USDA Natural Resources Conservation Service

Ecological site R034AA203UT
Semi-desert Saline Terraces (Gardner's saltbush/ 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 (2900m) 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 (230-380 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 saline or saline-sodic
o are moderately deep, deep, or very deep
o are not skeletal within 20” of the soil surface; and have minimal 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 fine sandy loam to clay 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

R034AA201UT	**Semi-desert Saline Well-Drained Terraces (Indian ricegrass/ Greasewood)**

Similar sites

R034AA201UT	**Semi-desert Saline Well-Drained Terraces (Indian ricegrass/ Greasewood)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex gardneri*
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This site occurs on stream or river terraces, alluvial fans, and alluvial flats. It is found on all aspects at elevations between 5,700 and 7,000 feet. The water table is at least 5 feet below the soil surface. Runoff is low to medium and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Alluvial fan (3) Alluvial flat
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 of this site is characterized by warm, dry summers and cold snowy winters. This climate is modified by local topographic conditions. The mountains appreciably modify both the precipitation and temperature patterns. April, May, September and October are the wettest months; December, January, February and July are the driest.

Table 3. Representative climatic features

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

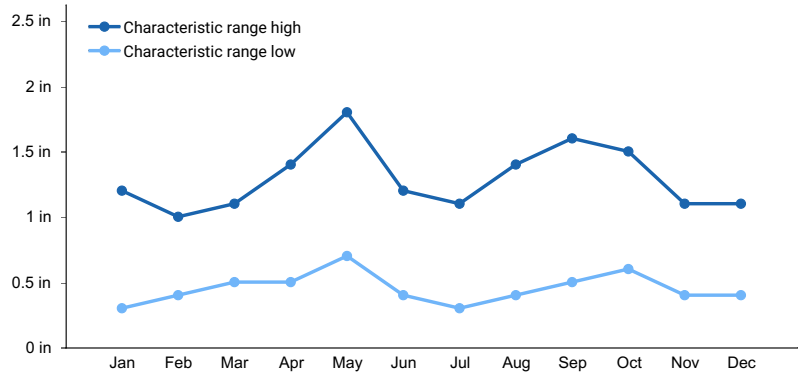


Figure 1. Monthly precipitation range

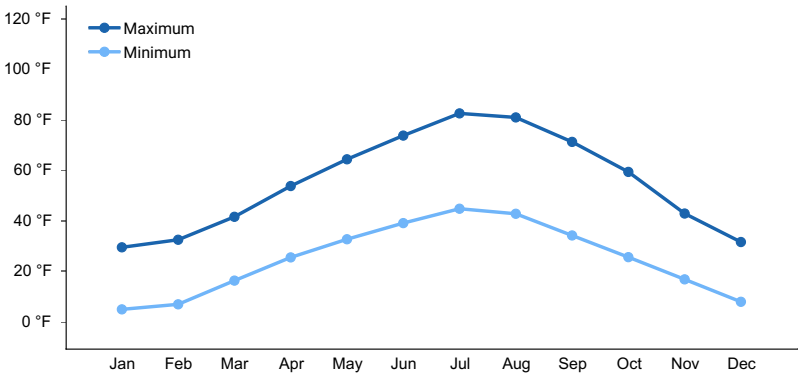


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

This site is not greatly 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 or residuum derived from sandstone, limestone, quartzite, shale, or conglomerate rocks. Surface and subsurface textures are silt loams, clay loams, loams, or fine sandy loams. Rock fragments do not exceed 15 percent by volume. These soils are well drained and have slow to moderate permeability. Available water holding capacity ranges from 2 to 4 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 (2) Residuum–metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Silt loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	20–60 in
Surface fragment cover <=3"	0–15%

Surface fragment cover >3"	0–15%
Available water capacity (0-40in)	2–4 in
Soil reaction (1:1 water) (0-40in)	8.4–9.6
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 then grazed as the amount of browse increase.

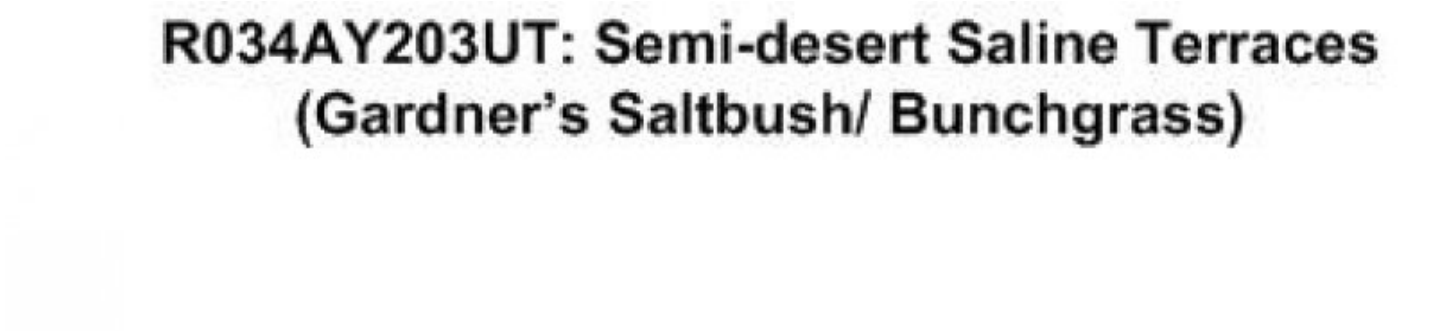
Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas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

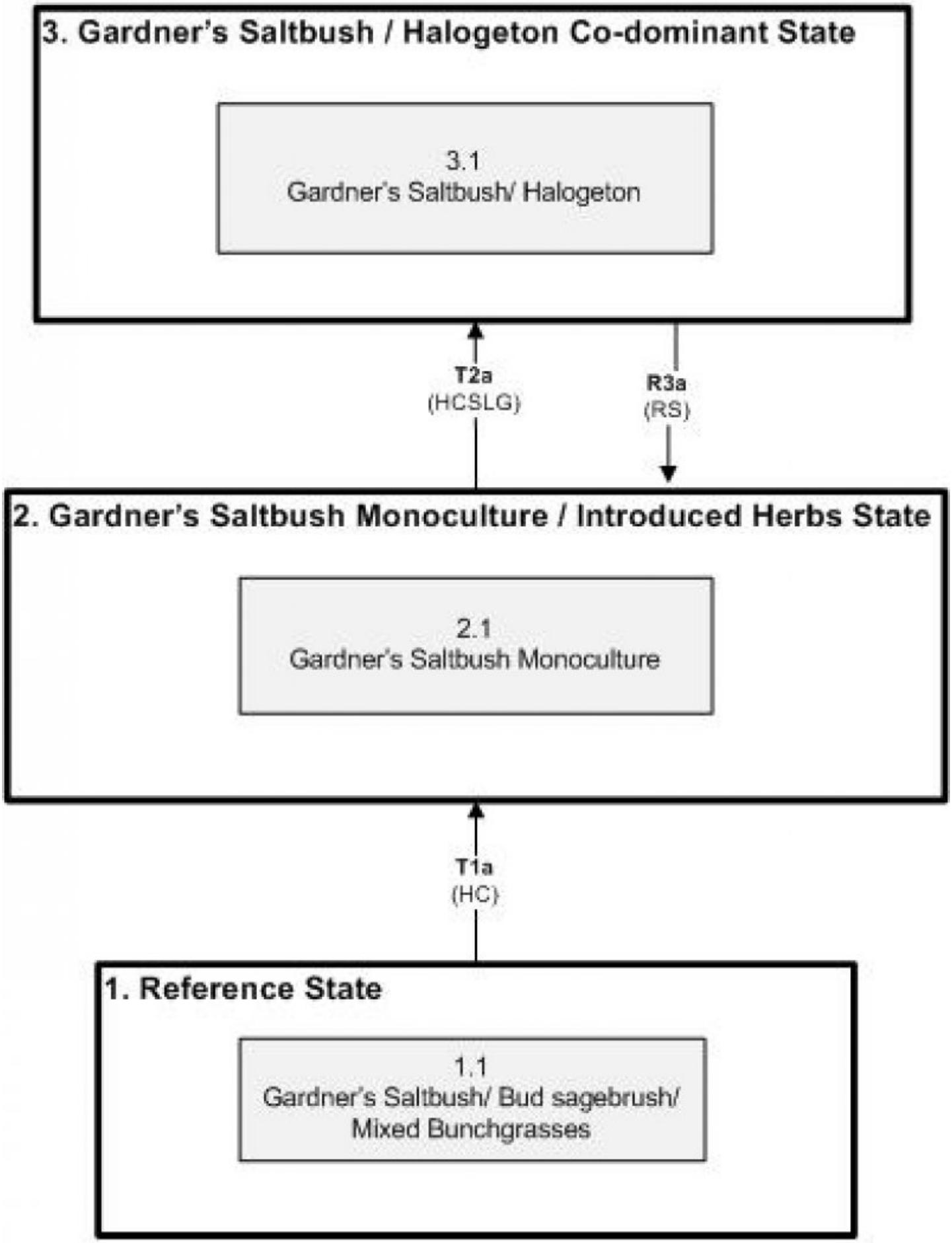
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the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




3. Gardner's Saltbush / Halogeton Co-dominant State
3.1
Gardner's Saltbush/ Halogeton
T2a
(HCSLG)
R3a
(RS)
2. Gardner's Saltbush Monoculture / Introduced Herbs State
2.1
Gardner's Saltbush Monoculture
T1a
(HC)
1. Reference State
1.1
Gardner's Saltbush/ Bud sagebrush/
Mixed Bunchgrasses

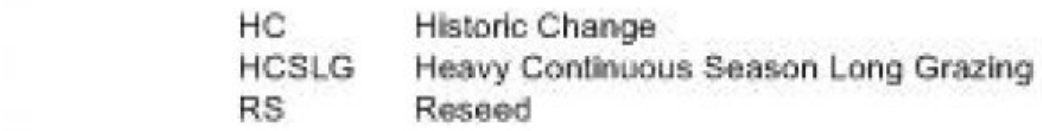


Figure 3. State and Transition Model

State 1
Reference State

The Reference State is a description of this ecological site just prior to Euro-American settlement but after centuries of use by Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and the familiarity of rangeland relict areas where they exist. Before Euro-American settlement these areas would have been sparsely vegetated by the suffrutescent (half-shrubs) Gardner's Saltbush (*Atriplex gardneri*) and bud sagebrush (*Picrothamnus desertorum*). Scattered among these would have been clumps of native perennial bunchgrasses including bottlebrush squirreltail (*Elymus elymoides*) and Indian ricegrass (*Achnatherum hymenoides*) with minor amounts of Bluebunch wheatgrass (*Pseudoroegneria spicata*) and needleandthread (*Hesperostipa comata*) (1.1). 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
Gardner's Saltbush/ Bud sagebrush/ Mixed Bunchgrasses

Community Phase 1.1: Gardner's Saltbush/ Bud sagebrush/ Mixed Bunchgrasses This plant community (1.1) is characterized by a co-dominance of Gardner's saltbush and bud sagebrush with mixed perennial bunchgrasses including bottlebrush squirreltail, Indian ricegrass, and minor amounts of Bluebunch wheatgrass and needle and thread.

State 2
Gardner's Saltbush Monoculture/ Introduced Herb State

State 2 is a description of the ecological site shortly following Euro-American settlement, which is dominated by Gardner's Saltbush. Perennial bunch grasses and bud sagebrush has been removed because of historic heavy grazing. Negative feedbacks that maintain state resiliency are: ground cover provided by both grasses and leaf litter which help maintain soil stability, and retention of water at the site. Positive feedbacks that reduce state resiliency are: reduction in perennial grass cover which puts this plant community and state at-risk to further degradation from lack of soil stabilization and reduced soil moisture retention. These feedbacks can be reversed with release from grazing pressure, especially during spring.

Community 2.1
Gardner's Saltbush Monoculture/ Introduced Herb State

Community Phase 2.1: Gardner's Saltbush Monoculture This plant community (2.1) is characterized by a monoculture of Gardner's saltbush as a result of heavy continuous season-long grazing which effectively removed the bud sagebrush and bunchgrasses.

State 3
Gardner's Saltbush / Halogeton Co-dominant State

Once halogeton was introduced to these sites, livestock grazing became much more limited due to the poisonous qualities of this exotic species, nevertheless Halogeton continued to usurp space and resources and pump salts to the soil surface (Eckert and Kinsinger, 1960) impeding establishment of other herbs. Negative feedbacks that maintain state resiliency are: the absence of perennial grass seed source, and the establishment of exotic

poisonous species. Halogeton also pumps sodium to the soil surface (Eckert and Kinsinger, 1960) causing surface slacking which impedes establishment of more desirable herbs.

Community 3.1
Gardner's Saltbush / Halogeton Co-dominant State

Community Phase 3.1: Gardner's saltbush/ Halogeton This plant community (3.1) is characterized by a co-dominance of Gardner's saltbush and halogeton.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Gardner's Saltbush Monoculture/ Introduced Herbs State) The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with year long heavy livestock grazing and climate change, will cause State 1 to transition to State 2, the current potential. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical. Additionally, historic year around livestock grazing (T1a) quickly reduced the perennial grass and bud sagebrush components. This quickly led to a near monoculture of Gardner's saltbush, the only major perennial able to reproduce vegetatively. Little recovery of other species occurred following reduction of livestock grazing pressure beginning in the 1930s because of local extinction of seed sources for the original companion species.

Transition T2A
State 2 to 3

Transition T2a: from State 2 to State 3 (Gardner's Saltbush Monoculture/ Introduced Herbs State to Gardner's Saltbush /Halogeton State) The Gardner's Saltbush Monoculture/ Introduced Herbs State will transition to the Gardner's Saltbush / Halogeton Co-dominant State following heavy continuous growing season-long grazing. In 1943, the introduction of halogeton (*Halogeton glomeratus*) (T2a) resulted in the first important exotic entering this habitat. Halogeton's poisonous nature caused further reduction of livestock grazing. Key indicators of approach to transition: loss of perennial grass understory; introduction of exotic, poisonous species Trigger causing transition: sustained heavy grazing especially during the growing season Restoration pathway: not apparent at this time.

Restoration pathway R3A
State 3 to 2

Restoration Pathway R3a: From State 3 to State 2 (Gardner's Saltbush/Halogeton co-dominant state to Gardner's Saltbush Monoculture/Introduced Herbs State) Very few feasible alternatives for improving cover or forage production have emerged. Reseeding with tall wheatgrass (*Thinopyrum ponticum*) may offer opportunities for re-establishment of a palatable herbaceous understory.

Additional community tables

Animal community

The suitability for livestock grazing is fair to good. This site provides grazing for cattle and sheep year-round, but prolonged spring grazing reduces the saltbush and perennial grass component and encourages invasion of greasewood and exotics.

Inventory data references

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

Other references

Eckert, R. E. and F. E. Kinsinger. 1960. Effects of *Halogeton glomeratus* leachate on chemical and physical characteristics of soils. Ecology 41: 764-772.

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:**

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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:**
