USDA Natural Resources
Conservation Service

Ecological site R034BY202UT
Semidesert Bouldery 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

The soils of this site formed mostly in colluvium, outwash and/or slope alluvium derived from sandstone and shale. Surface soils are very bouldery fine sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile and make up more than 50 percent of the soil volume. These soils are deep to very deep, well-drained, and have a moderate to moderately rapid permeability. pH is slightly to moderately alkaline. Available water-holding capacity ranges from 2 to 3 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly ustic aridic and the soil temperature regime is mesic. Precipitation ranges from 8-12 inches annually. Average annual soil loss in potential is approximately 5 tons/acre.

Associated sites

R034BY209UT	**Semidesert Loam (Salina wildrye)** Semidesert Loam (Salina wildrye)
R034BY225UT	**Semidesert Shallow Loam (Wyoming big sagebrush)** Semidesert Shallow Loam (Wyoming big sagebrush)
R034BY233UT	**Semidesert Shallow Loam (Utah Juniper-Pinyon)** Semidesert Shallow Loam (Utah juniper-Pinyon pine)

Table 1. Dominant plant species

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

Physiographic features

This site occurs on dissected alluvial fans and fan remnants. Slopes are mostly 3 to 20 percent. Elevations range from 5,300 feet on east aspects to 6,100 feet on southwest aspects.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	5,300–6,100 ft
Slope	3–20%
Ponding depth	Not specified
Water table depth	Not specified
Aspect	E, SW

Climatic features

Average annual precipitation is 8 to 12 inches.

Approximately 65% 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 10 degrees celsius and the soil temperatures are in the mesic regime. The average freeze-free period is 100 to 140 days. In average years, plants begin growth around March 30 and end growth around September 30.

Table 3. Representative climatic features

Frost-free period (characteristic range)	

Freeze-free period (characteristic range)	100-140 days
Precipitation total (characteristic range)	8-12 in

Influencing water features

None.

Soil features

The soils of this site formed mostly in colluvium, outwash and/or slope alluvium derived from sandstone and shale. Surface soils are very bouldery fine sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile and make up more than 50 percent of the soil volume. These soils are deep to very deep, well-drained, and have a moderate to moderately rapid permeability. pH is slightly to moderately alkaline. Available water-holding capacity ranges from 2 to 3 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly ustic aridic and the soil temperature regime is mesic. Precipitation ranges from 8-12 inches annually. Average annual soil loss in potential is approximately 5 tons/acre.

Modal Soil: Strych BYV-FSL, 3-20% — loamy-skeletal, mixed, mesic Ustollic Calciorthids

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Outwash–sandstone and shale (3) Slope alluvium–sandstone and shale
Surface texture	(1) Very bouldery fine sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	60–80 in
Soil depth	60–80 in
Surface fragment cover <=3"	12–16%
Surface fragment cover >3"	42–46%
Available water capacity (Depth not specified)	2–3 in
Calcium carbonate equivalent (Depth not specified)	15–20%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	19–23%
Subsurface fragment volume >3" (Depth not specified)	35–39%

Ecological dynamics

State 1: Reference State
The reference state was determined by study of rangeland relic areas, areas protected from excessive disturbance

and outside influences, such as grazing and recreation. Literature reviews, trends in plant community dynamics, and historical accounts are also considered.

The reference state represents the historic plant communities and ecological dynamics of the semidesert bouldery loam, shadscale site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under current climatic conditions; natural disturbances are inherent in its development. This state is dominated by perennial grasses and shadscale. The primary disturbance mechanism is climate fluctuations. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is relatively rapid due to niches being filled with highly adapted native vegetation.

Reference State: Community phases disturbed by climate fluctuations and insect herbivory.

Indicators: A site dominated by shadscale with Indian ricegrass and galleta. Salina wildrye and needle-and-thread may or may not be present.

Feedbacks: Extended periods of above average precipitation resulting in an increase in the native perennial plant vigor. Insect herbivory that reduces shrub vigor and allows grass production to increase.

At-risk Community Phase: All communities are at risk when nutrients are available for invasive plants to establish. Plant community 1.2 is especially at risk due to limited production and cover of understory grasses.

Trigger: Introduction of invasive plants to fill available niches.

Community Phase 1.1: Shrubland with Grasses
This plant community phase is dominated by shadscale, Torrey mormontea (jointfir), and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and galleta. Indian ricegrass is typically the dominant perennial grass species in this plant community phase. Other perennial grasses may or may not be present. Other perennial shrubs, and forbs may be present and cover is variable.

Community Phase Pathway 1.1a
This pathway occurs when climatic events, such as drought disfavor the establishment and persistence of perennial grasses.

Community Phase 1.2: Shrubland
This plant community phase is dominated by shadscale and Torrey mormontea, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and galleta. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable.

Community Phase Pathway 1.2a
This pathway occurs when climatic events, such as years with normal to above average precipitation favor the establishment of perennial grasses.

Transition T1a
This transition occurs as invasive species become established in the plant community. Common invasive species include cheatgrass, halogeton, and Russian thistle. Disturbances that may accelerate this transition include improper livestock grazing and extended drought. Invasive species such as cheatgrass have also been known to invade intact perennial plant community where no disturbance has occurred.

State 2: Current Potential State
This state is similar to state one, however there are invasive species established in the understory—cheatgrass and halogeton being the most common. The primary disturbance mechanism is climate fluctuations; however livestock grazing may influence the ecological dynamics of the site.

Current Potential State: Plant communities disturbed by fluctuating climatic conditions insect herbivory, and livestock grazing.

Indicators: A site dominated by shadscale and Indian ricegrass, and galleta, where Salina wildrye and needle-and-

thread may or may not be present. Invasive species are present.

Feedbacks: Fluctuations in climate allow for the maintenance of both shrubs and perennial grasses.

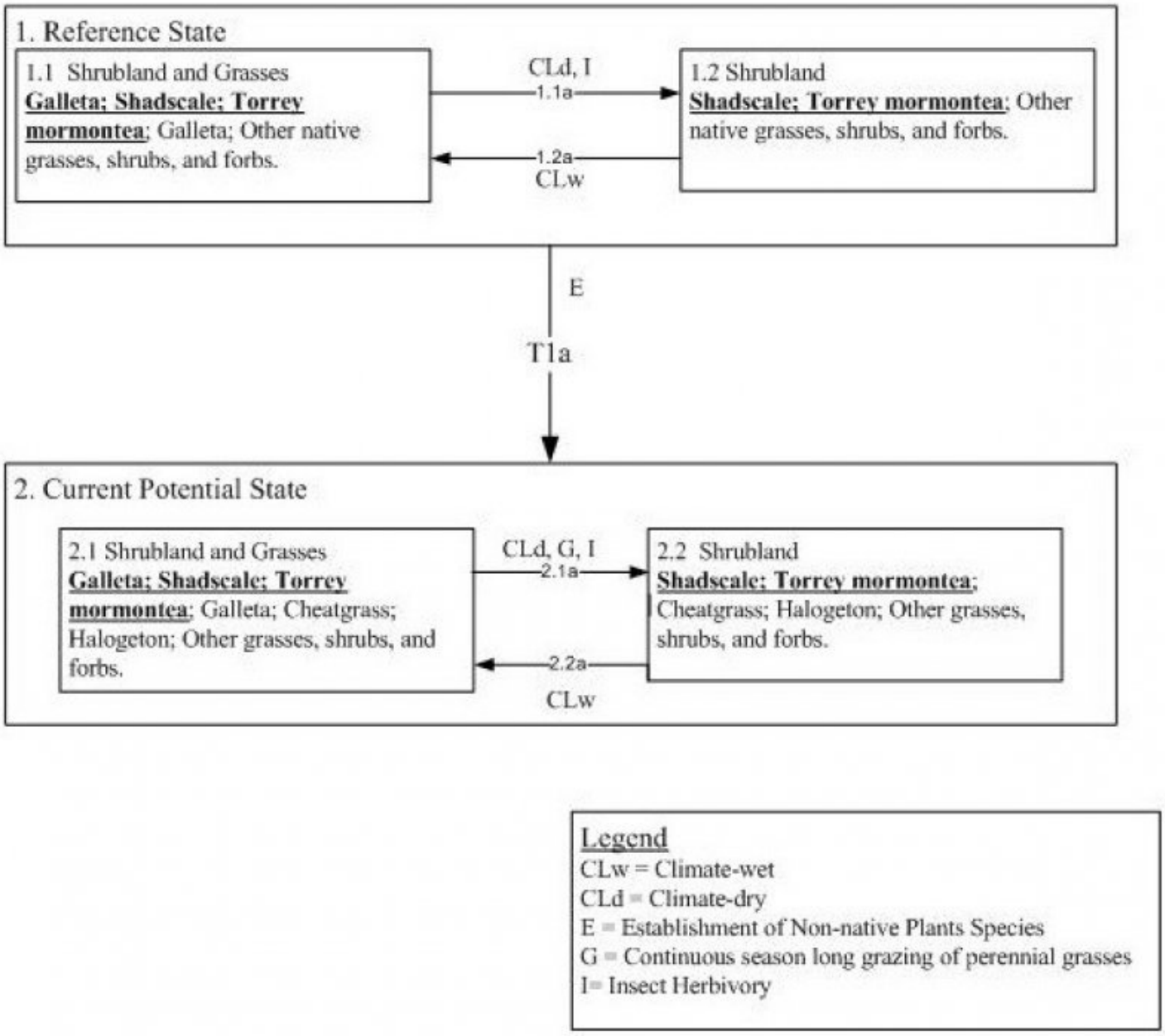
Community Phase 2.1: Shrubland with grasses
This plant community phase is dominated by shadscale, Torrey mormontea, and perennial grasses. Grasses may include but are not limited to, Indian ricegrass and galleta. Other perennial or invasive grasses, shrubs, and forbs my or may not be present and cover is variable. This plant community is very similar to plant community 1.1 in production and cover. The main difference is that invasive species are present in this phase.

Community Phase Pathway 2.1a
This pathway occurs when events, such as drought or continuous season long grazing of perennial grasses, disfavor the persistence of perennial grasses.

Community Phase 2.2: Shrubland
This plant community phase is dominated by shadscale and Torrey mormontea, where warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass and galleta. Other perennial or invasive grasses, shrubs, and forbs my or may not be present and cover is variable. This plant community is very similar to plant community 1.2 in production and cover. The main difference is that invasive species are present in this phase.

Community Phase Pathway 2.2a
This pathway occurs when events, such as years with normal to above average precipitation favor the establishment of perennial grasses, and when grazing regimes are used that promote the establishment and persistence of perennial grasses.

State and transition model



State 1
Reference State

Community 1.1
Reference State

The dominant aspect of the plant community is grass and shrubs. The composition by air-dry weight is approximately 55 percent perennial grasses, 10 percent forbs and 35 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	206	371	481
Shrub/Vine	131	236	306
Forb	38	68	88
Total	**375**	**675**	**875**

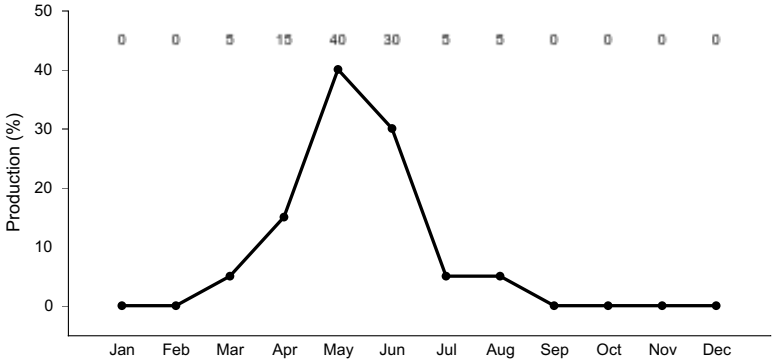


Figure 2. Plant community growth curve (percent production by month). UT2021, PNC. Excellent Condition.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			175–315	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	70–105	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	35–70	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	35–70	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	35–70	–
3	**Sub-Dominant Shrubs**			35–91	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	7–35	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	7–14	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	7–14	–
Grass/Grasslike					
0	**Dominant Grasses**			245–385	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	140–175	–
	needle and thread	HECO26	*Hesperostipa comata*	35–70	–
	James' galleta	PLJA	*Pleuraphis jamesii*	35–70	–
	saline wildrye	LESA4	*Leymus salinus*	35–70	–
1	**Sub-Dominant Grasses**			63–133	
	Grass, annual	2GA	*Grass, annual*	21–35	–
	Grass, perennial	2GP	*Grass, perennial*	21–35	–
	purple threeawn	ARPU9	*Aristida purpurea*	7–21	–
	blue grama	BOGR2	*Bouteloua gracilis*	7–21	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	7–21	–
Forb					
0	**Dominant Forbs**			21–35	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	21–35	–
2	**Sub-Dominant Forbs**			112–266	
	Forb, annual	2FA	*Forb, annual*	35–70	–
	Forb, perennial	2FP	*Forb, perennial*	35–70	–
	woolly locoweed	ASMO7	*Astragalus mollissimus*	7–21	–
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	7–21	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	7–21	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	7–21	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	7–21	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	7–21	–
Tree					
7	**Trees**			1–15	
	twoneedle pinyon	PIED	*Pinus edulis*	7–14	–
	Utah juniper	JUOS	*Juniperus osteosperma*	7–14	–

Animal community

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

This site provides food and cover for wildlife

Hydrological functions

The soil is in hydrologic group B. The runoff curve numbers are 61 through 79 depending on the watershed condition.

Recreational uses

This site may have aesthetic appeal. Recreation activities include hiking and hunting.

Wood products

Firewood may become available from invading juniper and pinyon trees.

Contributors

George Cook

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	05/21/2012
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 on steeper slopes or on areas located below exposed bedrock, or other water shedding areas, where increased runoff may occur. Rills present should be < 1 inch deep, fairly short (< 8 feet) and somewhat widely spaced (6-8 feet). An increase in rill development may also be observed 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:** A very few sinuous flow patterns may be present and wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat on slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (< 1 foot wide), and spaced widely (10-20 yards) on gentle slopes (< 15%) and

more closely (< 10 yards) on steeper slopes (> 15%).

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals may form at the base of plants that occur on the edge of water flow patterns, but should not show any 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):** 15–25%. (Soil surface is typically covered 35-75% 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:** None. Trees break the wind and reduce the potential for wind erosion. The gravels and sub-rounded rock fragments on the soil surface help armor it and reduce the potential for wind erosion.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some minor redistribution caused by water movement. Minor litter removal may also 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 >10% 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 an erosion rating of 5 or 6 under the plant canopies, and a rating of 4 to 5 in the interspaces. The average should be a 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):** (Strych) Soil surface horizon is typically 0 to 1 inches deep. Texture is a stony finr sandy loam, structure is weak thin platy. Color is yellowish brown (10YR 5/4). An ochric epipedon ranges to a depth of 1 inch. 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:** Spatial distribution of well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time

for infiltration. Crowns of trees and accumulating litter at base of trees appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy.

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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, There may be dense layers of rock fragments or other naturally occurring hard layers found in the soil profile. These should not be considered to be compaction layers.

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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: Trees (two-needle pinyon/Utah juniper) > = Non-sprouting shrubs (shadscale) >> Perennial bunchgrasses (Indian ricegrass, Salina wildrye).

    Sub-dominant: Sprouting shrubs (Torrey ephedra, winterfat) >> Rhizomatous grasses (James galleta) >> Forbs (scarlet globemallow, woolly milkvetch) > Biological soil crusts.

    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 recent natural disturbances 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 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 in trees, shrubs, or grasses. During severe (multi-year) drought up to 20% of the pinyons and junipers may die, either from drought, insect damage or pathogens such as mistletoe. There may be partial mortality on individual bunchgrasses and shrubs during drought periods, and complete mortality of individual plants during severe drought periods, particularly on the shallower and coarser soils associated with this site. Because woody stems may persist for many years, both pinyons and junipers (especially older trees) will normally have dead stems within the plant canopy.

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14. **Average percent litter cover (%) and depth (in):** Litter cover should be a 1 to 2 leaf thickness in the interspaces, up to 1/2” under shrub canopies, and up to 1” under tree canopies. Litter cover may increase to 30% 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 650 - 700#/acre on an average year, but could range from 350 to 900#/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 various mustard species are the most likely 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.
