USDA Natural Resources Conservation Service

Ecological site R028AB112UT
Desert Alkali Sandy Loam (Shadscale)

Accessed: 05/19/2024

General information

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

MLRA notes

Major Land Resource Area (MLRA): 028A–Ancient Lake Bonneville

This site occurs in MLRA 28A, LRU B, the southern part of MLRA 28A. This LRU has a mesic soil temperature regime and a typic aridic soil moisture regime. Typically most precipitation occurs in the winter with some precipitation coming in the late summer with convective storms. Mean annual precipitation is between 4 to 8 inches. The north desert ecological zone typically has no big sagebrush (Artemisia tridentata spp.), but typically is dominated by shadscale (Atriplex confertifolia), winterfat (Krascheninnikovia lanata), saltbushes (Atriplex spp), Indian ricegrass (Achnatherum hymenoides), and bottlebrush squirreltail (Elymus elymoides). Unlike the northern LRUs, there is typically galleta (Pleuraphis jamesii) grass in the plant community.

Classification relationships

MLRA 28A, LRU B, desert zone, south portion of MLRA

Ecological site concept

This site occurs on valley floors, dunes, or lake terraces, typically between 4300 to 5800 feet on low slopes. Shadscale is the dominant plant in reference condition.

Associated sites

R028AY119UT	**Desert Flat (Shadscale)** This site is also a similar site with soil and vegetation differentiae.
R028AY124UT	**Desert Loam (Shadscale)**

Similar sites

R028AY014NV	**GRAVELLY SANDY LOAM 5-8 P.Z.** This site is similar in soil and vegetation characteristics.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on lower parts of alluvial fans on the valley floors, dunes or lake terraces. It is typically found

between 4300 to 5800 feet on low slopes. There is no flooding or ponding on this site.

Table 2. Representative physiographic features

Landforms	(1) Valley floor (2) Dune (3) Lake terrace
Flooding frequency	None
Ponding frequency	None
Elevation	4,300–5,800 ft
Slope	0–3%

Climatic features

The climate is cold and snowy in the winter and warm and dry in the summer. The average annual precipitation is 5 to 8 inches. Approximately 70 percent comes as rain from March through October. On the average, June through September are the driest months and March through May at the wettest months.

Mean Annual Air Temperature: 45-50
Mean Annual Soil Temperature: 47-52

Climate tables derived from PRISM model.

Table 3. Representative climatic features

Frost-free period (average)	0 days
Freeze-free period (average)	130 days
Precipitation total (average)	7 in

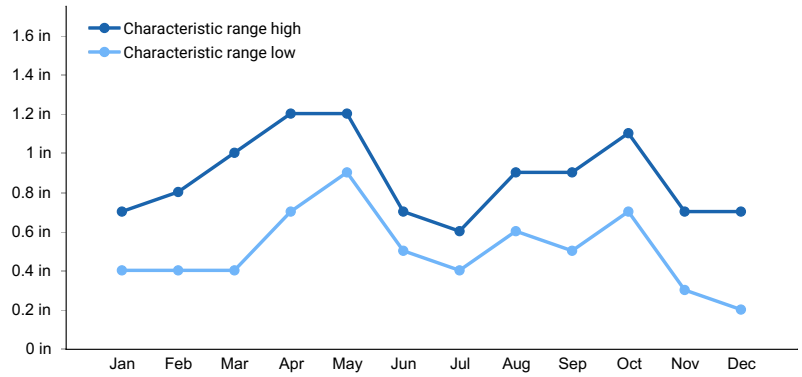

Figure 1. Monthly precipitation range

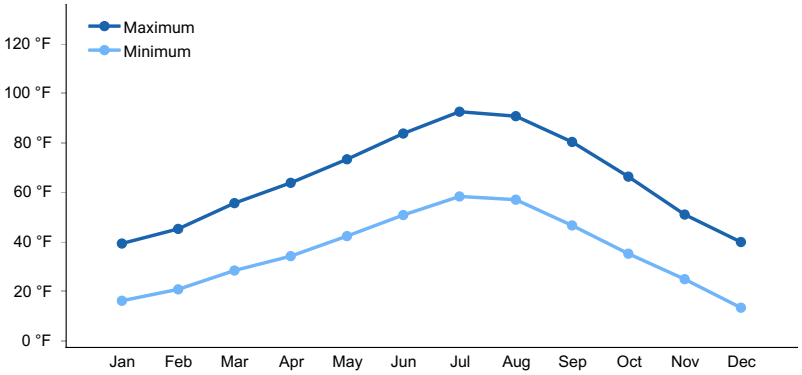

Figure 2. Monthly average minimum and maximum temperature

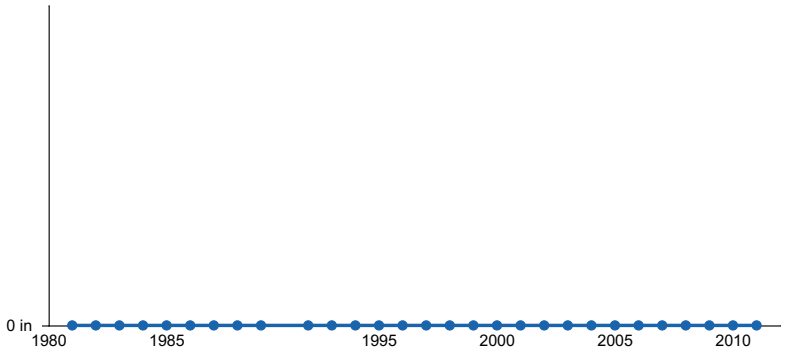

Figure 3. Annual precipitation pattern

Influencing water features

Soil features

The soils in this site are more than 60 inches deep and well drained.

They formed in lacustrine sediments derived mainly from mixed parent materials. The surface horizon is sandy loam or gravely sandy loam in texture and 4 to 10 inches thick. Rock fragments are not found in or on this soil.

The soil surface horizon is underlain with a layer of sodium accumulation in the subsoil.

The water supplying capacity is 2 to 5 inches. Natural geologic erosion in potential is approximately 0.5 tons/acre/year.

Table 4. Representative soil features

Surface texture	(1) Very gravelly sandy loam
Drainage class	Well drained
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass, squirreltail, and winterfat decrease while low rabbitbrush increases.

When the potential natural plant community is burned, Indian ricegrass and shadscale decrease while low rabbitbrush increases.

Annual forbs and annual grasses are most likely to invade this site.

This site is similar to the Nevada site, 028AY014NV. The STM developed by Nevada is used below.

State and transition model

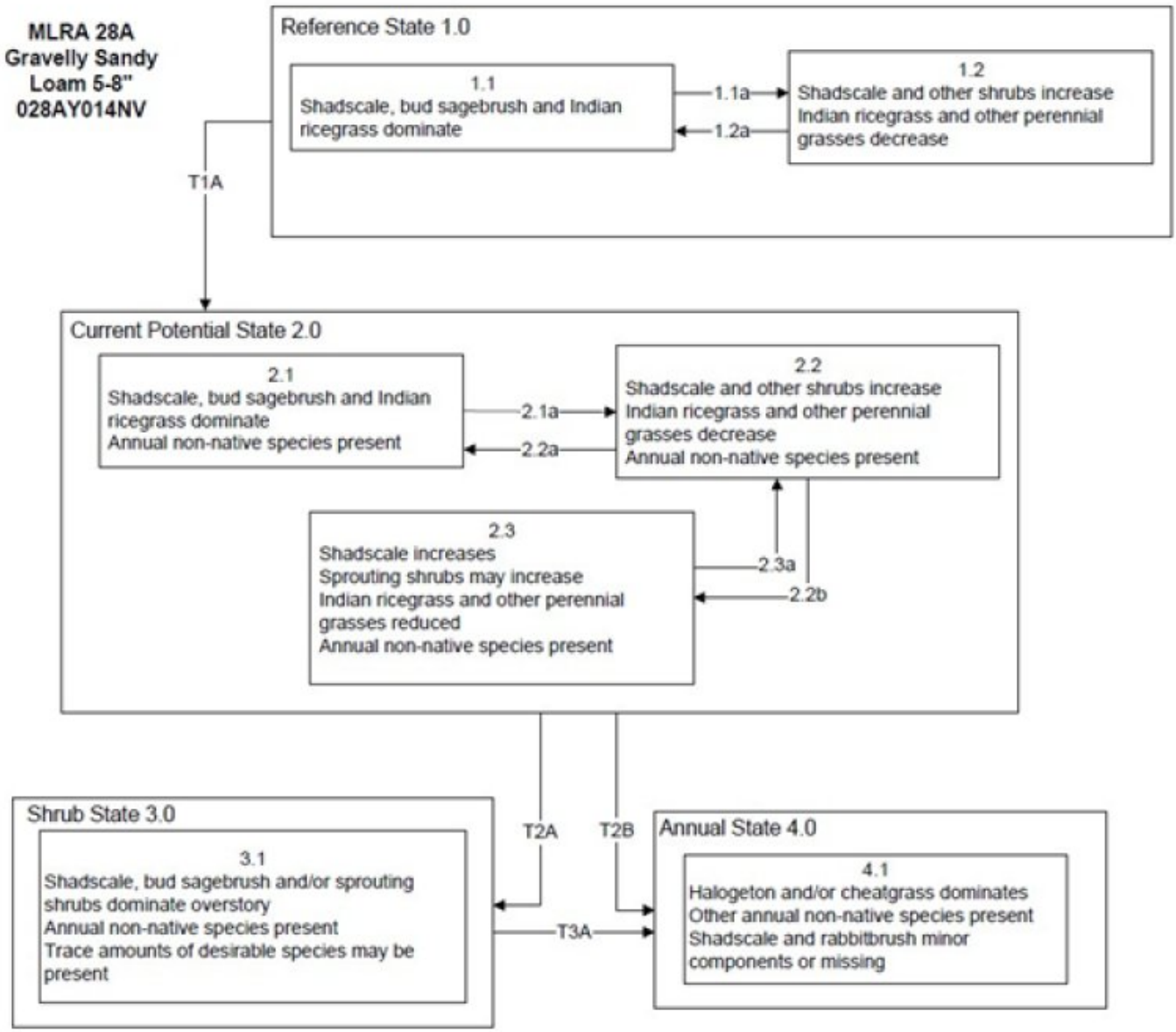

Figure 5. R028AE112UT STM

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 1.1
Shadscale saltbush, Indian ricegrass

This community is dominated by shadscale, bud sagebrush and Indian ricegrass. Galleta grass and King’s desertgrass 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 20 percent perennial grasses, 5 percent forbs, and 75 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	188	300	450
Grass/Grasslike	50	80	120
Forb	13	20	30
Total	**251**	**400**	**600**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-50%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	2-5%
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	–	–	–	–
>1 <= 2	–	45-55%	10-20%	0-10%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

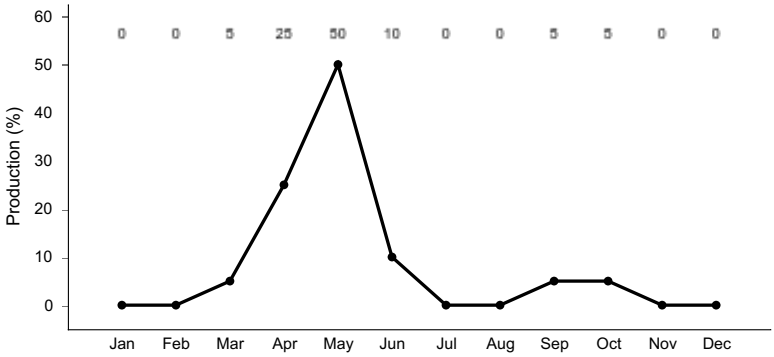

Figure 7. Plant community growth curve (percent production by month). UT1121, PNC. Excellent Condition.

Community 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.

Pathway 1.1a
Community 1.1 to 1.2

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

Pathway 1.2a
Community 1.2 to 1.1

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.

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 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 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 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).

Pathway 2.1a
Community 2.1 to 2.2

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.

Pathway 2.2a
Community 2.2 to 2.1

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.

Pathway 2.2b
Community 2.2 to 2.3

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

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 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.

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 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.

Transition T1A
State 1 to 2

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.

Transition T2A
State 2 to 3

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
State 2 to 4

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.

Transition T3A
State 3 to 4

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.

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	**Primary Shrubs**			148–338	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	180–203	–
	green molly	BAAM4	*Bassia americana*	23–45	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	23–45	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	23–45	–
3	**Secondary Shrubs**			14–23	
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	5–14	–
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	5–14	–
Grass/Grasslike					
0	**Primary Grasses**			68–113	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	45–68	–
	squirreltail	ELEL5	*Elymus elymoides*	23–45	–
1	**Seconary Grasses**			14–23	
	King's eyelashgrass	BLKI	*Blepharidachne kingii*	5–14	–
	James' galleta	PLJA	*Pleuraphis jamesii*	5–14	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	5–14	–
Forb					
2	**Forbs**			14–23	
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	5–14	–
	cushion cryptantha	CRCI2	*Cryptantha circumscissa*	5–14	–
	alkali pepperweed	LEDI2	*Lepidium dictyotum*	5–14	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	5–14	–

Animal community

As ecological condition deteriorates due to overgrazing, Indian ricegrass, squirreltail, and winterfat decrease while low rabbitbrush increases.

When the potential natural plant community is burned, Indian ricegrass and shadscale decrease while low rabbitbrush increases.

Annual forbs and annual grasses are most likely to invade this site.

Hydrological functions

The soils are in hydrologic group D with runoff curves ranging from 80 to 89 depending on hydrologic condition.

Recreational uses

Hunting and hiking.

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Juab County, UT	
Township/Range/Section	T12S R17W S5
General legal description	Southwest of Calleo, Juab County, Utah; NW ¼ of the NE ¼ of Section 5, Township 12S, Range 17W.

Other references

Stringham, T.K., P. Novak-Echenique, P. Blackburn, C. Coombs, D. Snyder, and A. Wartgow. 2015. Final Report for USDA Ecological Site Description State-and-Transition Models, Major Land Resource Area 28A and 28B Nevada. University of Nevada Reno, Nevada Agricultural Experiment Station Research Report 2015-01. p. 1524.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	V. Keith Wadman (NRCS Ret.), Shane A. Green (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	01/23/2009
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very minor rill development may be evident in the reference community only following significant storm or snow melt events. Rill presence may be more apparent where run-on from adjacent upland sites or exposed bedrock concentrate flows. Any rill development will be short (< 5 feet) and widely spaced (10 – 20 feet). Slopes >10% may exhibit increased rill lengths (5 to 10 feet) with more narrow spacings (8 to 15 feet). Evidence of rills will decrease in the months following major weather events.

---

2. **Presence of water flow patterns:** Only very slight evidence of water flow may be evident in the reference community only following significant weather events. Flow patterns affect <5% of the site and may increase to 10% on slopes >10%. Flow patterns are normally <20 feet long, follow natural contours, and are typically spaced 10 to 15 feet apart.

---

3. **Number and height of erosional pedestals or terracettes:** Very minor pedestal and/or terracette development is evident in the reference community. 1 – 2 inches of elevational mounding in Indian ricegrass bunches and Four-wing saltbush canopies are normal and should not be mistaken for erosional pedestals.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 50% - 60% in the reference community. Ground cover (the inverse of bare ground) typically includes: coarse fragments – < 1%; plant canopy – 20% to 30%; litter – 10% to 20%.

---

5. **Number of gullies and erosion associated with gullies:** Some gully channels are a normal component of desert environments, but only where natural circumstances allow for concentrated runoff from adjacent sites. Gullies associated with reference areas will typically have stable, partially vegetated sides and bottoms with no evidence of head-cutting. Some evidence of disturbance may be evident following significant weather events or when gullies convey runoff from higher elevation rocky or naturally eroding areas.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** Some minor evidence of wind generated soil movement is present in reference communities. Slight depositional mounding in perennial grass bunches and under Shadscale canopies is a normal characteristic of this site.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place within or under plant canopies. Some movement of the finest material (< 1/8" or less) may move (1' – 2') in the direction of prevailing winds or down slope if being transported by water. Little accumulation is observed behind obstructions.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 3 to 4. Surface texture is silt loam (<1 inch) with a sandy clay loam, natric horizon from inches 1 thru 10 containing very few coarse fragments.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Effective soil surface is ½ to 10 inches deep and structure is weak thin platy. The A-horizon color is 2.5YR 6/2. Soils have a Natric horizon that extends 10 inches into the soil profile. Where surface soil is lost, increased clay and silt percentages are common in the remaining soil material.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The presence of healthy perennial bunchgrasses and Shadscale in the reference community provides for the best infiltration and least runoff from storm events and snow melt. As perennial vegetation decreases and bare ground increases, runoff increases and soil loss is accelerated.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Soils are deep to very deep. Increases in clay or silt content in subsoil layers could be mistaken for compaction.

---

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: Dominant: Non-sprouting shrubs (e.g. Shadscale and Bud sage) 45 – 55%, > > cool season grasses (e.g. Indian ricegrass and Bottlebrush squirreltail) 15 – 25%.

    Sub-dominant: Sub-dominant: Mixed shrubs (e.g. Winterfat and Greenmolly) 10 - 20% > Perennial grasses (e.g. Sand dropseed and Galleta) 1 - 3%.

    Other: Others: Shrubs (e.g. Low rabbitbrush and horsebrush sp.) 1-3%, perennial forbs (e.g. Scarlet globemallow and Evening primrose) 3-5%, biological crusts (e.g. lichens, mosses, cyanobacteria) 1-3%.

    Additional: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state.
    Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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 80% of the shadscale may die. There may be partial mortality of individual bunchgrasses and other shrubs during severe drought.

---

14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 10 to 20% with a spike when Bud Sage and Shadscale drops its leaves. Depth varies from ¼ - ¾ inch with depth increasing near plant canopies.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 350 – 450 pounds on an average year.

---

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 likely to invade this site.

---

17. **Perennial plant reproductive capability:** All perennial plant species have the ability to reproduce in most years except drought years.
