transition T1A

State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Black Sagebrush/ 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, have 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

Transition T2a: from State 2 to State 3 (Black Sagebrush/ Introduced Non-natives State to Moderately Grazed Remnants State) The Black Sagebrush/ Introduced Non-natives State will transition to the Moderately Grazed

Remnants State when fire return intervals are 3 to 4 decades long and/or when continuous spring grazing is allowed. This will result in black sagebrush beginning to dominate the site at the expense of the associated perennial herbs. The approach of this transition is indicated by an increase in black sagebrush and native perennial forbs.

Restoration pathway R3A State 3 to 2

Restoration Pathway R3a: from State 3 to State 2 (Moderately Grazed Remnants State to Black Sagebrush/ Introduced Non-natives State) Restoration back to the Black Sagebrush/ Introduced Non-natives State is possible when more conservative grazing practices are used such as by avoiding the growing season of the understory component.

Transition T3A State 3 to 4

Transition T3a: from State 3 to State 4 (Moderately Grazed Remnants State to Dense Black Sagebrush/ Unpalatable Forbs State) The Moderately Grazed Remnants State will transition to the Dense Black Sagebrush/ Unpalatable Forbs State following heavy continuous season-long grazing. This transition is indicated by increases in size, density, and cover of black sagebrush, and an increase in the proportion of unpalatable forbs. Heavy livestock grazing, especially during the spring growth period, will trigger this transition.

Additional community tables

Animal community

The suitability for livestock grazing is fair to good. This site provides grazing for cattle and sheep year-round, although prolonged heavy spring use will result in loss of native perennial herbs and expansion of unpalatable shrubs and exotics.

Recreational uses

Recreation activities include hunting, horseback riding, ATV riding, birdwatching, etc.

Wood products

There are no wood products from this site unless there is Utah juniper invasion onto the site. With this event you will be able to harvest cedar posts and firewood.

Inventory data references

Data gathered by qualified range professionals within NRCS and cooperating partners.

Other references

Galatowitsch, S.M. 1990. Using the original land survey notes to reconstruct pre-settlement landscapes in the American West. *Great Basin Naturalist*: 50(2): 181-191. Keywords: [Western U.S., conservation, history, human impact]

Noy-Meir I. 1973. Desert ecosystem: environment and producers. *Annual review of ecology and systematics*: 4: 25–51.

Parson, R. E. 1996. *A History of Rich County*. Utah State Historical Society, County Commission, Rich County, Utah. Keywords: [Rich County, Utah, Historic land use, European settlements]

USDA-NRCS. 2003. *National Range and Pasture Handbook*. in USDA, editor, USDA-Natural Resources Conservation Service-Grazing Lands Technology Institute. Keywords: [Western US, Federal guidelines, Range pasture management]

Contributors

USU

Approval

Kirt Walstad, 9/07/2023

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	04/25/2024
Approved by	Kirt Walstad
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:**
