USDA Natural Resources Conservation Service

Ecological site R034AA237UT
Semi-desert Loamy Run-on (Basin big sagebrush/ Mixed bunchgrass)

Last updated: 9/07/2023
Accessed: 05/04/2024

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 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 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

R034AA220UT	**Semi-desert Loam (Wyoming big sagebrush/ Bluebunch wheatgrass)**

Similar sites

R034AY230WY	**Overflow Foothills and Basins West (Ov)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. tridentata*
Herbaceous	(1) *Leymus cinereus* (2) *Pseudoroegneria spicata*

Physiographic features

This site occurs on toe slopes, alluvial fans and stream terraces at elevations between 5,700 and 7,000 feet. It occurs on all aspects and on slopes ranging from 1 to 10 percent. Runoff is low to medium and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	5,700–7,000 ft
Slope	1–10%
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

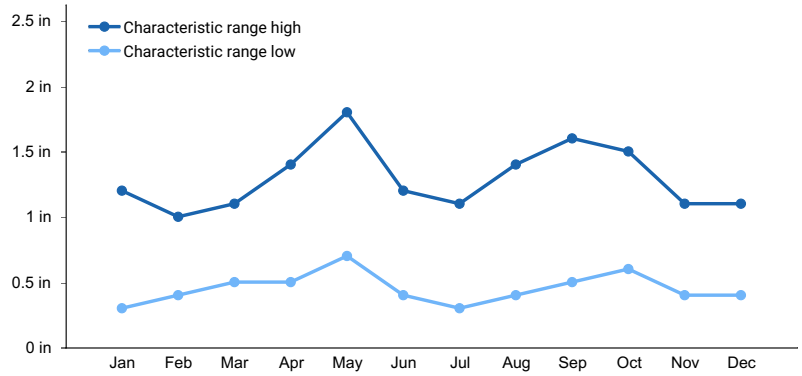


Figure 1. Monthly precipitation range

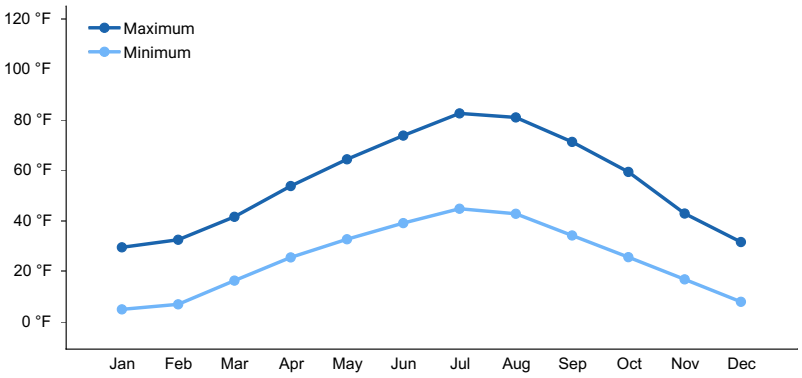


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

This site recieves extra moisture as run-on from upland areas.

Wetland description

N/A

Soil features

These soils are deep and formed in alluvium or colluvium derived from sandstone, limestone, quartzite, or mixed parent materials. The soil surface and profile are loams and silt loams with little rock. These soils are well-drained with moderately slow to moderately rapid permeability. Available water holding capacity ranges from 8 to 11 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) Alluvium–metamorphic and sedimentary rock (2) Colluvium–metamorphic and sedimentary rock
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%

Available water capacity (0-40in)	8–11 in
Soil reaction (1:1 water) (0-40in)	6.6–9
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, largely replacing cattle as the browse component increased.

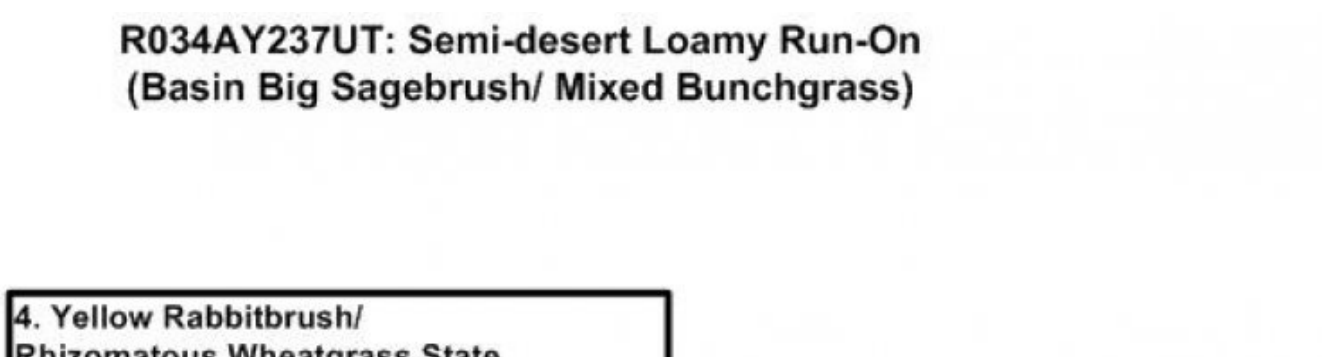
Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas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

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

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

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range & Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State and transition model



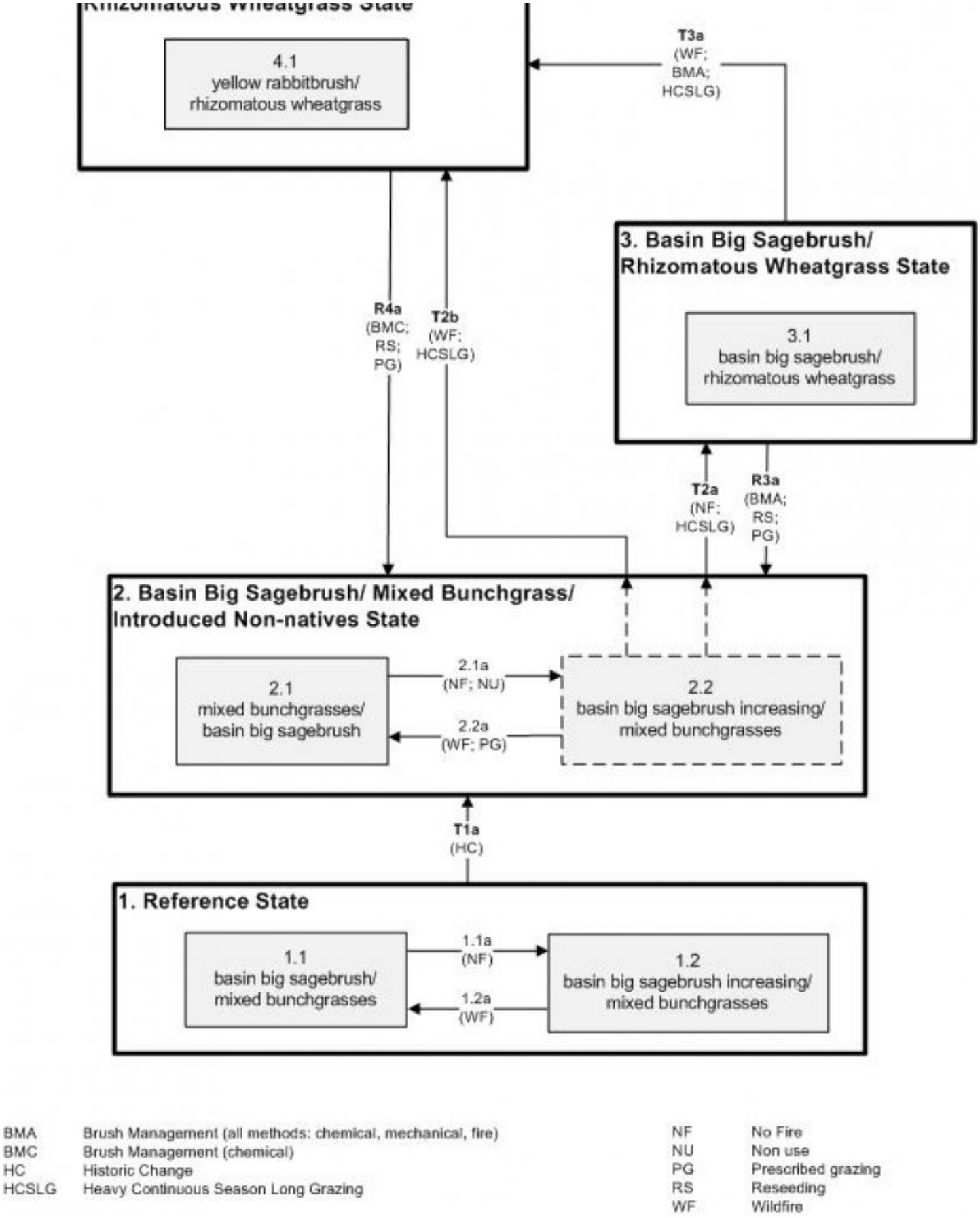


Figure 3. State and Transition Model

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. Pre-settlement fire return

intervals of 20 to 30 years tended to favor the native bunchgrasses. Under such conditions, the native plant community would have been characterized by mixed bunchgrasses and basin big sagebrush (*Artemisia tridentata* ssp. tridentata) (2.1). The major grasses would have included basin wildrye (*Leymus cinereus*), rhizomatous bluebunch wheatgrass (*Pseudoroegneria spicata*), bottlebrush squirreltail (*Elymus elymoides*), native bluegrasses (*Poa secunda*, *Poa fendleriana*), and thickspike wheatgrass (*Elymus lanceolatus*). Other associated woody species may have included yellow rabbitbrush (*Chrysothamnus viscidiflorus*) and winterfat (*Krascheninnikovia lanata*). 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
Reference State

Community Phase 1.1: basin big sagebrush/ mixed bunchgrasses The least modified plant community within the Reference State (1.1) would have been characterized by an assortment of native bunchgrasses and basin big sagebrush. Dominant grasses would have included basin wildrye, rhizomatous bluebunch wheatgrass, bottlebrush squirreltail, Poa spp., and thickspike wheatgrass.

Community 1.2
Basin big sagebrush increasing/ mixed bunchgrasses

Community Phase 1.2: basin big sagebrush increasing/ mixed bunchgrasses Basin big sagebrush would have increased in density as long as the community had not experienced wildfire. The native bunchgrass understory would have maintained its diversity.

Pathway CP 1.1A
Community 1.1 to 1.2

Community Pathway 1.1a Sites that experienced an absence of fire would have had an increase in basin big sagebrush along with the associated native bunchgrasses.

Pathway CP 1.2A
Community 1.2 to 1.1

Community Pathway 1.2a Wildfire would shift the plant community back towards one dominated by mixed bunchgrasses and basin big sagebrush (2.1).

State 2
Basin Big Sagebrush/ Mixed Bunchgrass/ 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 shortly following Euro-American settlement. This State can be regarded as the current potential. The range in plant communities within this State is characterized by the relative amount of bunchgrass present, which is primarily associated with the time since last fire. With more recent fires and prescribed grazing (2.2a) the plant community would be dominated by mixed bunchgrasses and basin big sagebrush (2.1). In the absence of fire and with protection from livestock grazing (2.1a), the plant community would shift to a more basin big sagebrush dominated site, but would still have remnants of the native bunchgrass understory (2.2). Resiliency of this State is maintained by the availability of native seed sources for both the mixed bunchgrasses and basin big sagebrush, and by wildfire. This site responds well to cool season fire and more moderate non-growing season grazing regimes provided that the seed sources for the mixed bunchgrasses are present. A pre-settlement fire return interval of 20-30 years favored the grasses. Without fire, bunchgrass diversity and production may diminish, while sagebrush may increase and ultimately outcompete the native bunchgrasses. This shift in plant community composition puts this State at greater risk in the event of a hot summer or fall fire; further degradation could occur if grazing were to be initiated immediately following such a fire. Hotter fires followed by heavy grazing could cause the replacement of the basin big sagebrush component with fire-tolerant species such as yellow rabbitbrush and rhizomatous wheatgrasses.

Community 2.1

Mixed bunchgrasses/ basin big sagebrush

Community Phase 2.1: Mixed bunchgrasses/ basin big sagebrush This plant community (2.1) is characterized by a slight dominance of a mix of native bunchgrasses and basin big sagebrush. Grass species would include: basin wildrye, rhizomatous bluebunch wheatgrass, bottlebrush squirreltail, and Poa spp.

Community 2.2
Basin big sagebrush increasing/ mixed bunchgrasses

Community Phase 2.2: basin big sagebrush increasing/ mixed bunchgrasses This plant community (2.2) is characterized by a slight dominance of basin big sagebrush and a native bunchgrass understory.

Pathway CP 2.1A
Community 2.1 to 2.2

Community Pathway 2.1a Sites that have experienced very limited to no grazing and an absence of fire will have a slight dominance of basin big sagebrush along with the associated native bunchgrasses.

Pathway CP 2.2A
Community 2.2 to 2.1

Community Pathway 2.2a A cool spring wildfire followed by prescribed grazing would shift the plant community back towards one dominated by mixed bunchgrasses and basin big sagebrush (2.1).

State 3
Basin Big Sagebrush/ Rhizomatous Wheatgrass State

State 3: Basin Big Sagebrush/ Rhizomatous Wheatgrass State Sites where heavy continuous season-long grazing has taken place in the absence of fire will develop into a basin big sagebrush-dominated plant community accompanied by rhizomatous bluebunch and western wheatgrasses. Resiliency of this State is maintained by the absence of fire and heavy grazing during the growing season for grasses, which removes grazing-intolerant grass species (bunchgrasses) and leaves only grazing-tolerant grasses and sagebrush. The dominance of basin big sagebrush and lack of native bunchgrasses places this State at risk in the event of a hot summer or fall fire.

Community 3.1
Basin Big Sagebrush/ Rhizomatous Wheatgrass State

Community Phase 3.1: basin big sagebrush/ rhizomatous wheatgrass This plant community (3.1) is characterized by a dominance of basin big sagebrush and rhizomatous wheatgrasses (predominantly Western wheatgrass).

State 4
Yellow Rabbitbrush/ Rhizomatous Wheatgrass State

Yellow rabbitbrush and rhizomatous wheatgrass will be found on sites that have experienced both heavy continuous season-long grazing and frequent wildfire disturbances. This is the most commonly found current State. The resiliency of this State is maintained by the ability of root-sprouting species (yellow rabbitbrush and rhizomatous wheatgrasses) to successfully establish after fire and out-compete other fire and grazing-intolerant species.

Community 4.1
Yellow Rabbitbrush/ Rhizomatous Wheatgrass State

Community Phase 4.1: yellow rabbitbrush/ rhizomatous wheatgrass This plant community (4.1) is characterized by a dominance of yellow rabbitbrush and rhizomatous bluebunch and western wheatgrass.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Basin Big Sagebrush/ Mixed Bunchgrass/ 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, 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 (Basin Big Sagebrush/ Mixed Bunchgrass/ Introduced Non-natives State to Basin Big Sagebrush/ Rhizomatous Wheatgrass State) The Mixed Bunchgrass/ Basin Big Sagebrush/ Introduced Non-natives State will transition to the Basin Big Sagebrush/ Rhizomatous Wheatgrass State in the absence of fire or with heavy grazing during the growing season of grasses, removing grazing intolerant species. The approach to this transition is indicated by an increase in basin big sagebrush cover, height, and age relative to grasses. Long periods (several decades) without fire and/or heavy grazing, especially during the growing season of grasses, will trigger the transition.

Transition T2B
State 2 to 4

Transition T2b: from State 2 to State 4 (Basin Big Sagebrush/ Mixed Bunchgrass/ Introduced Non-natives State to Yellow Rabbitbrush/ Rhizomatous Wheatgrass State) The Mixed Bunchgrass/ Basin Big Sagebrush/ Introduced Herb State transition to the Yellow Rabbitbrush/ Rhizomatous Wheatgrass State is triggered by a relatively hot (stand-replacing) wildfire followed by heavy growing season grazing disturbances which remove remaining (post-fire) grazing intolerant grass species. The approach to this transition is indicated by an increase in basin big sagebrush cover, height, and age relative to grasses.

Restoration pathway R3A
State 3 to 2

Restoration Pathway R3a: from State 3 to State 2 (Basin Big Sagebrush/ Rhizomatous Wheatgrass State to Mixed Bunchgrass/ Basin Big Sagebrush/ Introduced Non-natives State) It may be possible using a combination of brush management (e.g. chemicals, low tillage, mechanical methods via Lawson soil aerator, or prescribed fire), prescribed grazing, and reseeding with native bunchgrasses to restore this plant community to conditions associated with the Basin Big Sagebrush/ Mixed Bunchgrass/ Introduced Herb State (State 2).

Transition T3A
State 3 to 4

Transition 3a: from State 3 to State 4 (Basin Big Sagebrush/Rhizomatous Wheatgrass State to Yellow Rabbitbrush/ Rhizomatous Wheatgrass State) The Basin Big Sagebrush/Rhizomatous Wheatgrass State transition to the Yellow Rabbitbrush/Rhizomatous Wheatgrass State is triggered by a hot (stand-replacing) wildfire or brush management techniques (e.g. chemical, mechanical, fire), followed by heavy grazing during growing season of the grasses in close temporal proximity. The approach to this transition is indicated by an increase in basin big sagebrush cover, height, and age, and by an increase in the continuity of understory fuels.

Restoration pathway R4A
State 4 to 2

Restoration Pathway R4a: from State 4 to State 2 (Yellow Rabbitbrush/ Rhizomatous Wheatgrass State to Basin Big Sagebrush/ Mixed Bunchgrass/ Introduced Herb State) It may be possible using a combination of brush management (e.g. using chemicals), inter-seeding with native bunchgrasses, and prescribed grazing to restore this plant community to conditions associated with the Basin Big Sagebrush/ Mixed Bunchgrass/ Introduced Non-natives State if accelerated soil erosion or soil tillage has not taken place. Tillage eliminates the native perennial forbs, some of which are very difficult to replace because their seed is either very expensive or unavailable.

Additional community tables

Animal community

The suitability for livestock grazing is fair to good. This site provides grazing for cattle and sheep during all seasons, however prolonged spring use will result in loss of perennial grasses and increase unpalatable shrubs and exotics.

Recreational uses

Recreation activities include hunting, horseback riding, birdwatching, ATV riding, 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]

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	05/04/2024
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:

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:**