USDA Natural Resources
Conservation Service

Ecological site R034BY131UT
Desert Shaley Shallow Loam (Spiny greasebush)

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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 5 to 20 inches deep over bedrock and well drained. They formed in slope alluvium and colluvium over residuum derived from shale and sandstone
of the Green River formation. Soils have an extremely flaggy or channery loam surface over extremely channery clay loam. In many areas, the surface is so channery that very little soil exists. Roots grow between the rock fragments in these soils. The water supplying capacity is 0.4 to 0.6 inches. pH is moderately to strongly alkaline. The soil moisture regime is mostly ustic and the soil temperature regime is mesic. Precipitation ranges from 5-8 inches annually. Average annual soil loss in potential is approximately 1 ton per acre.

Associated sites

R034BY118UT	**Desert Shallow Loam (Black Sagebrush)** Desert Shallow Loam (Black sagebrush)
R034BY133UT	**Desert Very Steep Shallow Loam (Shadscale)** Desert Very Steep Shallow Loam (Shadscale)

Similar sites

R034BY133UT	**Desert Very Steep Shallow Loam (Shadscale)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Glossopetalon spinescens var. meionandrum*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on dissected hillsides. Slopes are mostly 4 to 50 percent. Elevations range from 5,300 to 6,600 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	5,300–6,600 ft
Slope	4–50%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

Average annual precipitation is 5 to 8 inches. Approximately 65 percent occurs as rain from March through October. 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. Because the soils are so shallow and rocky, much of the moisture runs off the site causing it to be very dry. In average years, plants begin growth around April 1 and end growth around August 1.

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 5 to 20 inches deep over bedrock and well drained. They formed in slope alluvium and colluvium over residuum derived from shale and sandstone of the Green River formation. Soils have an extremely flaggy or channery loam surface over extremely channery clay loam. In many areas, the surface is so channery that very little soil exists. Roots grow between the rock fragments in these soils. The water supplying capacity is 0.4 to 0.6 inches. pH is moderately to strongly alkaline. The soil moisture regime is typic aridic and the soil temperature regime is mesic. Precipitation ranges from 5-8 inches annually. Average annual soil loss in potential is approximately 1 ton per acre.

Modal Soil: Walknolls FLX-L (Dry, Eroded) 4-25%, 25-50% — loamy-skeletal, mixed (calcareous), mesic Lithic Torriorthents

Table 4. Representative soil features

Parent material	(1) Slope alluvium–sandstone and shale (2) Colluvium–sandstone and shale (3) Residuum–sandstone and shale
Surface texture	(1) Extremely flaggy, channery loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	5–20 in
Soil depth	5–20 in
Surface fragment cover <=3"	21–25%
Surface fragment cover >3"	54–58%
Available water capacity (Depth not specified)	0.4–0.6 in
Calcium carbonate equivalent (Depth not specified)	5–15%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	65–69%
Subsurface fragment volume >3" (Depth not specified)	8–12%

Ecological dynamics

State 1: Reference State
The main driver of plant community change in the reference state is drought. In wet years, this site can support perennial grasses, particularly Indian ricegrass. However, due to harsh shallow shaley soils and low water-holding capacity, dry years can result in a loss of perennial grasses. The resilience of this site to drought conditions will be lower on shallower soils with lower water holding capacity and/or harsher soil conditions. This state is susceptible to non-native invasive species establishment. Disturbances such as livestock grazing and recreation can increase the likelihood of invasion by promoting germination sites and/or seed sources for non-native species.

Community Phase 1.1: Spiny greasbush shrubland with perennial grasses.
This plant community phase is dominated by spiny greasebush, shadscale, Indian ricegrass and bottlebrush squirrel tail. Indian ricegrass is typically the dominant perennial grass species. 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. Improper livestock grazing and/or surface disturbance may accelerate this transition.

Community Phase 1.2: Spiny greasebush shrubland.
This plant community phase is dominated by spiny greasebush, and other shrubs. Grasses are limited or absent from the community.

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

Transition T1A
This transition occurs with the establishment of non-native invasive species. Disturbances that promote this transition include season long continuous grazing of perennial grasses, prolonged drought, recreation or other surface disturbances. Once invasive plants are found in the plant community, a return to the reference state is not likely.

State 2: Current Potential
The invaded state resembles the reference state in both community structure and function, but non-native species, notably cheatgrass, are present. As a result, the resilience of the state is somewhat reduced and the possibility of further degradation is greater.

Community Phase 2.1: Spiny greasebush / Perennial grasses
This plant community is similar to Reference State Community 1.1. except that invasive species are now present. Dominant species are spiny greasebush, shadscale, Indian ricegrass, and James' galleta. Indian ricegrass is typically the dominant perennial grass species in this plant community phase.

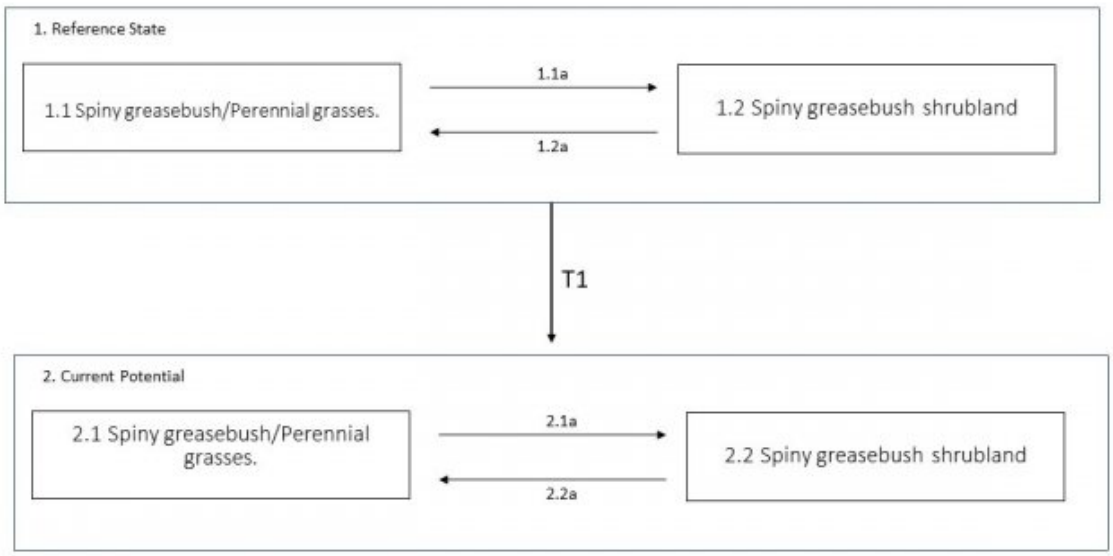
Community Phase Pathway 2.1A
This pathway occurs when weather events, such as drought disfavor the establishment and persistence of perennial grasses. Improper livestock grazing and/or surface disturbance may accelerate this transition. Annuals such as Russian thistle, mustards, and cheatgrass may be able to take advantage of these conditions during short term wet spells.

Community Phase 2.2: Spiny greasebush with invasives
This plant community is similar to Reference State Community 1.2 except that invasive species are now present. Perennial grasses are greatly reduced, and Russian thistle or other invasive annuals may take advantage of the unused resources. This phase may produce annuals, but it is still dominated by Spiny greasebush and other native shrubs.

Community Phase Pathway 2.2A
This pathway occurs when weather events, such as years with normal to above average precipitation favor the establishment and persistence of perennial grasses. Carefully managed livestock grazing, where present can accelerate this transition. Annual species such as Russian thistle, mustards, and cheatgrass may also increase

during this period--especially if they have banked seed in the soil for many years.

State and transition model



State 1
Reference State

Community 1.1
Reference State

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

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	13	44	74
Grass/Grasslike	5	17	29
Forb	2	7	12
Total	**20**	**68**	**115**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	29-31%
Grass/grasslike foliar cover	14-16%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%

Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	4-6%
>1 <= 2	–	–	14-16%	–
>2 <= 4.5	–	29-31%	–	–
>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**			29–45	
	spiny greasebush	GLSPM	*Glossopetalon spinescens var. meionandrum*	14–18	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	5–9	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	5–9	–
	ephedra buckwheat	EREP	*Eriogonum ephedroides*	5–9	–
3	**Sub-Dominant Shrubs**			20–69	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	9–14	–
	black sagebrush	ARNO4	*Artemisia nova*	1–5	–
	pygmy sagebrush	ARPY2	*Artemisia pygmaea*	1–5	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	1–5	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	1–5	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	1–5	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	1–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	1–5	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	1–5	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–5	–
	Nuttall's horsebrush	TENU2	*Tetradymia nuttallii*	1–5	–
	Spanish bayonet	YUHA	*Yucca harrimaniae*	1–5	–
Grass/Grasslike					

0	**Dominant Grasses**			15–25	
	James' galleta	PLJA	*Pleuraphis jamesii*	9–14	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	5–9	–
	squirreltail	ELEL5	*Elymus elymoides*	1–2	–
1	**Sub-Dominant Grasses**			6–20	
	Grass, annual	2GA	*Grass, annual*	1–5	–
	Grass, perennial	2GP	*Grass, perennial*	1–5	–
	purple threeawn	ARPU9	*Aristida purpurea*	1–2	–
	blue grama	BOGR2	*Bouteloua gracilis*	1–2	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	1–2	–
	muttongrass	POFE	*Poa fendleriana*	1–2	–
Forb					
0	**Dominant Forbs**			3–10	
	yellowleaf hawthorn	CRFL2	*Crataegus flava*	1–5	–
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	1–3	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	1–2	–
2	**Sub-Dominant Forbs**			13–32	
	Forb, annual	2FA	*Forb, annual*	1–5	–
	Forb, perennial	2FP	*Forb, perennial*	1–5	–
	Holboell's rockcress	ARHO2	*Arabis holboellii*	1–2	–
	oilshale cryptantha	CRBA6	*Cryptantha barnebyi*	1–2	–
	Gate Canyon buckwheat	ERHY3	*Eriogonum hylophilum*	1–2	–
	Uinta Basin waxfruit	GLSU	*Glaucocarpum suffrutescens*	1–2	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	1–2	–
	King's flax	LIKI2	*Linum kingii*	1–2	–
	Uinta Basin beardtongue	PEGR6	*Penstemon grahamii*	1–2	–
	White River beardtongue	PESC5	*Penstemon scariosus*	1–2	–
	hedgemustard	SIOF	*Sisymbrium officinale*	1–2	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	1–2	–
	arrow thelypody	THSA2	*Thelypodium sagittatum*	1–2	–

Animal community

This site is not commonly used by livestock because of its low forage production.

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

Recreational uses

This site provides scenic desert vistas and limited recreational opportunities.

Contributors

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Approval

Kirt Walstad, 3/08/2022

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 common. They may be more pronounced on steeper slopes and/or on areas located below exposed bedrock, or other water shedding areas where increased runoff may occur. Rills present should be < 2 inches deep, fairly long (> 15 feet) and somewhat widely spaced (8-10 feet). On steeper slopes, rills may be 20 to 25+ feet long and spaced 6 to 8 feet apart. The expression of rills may be less defined where coarse fragments (i.e., gravels and/or channers) dominate the soil surface.

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2. **Presence of water flow patterns:** Water flow patterns are somewhat common throughout the site. They often form sinuous flow patterns that wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (1 to 2 feet 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 1 inch) 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):** 25–30%. (Soil surface is typically covered by 60 to 80% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Bare ground spaces should not be greater than 3 to 6 feet and may be connected. 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:** Rare on slopes < 15%. A few widely scattered gullies will be expected to occur on steeper slopes and on areas below exposed bedrock. There they do occur, their length often

extends from the exposed bedrock to where the gully reaches a stream or other area where water and sediment accumulate. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind caused blowouts and deposition are not expected to be 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. Some litter removal may occur in flow channels with deposition occurring within 2 to 3 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 4 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 plant canopies and a rating of 2 or 3 in the interspaces. The average should be a 3 or 4. Surface texture is silty clay loam. 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):** (Cadrina) Soil surface horizon is typically 0 to 2 inches deep. Texture is an extremely stony loam, structure is moderate thin platy. Color is a pale brown (10YR 6/3). An ochric horizon extends 4 inches into the soil profile. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial vegetation is expected to help break raindrop impact and splash erosion reducing site erosion but not eliminating it. Spatial distribution of vascular plants slows runoff somewhat by obstructing surface flows and help create sinuous flow patterns that dissipate energy and allow time for some infiltration. Natural erosion would be expected in most storms and spring runoff.

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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 sandstone bedrock occurs at about 15 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 (spiny greasebush, bud sagebrush) > Cool season perennial bunchgrasses (bottlebrush squirreltail, Indian ricegrass) > Rhizomatous grasses (James galleta, blue grama) >Perennial forbs (scarlet globemallow) > Biological soil crusts.

    Sub-dominant: Sprouting shrubs (winterfat, green rabbitbrush) > Perennial bunchgrasses (Salina wildrye, purple threeawn) > Perennial forbs (roughseed cateye).

Other: 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: Moss and lichen communities will normally be found under plant canopies while the cyanobacteria may be found throughout the site. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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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 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 or insect infestations, up to 20% of the shrubs may die. There may be partial mortality of individual bunchgrasses and shrubs during less severe drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover ranges from 5 to 10%. Depth should vary from none to a 1 leaf thickness in the interspaces up to 1/4 inch under perennial plant canopies.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 45 to 90 pounds per acre on an average year. Production could vary from 0 to 130 pounds per acre during drought or above-average years.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Russian thistle, halogeton, common sunflower, and annual mustards.

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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 should be present during average and above average growing years.
