Ecological site R034AA215UT
Semi-desert Dense Clay (Low and/ or Early sagebrush/ Rhizomatous wheatgrass)

Last updated: 9/07/2023
Accessed: 05/10/2025

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.

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 moderately deep to deep
o are not skeletal within 20” of the soil surface; and have less than 35 percent rock fragments in the soil subsurface
o are not strongly or violently effervescent in the surface mineral layer (within top 10”)
o have surface textures that usually range from silty clay to clay in surface mineral layer (4”)
• have slopes less than 30 percent
• clay content is greater than 35% in mineral soil surface layer (1-2”)

Associated sites

R034AA210UT	**Semi-desert Shallow Clay (Early sagebrush)**

Similar sites

R034AY158WY	**Shallow Clayey Green River and Great Divide Basins (SwCy)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula* (2) *Artemisia spiciformis*
Herbaceous	(1) *Pascopyrum smithii*

Physiographic features

This site occurs on stream terraces, alluvial fans, and gentle hills at elevations between 5,700 and 7,000 feet. It is found on all aspects and has slopes ranging from 2 to 15 percent. The water table is greater than 60 inches below the soil surface and runoff is medium. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Alluvial fan (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	5,700–7,000 ft
Slope	2–15%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

The climate 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 driest.

Table 3. Representative climatic features

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

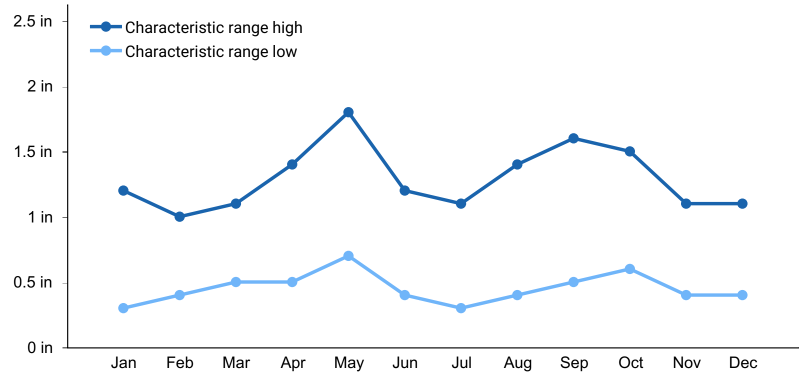


Figure 1. Monthly precipitation range

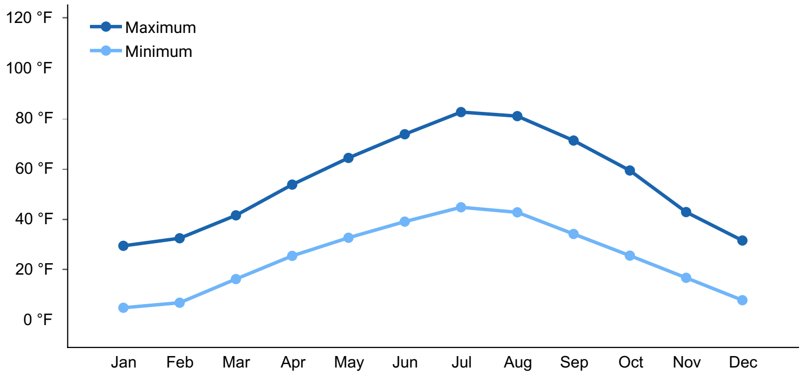


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site are moderately deep to deep and formed in alluvium derived from siltstone, shale, limestone, and conglomerate. These stream deposits have clay or silty clay textures. They are well-drained with slow permeability. Rock fragments may occur on the soil surface or throughout the profile but do not exceed 15 percent of the soil volume. The available water holding capacity ranges from 10 to 11 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

Parent material	(1) Alluvium–metamorphic and sedimentary rock
Surface texture	(1) Clay (2) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%

Available water capacity (0-40in)	10–11 in
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
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 followed, largely replacing the cattle as the proportion of browse increased.

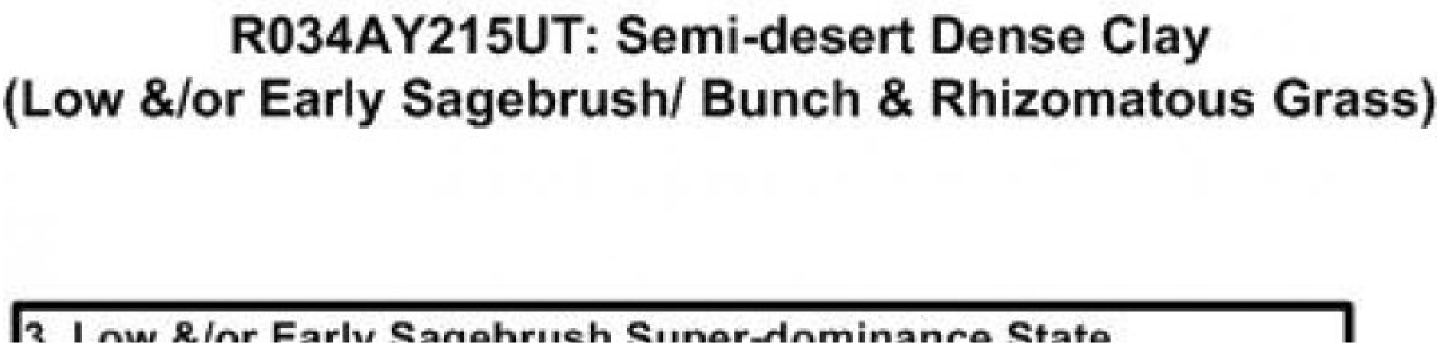
Below is a State and Transition Model diagram that illustrates the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas 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, 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



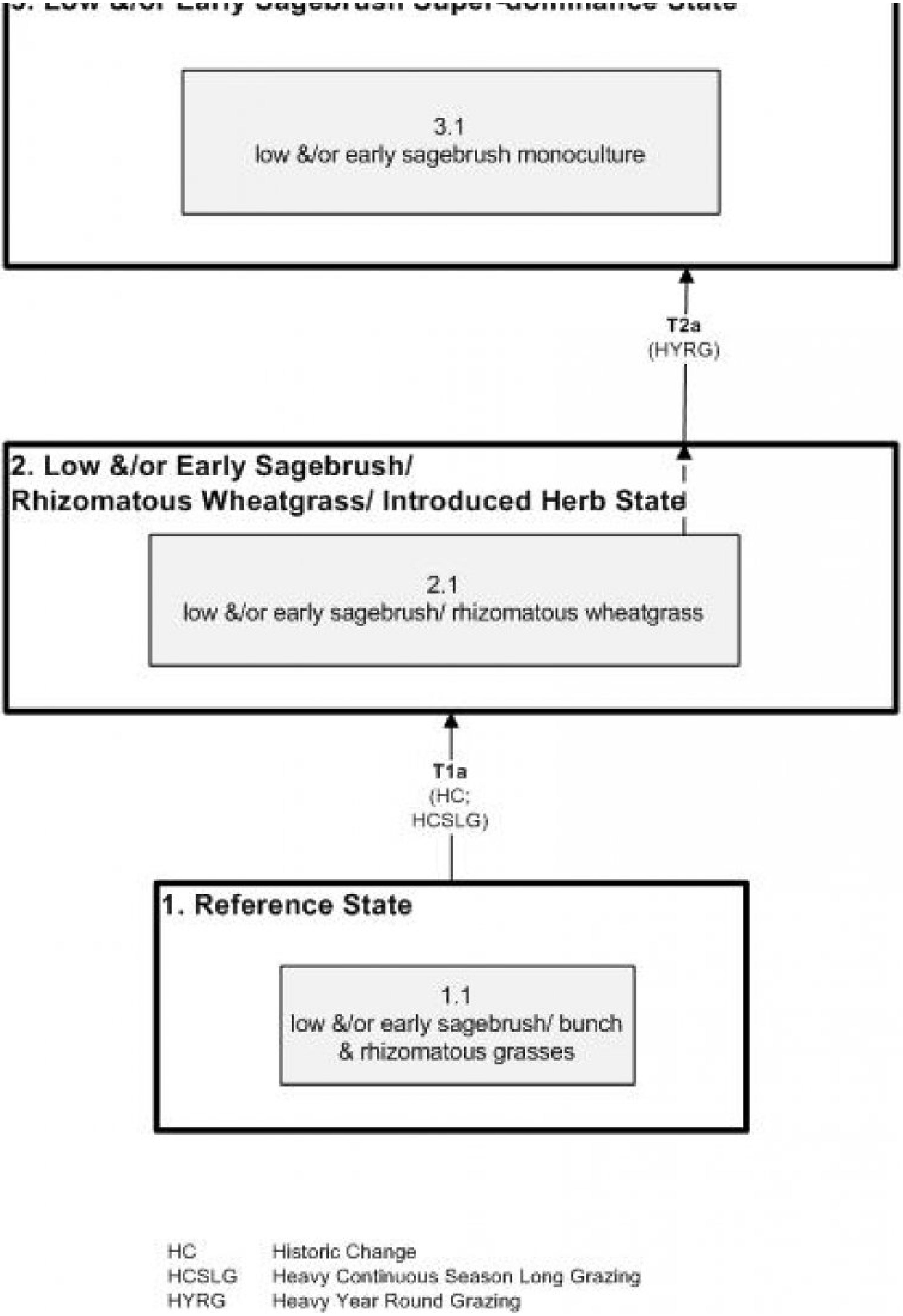


Figure 3. State and Transition Model

State 1

Reference State

The Reference State is a description of this ecological site prior to Euro-American settlement but 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 Reference State for this site would have been a sagebrush dominated semi-desert state, where low sagebrush (*Artemisia arbuscula* ssp. arbuscula) would have been dominant on upper slopes, especially windswept tops of slopes with shallower profiles, and early sagebrush (*Artemisia arbuscula* ssp. longiloba) would have been dominant on lower slopes with deeper clay soils. Minor amounts of bud sagebrush (*Picrothamnus desertorum*) would have been a likely companion in both circumstances. Mixtures of these three sagebrushes occurred in between. The entire ecological site was characterized by dense clay derived from alluviation of Mesozoic age rock. Soils on this site crack deeply with drought, which tends to disfavor shrubs and favor fibrous grass roots. The balance between bunchgrasses and rhizomatous grasses also would have varied with slope position and soil depth, where bunchgrasses would have been found on steeper, shallower sites, while rhizomatous grasses would have been found on deeper soils of lower slopes (Noy-Meir, 1973). 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 &/or Early Sagebrush/ Bunch & Rhizomatous Grasses

Community Phase 1.1: Low &/or Early Sagebrush/ Bunch & Rhizomatous Grasses This plant community (1.1) would have been characterized by low sagebrush with an understory of cool season bunchgrasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*) and squirrel tail (*Elymus elymoides*) on steeper, shallower sites. Early sagebrush would have occurred with an understory of warm season rhizomatous grasses such as western wheatgrass (*Pascopyrum smithii*) on lower slopes with deeper soils. A mixture of these species would have occurred on in-between sites.

State 2
Low &/or Early Sagebrush/ Rhizomatous Wheatgrass/ Introduced Herb 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. Herbs in this state have a later phenology. State 2 is a description of the ecological site shortly following Euro-American settlement, and is characterized by a denser sagebrush stand with a warm season herbaceous understory.

Community 2.1
Low &/or Early sagebrush/ Rhizomatous Wheatgrass

Community Phase 2.1: Low &/or Early sagebrush/ Rhizomatous Wheatgrass This plant community (2.1) is characterized by a dense stand of low or early sagebrush with a predominately rhizomatous wheatgrass understory. A small component of introduced non-native species, such as cheatgrass (*Bromus tectorum*) may also be present. This state maintains resiliency (negative feedback) by having ground cover provided by both grasses and leaf litter, which help maintain soil stability and water retention. Reduction of soil stability and water retention results in a more xeric state. A reduction of resiliency (positive feedbacks) occurs when perennial grass cover is reduced, thus putting the state at-risk of further degradation resulting in lack of soil stabilization and reduced soil moisture retention. This can be partially reversed with release from heavy grazing pressure.

State 3
Low &/or Early Sagebrush Super-dominance State

Heavy year-round grazing, mainly by sheep, resulted in a super-dominance of low or early sagebrush. The herbaceous understory was effectively nonexistent. The effective aridity of the Semi-desert Dense Clay ecological site makes it a poor prospect for management toward greater forage productivity. Furthermore, accelerated soil erosion from tillage could create problems further down the watershed. We suggest trials of small scale manipulations that are monitored closely for observation of biological responses and soil erosion.

Community 3.1

Low &/or Early Sagebrush Monoculture

Community Phase 3.1: Low &/or Early Sagebrush Monoculture This plant community is characterized by a super-dominance of low and/or early sagebrush. The stability of this state is maintained by the absence of perennial grass seed source, and soil loss which prevents the re-establishment of an understory component.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Low &/or Early Sagebrush/ Rhizomatous Wheatgrass/ Introduced Herb State) The simultaneous introduction of exotic species, both plants and animals, and extinctions of native flora and fauna, along with climate change, causes State 1 to transition to State 2, which is the current potential. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical. Livestock grazers typically favored spring grazing, and with the diminution of the cool season grasses, the next best use of green forage occurred later in the growing season. As a result, after heavy spring livestock grazing, bunchgrasses could not compete with the rhizomatous species and shrubs.

Transition T2A
State 2 to 3

Transition T2a: from State 2 to State 3 (Low &/or Early Sagebrush/ Rhizomatous Wheatgrass/ Introduced Herb State to Sagebrush Super-dominance State) Expansion to year-around use (T2), especially with use of itinerant sheep will lead to reduction of the rhizomatous wheatgrasses and sagebrush super-dominance (State 3). The approach to this transition is indicated by a loss of perennial grass understory, an increase in shrub component relative to grasses, and soil loss. Sustained heavy grazing during the growing season will trigger the transition. A restoration pathway is impracticable due to lack of grass seed source and soil loss.

Additional community tables

Animal community

The suitability for livestock grazing is fair to good. This site provides grazing for cattle and sheep year-round, however prolonged heavy spring grazing leads to loss of perennial grasses and increases unpalatable shrubs and exotics.

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	05/10/2025
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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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):**

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

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

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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):**

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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:

    Sub-dominant:

    Other:

    Additional:

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

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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):**

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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:**

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17. **Perennial plant reproductive capability:**
