USDA Natural Resources
Conservation Service

Ecological site R034BY117UT
Desert Shallow Clay (Mat Saltbush)

Last updated: 3/05/2022
Accessed: 05/09/2024

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.

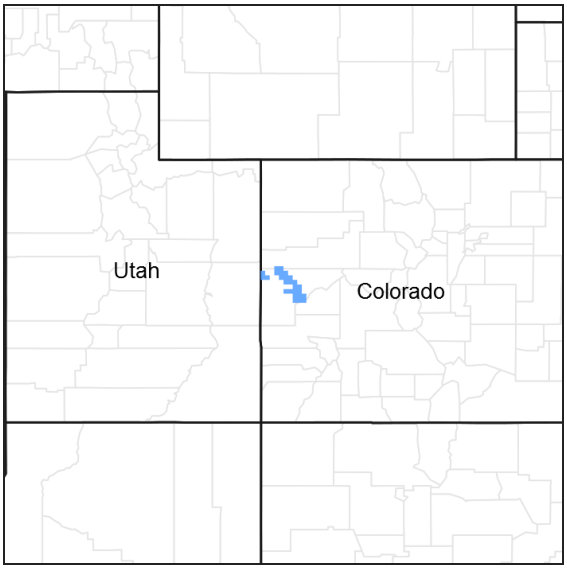

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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 and/or residuum from Mancos shale sources. Surface soils are very flaggy loam to silty clay loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 50 percent of the soil volume. These soils are generally shallow but can be moderately deep, well-drained, and have very slow to moderately slow permeability. pH is slightly to very strongly alkaline.. Available water-holding capacity ranges from 1 to 6 inches of water in the upper 40 inches of soil. The soil moisture regime is typic aridic and the soil temperature regime is mesic. Precipitation ranges from 5-8.5 inches annually.

Associated sites

R034BY101UT	**Desert Alkali Bench (Castlevalley saltbush)** Desert Alkali Bench (Castlevalley saltbush)
R034BY103UT	**Desert Clay (Castlevalley saltbush)** Desert Clay (Castlevalley saltbush)
R034BY121UT	**Desert Shallow Loam (Shadscale)** Desert Shallow Loam (Shadscale)

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex corrugata*
Herbaceous	(1) *Pleuraphis jamesii*

Physiographic features

This site occurs on hills, and benches on Mancos Shale.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Structural bench (3) Plain
Runoff class	High to very high
Flooding frequency	None

Ponding frequency	None
Elevation	1,219–2,073 m
Slope	1–50%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

Average annual precipitation is 5 to 8.5 inches.

Approximately 60-70% occurs as rain from March through September. On the average, November through February are the driest months and July through October are the wettest months. The mean annual air temperature is 8.4 degrees celsius and the soil temperatures are in the mesic regime. The average freeze-free period is 110 to 140 days. In average years, plants begin growth around March 15 and end growth around October 15.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	127-203 mm
Frost-free period (average)	
Freeze-free period (average)	140 days
Precipitation total (average)	

Influencing water features

None.

Soil features

The soils of this site formed mostly in alluvium and/or residuum from shale sources. Surface soils are very flaggy loam to silty clay loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 50 percent of the soil volume. These soils are generally shallow but can be moderately deep.
Soils deeper than 20 inches are usually shallow to a C/Cr horizon. They are well-drained, and have very slow to moderately slow permeability. pH is slightly to very strongly alkaline.. Available water-holding capacity ranges from 1 to 6 inches of water in the upper 40 inches of soil. The soil moisture regime is typic aridic and the soil temperature regime is mesic. Precipitation ranges from 5-8.5 inches annually.

Modal Soil: Hanksville SiCL 2-25%, 25-50% — fine, mixed, calcareous, mesic Typic Torriorthents

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Residuum–shale
Surface texture	(1) Very flaggy loam (2) Silty clay loam
Drainage class	Well drained
Permeability class	Very slow to moderately slow
Depth to restrictive layer	13–102 cm
Soil depth	13–102 cm

Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–30%
Available water capacity (Depth not specified)	2.54–15.24 cm
Calcium carbonate equivalent (Depth not specified)	5–40%
Electrical conductivity (Depth not specified)	0–16 mmhos/cm
Sodium adsorption ratio (Depth not specified)	2–25
Soil reaction (1:1 water) (Depth not specified)	7.4–11
Subsurface fragment volume <=3" (Depth not specified)	0–52%
Subsurface fragment volume >3" (Depth not specified)	0–12%

Ecological dynamics

State 1: Reference State
This reference state describes the natural biotic communities that may become established on the Desert Shallow Clay (mat saltbush) ecological site if all successional sequences are completed under the natural disturbance regime. This state is typically composed of a shrub layer dominated mat saltbush with lesser amounts of perennial warm and cool grasses present. It is normally self sustaining and stable due to its high resistance to natural disturbances and high resilience following natural disturbances. Once invasive plants become established, return to the reference state may not be possible.

Reference State: Community phases influenced by native herbivore grazing, insect herbivory, and weather.

Indicators: A sparse perennial cool and warm season grass understory with mat saltbush forming the dominant visual aspect.

Feedbacks: Extended drought and/or improper grazing that result in a reduction of native perennial plant vigor which may cause invasive species to become established in the understory, increased bare spaces, erosion, and soil loss. Properly managed grazing that maintains the perennial bunchgrass understory.

At-risk Community Phase: All communities in this state are at risk when native plants are stressed and/or nutrients become available for invasive plants to establish.

Trigger: Introduction and establishment of non-native invasive plants such as cheatgrass and Russian thistle.

Community Phase 1.1: Mat saltbush; Perennial Grass Community Phase
This community is characterized by a mat saltbush shrub canopy with perennial native grasses present in the herbaceous layer. Commonly occurring grasses include Indian ricegrass and James galleta. As grass cover increases, shrub interspaces are reduced. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable.

Composition by air dry weight is approximately 10 percent forbs, 15 percent grasses, and 75 percent shrubs. Bare ground is variable (40-70%) depending on the number of surface rock fragments which is also variable. Steep hillslopes in this ecological site are often dissected by rills and gullies.

Transition T1A
T1A – This transition is from the reference state where only native perennial warm and cool season grasses occur to a state that also includes invasive species. Events may include combinations of conditions favorable for the establishment of invasive plant species, including improper livestock grazing, heavy wildlife browsing, prolonged

drought, and surface disturbances. However, invasive species such as cheatgrass have been known to invade intact perennial plant communities with little to no disturbance. Once invasive species are present in the plant community, a threshold has been crossed.

State 2: Current Potential State
The current potential state is similar to the reference state except that invasive species are now present. It is generally dominated by mat saltbush, native perennial grasses and forbs may also be present.

Primary disturbance mechanisms include climate fluctuations, native herbivore grazing, domestic livestock grazing, and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. Timing of these disturbances dictates the ecological dynamics that occur. Do to a lack of disturbed locations, the long term effects of such disturbances are not understood.

Reference State: Community phases disturbed by climate fluctuations.

Indicators: A site dominated by mat saltbush. James galleta, and Indian ricegrass may also be present. Non-native species are now present in the stand.

Feedbacks: Extended drought resulting in a reduction of native perennial plant vigor. Normal fluctuations in weather allowing for the maintenance of both shrubs and perennial grasses.

At-risk Community Phase: This state is at risk when perennial plant cover is reduced and nutrients become available for invasive plants to flourish.

Trigger: Spread of invasive plants to fill available niches.

Community Phase 2.1: Mat saltbush/ Invasive Weed Phase
This community phase is characterized by a mat saltbush shrub canopy, where perennial native grasses are present. Invasive plants are also present. Commonly seen grasses include Indian ricegrass, James galleta, false annual wheatgrass, and cheatgrass. Other grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground, rock fragments, and biological crust cover are very similar to community phase 1.1 in their variability and responses to each other.

The following tables provide an example of the typical vegetative floristics of a community phase 2.1 plant community.

Transition T2A
T2A – This transition is from a state dominated by perennial shrubs, grasses and invasive weeds to a state that is dominated by annual invasive species. Events include brush treatments, improper livestock grazing and/or wildlife browsing coupled with prolonged drought, and surface disturbances that remove shrubs including off-road vehicle use, and road and pipeline development. Once brush is removed and invasive plants dominate, a threshold has been crossed.

State 3: Annual Weed State
The Annual Weed State is generally dominated by invasive annual plants such as false annual wheatgrass, cheatgrass, halogeton and Russian thistle. Mat saltbush may or may not be present.

Annual Weed State: Community phases maintained, in a self-sustaining manner, by invasive annual weed domination and/or occasional fire.

Indicators: A site where ecological processes are driven by cheatgrass and/or other invasive annual forbs.

Feedbacks: A self sustaining disturbance regime of invasive annual weed domination and/or occasional fire.

Community Phase 3.1: Annual Weedy Herbaceous Phase
This community phase is characterized by a reduction in mat saltbush and other shrubs, and an increase in invasive annuals. Common invasives include Russian thistle, halogeton, false annual wheatgrass, and cheatgrass. This state is the result of disturbances that reduce shrub canopy cover. Bare ground, rock fragments, and biological crust

cover are very similar to community phase 1.1 in their variability and responses to each other.

State and transition model

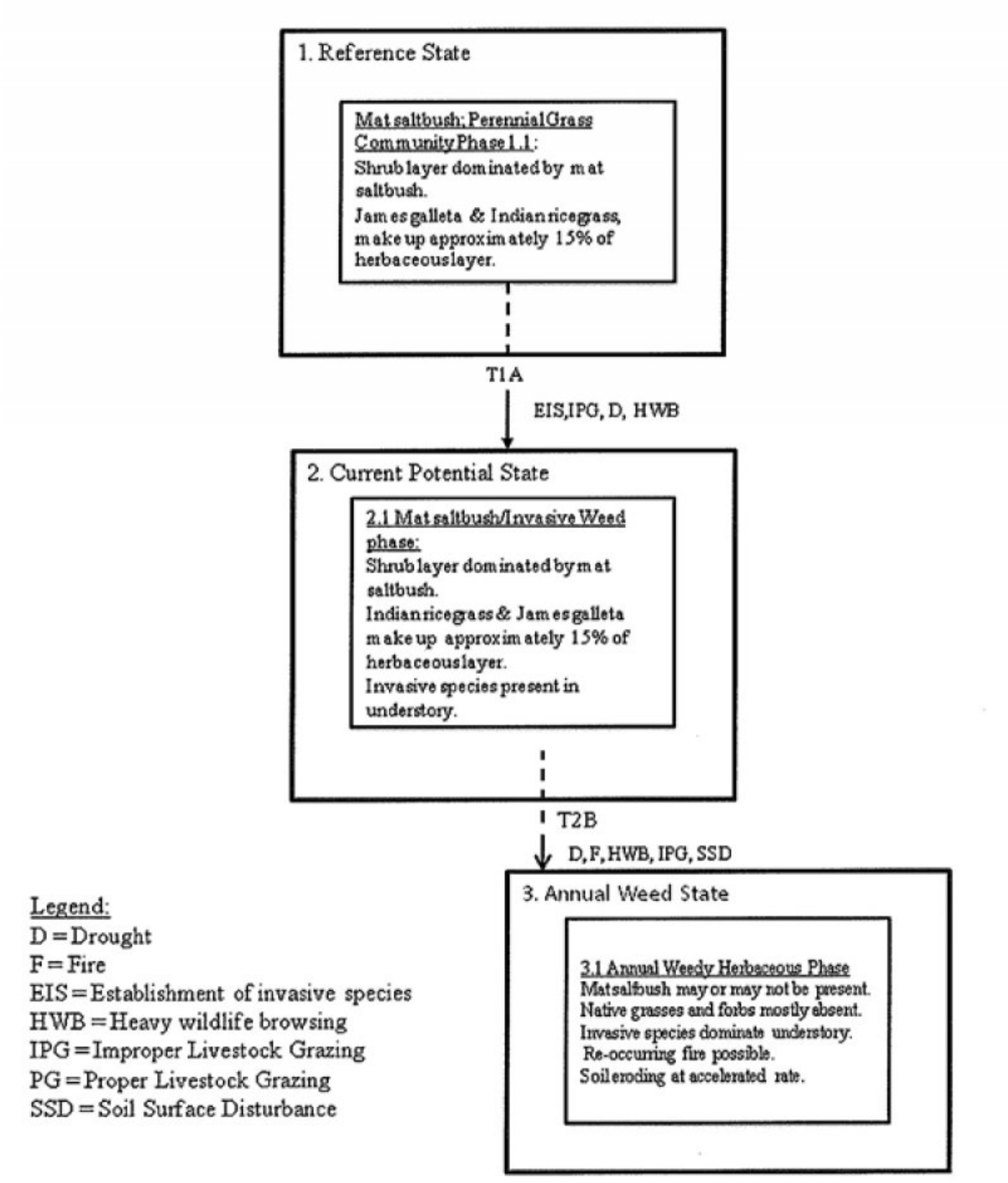

Figure 2. STM

State 1
Reference State

Community 1.1
Reference State

The dominant aspect of the plant community is mat saltbush. The composition by air-dry weight is approximately 15 percent perennial grasses, 10 percent forbs, and 75 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	105	147	273
Grass/Grasslike	21	29	55
Forb	15	20	37
Total	**141**	**196**	**365**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	9-11%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	29-31%	9-11%	4-6%
>0.3 <= 0.6	–	–	–	–
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			141–168	
	mat saltbush	ATCO4	*Atriplex corrugata*	135–157	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	7–11	–
3	**Sub-Dominant Shrubs**			58–101	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–22	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	7–11	–
	valley saltbush	ATCU	*Atriplex cuneata*	7–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	7–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	7–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	7–11	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	7–11	–
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	7–11	–
Grass/Grasslike					
0	**Dominant Grasses**			20–40	
	squirreltail	ELEL5	*Elymus elymoides*	7–11	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–7	–
1	**Sub-Dominant Grasses**			13–22	
	Grass, annual	2GA	*Grass, annual*	7–11	–
	Grass, perennial	2GP	*Grass, perennial*	7–11	–
Forb					
0	**Dominant Forbs**			16–40	
	desert trumpet	ERIN4	*Eriogonum inflatum*	4–11	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	2–7	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6–7	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	6–7	–
	pale evening primrose	OEPA	*Oenothera pallida*	6–4	–
	woolly plantain	PLPA2	*Plantago patagonica*	6–4	–
2	**Sub-Dominant Forbs**			31–58	
	Forb, annual	2FA	*Forb, annual*	7–11	–
	Forb, perennial	2FP	*Forb, perennial*	7–11	–
	Uinta Basin gilia	ALST12	*Aliciella stenothyrsa*	2–4	–
	sego lily	CANU3	*Calochortus nuttallii*	2–4	–
	Bateman's buckwheat	ERBA5	*Eriogonum batemanii*	2–4	–
	basin fleabane	ERPU9	*Erigeron pulcherrimus*	2–4	–
	common sunflower	HEAN3	*Helianthus annuus*	2–4	–
	prairie sunflower	HEPE	*Helianthus petiolaris*	2–4	–
	Gray's biscuitroot	LOGR	*Lomatium grayi*	2–4	–
	oblongleaf basindaisy	PLINO	*Platyschkuhria integrifolia var. oblongifolia*	2–4	–

Animal community

This site provides proper grazing for sheep and cattle during fall, winter, and spring.
This site provides food and limited cover for wildlife. Wildlife using this site include mice, kangaroo rat, snake, jackrabbit, coyote, bobcat, and hawk.

Hydrological functions

The soil is in hydrologic groups c and d. The runoff curve numbers are 74 through 89 depending on the condition of the watershed.

Recreational uses

Recreation values are hiking and hunting.

Wood products

None

Contributors

J. Lee Broadbent

Approval

Kirt Walstad, 3/05/2022

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)	V. Keith Wadman (NRCS, Ret.)
Contact for lead author	shane.green@ut.usda.gov
Date	06/01/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are very common. They may be more pronounced on steeper slopes and/or on areas located below exposed bedrock, or other water shedding areas where increased runoff may occur. Rills present should be < 2 inches deep, fairly long (> 15 feet) and somewhat widely spaced (8-10 feet). On steeper slopes, rills may be 20 to 25+ feet long and spaced 6 to 8 feet apart. The expression of rills may be less defined where coarse fragments (i.e., gravels and/or channers) dominate the soil surface.

---

2. **Presence of water flow patterns:** Water flow patterns are very common throughout the site. They often form sinuous

flow patterns that wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (1 to 2 feet wide), and spaced widely (10-20 yards) on gentle slopes (<15%) and more closely (<10 yards) on steeper slopes (>15%).

---

3. **Number and height of erosional pedestals or terracettes:** Small pedestals will often form at the base of plants that occur on the edge of water flow patterns, but should show few (2 to 4%) exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 1 inch) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 55–65%. Soil surface may be partly covered by gravels or channers. Most bare ground is associated with water flow patterns, rills, and gullies. Bare ground spaces should not be greater than 2 to 3 feet and may be connected. Poorly developed biological soil crusts that are interpreted as functioning as bare ground should be recorded as bare ground.

---

5. **Number of gullies and erosion associated with gullies:** Somewhat rare on slopes < 15%. A few scattered gullies will be expected to occur on steeper slopes and on areas below exposed bedrock. There they do occur, their length often extends from the exposed bedrock to where the gully reaches a stream or other area where water and sediment accumulate. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind caused blowouts and deposition are not expected to be present.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Some litter removal may occur in flow channels with deposition occurring within 2 to 3 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 4 feet) with increases in slopes > 15% and/or increased runoff resulting from heavy thunderstorms.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 3 to 4 under plant canopies and a rating of 2 to 3 in the interspaces. The average should be a 3. Surface texture is silty clay loam. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Chipeta) Soil surface horizon is typically 0 to 5 inches deep. Texture is a silty clay loam, structure is typically weak fine subangular blocky. Color is a brownish gray (2.5YR 6/2). An ochric horizon extends 5 inches into the soil profile. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial vegetation is expected to break raindrop impact and splash erosion reducing splash erosion but not eliminating it. Spatial distribution of vascular plants slows runoff somewhat by obstructing surface flows and help create sinuous flow patterns that dissipate energy and allow time for some infiltration. Natural erosion would be expected in most storms and spring runoff.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Clay content within the soil profile increases with depth. Weathered calcareous marine shale occurs at agout 17 inches. These should not be mistaken for a compaction layer.

---

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: Non-sprouting shrubs (mat saltbush, bud sagebrush) > Rhizomatous grasses (James galleta) >> Perennial forbs (Indian pipeweed) > Biological soil crusts.

    Sub-dominant: Sprouting shrubs (winterfat, shortspine horsebrush) > Cool season perennial bunchgrasses (Indian ricegrass, bottlebrush squirreltail) > Perennial forbs (scarlet globemallow).

    Other: Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Moss and lichen communities will normally be found under plant canopies while the cyanobacteria may be found throughout the site. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present during years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought or insect infestations, up to 20% of the winterfat may die. There may be partial mortality of individual bunchgrasses and shrubs during severe drought.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 10 to 15%. Depth should vary from none to a 1 leaf thickness in the interspaces and from 1/4 - 1/2 inches under perennial plant canopies.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 150 to 200 pounds per acre on an average year. Production could vary from 100 to 350 pounds per acre during drought or above-average years.

---

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: Russian thistle, halogeton, kochia, common sunflower, and annual mustards.

---

17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species should be present during average and above average growing years.
