USDA Natural Resources
Conservation Service

Ecological site R034AA239UT
Semi-desert Silt (Basin big sagebrush/ Bluebunch wheatgrass)

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 silty clay loam 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

R034AA223UT	**Semi-desert Silt Loam (Wyoming big sagebrush/ Bluebunch wheatgrass)**

Similar sites

R034AY206WY	**Clayey Overflow Foothills and Basins West (CyO)**

Table 1. Dominant plant species

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

Physiographic features

This site is found on alluvial fans and stream terraces at elevations between 5,700 and 7,000 feet. It is found on all aspects and on gentle slopes ranging from 0 to 15 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	0–15%
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

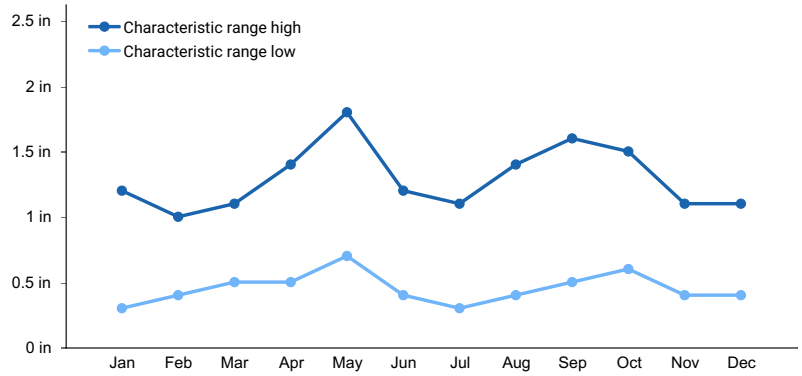

Figure 1. Monthly precipitation range

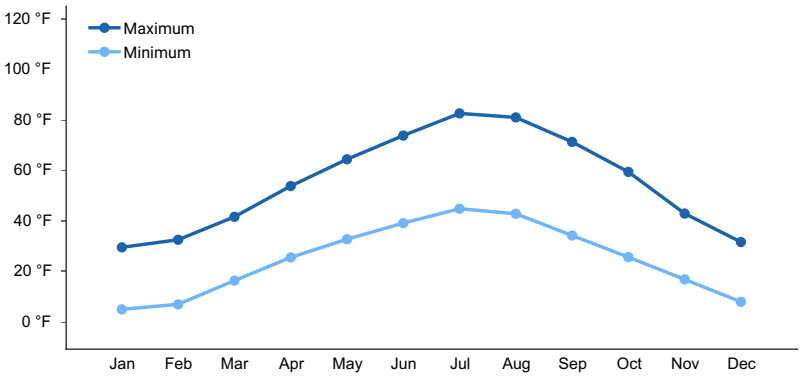

Figure 2. Monthly average minimum and maximum temperature

Influencing water features

This site is not usually influenced by streams and wetlands.

Wetland description

N/A

Soil features

The soils of this site are moderately deep to deep and formed in alluvium, colluvium, or residuum derived from siltstone, sandstone, or limestone. They have fine-textured surface and subsurface textures – more silty than clayey. Surface textures have less than 15 percent rock fragments, but subsurface textures may be gravelly or cobbly. The soils are well-drained and permeability is moderately slow to moderate. The soil moisture regime is xeric and the soil temperature regime is frigid.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone (2) Colluvium–limestone and siltstone (3) Residuum–sedimentary rock
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%

Surface fragment cover >3"	0–15%
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–35%

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 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

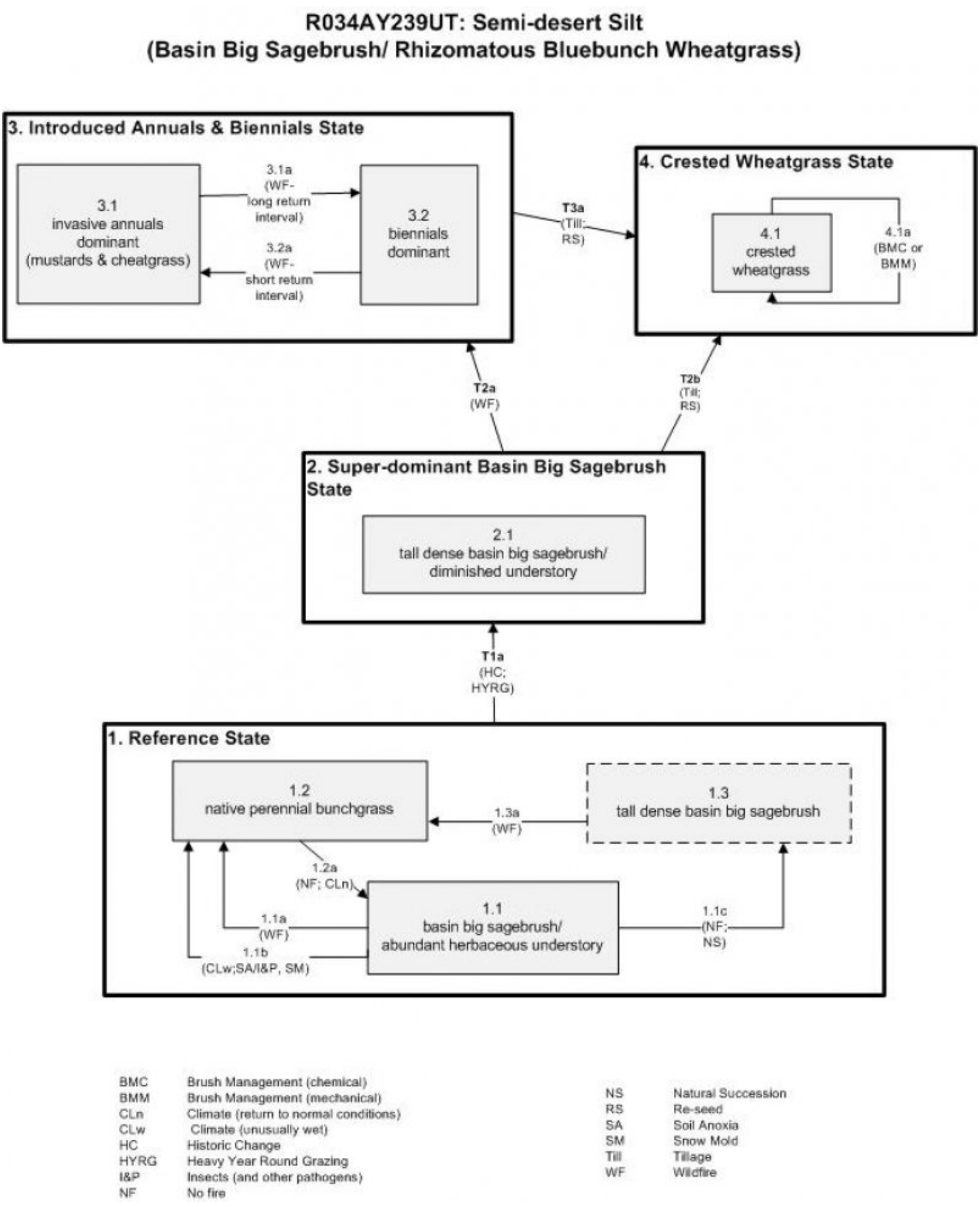

Figure 3. State and Transition Model

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. The major influences during

the Reference State would have been time since the last fire, Aroga moth, or snow mold outbreak. Thus three phases have been proposed to reflect these influences on resetting the successional clock. The basin big sagebrush (*Artemisia tridentata* ssp. tridentata) dominated community type with rich herb understory (1.1) would have been the most common phase found 10 to 30 years following the last fire. In this community, both cover- and production-based dominance would have been primarily from basin big sagebrush, but with a relatively rich understory of perennial herbs. The dominant grasses would have been the rhizomatous variant of bluebunch wheatgrass (*Pseudoroegneria spicata*) and western wheatgrass (*Pascopyrum smithii*). Other grasses would have included the small bluegrasses (Poa spp.) and bottlebrush squirreltail (*Elymus elymoides*). The dominant forbs would have likely been an assortment of buckwheats (Erigonum spp.), biscuitroots (Lomatium spp.), fleabanes (Erigeron spp.), granite prickly phlox (*Linanthus pungens*) and milkvetch (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. A recent fire, Aroga moth, or snowmold outbreak would have created a pathway (1.1a) toward temporary bunchgrass dominance (1.2). Freedom from fire, insect, or pathogens for 4 to 5 decades (1.1c) would have lead (1.1) to a phase where tall, dense sagebrush dominated (1.3). A burn (1.3a) of mature sagebrush stands would also have resulted in a bunchgrass-dominated phase (1.2). The patchiness of these natural disturbances would have created a mosaic of all three phases across the landscape where this ESD occurred.

Community 1.1
Basin big sagebrush/ abundant herbaceous understory

Community Phase 1.1: basin big sagebrush/ abundant herbaceous understory This community was characterized by the co-dominance of shrubs, primarily basin big sagebrush, and native perennial herbs. Productivity would have been dependent upon the moisture availability in the vadose (above the water table) zone.

Community 1.2
Native perennial bunchgrass

Community Phase 1.2: native perennial bunchgrass This was a temporary grassland variant of this plant community, dominated by the caespitose form of bluebunch wheatgrass. This community would have occurred shortly following wildfire or a sagebrush-killing pathogen outbreak, and would have existed for approximately a decade.

Community 1.3
Tall dense basin big sagebrush

Community Phase 1.3: tall dense basin big sagebrush This community would have been characterized by a dense, tall stand of basin big sagebrush with a slightly diminished understory component.

Pathway CP 1.1A and CP 1.1B
Community 1.1 to 1.2

Community Pathway 1.1a Wildfire would have temporarily created a grassland variant of the plant community. Community Pathway 1.1b Unusually wet periods (e.g. El Nino Southern Oscillation) would have caused temporary soil anoxia, killing the sagebrush. Similar effects would have occurred from the outbreak of Aroga moth or snow mold. This would have temporarily created a grassland variant of this plant community.

Pathway CP 1.1C
Community 1.1 to 1.3

Community Pathway 1.1c Forty or more years without fire or other natural disturbances would have promoted an increase in basin big sagebrush, creating a taller, denser stand.

Pathway CP1.2A
Community 1.2 to 1.1

Community Pathway 1.2a Sagebrush would have begun to re-establish after a period of approximately 10 years

after a return to a normal climate (temperatures and precipitation) and without wildfire.

Pathway CP 1.3A
Community 1.3 to 1.2

Community Pathway 1.3a Wildfire would have removed the shrub component, allowing the perennial herbaceous component to regain temporary dominance.

State 2
Super-dominant Basin Big Sagebrush State

State 2 is similar to Phase 1.3 of State 1 except some exotic species of both plants and animals have been introduced. Native Americans, along with their horses and burning practices, have been eliminated and climate has become warmer and the atmosphere enriched with carbon dioxide and sources of atmospheric nitrogen and sulphur. State 2 is thus a description of vegetation on this site shortly following Euro-American settlement. This state can be regarded as the current potential. The least modified plant community in State 2 is a basin big sagebrush dominated type with a less productive herbaceous understory (2.1), and with minor amounts of exotic annuals and biennials present. The reason for the diminished understory is historic unrestricted year round livestock grazing, first by cattle and later by sheep (Parson 1996). Opening of the interspaces between the shrubs has often resulted in wind moving the fine soil particles into coppice dunes under the larger shrubs, creating mounded micro-relief and patchier nutrient reserves. This long period of pronounced removal of the herbaceous component also resulted in lengthening the fire-free interval, allowing both height and density of the sagebrush to increase more than occurred in the Reference State. Reductions in seasons of use and intensity of livestock grazing have brought little change in this vegetation type because of the super-dominance of sagebrush and its longevity. In fact, rest from livestock use could allow for the buildup of finer, more continuous fuels, especially following wet winters and springs.

Community 2.1
Tall dense basin big sagebrush/ diminished understory

Community Phase 2.1: tall dense basin big sagebrush/ diminished understory This phase is characterized by having tall, dense basin big sagebrush, a diminished understory, the presence of minor amounts of exotic annuals and biennials, and possibly mounded micro-relief.

State 3
Introduced Annuals & Biennials State

State 3 is characterized by the dominance of several fire-prone species including cheatgrass and mustards. When fire return intervals are frequent (approximately 3 to 10 years) (3.2a) invasive annual species such as cheatgrass and mustards will predominate (3.1). Longer intervals (approximately 10 to 50 years) between fire events (3.1a) will result in a plant community dominated by biennial forbs (3.2). There is little evidence for the return of the native grasses or forbs in State 3, even if all livestock grazing is removed for decades.

Community 3.1
Invasive annuals dominant

Community Phase 3.1: invasive annuals dominant This plant community will develop where fire return intervals are frequent. Annual species such as tall tumble mustard (*Sisymbrium altissimum*), cheatgrass, and Russian thistle (*Salsola tragus*) predominate.

Community 3.2
Biennials dominant

Community Phase 3.2: biennials dominant This plant community will develop when intervals between fires are longer, allowing biennial species to become established. Species may include hound’s tongue (Cynoglossum spp.) and Dyer’s woad (*Isatis tinctoria*).

Pathway CP 3.1A
Community 3.1 to 3.2

Community Pathway 3.1a Less frequent wildfire will promote a biennial forb-dominated plant community.

Pathway CP 3.2A
Community 3.2 to 3.1

Community Pathway 3.2a More frequent wildfire will maintain an invasive annuals-dominated plant.

State 4
Crested Wheatgrass State

State 4 is dominated by crested wheatgrass. Eventually, State 4 will be re-invaded, first by rabbitbrushes (Chrysothamnus spp.), and then whichever sagebrush has the greatest seed dispersal. Thus, if the maintenance of grass production is desired in State 4, it will require re-treatment of the brush either mechanically, chemically, or with fire (4.1a). Moderate livestock grazing will help maintain the resiliency of this state, but heavy livestock grazing will reduce its resiliency. There is little evidence for the return of the native grasses or forbs in States 3 or 4, even if all livestock grazing is removed for decades.

Community 4.1
Crested Wheatgrass State

Community Phase 4.1: crested wheatgrass This plant community was artificially created by tilling and seeding of crested wheatgrass to increase forage for livestock. Community Pathway 4.1a Periodic retreatment using chemicals or mechanical means will be required to prevent woody encroachment of the crested wheatgrass seeding.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Super-Dominant Basin Big Sagebrush State) The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with climate change, has caused State 1 to transition to State 2. In addition to these historic changes, the advent of heavy continuous year-round grazing by livestock further contributed to this transition. 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 (Super-dominant Basin Big Sagebrush State to Introduced Annuals & Biennials State) Rest from livestock use allows the buildup of finer fuels including cheatgrass (*Bromus tectorum*) and mustards (Brassica, Descurainia, and/or other spp.) which could come to dominate (State 3) following wildfire (T2a).

Transition T24
State 2 to 4

Transition T2b: from State 2 to State 4 (Super-dominant Basin Big Sagebrush State to Crested Wheatgrass State) Because of national demands for red meat production following World War II, many of the areas in State 2 were tilled and seeded to crested wheatgrass to increase forage for livestock.

Transition T3A
State 3 to 4

Transition T3a: from State 3 to State 4 (Introduced Annuals & Biennials State to Crested Wheatgrass State) Similarly to the impoverished sites in State 2, because of national demands for red meat production following World War II, many of the areas in State 3 were also tilled and seeded to crested wheatgrass (T3a) to increase forage for

livestock, especially in areas which re-burned frequently.

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 use will lead to diminished perennial grasses and expansion of unpalatable shrubs and exotics.

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:**

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:**