Ecological site R034BY003UT
Alkali Fan (Castlevalley Saltbush)

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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): 034B–Warm Central Desertic Basins and Plateaus

MLRA 34B occurs in is in Utah (70 percent) and Colorado (30 percent). It makes up about 12,850 square miles (33,290 square kilometers). A small part of the area is in the High Plateaus of Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. The northern part of the MLRA occurs in the Uinta Basin Section, which is bounded by the Uinta Mountains to the north, the Wasatch Range to the west, the Roan Plateau to the south, and the Rabbit Hills to the east. The southern part of the MLRA occurs in the northern third of the Canyon Lands Section. This section is bounded by the Roan Plateau to the north, the Wasatch Plateau to the west, the southern end of the San Rafael Swell to the south, and the western slope of the Rocky Mountains to the east. Elevation ranges from 4,100 feet (1,250 meters) near Green River, Utah, to 7,500 feet (2,285 meters) at the base of the Wasatch Range and the Roan Plateau. Most of this area is covered by residual basin-floor materials and materials washed in from the surrounding mountains and plateaus. Shale and sandstone are the dominant rock types. The Tertiary-age Green River, Uinta, and Duchesne Formations dominate the northern part of the MLRA. The southern part is dominated by Cretaceous-age materials with lesser amounts of Jurassic and Triassic materials. The dominant Cretaceous formations are Mancos Shale, Dakota Sandstone, and the members of the Mesa Verde Group. The dominant Jurassic formations are the Morrison, Entrada, and Navajo. The dominant Triassic formations are the Chinle and Moenkopi. Quaternary alluvial, eolian, and glacial deposits occur in both parts of the MLRA. The average annual precipitation in most of this area ranges from 6 to 10 inches (150 to 255 millimeters). A small part of this area receives as much as 24 inches of annual precipitation. Much of the precipitation occurs as high-intensity, convective thunderstorms during the period July through September. May and June are usually the drier months. Precipitation is more evenly distributed throughout the year in the northern part of the MLRA than in the southern part, where there is a significant peak in late summer. The northern part of the MLRA receives more precipitation as snow during winter than the southern part. The average annual temperature ranges from 41 to 54 degrees F (5 to 12 degrees C). The freeze-free period averages 170 days and ranges from 110 to 235 days. The dominant soil orders in this MLRA are Aridisols and Entisols. Mollisols occur at the higher elevations, particularly in the northern part of the MLRA. The dominant soil temperature regime is mesic, and the dominant soil moisture regime is aridic. The soils receiving less than 8 inches (205 millimeters) of precipitation annually have an aridic soil moisture regime. The soils receiving 8 to 12 inches (205 to 305 millimeters) have an aridic soil moisture regime that borders on ustic. The soils receiving 12 to 16 inches (305 to 405 millimeters) generally have an ustic soil moisture regime that borders on aridic. The dominant soil mineralogy is mixed and soils are formed in slope alluvium or residuum derived from shale or sandstone. Many of the soils are shallow or moderately deep to shale or sandstone bedrock. The soils at the lower elevations generally have significant amounts of calcium carbonate, salts, and gypsum.

Ecological site concept

The soils of this site formed mostly in alluvium from sandstone and shale. Surface soils are fine sandy loam to silt loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up less than 35 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderately slow permeability. pH is moderately to very strongly alkaline.. Available water-holding capacity ranges from 3.8 to 6.9 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly typic aridic and the soil temperature regime is mesic. Precipitation ranges from 5-9 inches annually.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex cuneata*

Herbaceous	Not specified

Physiographic features

This site occurs on broad alluvial fans and along flood plain drainages. Slopes range from 0-15%. Elevations range from 4,000-5,000 feet.

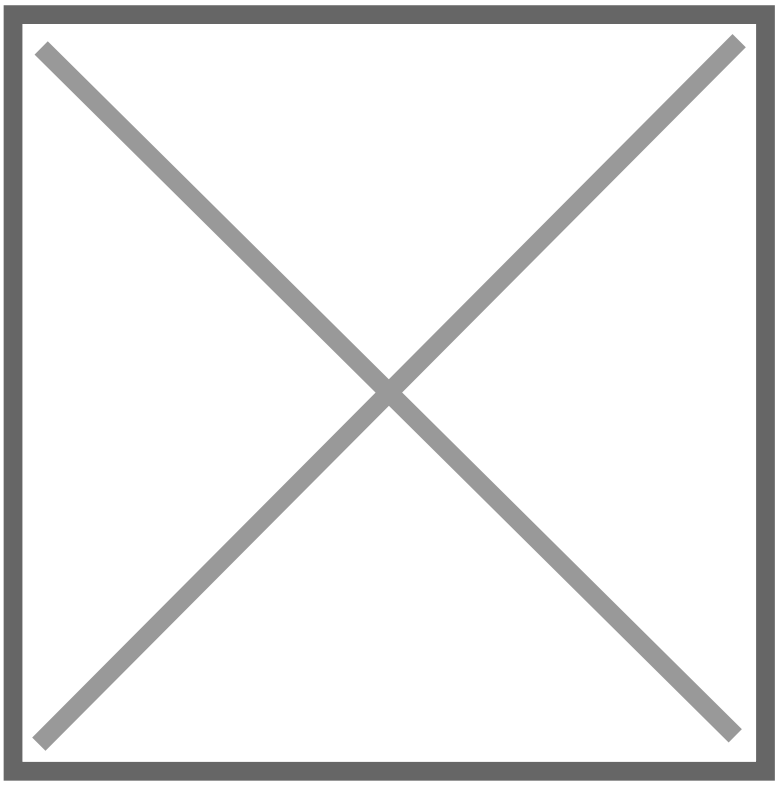

Figure 1.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain
Runoff class	Medium to very high
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	1,220 – 1,520 m
Slope	0 – 20 %

Ponding depth	Not specified
Water table depth	Not specified
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Average annual precipitation is 5-9". Mean annual air temperature is 51-56 degrees Fahrenheit. The average frost free season is 140-180 days. The ecological zone for this site is desert with 50-55% of the precipitation occurring during the plant growth period, March-October. Precipitation is extremely variable but on the average the driest months are June, January and February. The wettest months are April, August and October. Some run-in occurs along drainages which supplements the precipitation and makes more water available for plant growth in those areas.

Table 3 Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	130-230 mm
Frost-free period (average)	
Freeze-free period (average)	
Precipitation total (average)	180 mm

Influencing water features

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

Soil features

The soils of this site formed mostly in alluvium from sandstone and shale. Surface soils are fine sandy loam to silt loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up less than 35 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderately slow permeability. pH is moderately to very strongly alkaline.. Available water-holding capacity ranges from 3.8 to 6.9 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly typic aridic and the soil temperature regime is mesic. Precipitation ranges from 5-9 inches annually.

Table 4. Representative soil features

Parent material	(1) Alluvium – sandstone and shale
Surface texture	(1) Fine sandy loam (2) Silt loam

Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	50 – 150 cm
Soil depth	50 – 150 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 20 %
Available water capacity (Depth not specified)	9.65 – 17.53 cm
Calcium carbonate equivalent (Depth not specified)	0 – 40 %
Electrical conductivity (Depth not specified)	0 – 10 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0 – 10
Soil reaction (1:1 water) (Depth not specified)	7.9 – 9.6
Subsurface fragment volume <=3" (Depth not specified)	10 – 20 %
Subsurface fragment volume >3" (Depth not specified)	0 – 10 %

Table 5. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (Depth not specified)	Not specified
Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

State 1
Reference State
The reference state was determined by literature review, historical accounts and observations of trends in plant community dynamics.

Relic areas not influenced by grazing were not located within this site and may not exist. Community composition data were inferred from State 2.

The reference state represents the plant communities and ecological dynamics of this ecological site under pre-settlement conditions and a natural disturbance regime. The plant communities of the reference state were likely similar to the climate induced plant communities of the interpretive state (State 2), and were characterized by a relatively sparse shrub cover of valley saltbush with Indian ricegrass and James' galleta. Indian ricegrass and valley saltbush cover were likely higher in the reference state. James' galleta often increases under grazing due to loss of less grazing tolerant species. Annual forbs were likely sparse and a minor component of the vegetation communities, highly dependent on precipitation timing and amount. The primary disturbances included fluctuations in precipitation and native ungulate browsing. Plant community composition likely changed during wet and dry periods, fluctuating between community phases 1.1 and 1.2.

Reference State: Plant communities influenced by climate fluctuations between wet and dry periods.

Indicators: Communities dominated by valley saltbush, with Indian ricegrass and James' galleta important perennial grasses. No invasive species present.

Feedbacks: Natural fluctuations in climate allow for a self-sustaining sparse shrub community with shrub and grass components.

At-risk Community Phase: Community 1.2 is particularly susceptible to damage from livestock grazing, invasion by non-native species, and erosion.

Trigger: Improper livestock grazing in an arid system that did not evolve with large herbivores, which reduced plant cover and disturbed soils, and concomitant invasion of non-native plants that permanently altered ecological dynamics.

Community 1.1
Valley saltbush /Indian ricegrass – James' galleta shrubland
Data for this community phase does not exist, but the community composition was likely similar to community phase 2.1, except with higher vegetative cover and production, fewer forbs, and a greater importance of Indian ricegrass and less importance of James' galleta. Species composition in the below table was interpreted from Community Phase 2.1.

Community 1.2
Valley saltbush /James' galleta – Indian ricegrass shrubland
Data for this community phase does not exist, but the community composition was likely similar to community phase 2.2, except with higher vegetative cover and production and fewer forbs. James' galleta may naturally have been a more dominant grass in this phase due to higher drought tolerance than Indian ricegrass.

Pathway 1.1a
Community 1.1 to 1.2
This pathway occurs when a dry climatic phase triggers mortality and dieback in valley saltbush, Indian ricegrass, and other shallow-rooted shrubs and herbaceous species. James' galleta may be impacted with severe drought, but is generally more tolerant of drought conditions than the other dominant species.

Pathway 1.2a
Community 1.2 to 1.1
This pathway occurs with wetter than normal, or a return to normal precipitation periods and time, that allow for recruitment and growth of valley saltbush and Indian ricegrass.

State 2
Current Potential
This state represents the current potential of this ecological site, and the dynamics include disturbance by livestock and invasive species in addition to the climate fluctuations that influenced the reference state. This state will naturally fluctuate between community phases 2.1 and 2.2, and will shift to community phase 2.3 with abusive livestock use. Continued abusive use, especially if coupled with drought, could cause a transition to a degraded state (state 3), or a forb dominated state (state 4).

Current Potential State: Plant communities influenced by climate fluctuations between wet and dry periods, livestock grazing, and invasive plants.

Indicators: Communities dominated by valley saltbush with Indian ricegrass and James' galleta important perennial grasses. Invasive species including cheatgrass and redstem stork's bill (Erodium cicutarium) are typically present but not abundant.

Feedbacks: Natural fluctuations in climate allow for a self-sustaining sparse shrub community with shrub and grass components. Improper livestock use that damages soils, reduces vegetative cover and promotes establishment of non-native species.

At-risk Community Phase: Community phases 2.2 and 2.3 are at risk of transitioning to a degraded or forb dominated state with continued

abusive livestock grazing use, especially in combination with drought.

Trigger: Continuous improper livestock grazing, or severe drought with invasive plant invasion.

Community 2.1
Valley saltbush /Indian ricegrass – James' galleta shrubland
This phase is characterized by shrub dominance, with 20-30% cover of valley saltbush. Secondary shrubs are of minor importance. Common species include green molly (Bassia americana), greasewood (Sarbotus vermiculatus), and broom snakeweed (Gutierrezia sarothrae). Perennial grasses are an important component of this phase, with Indian ricegrass, squirreltail (Elymus elymoides), and James' galleta important species. Western wheatgrass (Pascopyrum smithii) and/or alkali sacaton (Sporobolis airoides) may be present as minor species. Cheatgrass may be present. The forb component of this community is highly variable, with composition and amounts of forbs varying from year to year and site to site. Wingnut cryptantha (Cryptantha pterocarya), Hayden's milkvetch (Astragalus bisulcatus), and miniature woollystar (Eriastrum diffusum) were recorded in this phase, but many others could be present at a given location. The non-native annual forb redstem stork's bill may be present. Gravels average 22%, bare ground 29%, litter 9% and total foliar canopy 42%.

Community 2.2
Valley saltbush /James' galleta shrubland
This community phase is characterized by 9 to 16% cover of valley saltbush, with minor secondary shrubs as in community phase 2.1. James' galleta is the dominant grass in this phase, with 14 to 30% cover. Squirreltail is the second most abundant grass at 1 to 6% cover, while Indian ricegrass has 0 to 4% cover. Cheatgrass may be present at low amounts. Forbs may be more diverse in this phase, due to reduced competition with shrubs. The below table lists commonly forb encountered species. Redstem stork's bill may be present at low amounts. Gravels range from 0 to 18%, bare ground 34-38%, litter 4-10% and total foliar canopy 34-56%.

Community 2.3
Valley saltbush
Community composition data were not collected for this phase. This community phase is characterized by dominance of bare ground, almost no herbaceous cover, and greatly reduced shrub cover. This phase is at high risk of erosion and invasive species dominance.

Pathway 2.1a
Community 2.1 to 2.2
This pathway occurs when a dry climatic phase triggers mortality and dieback in valley saltbush, Indian ricegrass, and other shallow-rooted shrubs and herbaceous species. James' galleta may be impacted with severe drought, but is generally more tolerant of drought conditions than the other dominant species.

Pathway 2.1b
Community 2.1 to 2.3
This pathway occurs when abusive livestock grazing, often in combination with drought, remove the bulk of herbaceous vegetation, and remove significant shrub cover, leaving a phase dominated by bare ground with low shrub cover.

Pathway 2.2a
Community 2.2 to 2.1
This pathway occurs with wetter than normal, or a return to normal precipitation periods and time, that allow for recruitment and growth of valley saltbush and Indian ricegrass.

Pathway 2.2b
Community 2.2 to 2.3
This pathway occurs when abusive livestock grazing, often in combination with drought, remove the bulk of herbaceous vegetation, and remove significant shrub cover, leaving a phase dominated by bare ground with low shrub cover.

Pathway 2.3a
Community 2.3 to 2.1
This pathway may occur with time in the absence of further disturbance, and will occur more quickly with favorable precipitation conditions. The time necessary for recovery is unknown; one study found an increase in Gardner's saltbush cover after 14 years of rest from grazing. Recovery times will depend on precipitation and the level of degradation.

Pathway 2.3b
Community 2.3 to 2.2
This pathway may occur with rest from grazing and no additional disturbance. James' galleta may recover more quickly, and this pathway may be more likely than pathway 2.3a.

State 3
Degraded
This state is characterized by low vegetative cover with eroded soils and dynamics influenced by halogeton invasion. Reduced vegetative cover in this state has exposed soil to erosion, and soil surfaces have high gravel cover, sometimes approaching a desert pavement

appearance. Halogeton alters soil biology and chemistry, which can make soils more hostile for native plant recruitment, and facilitates further halogeton establishment. This state is very vulnerable, and continued abusive use, especially if coupled with drought, or severe drought alone could cause a transition to a forb dominated state (State 4).

Degraded State: Plant communities influenced by abusive livestock grazing, climate fluctuations and halogeton invasion.

Indicators: Low vegetative cover and high cover of bare ground and gravels. Halogeton is significant but not dominant. Forbs are more important and diverse in this state than in the interpretive or reference state.

Feedbacks: Improper livestock use that damages soils, reduces vegetative cover and promotes soil erosion, establishment of non-native species, and an increase in forbs.

At-risk Community Phase: Community phase 3.1 is at high risk of transitioning to a forb dominated state (State 4).

Trigger: Continuous improper livestock grazing, and/or severe drought or other disturbance that removes vegetation.

Community 3.1
Valley saltbush / James' galleta- Halogeton
This community phase is characterized by low cover of valley saltbush, at 4 to 7%. James' galleta is the dominant species, with 5 to 10% cover. Drop-seed grasses (Sporobolis cryptandrus and S. contractus), which are more tolerant of grazing, are typically present. Indian ricegrass may be present at low cover. Forbs make a significant contribution to this community phase, although cover and density will vary with precipitation. Freckled milkvetch (Astragalus lentiginosus) and woolly plantain (Plantago patagonica) are among the more productive forbs that are typically present. Halogeton is prevalent in this community phase, but is still at relatively low cover. Gravels range from 45 to 50%, bare ground 25-30%, litter 5-7% and total foliar canopy 23-27%.

State 4
Forb dominated
This state is characterized by dominance by forbs, with halogeton the most important species. Valley saltbush may be eliminated or greatly reduced. James' galleta is the dominant grass, and Indian ricegrass may be eliminated or greatly reduced. Desert trumpet (Eriogonum inflatum) may be an important species. Reduced vegetative cover in this state has exposed soil to erosion, and soil surfaces have high gravel cover, sometimes approaching a desert pavement appearance. Halogeton alters soil biology and chemistry, which can make soils more hostile for native plant recruitment, and facilitates further halogeton establishment.

Annual dominated State: Plant communities influenced by climate fluctuations between wet and dry periods, livestock grazing, and invasive plants.

Indicators: Communities dominated by forbs, with halogeton the dominant species. Valley saltbush is eliminated or greatly reduced. High cover of bare ground and gravels, and erosion is typically visible.

Feedbacks: Low or absent cover of native perennials, a halogeton seedbank, and altered soils promote the maintenance of a halogeton dominated state.

Community 4.1
Forb dominated
This community phase is characterized by absence or very low cover of valley saltbush and dominance of forbs. Halogeton is the dominant plant, and desert trumpet is an important species. James' galleta is the most abundant native perennial grass, but is present at much reduced levels relative to more intact states. Gravels average 47%, bare ground 30%, litter 3% and total foliar canopy 21%.

Transition T1A
State 1 to 2
Transition from reference state (State 1) to interpretive state (State 2). This transition occurred with pervasive intensive livestock use beginning in the 1880's. Livestock grazing introduced invasive species such as cheatgrass and halogeton, and increased site susceptibility to continued invasion; once established these species are virtually impossible to remove, thus causing a shift to an altered state. The composition and productivity of the altered state was also likely affected, with reduced cover of palatable, grazing intolerant species and increasing the importance of less palatable, more grazing tolerant species.

Transition T2A
State 2 to 3
Transition from interpretive state (State 2) to degraded state (State 3). This transition may occur with continued heavy grazing that reduces valley saltbush cover and exposes soils to invasion by halogeton and erosion.

Transition T2B
State 2 to 4
Transition T2B Transition from interpretive state (State 2) to forb dominated state (State 4). This transition may occur when severe abusive grazing, often in combination with drought, that eliminates or depletes valley saltbush cover to the extent that halogeton and

other forbs dominate.

Transition T3A
State 3 to 4
Transition from degraded state (State 3) to forb dominated state (State 4). This transition may occur with continued abusive grazing, often in combination with drought, that eliminates or depletes valley saltbush cover to the extent that halogeton and other forbs dominate. This transition may occur even if livestock grazing is removed if drought or other disturbance removes valley saltbush cover and provides an opening for halogeton to become dominant.

State and transition model

Additional community tables

Approval

Kirt Walstad, 3/04/2022

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	06/20/2026
Approved by	
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:**

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17. **Perennial plant reproductive capability:**