USDA Natural Resources
Conservation Service

Ecological site R034BY133UT
Desert Very Steep Shallow Loam (Shadscale)

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 034B–Warm Central Desertic Basins and Plateaus

MLRA 34B occurs in is in Utah (70 percent) and Colorado (30 percent). It makes up about 12,850 square miles (33,290 square kilometers). A small part of the area is in the High Plateaus of Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. The northern part of the MLRA occurs in the Uinta Basin Section, which is bounded by the Uinta Mountains to the north, the Wasatch Range to the west, the Roan Plateau to the south, and the Rabbit Hills to the east. The southern part of the MLRA occurs in the northern third of the Canyon Lands Section. This section is bounded by the Roan Plateau to the north, the Wasatch Plateau to the west, the southern end of the San Rafael Swell to the south, and the western slope of the Rocky Mountains to the east. Elevation ranges from 4,100 feet (1,250 meters) near Green River, Utah, to 7,500 feet (2,285 meters) at the base of the Wasatch Range and the Roan Plateau.

Most of this area is covered by residual basin-floor materials and materials washed in from the surrounding mountains and plateaus. Shale and sandstone are the dominant rock types. The Tertiary-age Green River, Uinta, and Duchesne Formations dominate the northern part of the MLRA. The southern part is dominated by Cretaceous-age materials with lesser amounts of Jurassic and Triassic materials. The dominant Cretaceous formations are Mancos Shale, Dakota Sandstone, and the members of the Mesa Verde Group. The dominant Jurassic formations are the Morrison, Entrada, and Navajo. The dominant Triassic formations are the Chinle and Moenkopi. Quaternary alluvial, eolian, and glacial deposits occur in both parts of the MLRA.

The average annual precipitation in most of this area ranges from 6 to 10 inches (150 to 255 millimeters). A small part of this area receives as much as 24 inches of annual precipitation.
Much of the precipitation occurs as high-intensity, convective thunderstorms during the period July through September. May and June are usually the drier months. Precipitation is more evenly distributed throughout the year in the northern part of the MLRA than in the southern part, where there is a significant peak in late summer. The northern part of the MLRA receives more precipitation as snow during winter than the southern part. The average annual temperature ranges from 41 to 54 degrees F (5 to 12 degrees C). The freeze-free period averages 170 days and ranges from 110 to 235 days.

The dominant soil orders in this MLRA are Aridisols and Entisols. Mollisols occur at the higher elevations, particularly in the northern part of the MLRA. The dominant soil temperature regime is mesic, and the dominant soil moisture regime is aridic. The soils receiving less than 8 inches (205 millimeters) of precipitation annually have an aridic soil moisture regime. The soils receiving 8 to 12 inches (205 to 305 millimeters) have an aridic soil moisture regime that borders on ustic. The soils receiving 12 to 16 inches (305 to 405 millimeters) generally have an ustic soil moisture regime that borders on aridic. The dominant soil mineralogy is mixed and soils are formed in slope alluvium or residuum derived from shale or sandstone. Many of the soils are shallow or moderately deep to shale or sandstone bedrock. The soils at the lower elevations generally have significant amounts of calcium carbonate, salts, and gypsum.

Ecological site concept

Characteristic soils in this site are mostly less than 20 inches deep and well drained. They formed in colluvium and residuum derived mainly from shale and sandstone parent materials. Steep slopes and shallow depths are the most limiting factors. Soils have a channnery loam, clay loam or extremely bouldery sandy loam surface over extremely channery or extremely gravelly sandy loam to clay loam. Permeability is moderately slow to moderately rapid and runoff is very high. The water supplying capacity is 1 to 2 inches. Average annual soil loss in potential is approximately 5-10 tons/acre.

Associated sites

R034BY104UT	**Desert Clay (Shadscale)** Desert Clay (Shadscale)
R034BY250UT	**Semidesert Very Steep Loam (Salina Wildrye)** Semidesert Very Steep Loam (Salina wildrye)

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia* (2) *Atriplex gardneri*
Herbaceous	(1) *Pleuraphis jamesii* (2) *Leymus salinus ssp. salinus*

Physiographic features

This site occurs on canyons, escarpments, hills and steep side slopes. Slopes are mostly 50 to 90 percent. Elevations range from 4,000 feet on north and east aspects to 6,400 feet on south and west aspects.

Table 2. Representative physiographic features

Landforms	(1) Canyon (2) Escarpment (3) Hill
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	4,000–6,400 ft
Slope	50–90%
Ponding depth	Not specified
Water table depth	Not specified
Aspect	W, S

Climatic features

Average annual soil loss in potential is approximately 5-10 tons/acre. Average annual precipitation is 5 to 8 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 April 1 and end growth around September. On north facing slope, plant growth may be delayed up to two weeks.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	5-8 in

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 mostly less than 20 inches deep and well drained. They formed in colluvium and residuum derived mainly from shale and sandstone parent materials. Steep slopes and shallow depths are the most limiting factors. Soils have a channnery loam, clay loam or extremely bouldery sandy loam surface over extremely channery or extremely gravelly sandy loam to clay loam. Permeability is moderately slow to moderately rapid and runoff is very high. The water supplying capacity is 1 to 2 inches. Average annual soil loss in potential is approximately 5-10 tons/acre.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Residuum–sandstone and shale
Surface texture	(1) Channery loam (2) Clay loam (3) Extremely bouldery sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Depth to restrictive layer	5–40 in
Soil depth	5–40 in
Surface fragment cover <=3"	0–29%
Surface fragment cover >3"	0–32%
Available water capacity (Depth not specified)	1–6.8 in
Calcium carbonate equivalent (Depth not specified)	1–15%
Electrical conductivity (Depth not specified)	0–8 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)	0–44%
Subsurface fragment volume >3" (Depth not specified)	0–32%

Ecological dynamics

tate 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, gardner's saltbush, galleta and Salina wildrye. Indian ricegrass and squirreltail are minor components along with green molly 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 20 percent perennial grasses, 10 percent forbs, and 70percent 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, gardner's saltbush, galleta and Salina wildrye. Indian ricegrass and squirreltail. Indian ricegrass, bud sagebrush and green molly 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, snakeweed, and yellow 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 yellow rabbitbrush.

Community Phase 2.3: Shadscale, other shrubs, annual non-natives
Shadscale and yellow 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, Gardner's saltbush 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 Gardner's saltbush 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.

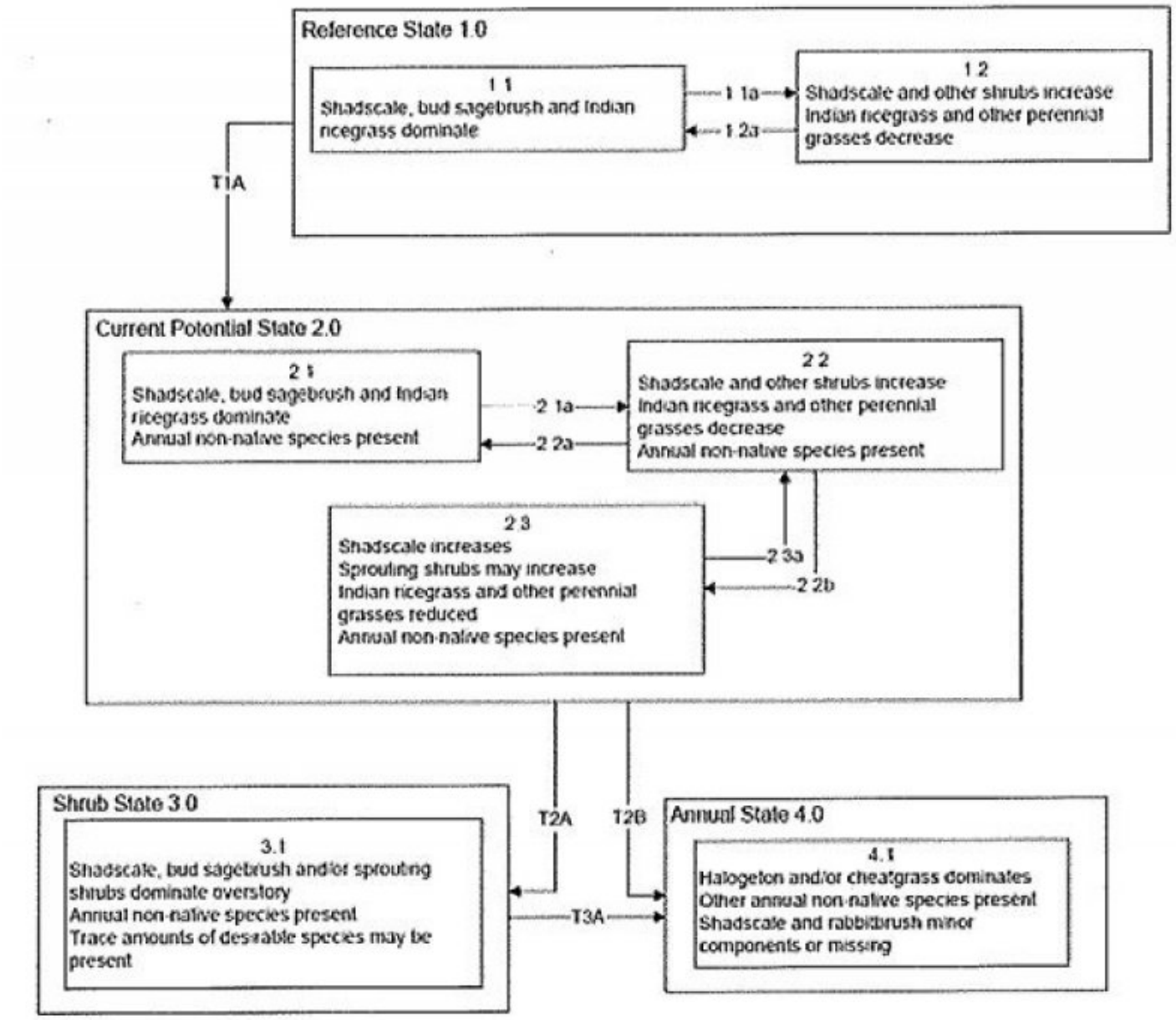
Slow variables: Increased production and cover of non-native annual species.

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 bud 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. The composition by air-dry weight is approximately 20 percent perennial grasses, 10 percent forbs and 70 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	157	227	297
Grass/Grasslike	45	65	85
Forb	23	33	43
Total	**225**	**325**	**425**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	39-41%
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 (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	4-6%
>1 <= 2	–	39-41%	14-16%	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			135–230	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	88–123	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	35–53	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	4–18	–
	green molly	BAAM4	*Bassia americana*	4–18	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	4–18	–
3	**Sub-Dominant Shrubs**			32–67	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	4–18	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–7	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–7	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	4–7	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	4–7	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	4–7	–

	shortspine horsebrush	TESP2	*Tetradymia spinosa*	4–7	–
	Spanish bayonet	YUHA	*Yucca harrimaniae*	4–7	–
Grass/Grasslike					
0	**Dominant Grasses**			57–106	
	James' galleta	PLJA	*Pleuraphis jamesii*	35–53	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	18–35	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	4–18	–
1	**Sub-Dominant Grasses**			28–71	
	Grass, annual	2GA	*Grass, annual*	4–18	–
	Grass, perennial	2GP	*Grass, perennial*	4–18	–
	purple threeawn	ARPU9	*Aristida purpurea*	4–7	–
	squirreltail	ELEL5	*Elymus elymoides*	4–7	–
	Sandberg bluegrass	POSE	*Poa secunda*	4–7	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	4–7	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	4–7	–
Forb					
0	**Dominant Forbs**			4–7	
	yellow milkvetch	ASFL	*Astragalus flavus*	4–7	–
2	**Sub-Dominant Forbs**			84–140	
	Forb, annual	2FA	*Forb, annual*	18–28	–
	Forb, perennial	2FP	*Forb, perennial*	18–28	–
	Nevada onion	ALNE	*Allium nevadense*	4–7	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	4–7	–
	sego lily	CANU3	*Calochortus nuttallii*	4–7	–
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	4–7	–
	basin fleabane	ERPU9	*Erigeron pulcherrimus*	4–7	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	4–7	–
	tufted evening primrose	OECAC2	*Oenothera caespitosa ssp. caespitosa*	4–7	–
	Thompson's peteria	PETH5	*Peteria thompsoniae*	4–7	–
	oblongleaf basindaisy	PLINO	*Platyschkuhria integrifolia var. oblongifolia*	4–7	–
	woolly plantain	PLPA2	*Plantago patagonica*	4–7	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	4–7	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	4–7	–

Animal community

This site receives very little use from livestock because of very steep slopes.

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

Hydrological functions

The soil is in hydrologic group C. The runoff curve numbers are 74 through 86 depending on the condition of the watershed.

Recreational uses

This site provides aesthetic appeal because of the canyon escarpments and steep slopes. Recreational opportunities are limited.

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	06/04/2012
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. Their expression may be less defined where coarse fragments (i.e., gravels and/or channers) dominate the soil surface. Rill occurrence may increase slightly on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Rills should be < 1 inches deep, long (20 to 30 feet) and somewhat widely spaced (5-10 feet). An increase in rill development activity may be observed immediately following major thunderstorm or spring runoff events.

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2. **Presence of water flow patterns:** Sinuous flow patterns are common and wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat as slopes approach 80%. Water flow patterns are long (20 to 30 feet), somewhat narrow (1 to 2 feet wide), and spaced widely (5 to 10 yards) and more closely spaced(3 to 6 yards) on slopes nearing 70 to 80%.

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals will form at the base of plants that occur on the edge of water flow patterns, 2 to 4% of plants show minor exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller 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):** 20–25%. (Soil surface is typically covered by 0-25% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Bare ground spaces not associated with flow patterns should not be greater than 1 to 2 feet in diameter and may be connected.

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5. **Number of gullies and erosion associated with gullies:** A few gullies may occur. Any gullies preaent may extend down the length of the site until they reach a stream or other area where water and sediment is deverted or accumulates. Gullies show slightly more indication of erosion as slopes approach 80%, or where the site occurs adjacent to watershed areas with concentrated flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Perennial shrubs along with any surface coarse fragments on this site help break the wind and help reduce the potential for wind erosion.

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7. **Amount of litter movement (describe size and distance expected to travel):** Because of the sites very steep slopes, some litter redistribution downslope caused by water movement is normal. Some litter removal may occur in flow channels with deposition occurring within 3 to 5 feet at points of obstruction. The majority of litter still accumulates at the base of plants. Some grass leaves, stems and small woody twigs may accumulate in soil depressions adjacent to plants. Woody stems are likely to move 1 to 2 feet. A slight increase in litter movement is expected following runoff resulting from heavy spring runoff or 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 an erosion rating of 5 or 6 under the plant canopies, and a rating of 3 to 5 in the interspaces. The average should be a 4 or 5. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Montwel 50-80% slopes) Soil surface A horizon is typically 0 to 2 inches deep. Structure is weak very fine, fine, and medium subangular blocky. Color is strong brown (7.5YR 5/4). 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:** Good spatial distribution of well developed biological soil crusts (where present) intercept raindrops, reducing splash erosion and providing areas of increased surface detention to store water, allowing additional time for infiltration.

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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. Fractured Shale occurs at about 36 inches.

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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, bud sagebrush > cool season perennial grasses (Salina wildrye, Indian ricegrass) >> warm season rhizomatous grasses (James galleta).

    Sub-dominant: Sprouting shrubs (Gardner saltbush, green rabbitbrush) > cool season perennial grasses (Nevada bluegrass, bottlebrush squirreltail) = > forbs (yellow milkvetch) > biological soil crusts (where present).

    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 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: Factors contributing to temporal variability include insects and other pathogens (mistletoe), drought, extreme precipitation events, etc. Factors contributing to spatial variability include slope, amount of rock fragments, aspect, etc. Following a recent disturbance such as fire, drought or insects, that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions may reflect a different functional 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 on shrubs, or grasses. There may be partial mortality on individual bunchgrasses and shrubs during drought periods, and complete mortality of individual plants during severe drought periods.

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14. **Average percent litter cover (%) and depth (in):** Cover should be composed mostly of fine litter. Depth should vary from a 1 leaf thickness in the interspaces, to up to 1/2” under herbaceous canopies, and up to 3/4” under shrub canopies. Litter cover may increase to 25% on some years due to increased production of plants.

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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 - 350#/acre on an average year, but could range from 200 to 450#/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:** Few invasive species are capable of dominating this site. When invasion does occur, cheatgrass, alyssum, and mustard species are the most likely species to invade.

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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. 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.
