Ecological site R034AA210UT
Semi-desert Shallow Clay (Early sagebrush)

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

Associated sites

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

Similar sites

R034AY104WY	**Clayey Green River and Great Divide Basins (Cy)**
R034AY110WY	**Dense Clay Green River and Great Divide Basins (DC)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia spiciformis* (2) *Krascheninnikovia lanata*
Herbaceous	(1) *Pascopyrum smithii* (2) *Astragalus*

Physiographic features

This site occurs on hillsides, ridges, and escarpments at elevations between 5,700 to 7,000 feet. It is found on all aspects and on slopes ranging from 3 to 60 percent. Runoff is high and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

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

Climatic features

The climate is characterized by warm, dry summers and cold, snowy winters. This climate is modified by local topographic conditions. The mountains appreciably modify both the precipitation and temperature patterns. April, May, September and October are the wettest months; December, January, February and July are the driest.

Table 3. Representative climatic features

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

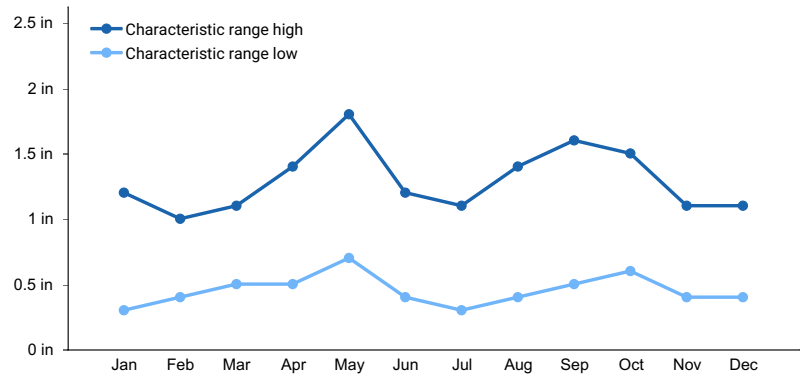


Figure 1. Monthly precipitation range

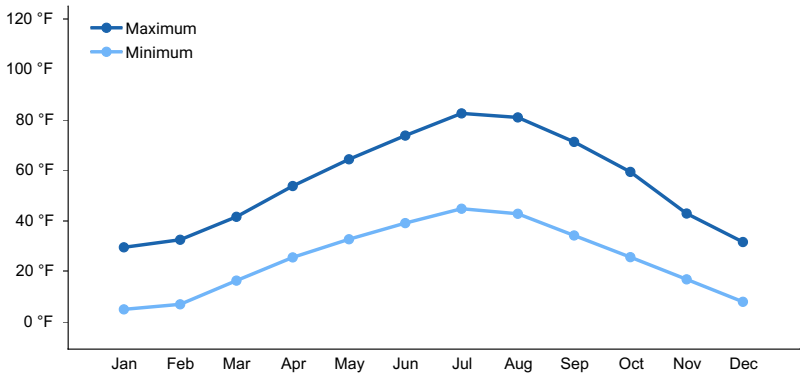


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

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

Wetland description

N/A

Soil features

These soils are shallow or very shallow and well to moderately well drained. They have clayey surface and subsurface textures. They may have rock fragments in the surface or subsurface. These soils are formed in residuum derived from shale, siltstone, or limestone. The soil moisture regime is xeric and the soil temperature regime is frigid.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone and siltstone (2) Residuum–limestone and shale
Surface texture	(1) Clay (2) Clay loam (3) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained to moderately well drained
Permeability class	Slow to moderately slow
Soil depth	20 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–15%

Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–60%
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 as the proportion of browse increased.

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

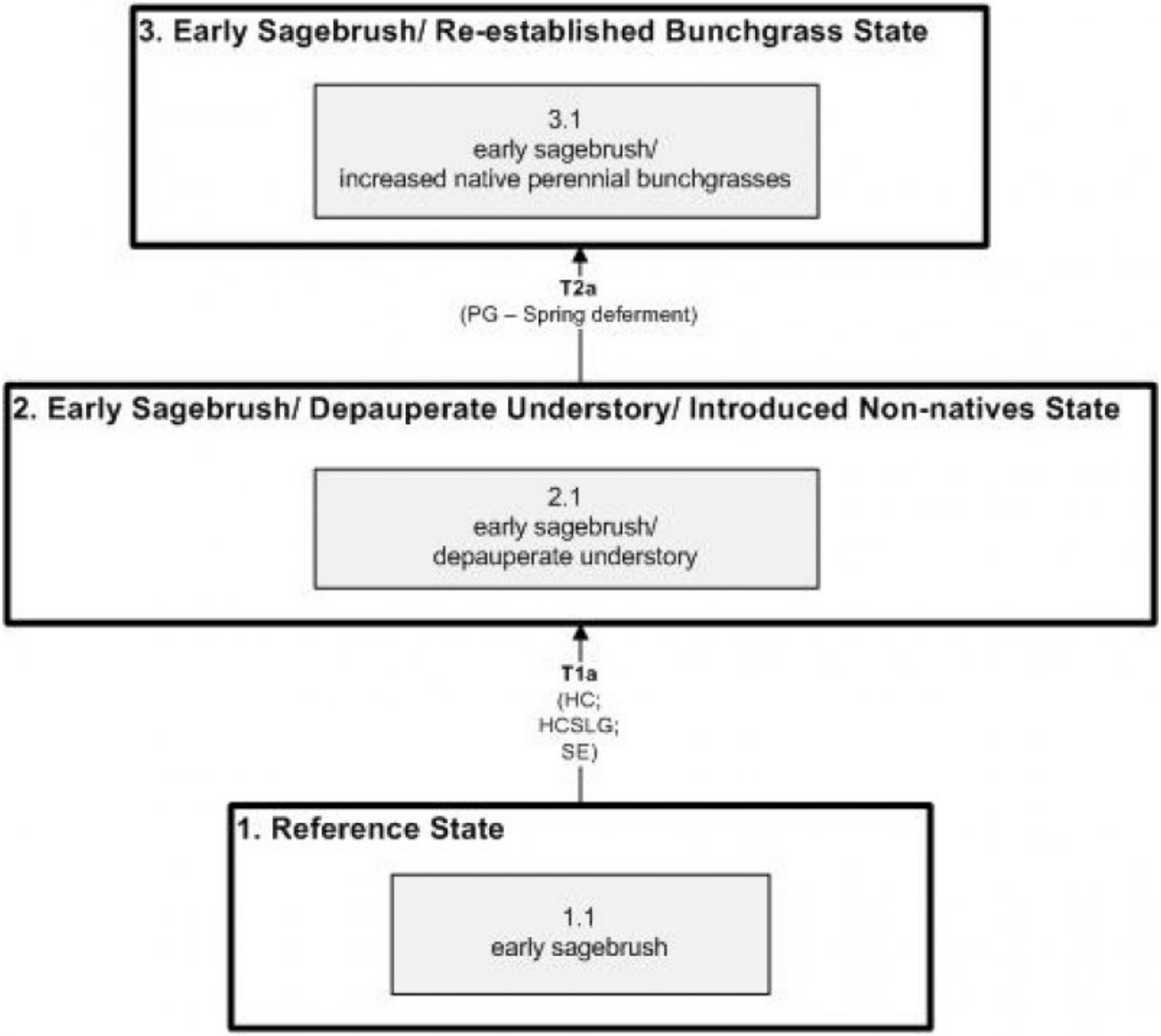
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the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

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

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

State and transition model

R034AY210UT: Semi-desert Shallow Clay (Early Sagebrush)



HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
PG	Prescribed Grazing
SE	Soil Erosion

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 the familiarity of rangeland relict areas where they exist. The least modified plant community would have been an early sagebrush-dominated (*Artemisia arbuscula* ssp. longiloba) site with scattered winterfat (*Krascheninnikovia lanata*) and other associated shrubs, with various caespitose perennial forbs such as milkvetch (Astragalus spp.) and stemless mock goldenweed (*Stenotus acaulis*), and a grassy understory composed mainly of Western wheatgrass (*Pascopyrum smithii*) (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. This ESD is related to R034AY2iiUT, but where clayish soils are shallow, usually at the tops of slopes where clay parent materials are exposed, and occasionally in low swales, early sagebrush prevails. Herbaceous production would have been less than adjacent ecological sites not on clayish soils because of the Inverse Texture Principle (Noy-Meir, 1973). In deserts and semi-deserts, finer textured soils are effectively drier and thus typically have lower production potential than coarser textured soils. The herbage also dried out earlier than adjacent ecological sites.

Community 1.1
Early sagebrush

Community Phase 1.1: Early sagebrush This plant community would have been composed of early sagebrush, a scattering of shrubs, such as winterfat, and a grassy understory composed mainly of Western wheatgrass.

State 2
Early Sagebrush/ Depauperate Understory/ Introduced Non-natives State

State 2 is a description of the ecological site shortly following Euro-American settlement. Early sagebrush is the dominant species, with a much reduced native perennial understory and evidence of accelerated soil erosion in some areas due to the heavy utilization by livestock. Accelerated soil erosion will reduce state resiliency, while a reduction of livestock grazing will maintain state resiliency.

Community 2.1
Early sagebrush/ Depauperate understory

Community Phase 2.1: Early sagebrush/ Depauperate understory This state is dominated by early sagebrush and a depauperate understory. It occurs following a decade or so of unrestricted livestock grazing, including grazing during the growth season for desirable herbs.

State 3
Early Sagebrush/ Re-established Bunchgrass State

This state is characterized by a dominance of early sagebrush with a bunchgrass understory, and can result from reduction of livestock grazing especially some deferment during the growth season for herbs. It should be considered the current reference community. Because of the lower forage production in State 2 and 3, many will be tempted to try to improve the situation with chemical or mechanical reductions of brush to enhance the grasses. When that doesn’t work, some will attempt to plow and re-seed with Eurasian grasses. These manipulations are much less successful than on adjacent ecological sites with coarser textured soils, and are not recommended. Resuming heavy livestock grazing, especially during the growth season of desirable herbs will reduce state resiliency. State resilience will be maintained with moderate livestock use, especially during the growth periods of desirable herbs.

Community 3.1
Early sagebrush/ Increased native perennial bunchgrasses

Community Phase 3.1: Early sagebrush/ Increased native perennial bunchgrasses This phase can be achieved as a result of moderated livestock grazing, especially during the growth season of herbs. The possibilities for recovered grasses are caespitose bluebunch wheatgrass, bottlebrush squirreltail, several small Poa spp., and Indian ricegrass.

Transition T1A
State 1 to 2

Transition T1a: from State 1 to State 2 (Reference State to Early Sagebrush/ Depauperate Understory/ 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. The heavy continuous livestock grazing that occurred on these sites not only depleted the herbaceous component, but triggered accelerated soil erosion especially on steeper locations, permanently lowering site potential.

Transition T2A
State 2 to 3

Transition T2a: from State 2 to State 3 (Early Sagebrush/ Depauperate Understory/ Introduced Non-natives State to Early Sagebrush/ Re-established Bunchgrass State) Relaxation of the grazing pressure, especially deferment during the growing season of the grasses will allow some recovery of the grasses. However, they will be mostly bunch form and short-lived, namely bottlebrush squirreltail (*Elymus elymoides*) and Sandberg bluegrass (*Poa secunda*). A key indicator of the approach to this transition is an increase in desirable native perennial herbs. A reduction in livestock grazing, especially some deferment during the growth season for herbs, 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 year-round, however prolonged heavy spring use will lead to loss of perennial herbs and increases in unpalatable shrubs and exotics.

Inventory data references

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

Other references

Galatowitsch, S.M. 1990. Using the original land survey notes to reconstruct pre-settlement landscapes in the American West. Great Basin Naturalist: 50(2): 181-191. Keywords: [Western U.S., conservation, history, human impact]

Noy-Meir I. 1973. Desert ecosystem: environment and producers. Annual review of ecology and systematics: 4: 25–51.

Parson, R. E. 1996. A History of Rich County. Utah State Historical Society, County Commission, Rich County, Utah. Keywords: [Rich County, Utah, Historic land use, European settlements]

USDA-NRCS. 2003. National Range and Pasture Handbook. in USDA, editor, USDA-Natural Resources Conservation Service-Grazing Lands Technology Institute. Keywords: [Western US, Federal guidelines, Range pasture management]

Contributors

USU

Approval

Kirt Walstad, 9/07/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/04/2024
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:**