USDA Natural Resources
Conservation Service

Ecological site R034BY106UT
Desert Loam (Shadscale)

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.

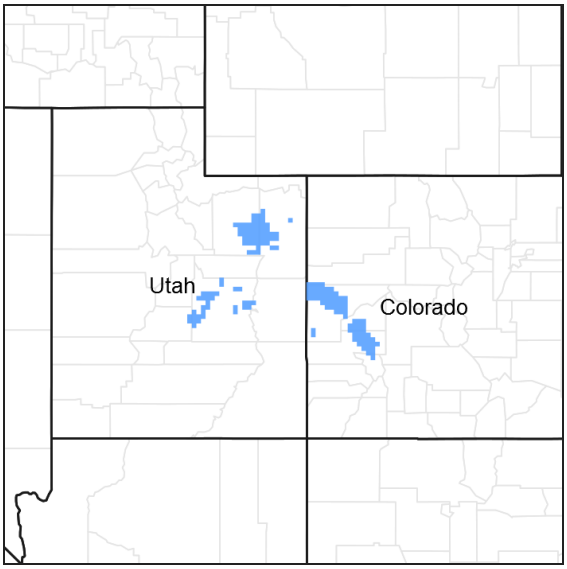


Figure 1. Mapped extent

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, flood-plain steps, fan remnants, and shale hills. Slopes are mostly 1 to 40 percent. Elevations range from 4,000 feet on all aspects to 6,500 feet on south aspects. Characteristic soils in this site are deep and well drained. They formed in slope alluvium over residuum derived mainly from sedimentary parent materials. Soils are fine-loamy with a surface texture of clay loam, silty clay loam to loam. Permeability is moderately slow to moderate and runoff is low to medium. pHs are slightly to strongly alkaline. The water supplying capacity is 4 to 7 inches. Average annual soil loss in potential is less than 1 ton/acre. Soil temperature regime is mesic and soil moisture regime is typic aridic. Precipitation ranges from 5-8 inches annually.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on alluvial flats, flood-plain steps, fan remnants, and shale hills. Slopes are mostly 1 to 40 percent. Elevations range from 4,000 feet on all aspects to 6,500 feet on south aspects.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Hill (3) Flood-plain step (4) Fan remnant
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,219–1,981 m
Slope	1–40%
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 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 125 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)	110-125 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 and well drained. They formed in slope alluvium over residuum derived mainly from calcareous shale. Soils are fine-loamy with a surface texture of clay loam, silty clay loam to loam. Permeability is moderately slow to moderate and runoff is low to medium. pHs are slightly to strongly alkaline. The water supplying capacity is 4 to 7 inches. Average annual soil loss in potential is less than 1 ton/acre. Soil temperature regime is mesic and soil moisture regime is typic aridic. Precipitation ranges from 5-8 inches annually.

Modal Soil: Minchey L, 1-4% — fine-loamy, mixed, mesic Typic Calciorthids

Table 4. Representative soil features

Parent material	(1) Slope alluvium–calcareous shale (2) Residuum–calcareous shale
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	51–152 cm
Soil depth	51–152 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	10.16–17.78 cm
Calcium carbonate equivalent (Depth not specified)	0–25%
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)	7.4–9

Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

State 1: Reference State
The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The Reference State has two general community phases: a shrub-grass dominate phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. This site is very stable, with little variation in plant community composition. Plant community changes would be reflected in production response to long term drought or herbivory. Wet years will increase grass production, while drought years will reduce production. Shrub production will also increase during wet years; however, extreme growing season wet periods has been shown to cause shadscale death.

Community Phase 1.1: Shadscale saltbush, Indian ricegrass
This community is dominated by shadscale, bud sagebrush and Indian ricegrass. Galleta grass and squirreltail are minor components along with winterfat and bud sagebrush.

Community phase changes are primarily a function of chronic drought. Drought will favor shrubs over perennial bunchgrasses. However, long-term drought will result in an overall decline in plant community production, regardless of functional group. Extreme growing season wet periods may also reduce the shadscale component. Fire is very infrequent to non-existent.

The dominant aspect of the plant community is shadscale. The composition by air dry weight is approximately 45 percent perennial grasses, 10 percent forbs, and 45 percent shrubs.

Community Phase Pathway 1.1a
Long-term drought, extreme wet periods and/or herbivory. Drought will favor shrubs over perennial bunchgrasses. Extreme wet periods will reduce the shadscale component.

Community Phase 1.2: Shadscale
Shrubs such as shadscale and bud sagebrush increase in the community. Perennial bunchgrasses decrease with drought and may become a minor component.

Community Phase Pathway 1.2a
Release from drought and/or herbivory would allow the vegetation to increase and bare ground would eventually decrease. Extreme growing season wet period may reduce shadscale.

Transition T1A
Trigger: This transition is caused by the introduction of non-native annual plants, such as halogeton, mustards and cheatgrass.

Slow variables: Over time the annual non-native species will increase within the community.

Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

State 2: Current Potential State
This state is similar to the Reference State 1.0. with the addition of a shadscale and sprouting shrub dominated community phase. Ecological function has not changed, however the resiliency of the state has been reduced by the

presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent.

Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Community Phase 2.1: Shadscale, bud sagebrush, Indian ricegrass
This community is compositionally similar to the Reference State Community Phase 1.1 with the presence of non-native species in trace amounts. This community is dominated by shadscale and Indian ricegrass. Galleta grass, bud sagebrush and winterfat are also important species on this site. Community phase changes are primarily a function of chronic drought or extreme wet periods. Fire is infrequent and patchy due to low fuel loads.

Community Phase Pathway 2.1a
Inappropriate growing season grazing favors unpalatable shrubs over bunchgrasses, winterfat and bud sagebrush. Long term drought will also decrease the perennial bunchgrasses in the understory.

Community Phase 2.2: Shadscale, other shrubs
Shadscale and rabbitbrush increase while Indian ricegrass and bud sagebrush decline. Bare ground increases along with annual weeds. Prolonged drought may lead to an overall decline in the plant community. Galleta grass may increase. Wet periods will decrease the shadscale component.

Community Phase Pathway 2.2a
Release from drought and/or appropriate grazing management that facilitates an increase in perennial grasses, winterfat and bud sagebrush. Extreme growing season wet period may reduce shadscale.

Community Phase Pathway 2.2b
Long term drought and/or inappropriate grazing will significantly reduce perennial grasses, winterfat and bud sagebrush in favor of shadscale and rabbitbrush.

Community Phase 2.3: Shadscale, other shrubs, annual non-natives
Shadscale and rabbitbrush dominates the overstory and perennial bunchgrasses, winterfat and bud sagebrush are reduced, either from competition with shrubs or from inappropriate grazing, chronic drought or both. Galleta may increase. Annual non-native species may be stable or increasing due to a lack of completion with perennial bunchgrasses. Bare ground may be significant. This community is at risk of crossing a threshold to either State 3.0 (shrub) or State 4.0 (annual).

Transition T2A
Trigger: Long-term inappropriate grazing and/or long-term drought will decrease or eliminate deep rooted perennial bunchgrasses and favor shrub growth and establishment.

Slow variables: Long term decrease in deep-rooted perennial grass density.

Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Transition T2B
Trigger: Fire and/or soil disturbing treatments such as drill seeding and plowing. An unusually wet spring may facilitate the increased germination and production of cheatgrass leading to its dominance within the community.

Slow variables: Increased production and cover of non-native annual species.

Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community. Increased, continuous fine fuels from annual non-native plants modify the fire regime by changing intensity, size and spatial variability of fires.

State 3: Shrub State
This state has one community phase that is characterized by shadscale, bud sagebrush or a sprouting shrub overstory with very little to no understory. The site has crossed a biotic threshold and site processes are being controlled by shrubs. Shrub cover exceeds the site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory dominates site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed. Bare ground has increased.

Community Phase 3.1: Shadscale, other shrubs, annual non-natives
Decadent shadscale and bud sagebrush dominate the overstory. Rabbitbrush and/or other sprouting shrubs may be a significant component or dominant shrub. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Annual nonnative species increase. Bare ground is significant.

Transition T3A
Trigger: Fire and/or soil disturbing treatments such as drill seeding and plowing.

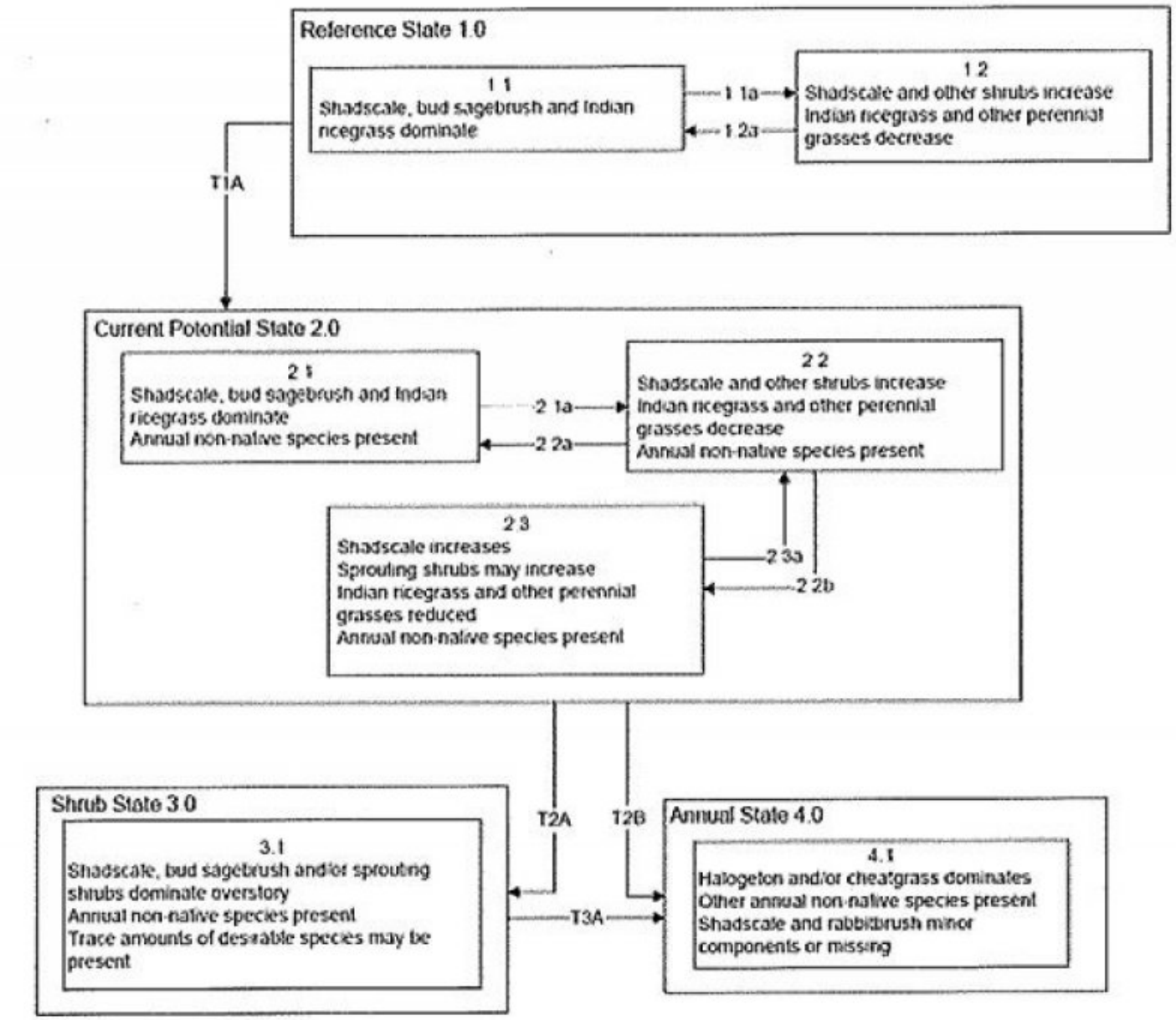
Slow variables: Increased production and cover of non-native annual species.

Threshold: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

State 4: Annual State
This state has one community phase. In this state, a biotic threshold has been crossed and state dynamics are driven by the dominance and persistence of the annual plant community which is perpetuated by a shortened fire return interval. The herbaceous understory is dominated by annual non-native species such as cheatgrass and halogeton. Bare ground may be abundant. Resiliency has declined and further degradation from fire facilitates a cheatgrass and sprouting shrub plant community. The fire return interval has shortened due to the dominance of cheatgrass in the understory and is a driver in site dynamics.

Community Phase 4.1: Halogeton, cheatgrass
This community is dominated by annual non-native species. Halogeton most commonly invades these sites. Trace amounts of shadscale and other shrubs may be present, but are not contributing to site function. Bare ground may be abundant, especially during low precipitation years. Soil erosion from wind and soil temperature are driving factors in site function.

State and transition model



State 1
Reference State

Community 1.1
Reference Plant Community

The dominant aspect of the plant community is shadscale and Indian ricegrass. The composition by air-dry weight is approximately 45 percent grasses, 10 percent forbs, and 45 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	139	240	341
Grass/Grasslike	138	239	340
Forb	31	54	76
Total	**308**	**533**	**757**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	19-21%
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%	19-21%	–
>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**			168–252	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	84–112	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	56–84	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	28–56	–
3	**Sub-Dominant Shrubs**			56–185	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	28–56	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	6–17	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	6–17	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	6–17	–
	spiny hopsage	GRSP	*Grayia spinosa*	6–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6–17	–

	green molly	BAAM4	*Bassia americana*	6–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	6–17	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	6–17	–
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	6–17	–
Grass/Grasslike					
0	**Dominant Grasses**			140–252	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	84–140	–
	squirreltail	ELEL5	*Elymus elymoides*	28–56	–
	James' galleta	PLJA	*Pleuraphis jamesii*	28–56	–
1	**Sub-Dominant Grasses**			56–123	
	Grass, annual	2GA	*Grass, annual*	17–28	–
	Grass, perennial	2GP	*Grass, perennial*	17–28	–
	purple threeawn	ARPU9	*Aristida purpurea*	6–17	–
	needle and thread	HECO26	*Hesperostipa comata*	6–17	–
	Sandberg bluegrass	POSE	*Poa secunda*	6–17	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6–17	–
Forb					
0	**Dominant Forbs**			17–28	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	17–28	–
2	**Sub-Dominant Forbs**			28–84	
	Forb, annual	2FA	*Forb, annual*	28–56	–
	Forb, perennial	2FP	*Forb, perennial*	28–56	–
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	6–11	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	6–11	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	6–11	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	6–11	–
	narrowleaf goosefoot	CHLE4	*Chenopodium leptophyllum*	6–11	–
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	6–11	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	6–11	–
	basin fleabane	ERPU9	*Erigeron pulcherrimus*	6–11	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	6–11	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	6–11	–
	rusty lupine	LUPU	*Lupinus pusillus*	6–11	–
	whitestem blazingstar	MEAL6	*Mentzelia albicaulis*	6–11	–
	pale evening primrose	OEPA	*Oenothera pallida*	6–11	–
	cleftleaf wildheliotrope	PHCRC	*Phacelia crenulata var. corrugata*	6–11	–

	wildheliotrope				
	longleaf phlox	PHLO2	*Phlox longifolia*	6–11	–
	woolly plantain	PLPA2	*Plantago patagonica*	6–11	–
	Navajo tea	THSU	*Thelesperma subnudum*	6–11	–

Animal community

This site provides proper grazing for sheep and cattle during fall and winter.

This site provides food and limited cover for wildlife. Wildlife using this site include lizard, snake, mice, sparrow hawk, jackrabbit, and coyote.

Hydrological functions

The soil is in hydrologic groups B and C. The runoff curve numbers are 61 to 86 depending upon the overall watershed condition.

Recreational uses

This site may have aesthetic values but with low hunting opportunities.

Wood products

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	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:** None to very few rills present. Some very minor rill development may occur on steeper

slopes or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Where these rills are present, they should be fairly short (3-6 feet), <1 inch deep and somewhat widely spaced (10-20 feet). Minor rill development may be observed on all slopes following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Some very minor evidence of water flow patterns may be found around perennial plant bases. They are expected to be short (3-6 feet), stable, sinuous and not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat with slope.

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3. **Number and height of erosional pedestals or terracettes:** Perennial vegetation shows little evidence of erosional pedestalling (1 to 2% of individual plants). Plant roots are covered and litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20 to 25% bare ground. Up to 10% of the soil surface is covered by coarse fragments. Bare ground spaces should not be greater than 1 to 2 feet in diameter.

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5. **Number of gullies and erosion associated with gullies:** No gullies present on site. A very few gullies may be present in landscape settings where they transport runoff from areas of greater water flow such as exposed bedrock. These gullies will be limited to slopes exceeding 20% and adjacent to sites where this runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of wind generated soil movement is present. Wind caused blowouts and deposition are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow channels with deposition occurring within 1 to 2 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 6 feet) with increases in slopes >15% and/or increased runoff resulting from heavy thunderstorms.

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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 the plant canopies, and a rating of 4 in the interspaces. The average rating should be a 4. Soil surface textures are typically loams and sandy clay loams.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Boreham) Soil surface 0-11 inches. Texture is a loam; color is pale brown (10YR 5/3) and structure is weak fine and medium granular. Ochric epipedon ranges from 11 to 60 inches. 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 produces sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, also protects soil from splash erosion and encourages a higher rate of infiltration. Plant spatial distribution should slow runoff, allowing additional time for infiltration. Bare spaces are expected to be small (< 2 feet)and irregular in shape and are usually not connected. Vegetative structure is usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing maximum time for infiltration, and reducing runoff and erosion in all but the most extreme storm events. When perennial grasses and shrubs decrease due to natural events including drought, insect damage, etc., which reduce ground cover and increase bare ground, runoff is expected to increase and associated infiltration reduced.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Some soils have a calcic horizon within the soil profile that could be mistaken for a compaction pan.

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, bud sagebrush) > Cool Season perennial bunchgrasses (Indian ricegrass, bottlebrush squirreltail) > Forbs (Scarlet globemallow).

    Sub-dominant: Sprouting shrubs (fourwing saltbush, winterfat) > Warm season rhizomatous grasses (James galleta) > Perennial forbs (woolly milkvetch).

    Other: A wide variety of other perennial grasses and both perennial and annual forbs can be expected to occur in the plant community.

    Additional: Natural disturbance regimes include fire, drought, and insects. Assumed disturbance cycle of 30 to 40+ years. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect functional community phases within the reference state.

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 under average to above average growing conditions with age class expression likely subdued during periods of extended drought. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during periods of extended drought, or insect infestations. In general, a mix of age classes should be expected with some dead and decadent plants present.

14. **Average percent litter cover (%) and depth (in):** Litter cover will be heavier under plants. Most litter will be herbaceous and depths of 1/2 to 1 inch would be considered normal. Perennial vegetation should be well distributed on the site.

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 450 - 500 #/acre on an average year but could range from 250 - 700 #/acre during periods of prolonged drought or above average precipitation.

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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:** Cheatgrass, Russian thistle, and other non-native, invasive annual forbs.

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