Ecological site R030XB135NV
Steep Limestone Hill

Last updated: 2/26/2025
Accessed: 05/11/2025

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): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas.

The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity.

In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave.

Arid Eastern Mojave Land Resource Unit (XB)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Arid Eastern Mojave LRU where precipitation is bi-modal, occurring during the winter months and summer months. The Arid Eastern Mojave LRU is designated by the 'XB' symbol within the ecological site ID. This LRU is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. This LRU is essentially equivalent to the Eastern Mojave Basins and Eastern Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions

Elevations range from 1650 to 4000 feet and precipitation is between 4 to 8 inches per year. This LRU is

distinguished from the Arid Western Mojave (XA) by the summer precipitation, falling between July and September, which tends to support more warm season plant species. The 'XB' LRU is generally east of the Mojave River and the 117 W meridian (Hereford et. al 2004). Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, cacti, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

Ecological site concept

This ecological site is found on hill and mountain landforms within portions of the Colorado River watershed above 3000 feet elevation. Slopes are greater than 15 percent slope. Soils formed in colluvium and residuum from sedimentary or non-foliated metamorphic rock and have a very shallow and shallow depth class.

This is a group concept and provisional STM that also covers R030XB136NV.

Associated sites

R030XB001NV	**LIMY HILL 5-7 P.Z.**
R030XB068NV	**LIMESTONE HILL 5-7 P.Z.**
R030XB136NV	**SHALLOW LIMESTONE 7-9 P.Z.** This is the same ecological site concept.

Similar sites

R030XB057NV	**SHALLOW GRANITIC LOAM 5-7 P.Z.** granitic parent material soils
R030XB014NV	**SHALLOW GRAVELLY LOAM 7-9 P.Z.** BOER4 major grass
R030XB108NV	**GRAVELLY INSET FAN 7-9 P.Z.** more productive site; occurs on inset fans
R030XB015NV	**SHALLOW GRAVELLY SLOPE 7-9 P.Z.** BOER4 major grass
R030XB030NV	**SHALLOW LIMESTONE SLOPE 5-7 P.Z.** PLRI3 major grass; MOUT & TICA3 rare to absent
R030XB076NV	**SHALLOW GRAVELLY SLOPE 6-8 P.Z.** less shrub diversity; PLRI3 major grass
R030XB107NV	**COARSE GRAVELLY LOAM 5-7 P.Z.** PLRI3 codominant plant; more productive site
R030XB136NV	**SHALLOW LIMESTONE 7-9 P.Z.** more productive site, upper elevation of the same ecological site concept which may be expressed on northerly slopes at the same elevation.
R030XB056NV	**SHALLOW GRANITIC SLOPE 5-7 P.Z.** soils derived from granitic parent materials
R030XB128NV	**SHALLOW LIMESTONE HILL 5-7 P.Z.** MOUT & TICA3 rare to absent; AMDU2 important shrub
R030XB029NV	**SHALLOW GRAVELLY LOAM 5-7 P.Z.** more productive site; MOUT & TICA3 rare to absent

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima*
Herbaceous	(1) *Achnatherum speciosum*

Physiographic features

This site occurs on hills and lower elevation mountain sideslopes on all exposures. Slopes range from 30 to 75 percent. Elevations are 2100 to 4900 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope
Elevation	2,100–4,900 ft
Slope	30–75%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Mojave Desert has extreme fluctuations of daily temperatures, strong seasonal winds, and clear skies. The climate is arid and is characterized with cool, moist winters and hot, dry summers. Most of the rainfall falls between November and April. Summer convection storms from July to September may contribute up to 25 percent of the annual precipitation. Average annual precipitation is 7 to 9 inches. Mean annual air temperature is 59 to 65 degrees F. The average growing season is about 180 to 210 days.

Table 3. Representative climatic features

Frost-free period (average)	210 days
Freeze-free period (average)	
Precipitation total (average)	9 in

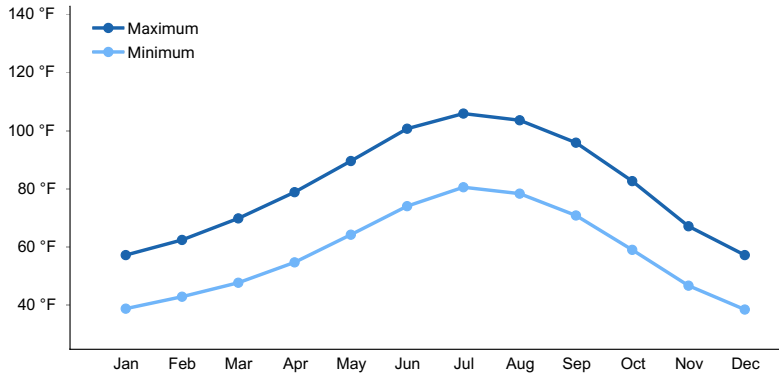


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very shallow and shallow over limestone (sedimentary) bedrock. Available water capacity is very low, runoff is very high, and the soils are well drained. A surface cover of more than 50 percent rock fragments (gravels, cobbles and stones) provides a stabilizing effect on surface erosion conditions. The soils have a calcic horizon from 3 to 13 inches. The soil series correlated to this site include Zeheme.

Table 4. Representative soil features

Parent material	(1) Colluvium–limestone
Surface texture	(1) Very gravelly fine sandy loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	7–14 in
Surface fragment cover <=3"	65–70%
Surface fragment cover >3"	10–12%
Available water capacity (0-40in)	0.5–0.6 in
Calcium carbonate equivalent (0-40in)	10–40%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	41–59%
Subsurface fragment volume >3" (Depth not specified)	10–12%

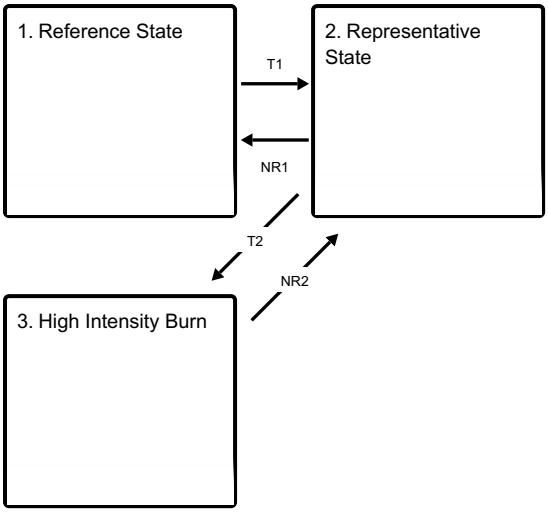
Ecological dynamics

Following wildfire, fire tolerant/crown-sprouting shrubs (snakeweed, ephedra, etc.), threeawn, desert Indianwheat, and other annual forbs and grasses significantly increase and may dominate the site. Introduced annual grasses and forbs such as red brome and filaree readily invade this site. Utah mortonia is most prevalent on southerly aspects. Turbinella oak, cliffrose, skunkbush sumac, and Utah agave occur at the upper elevations within the range of this plant community.

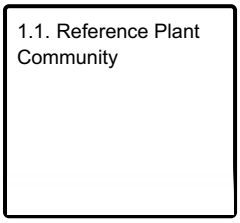
Fire Ecology:
Historical fire return intervals appear to have been on the order of centuries, allowing late seral blackbrush stands to reestablish. Low amounts of fine fuels in interspaces probably limited fire spread to only extreme fire conditions, during which high winds, low relative humidity, and low fuel moisture led to high intensity stand-replacing crown fires. Blackbrush stands are subject to fire, and fire will start and spread easily due to the dense, close spacing nature and resinous foliage of blackbrush. Blackbrush is slow to reestablish. Range ratany is top-killed by fire. Range ratany resprouts from the root crown after fire. Following fire, Virgin River encelia depends on off-site seed rather than on-site sprouts for regeneration. Nevada ephedra is top-killed by fire. Underground regenerative structures commonly survive when aboveground vegetation is consumed by fire. Nevada ephedra generally sprouts after fire damages aboveground vegetation and may increase in plant cover. Desert needlegrass has persistent dead leaf bases, which make it susceptible to burning. Fire removes the accumulation; a rapid, cool fire will not burn deep into the root crown and surviving tufts will resprout. A moderately hot fire will kill the aboveground portions of slim tridens, but survival of the rhizomes is usually good. Extremely hot fires will cause much more damage, especially among thin grasses not well protected by the buildup of vegetative material.

State and transition model

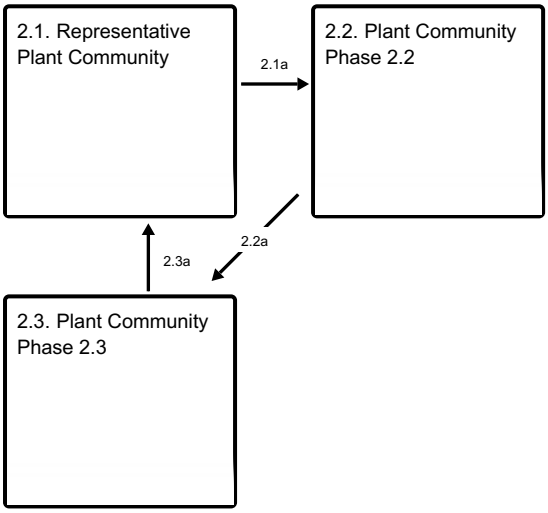
Ecosystem states



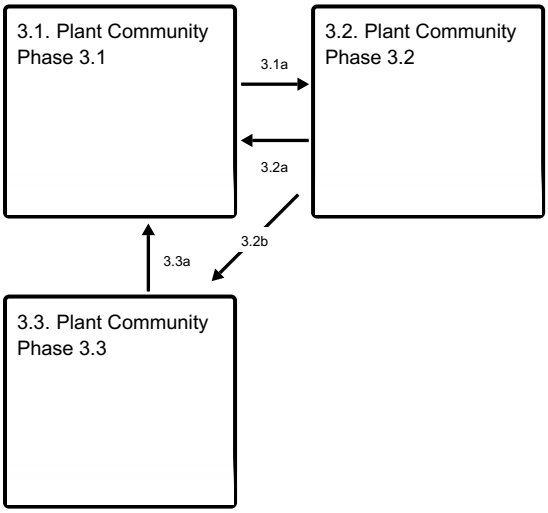
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

The Reference State is representative of the natural range of variability under pristine conditions. The plant community is shrub dominated with natural disturbance regimes primarily driven by long-term drought, insect outbreaks, and infrequent wildfire. Historically, this state experienced an extended fire return interval due to low fuel loading, which resulted in long-lived stable plant communities.

Community 1.1
Reference Plant Community

The reference plant community is dominated by blackbrush. Desert needlegrass, Utah mortonia, and shrubby tequilia are other important species associated with this site. Potential vegetative composition is about 10% annual and perennial grasses, 5% annual and perennial forbs and 85% shrubs. Approximate ground cover (basal and crown) is 10 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	85	149	234
Grass/Grasslike	10	18	28
Forb	5	8	13
Total	**100**	**175**	**275**

State 2
Representative State

Introduced annuals such as red brome, schismus and redstem stork's bill have invaded the reference plant community and have become a dominant component of the herbaceous cover. This invasion of non-natives is attributed to a combination of factors including surface disturbances, changes in the kinds of animals and their grazing patterns, drought, and changes in fire history. Following wet years, dried non-natives annuals can provide enough fuel to carry wildfires where large, intense wildfires historically have been infrequent.

Community 2.1
Representative Plant Community

This plant community is compositionally similar to the Reference Plant Community with the presence of non-native species in the understory. Primary ecological processes have not been compromised at this time.

Community 2.2
Plant Community Phase 2.2

This plant community is characterized by increased annual, perennial, native and non-native grasses. Few surviving shrubs will remain on the site. This plant community is identified as “at-risk”. Continued heavy disturbance or repeated fire will exclude native vegetation and change the ecological dynamics of the site.

Community 2.3
Plant Community Phase 2.3

Shrubs have begun to regenerate. Woody species with high seed production and early establishment will be the first to return. Once large shrubs are established and begin to produce shade it will favor the establishment of additional native perennials.

Pathway 2.1a
Community 2.1 to 2.2

Anthropogenic disturbance removes shrubs and favors an increase of herbaceous vegetation and non-native species.

Pathway 2.2a
Community 2.2 to 2.3

Changes in management remove disturbance and allow woody species to regenerate. Post disturbance colonization by woody species will be limited to those with high growth rates, high reproductive ability and relatively short life spans (GUTIE, ENFAV, ERFA). Blackbrush will begin to reestablish provided favorable climatic conditions and available seed source.

Pathway 2.3a
Community 2.3 to 2.1

Many years with no fire, minimal disturbance, the presence of a blackbrush seed source, ideal climatic conditions and multiple recruitment pulses blackbrush seedlings will establish and recruit into the stand.

State 3
High Intensity Burn

This state is characterized by the inability of blackbrush to return to site following a fire, due to insufficient climatic conditions and the lack of an available seed source. In the absence of ideal conditions blackbrush will not return to the site. Species will consist of fire tolerant shrubs with high growth rates and high reproductive capacities.

Community 3.1
Plant Community Phase 3.1

Is characterized by dominance of grasses; annual, perennial, native and non-native. Few surviving shrubs remain on the site. Non-native annuals provide a significant amount of herbaceous biomass.

Community 3.2
Plant Community Phase 3.2

This plant community is dominated by pioneering woody species tolerant of post fire conditions. Scattered shrubs consist of those with the ability to sprout from the root crown following fire. Perennial bunchgrasses and non-native annuals are common and wide spread.

Community 3.3
Plant Community Phase 3.3

This plant community is dominated by a variety of shrubs that were present in smaller quantities in the Reference State. Blackbrush continues to be excluded from this site due to the lack of seed source and ideal conditions required for recruitment and establishment.

Pathway 3.1a
Community 3.1 to 3.2

Time without disturbance pioneering shrubs germinate and establish from an offsite seed source and sprouting shrubs begin to reappear.

Pathway 3.2a
Community 3.2 to 3.1

Small scale fire of other localized disturbances remove patches of woody vegetation and encourage growth of perennial bunchgrasses and non-native annuals.

Pathway 3.2b
Community 3.2 to 3.3

Removal of disturbance and the absence of fire favors establishment of long-live native perennial vegetation.

Pathway 3.3a
Community 3.3 to 3.1

Large disturbance, like fire, removes woody vegetation and promotes growth of non-native annuals.

Transition T1
State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal. Non-natives can alter disturbance regimes significantly from their natural or historic range and change ecological processes therefore creating an unlikely scenario to restore the site back to reference.

Restoration pathway NR1
State 2 to 1

No Recovery (NR) - Non-native annuals species have become naturalized in these systems creating an unlikely scenario to restore the site back to reference.

Transition T2
State 2 to 3

Large scale high intensity fire in combination with insufficient conditions for the re-establishment of blackbrush.

Restoration pathway NR2
State 3 to 2

No Recovery (NR) - Recovery within our lifetime is extremely difficult and challenging without an infinite amount of resources to achieve restoration.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			3–38	
	desert needlegrass	ACSP12	*Achnatherum speciosum*	1–15	–
	slim tridens	TRMU	*Tridens muticus*	1–15	–
	threeawn	ARIST	*Aristida*	1–8	–
2	**Secondary Perennial Grasses**			1–8	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–4	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	1–4	–
	bush muhly	MUPO2	*Muhlenbergia porteri*	1–4	–
	big galleta	PLRI3	*Pleuraphis rigida*	1–4	–
3	**Annual Grasses**			1–8	
Forb					
4	**Perennial Forbs**			1–8	
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	1–4	–
5	**Annual Forbs**			1–15	
	desert Indianwheat	PLOV	*Plantago ovata*	1–4	–
Shrub/Vine					
6	**Primary Shrubs**			134–256	
	blackbrush	CORA	*Coleogyne ramosissima*	105–140	–
	Utah mortonia	MOUT	*Mortonia utahensis*	8–45	–
	woody crinklemat	TICA3	*Tiquilia canescens*	8–25	–
	Virgin River brittlebush	ENVI	*Encelia virginensis*	4–15	–
	Nevada jointfir	EPNE	*Ephedra nevadensis*	4–8	–
	Utah agave	AGUT	*Agave utahensis*	1–8	–
7	**Secondary Shrubs**			4–18	
	Utah butterflybush	BUUT	*Buddleja utahensis*	2–5	–
	hedgehog cactus	ECHIN3	*Echinocereus*	2–5	–
	foxtail cactus	ESCOB	*Escobaria*	2–5	–
	California barrel cactus	FECY	*Ferocactus cylindraceus*	2–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	2–5	–
	creosote bush	LATR2	*Larrea tridentata*	2–5	–
	water jacket	LYAN	*Lycium andersonii*	2–5	–
	pricklypear	OPUNT	*Opuntia*	2–5	–
	wirelettuce	STEPH	*Stephanomeria*	2–5	–
	Joshua tree	YUBR	*Yucca brevifolia*	2–5	–
	Mojave yucca	YUSC2	*Yucca schidigera*	2–5	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production, and steep slopes. Desert needlegrass produces considerable basal foliage and is good forage while young. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle but rarely grazed by sheep. Slim tridens is palatable and moderately nutritious. It is eaten by all classes of livestock. Blackbrush areas

are economically important for winter grazing by domestic livestock, especially sheep. But it does provide poor forage during the spring, summer, and fall for domestic cattle, horses, and domestic sheep. Range ratany is an important forage species for all classes of livestock. Palatability of range ratany is rated fair to good for cattle and sheep. Encelia has no forage value for domestic livestock. Nevada ephedra is important winter range browse for domestic cattle, sheep and goats. Nevada ephedra is usually grazed heavily and seems to be perfectly safe for grazing livestock since it induces neither toxicity in ewes or cows, nor congenital deformities in lambs.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:
Blackbrush areas are economically important for winter grazing primarily for several wildlife species. Mule deer and bighorn sheep generally use the blackbrush vegetation type in winter. Range ratany is an important forage species for deer. Mule deer browse range ratany year-long with seasonal peaks. Mule deer peak use is from February to April and from August to October. Virgin River encelia is important to the desert tortoise as a source of succulent forage in periods of low moisture. Encelia is a browse species of desert mule deer and desert bighorn sheep. Mule deer, bighorn sheep, and pronghorn browse Nevada ephedra, especially in spring and late summer when new growth is available. Mountain quail eat ephedra seeds. Desert bighorn sheep and feral horses and burros will graze desert needlegrass. Slim tridens seeds are a source of food for rodents and birds.

Hydrological functions

Runoff is very high. Permeability is moderately rapid. Hydrologic soil group is D.

Other products

Some Native American tribes steeped the twigs of Nevada ephedra and drank the tea as a general beverage.

Other information

Desert needlegrass may be used for groundcover in areas of light disturbance, but it is susceptible to excessive trampling.

Type locality

Location 1: Clark County, NV	
UTM zone	N
UTM northing	4016815
UTM easting	761395
General legal description	Azure Ridge area, about 5 air miles east of Gold Butte, Clark County, Nevada.

Other references

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

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Salem, B. B. (1989). Arid zone forestry: a guide for field technicians (No. 20). Food and Agriculture Organization (FAO).

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Contributors

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Approval

Sarah Quistberg, 2/26/2025

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)	
Contact for lead author	
Date	05/11/2025
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and 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):**

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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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
