USDA Natural Resources
Conservation Service

Ecological site R034AA248UT
Semi-desert Sand (Indian ricegrass/ Needle and thread)

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 receive any additional water.
• These soils:
o are not saline or saline-sodic
o are moderately deep to very deep
o are not skeletal within 20” of the soil surface; and have less than 35 percent rock fragments at the soil surface
o are not strongly or violently effervescent in the surface mineral layer (within top 10”)
o have surface textures that usually range from loamy sand to sandy loam in surface mineral layer (4”)
• have slopes greater than 30 percent
• clay content is not greater than 35% in mineral soil surface layer (1-2”)

Associated sites

R034AA240UT	**Semi-desert Shallowbreaks (Bluebunch wheatgrass/ Utah juniper)**

Similar sites

R034AY122WY	**Loamy Green River and Great Divide Basins (Ly)**
R034AY146WY	**Sands Green River and Great Divide Basins (Sa)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Stipa hymenoides* (2) *Hesperostipa comata*

Physiographic features

This site is located on gently rolling uplands between 5,700 and 7,000 feet in elevation. It can occur on all aspects. Slopes range from 6 to 15 percent. Runoff is medium and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,737–2,134 m
Slope	6–15%
Water table depth	152 cm
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)	330 mm

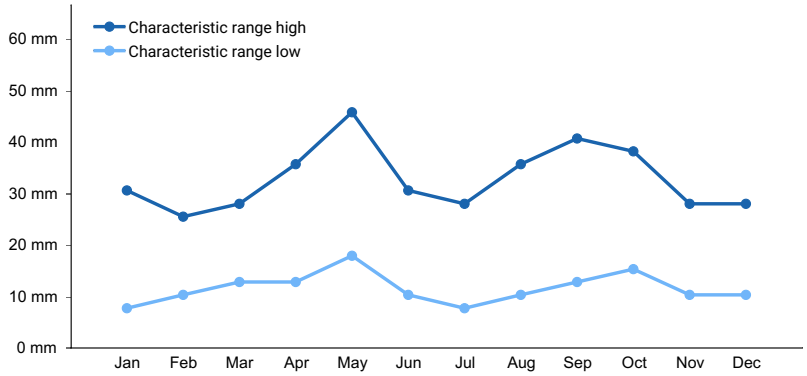


Figure 1. Monthly precipitation range

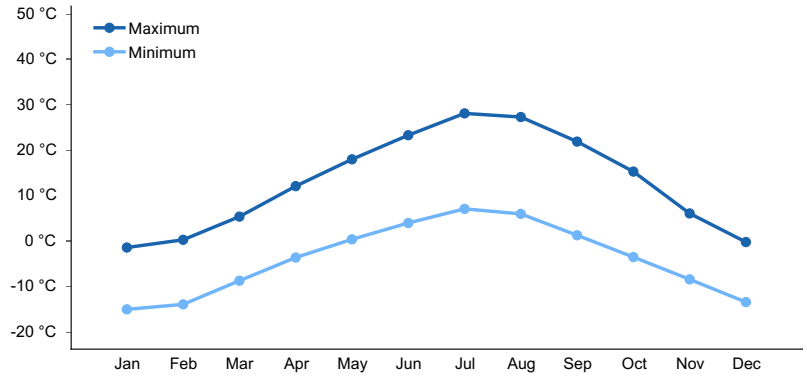


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

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 residuum and colluvium derived from sandstone, quartzite, limestone, siltstone, and conglomerate. Surface and subsurface textures are sandy loams or loamy sands. Rock fragments do not exceed 15 percent of the soil volume. These soils are well-drained with moderate permeability. Available water-holding capacity is 3 to 5 inches 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) Colluvium–metamorphic and sedimentary rock (2) Residuum–metamorphic and sedimentary rock
Surface texture	(1) Sandy loam (2) Loamy sand
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	51–152 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%

Available water capacity (0-101.6cm)	7.62–12.7 cm
Soil reaction (1:1 water) (0-101.6cm)	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 flocks followed as the proportion of browse increased.

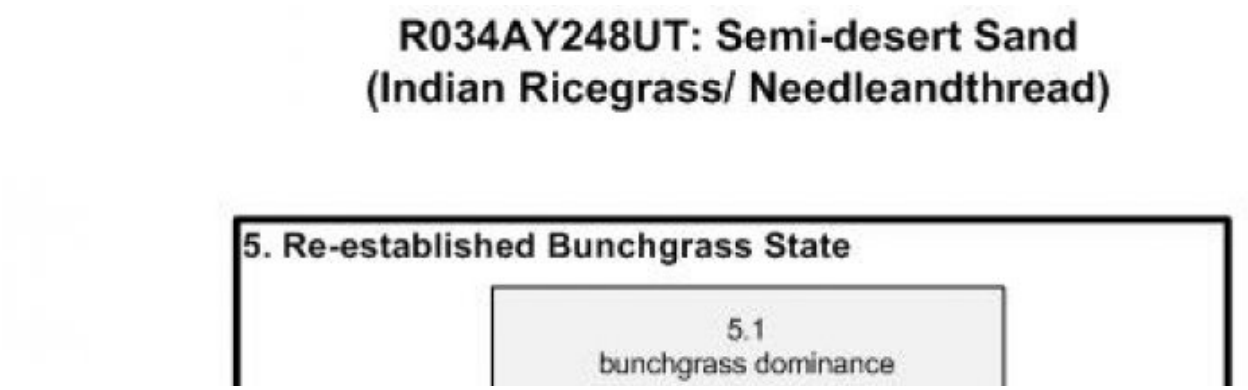
Below is a State and Transition Model diagram that illustrates the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas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

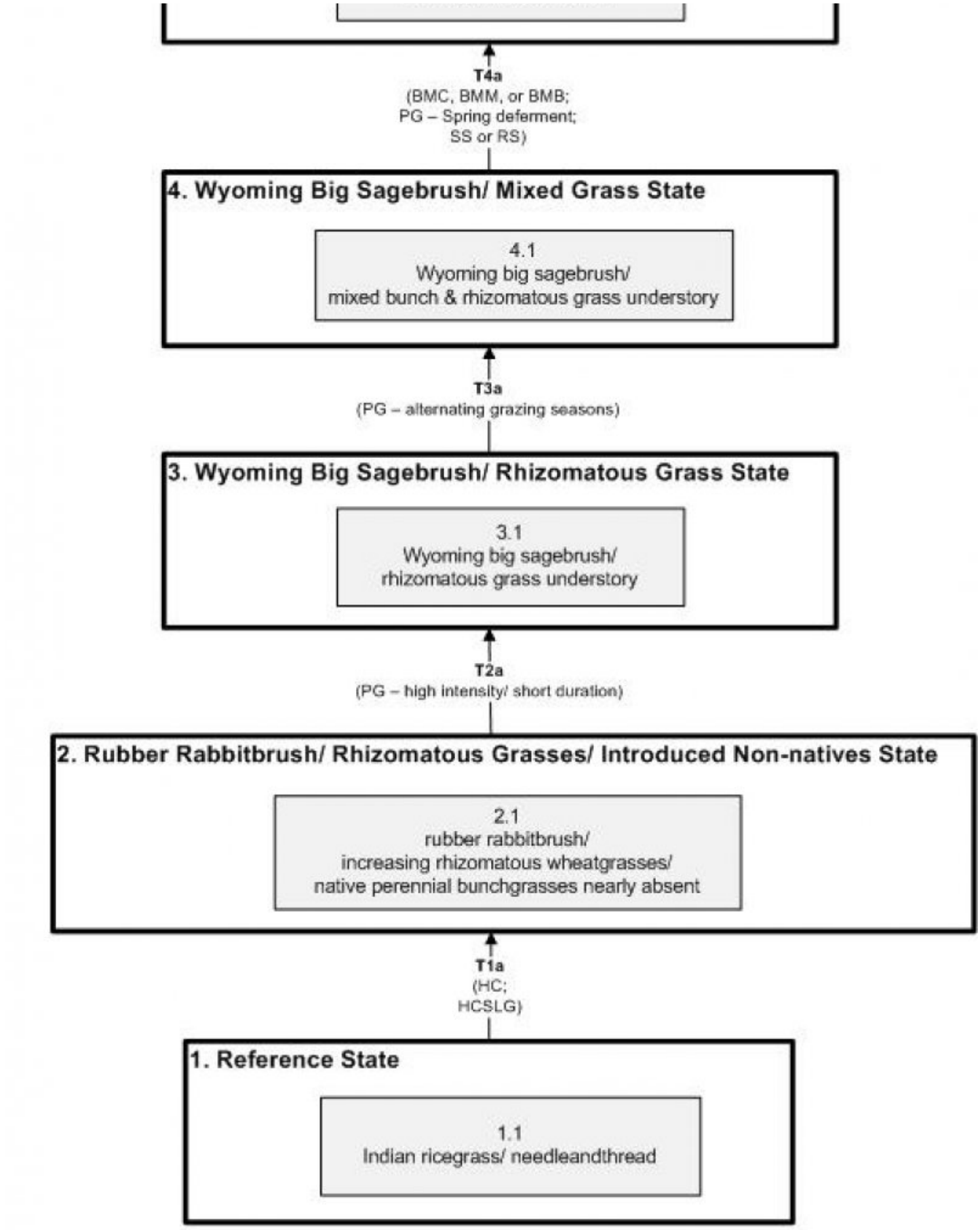
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the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





BMB	Bush Management (biological)	HCSLG	Heavy Continuous Season Long Grazing
BMC	Brush Management (chemical)	PG	Prescribed Grazing
BMM	Brush Management (mechanical)	RS	Re-seed
HC	Historic Change	SS	Seed Source

Figure 3. State and Transition Model

State 1
Reference State

The Reference State is a description of this ecological site immediately 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. Prior to the coming of European livestock in the 1840s, an Indian ricegrass (*Achnatherum hymenoides*) and needle and thread (*Hesperostipa comata*) dominated community (1.1) probably occurred in southern Rich County where sands were blown in from adjacent pluvial plains of Ice Age streams flowing from the western Uinta Mountains. 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
Indian ricegrass/ Needle and thread

Community Phase 1.1: Indian ricegrass/ Needle and thread This plant community would have been characterized by primarily Indian ricegrass and needle and thread bunchgrasses.

State 2
Rubber Rabbitbrush/ Rhizomatous Grasses/ Introduced Non-natives State

State 2 is a description of the ecological site shortly following Euro-American settlement, and is considered the current potential for this site. This was once a grassland where native perennial bunchgrasses were nearly grazed out due to the heavy sustained use from trail-connected livestock beginning in the early 1840s. Shrubs and grasses more tolerant of these impacts proliferated. Subsequently rubber rabbitbrush and slender wheatgrass grew to dominate the site, while what native perennial bunchgrasses remained were extremely scarce (2.1). A small component of non-native species, such as cheatgrass (*Bromus tectorum*) and bulbous bluegrass (*Poa bulbosa*), have now been introduced to these sites. Continued heavy livestock grazing reduces state resiliency. Alternatively, reducing livestock use will maintain state resiliency.

Community 2.1
Rubber Rabbitbrush/ Increasing Rhizomatous Wheatgrasses/ Native Perennial Bunchgrasses Nearly Absent

Community Phase 2.1: Rubber Rabbitbrush/ Increasing Rhizomatous Wheatgrasses/ Native Perennial Bunchgrasses Nearly Absent This plant community is dominated rubber rabbitbrush with a slender wheatgrass understory. Indian ricegrass and needle and thread are only a minor component or absent, and a small component of non-native annual grasses may be present.

State 3
Wyoming Big Sagebrush/ Rhizomatous Grass State

This is a brush dominated community with an understory of mostly grazing-tolerant rhizomatous grasses such as slender wheatgrass. Continued heavy livestock grazing will reduce state resiliency, while reduction of livestock grazing maintains state resiliency.

Community 3.1
Wyoming Big sagebrush/ Rhizomatous grass understory

Community Phase 3.1: Wyoming Big sagebrush/ Rhizomatous grass understory This community is characterized by Wyoming big sagebrush with a rhizomatous grass understory, composed primarily of slender wheatgrass.

State 4
Wyoming Big Sagebrush/ Mixed Grass State

This state is dominated by Wyoming big sagebrush with mix of caespitose and rhizomatous grasses (e.g. slender wheatgrass, Indian ricegrass, and needle and thread) and less palatable forbs deathcamas (Zigadenus spp.).

Community 4.1
Wyoming Big sagebrush/ Mixed bunch & rhizomatous grass understory

Community Phase 4.1: Wyoming Big sagebrush/ Mixed bunch & rhizomatous grass understory Wyoming big sagebrush dominated with mix of caespitose and rhizomatous grasses and forbs.

State 5
Re-established Bunchgrass State

This re-established bunchgrass-dominated state will have relatively lower species richness and productivity than the grasslands that existed previously on these sites. However, the primary species of Indian ricegrass, needleandthread, and bottlebrush squirreltail will likely be present provided the necessary seed source and no accelerated soil erosion has taken place. Additionally, the inevitable occurrence of a few exotic species and loss of the native perennial forbs will prevent a restoration to pre-settlement conditions. Continued high intensity, short duration grazing rotated between seasons maintains state resiliency of this state. A return to heavy growing season use every year will reduce state resiliency.

Community 5.1
Bunchgrass dominance

Community Phase 5.1: Bunchgrass dominance This is a return to a proxy of the grassland of the reference state, although it will differ in its species composition, and productivity will be lower because of reduction in soil nutrient pools.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Rubber Rabbitbrush/ Rhizomatous Grasses/ 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, causes State 1 to transition to State 2. Additionally, these sites were particularly favored by trail-connected livestock from the early 1840s onward. Thus, by the time of the GLO survey and through Stoddart's (1940) evaluation, much of the native perennial bunchgrasses were lost. Sites were quickly invaded by rubber rabbitbrush (*Ericameria nauseosa*) and the more grazing tolerant rhizomatous grasses, such as slender wheatgrass (*Elymus trachycaulus*). Reversal of these 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 (Rubber Rabbitbrush/ Rhizomatous Grasses/ Introduced Non-natives State to Wyoming Big Sagebrush/ Rhizomatous Grass State) With further diminishment of grazing pressure and a switch from season-long to high intensity short duration grazing from the 1970s onward, much of the rubber rabbitbrush has been replaced by Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis). A key indicator of the approach to this transition is the change in species composition. A reduction in lengths of time over which livestock grazing takes place will trigger the transition.

Transition T3A
State 3 to 4

Transition T3a: from State 3 to State 4 (Wyoming Big Sagebrush/ Rhizomatous Grass State to Wyoming Big Sagebrush/ Mixed Grass State) With grazing use currently alternating between seasons, and high intensity/ short duration grazing patterns, we can expect some recovery of the bunchgrasses. However, decades of season-long sheep use greatly diminished the native perennial forbs that were previously present. A key indicator of the approach to transition is an increase in bunchgrass cover. A diminishment of heavy growing-season utilization will trigger the transition. Continued heavy growing-season livestock utilization of grasses will reduce state resiliency. Reduction of growing-season utilization of bunchgrass will maintain state resiliency.

Transition T4A
State 4 to 5

Transition T4a: from State 4 to State 5 (Wyoming Big Sagebrush/ Mixed Grass State to Re-established Bunchgrass State) With mechanical, chemical, or biological (e.g. sheep use in fall season) shrub control of the sagebrush, followed by grazing deferment during the spring growth period of the bunch grasses, and provided adequate seed source, it might be possible to bring back the bunchgrasses, such as Indian ricegrass and needle and thread, to eventually dominate again. A key indicator of the approach to this transition is a change in species composition. Changes in the intensity and seasons of livestock use 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 during the spring, summer, and fall.

Recreational uses

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

Wood products

None.

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]

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]

Stoddart, 1940. Range Resources of Rich County, Utah. Bulletin 291, Agricultural Experiment Station, Utah State University, Logan, Utah. Keywords: [Rich County, Utah, rangeland resources, historical ecology]

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

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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	05/18/2024
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):

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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:**
