USDA Natural Resources
Conservation Service

Ecological site R034BY101UT
Desert Alkali Bench (Castlevalley saltbush)

Last updated: 3/05/2022
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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.

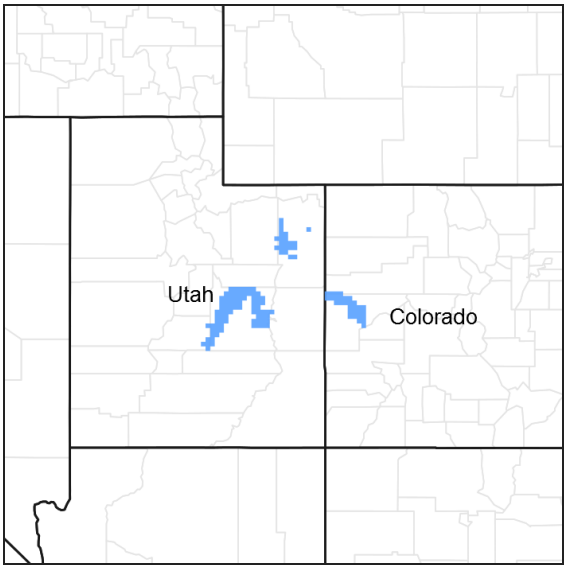


Figure 1. Mapped extent

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

This site occurs on alluvial flats, stream terraces or strath terraces. Slopes are mostly 0 to 8 percent, but side slopes of benches and mesas are sometimes as steep as 25 percent. Elevations range from 4,700 to 5,600 feet on all aspects. Characteristic soils in this site are deep over shale and well drained. They formed in mixed alluvium derived mainly from sedimentary rock and quartzite. Soils have a natric horizon and are strongly to very strongly alkali affected. Textures are gravelly sandy loam, clay loam to loam. A desert pavement on the surface is common. The water supplying capacity is 3 to 7 inches. Average annual soil loss in potential is approximately 1 ton/acre. Soil temperature regime is mesic and soil moisture regime is typic aridic.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Atriplex cuneata*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Elymus elymoides*

Physiographic features

This site occurs on alluvial flats, stream terraces or strath terraces. Slopes are mostly 0 to 8 percent, but side slopes of benches and mesas are sometimes as steep as 25 percent. Elevations range from 4,700 to 5,600 feet on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Stream terrace (3) Strath terrace
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,433–1,707 m
Slope	0–8%
Ponding depth	Not specified

Water table depth	Not specified

Climatic features

Average annual precipitation is 5 to 8 inches. Approximately 60 to 70 percent 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)	110-140 days
Precipitation total (characteristic range)	127-203 mm

Influencing water features

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

Soil features

Characteristic soils in this site are deep over shale and well drained. They formed in mixed alluvium derived mainly from sedimentary rock and quartzite. Soils have a natric horizon and are strongly to very strongly alkali affected. Textures are gravelly sandy loam, clay loam to loam. A desert pavement on the surface is common. The water supplying capacity is 3 to 7 inches. Average annual soil loss in potential is approximately 1 ton/acre. Soil temperature regime is mesic and soil moisture regime is typic aridic.

Modal Soil: Leebench L, 0-2% – fine-loamy, mixed, mesic Typic Natrargids

Table 4. Representative soil features

Parent material	(1) Alluvium–sedimentary rock (2) Alluvium–quartzite
Surface texture	(1) Gravelly sandy loam (2) Clay loam (3) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	51–152 cm
Soil depth	51–152 cm
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–10%
Available water capacity (Depth not specified)	7.62–17.78 cm
Calcium carbonate equivalent (Depth not specified)	1–15%
Electrical conductivity (Depth not specified)	0–10 mmhos/cm
Sodium adsorption ratio (Depth not specified)	5–30

Soil reaction (1:1 water) (Depth not specified)	8.5–11
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–25%

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). Which were characterized by a relatively sparse shrub cover of shadscale and valley saltbush with Indian ricegrass and squirreltail. Indian ricegrass, shadscale and valley saltbush cover were likely higher in the reference state. 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 shadcale and valley saltbush, with Indian ricegrass and squirreltail as 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
Shadscale-Valley saltbush /Indian ricegrass – Squirreltail 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 squirreltail. Species composition in the below table was interpreted from Community Phase 2.1.

Community 1.2
Shadscale -Valley saltbush /squirreltail – 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.

Pathway 1.1a
Community 1.1 to 1.2
This pathway occurs when a dry climatic phase triggers mortality and dieback in shadscale, valley saltbush, Indian ricegrass, and other shallow-rooted shrubs and herbaceous 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 shadscale, 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 shadscale, valley saltbush with Indian ricegrass and squirreltail 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
Shadscale-Valley saltbush /Indian ricegrass – squirreltail shrubland
This phase is characterized by shrub dominance of shadscale and valley saltbush. Secondary shrubs are of minor importance. Common species include winterfat (*Krascheninnikovia lanata*), greasewwod (Sarbotus vermiculatus), and broom snakeweed (*Gutierrezia sarothrae*). Perennial grasses are an important component of this phase, with Indian ricegrass, and squirreltail (*Elymus elymoides*) important species. Sand dropseed (*Sporobolus cryptandrus*) 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.
Desert trumpet (*Eriogonum inflatum*), woolly plantain (*Plantago patagonica*), and
scarlet globemallow (*Sphaeralcea coccinea*) are the most common, but many others could be present at a given location. The non-native annual forb redstem stork's bill may be present.

Community 2.2
Shadscale-Valley saltbush /Squirreltail shrubland
This community phase is characterized by valley saltbush and shadscale, with minor secondary shrubs as in community phase 2.1. Squirreltail is the dominant grass in this phase. Indian ricegrass is the second most abundant grass. 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.

Community 2.3
Shadscale-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 shadscale, valley saltbush, Indian

ricegrass, and other shallow-rooted shrubs and herbaceous 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 shadscale, 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. 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.

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
Shadscale-Valley saltbush / squirreltail- Halogeton
This community phase is characterized by low cover of shadscale and valley saltbush. Squirreltail is the dominant species. Sand dropseed (Sporobolis cryptandrus), 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. Desert trumpet (*Eriogonum inflatum*), woolly plantain (*Plantago*

patagonica), and scarlet globemallow (*Sphaeralcea coccinea*)are among the more productive forbs that are typically present. Halogeton is prevalent in this community phase, but is still at relatively low cover.

State 4
Forb dominated
This state is characterized by dominance by forbs, with halogeton the most important species. Shadscale and valley saltbush may be eliminated or greatly reduced. Squirreltail 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 and shadscale are 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 shadscale and valley saltbush and dominance of forbs. Halogeton is the dominant plant, and desert trumpet is an important species. Squirreltail is the most abundant native perennial grass, but is present at much reduced levels relative to more intact states.

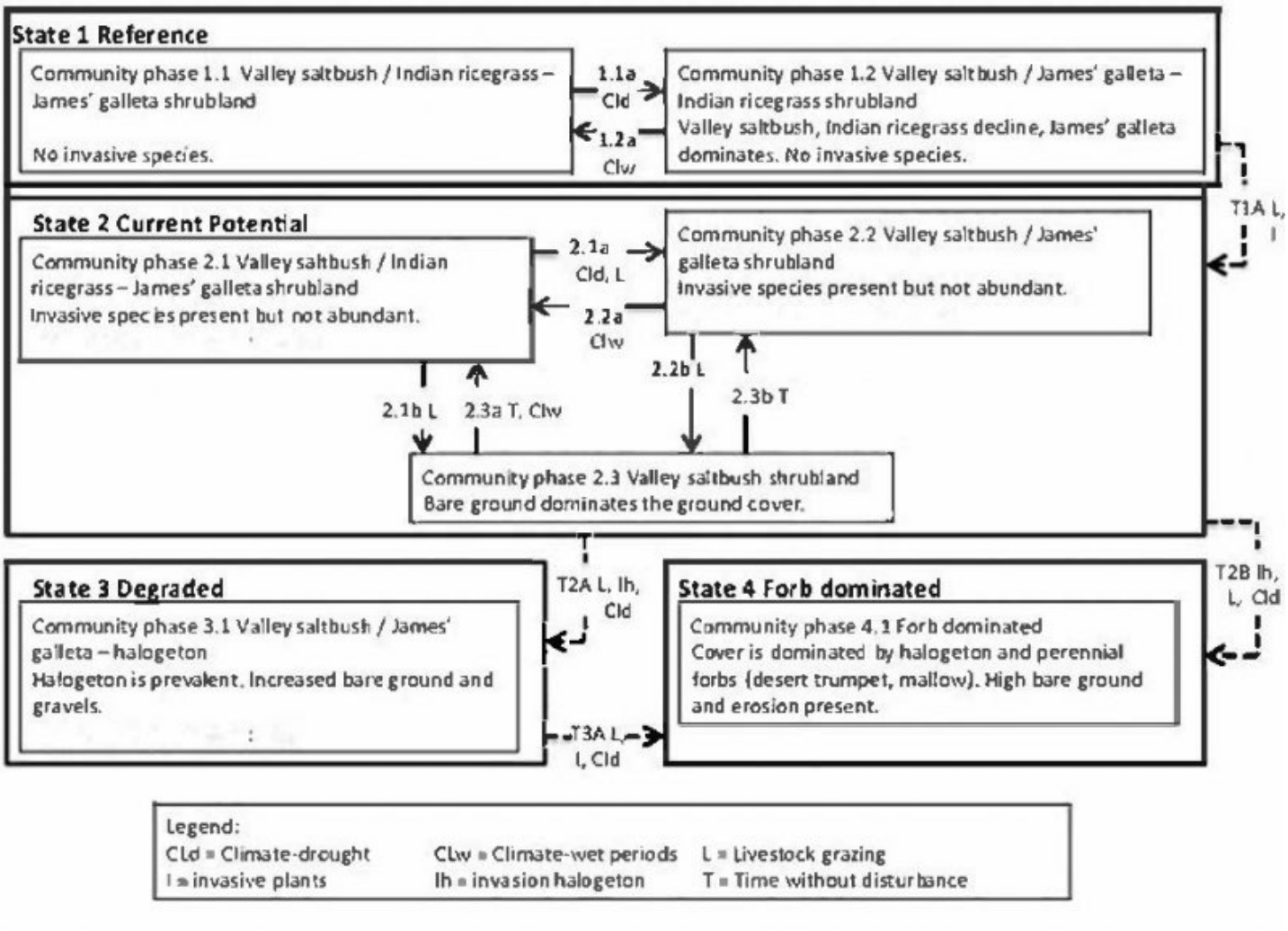
Transition T1A
State 1 to 2
Transition from reference state (State 1) to interpretive state (State 2). This transition occurred with pervasive intensive livestock use beginning in the 1880’s. Livestock grazing introduced invasive species such as cheatgrass and halogeton, and increased site susceptibility 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 shadscale and 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 shadscale and 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 shadscale and 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 shadscale and valley saltbush cover and provides an opening for halogeton to become dominant.

State and transition model



State 1
Reference State

Community 1.1
Reference State

The dominant aspect of this plant community is shadscale and castlevalley saltbush. The composition by air-dry weight is approximately 25 percent perennial grasses, 10 percent forbs, and 65 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	94	254	353
Grass/Grasslike	37	99	136
Forb	15	39	55
Total	**146**	**392**	**544**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	14-16%
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	–	–	–	4-6%
>0.3 <= 0.6	–	29-31%	14-16%	–
>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 Shrub**			224–314	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	90–112	–
	valley saltbush	ATCU	*Atriplex cuneata*	67–90	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	45–67	–
	green molly	BAAM4	*Bassia americana*	22–45	–
3	**Sub-Dominant Shrubs**			54–139	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	22–45	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–13	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	4–13	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–13	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	4–13	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	4–13	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	4–13	–
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	4–13	–
Grass/Grasslike					
0	**Dominant Grasses**			72–135	
	James' galleta	PLJA	*Pleuraphis jamesii*	45–67	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–45	

	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–45	–
	squirreltail	ELEL5	*Elymus elymoides*	4–22	–
1	**Sub-Dominant Grasses**			49–90	
	Grass, annual	2GA	*Grass, annual*	13–22	–
	Grass, perennial	2GP	*Grass, perennial*	13–22	–
	purple threeawn	ARPU9	*Aristida purpurea*	4–9	–
	little barley	HOPU	*Hordeum pusillum*	4–9	–
	alkali sacaton	SPAI	*Sporobolus airoides*	4–9	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	4–9	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	4–9	–
Forb					
0	**Dominant Forbs**			13–40	
	desert trumpet	ERIN4	*Eriogonum inflatum*	4–13	–
	woolly plantain	PLPA2	*Plantago patagonica*	4–13	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	4–13	–
2	**Sub-Dominant Forbs**			81–152	
	Forb, annual	2FA	*Forb, annual*	13–22	–
	Forb, perennial	2FP	*Forb, perennial*	13–22	–
	pink funnel lily	ANBR4	*Androstephium breviflorum*	4–9	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	4–9	–
	Fremont's goosefoot	CHFR3	*Chenopodium fremontii*	4–9	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	4–9	–
	bulbous springparsley	CYBU	*Cymopterus bulbosus*	4–9	–
	ballhead ipomopsis	IPCOC3	*Ipomopsis congesta ssp. congesta*	4–9	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	4–9	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	4–9	–
	Torrey's desertdandelion	MATO2	*Malacothrix torreyi*	4–9	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	4–9	–
	pale evening primrose	OEPA	*Oenothera pallida*	4–9	–
	basindaisy	PLIN7	*Platyschkuhria integrifolia*	4–9	–

Animal community

This site provides proper grazing for sheep and some cattle in the winter and spring. This site provides food and limited cover for wildlife. Wildlife using this site include jackrabbit, coyote, lizard, snake, hawk, mice, and sparrow.

Hydrological functions

The soil is in hydrologic group D. The runoff curve numbers are 80 through 89 depending on watershed condition.

Recreational uses

This site may have aesthetic values but limited recreational opportunities.

Wood products

Possibly firewood from invasion juniper; otherwise none.

Contributors

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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.

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Date	05/30/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** A few rills may be present. A slight increase in rill development may occur immediately following large storm events. Rills should show significant healing during the next one or two growing seasons because of frost-heave recovery and the sites coarse soil textures. Rills present should be < 1 inch deep and may average 5-10 feet in length. A slight increase in rill development may also be observed below adjacent exposed bedrock or other water shedding sites where sufficient water accumulates to cause erosion.

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2. **Presence of water flow patterns:** A few water flow patterns are present. They should be 1 to 2 feet in width, and fairly short (5-10 feet). Waterflow patterns may increase slighty on steeper slopes following large storm events. Biological soil crusts, where present, appear to help stabilize water flow patterns during precipitation events.

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3. **Number and height of erosional pedestals or terracettes:** A few small pedestals (1 to 2 inches) may form at the base of plants that occur on the edge of water flow patterns, they should not show any exposed roots. A few terracettes are common, they may form behind debris dams of small litter (up to 1/2 inch in diameter) in water flow patterns. These debris dams may accumulate small litter (leaves, grass and forb stems) and sediment.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 35–45%. (Soil surface is typically covered 5-10% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Poorly developed biological soil crusts that are interpreted as functioning as

bare ground should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** None at site level. Scattered landscape level gully channels, however, are a normal component of desert environments. Where landscape gullies are present, they should be stable, partially vegetated on their sides and bottoms, with no evidence of head-cutting. Some slight increase in disturbance may be evident following significant weather events or when gullies convey considerable runoff from higher elevation rocky or naturally eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very little evidence of active wind erosion; blowouts and depositional areas are not present. Slight depositional mounding within perennial grass crowns, under shadscale, castlevalley saltbush, and within biological soil crusts is normal for this site.

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7. **Amount of litter movement (describe size and distance expected to travel):** The majority of litter accumulates in place at the base of plants canopies. Slight movement of the finest material (< 1/8 inch) may move 1 to 2 feet in the direction of prevailing winds or down slope if being transported by water. Minor accumulation may be observed behind obstructions following significant weather events.

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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):** This site should have a soil stability rating of 4 or 5 under plant canopies, and a 3 to 4 in the interspaces. Average should be a 4. Surface textures are typically gravelly loams, gravelly sandy loams, and sandy loams containing up to 10% coarse fragments.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Bandbox Soil surface is typically 0 to 4 inches deep. Surface texture is a sandy loam and structure is moderate thin platy. The A-horizon color is brown (10YR 5/3). Soils have an Ochric epipedon that extends 12 inches into the soil profile. The A horizon is normally deeper and better developed under plant canopies. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial vegetation and any well developed biological soil crusts will break raindrop impact and reduce splash erosion. Good spatial distribution of vascular plants provide increased detention storage and surface roughness that slows runoff, allowing more time for infiltration. Interspaces between plants and any well developed biological soil crusts may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms.

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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):** None. An argillic/natric horizon occurs at 12 to 18 inches and should not be mistaken for a compaction layer.

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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: Non-sprouting shrubs (shadscale, castlevalley saltbush) > Cool season perennial bunchgrasses (Indian ricegrass, bottlebrush squirreltail) > Perennial forbs (scarlet globemallow) > Biological soil crusts.

Sub-dominant: Non-sprouting shrubs (bud sagebrush, green molly) > Rhizomatous grasses (James galleta) > Perennial forbs (woolly plantain).

Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Biological soil crust is variable in it's 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: Following a recent disturbance such as fire, drought or insect damage that remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions reflect a community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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 up to 20% of the plants may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts, particularly on the coarser soils associated with this site. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 15 to 20% with a small spike when bud sagebrush drops its leaves. Depth should be 1 leaf thickness in the interspaces and from 1/2 to 3/4 inches under perennial plant canopies.

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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 300 to 400 pounds per acre on an average year. Production could vary from 80 to 535 pounds per acre during drought or above-average years.

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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:** Russian thistle, annual bromes and halogeton are most likely to invade this site.

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