USDA Natural Resources Conservation Service

# Ecological site R030XB100NV
# GRAVELLY CLAYPAN 5-7 P.Z.

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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): 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 inset fans and fluves below 3600 feet elevation with headwaters also below 3600 feet elevation. Soils have a duripan. This site is within Plant Hardiness Zone 9b or lower which excludes species more common in the Sonoran Desert.

This site has been included with group concept R030XB137CA.

## Associated sites

| | |
|---|---|
| R030XB001NV | **LIMY HILL 5-7 P.Z.** |
| R030XB005NV | **Arid Active Alluvial Fans** |

## Similar sites

| | |
|---|---|
| R030XB123NV | **LIMESTONE SLOPE 5-7 P.Z.**<br>Soils derived from limestone |
| R030XB005NV | **Arid Active Alluvial Fans**<br>Less productive site |
| R030XB043NV | **CLAYPAN 5-7 P.Z.**<br>MUPO2 major grass; GRSP & KRLA2 major shrubs |
| R030XB039NV | **LIMY FAN 5-7 P.Z.**<br>On inset fans and fan skirt positions |
| R030XB001NV | **LIMY HILL 5-7 P.Z.**<br>Less productive site; greater shrub diversity; occurs on steep, convex, sideslopes |
| R030XB066NV | **BASALTIC FAN 5-7 P.Z.**<br>Soils derived from basalt or other mafic parent materials |
| R030XB007NV | **GRANITIC LOAM 5-7 P.Z.**<br>MUPO2 major grass; less productive site |
| R030XB044NV | **COBBLY CLAYPAN 5-7 P.Z.**<br>More productive site |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Ambrosia dumosa* |
| Herbaceous | (1) *Pleuraphis rigida* |

## Physiographic features

This site occurs on concave sideslopes and toeslopes of hills, on fan remnants and inset fans on all exposures. Slopes range from 0 to 30 percent, but slope gradients of 2 to 8 percent are typical. Elevations are 2200 to 4500 feet.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Fan remnant<br>(2) Inset fan<br>(3) Hill |

| | |
|---|---|
| Flooding duration | Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours) |
| Flooding frequency | Very rare to rare |
| Ponding frequency | None |
| Elevation | 671–1,372 m |
| Slope | 0–30% |
| Aspect | Aspect is not a significant factor |

## Climatic features

The climate is hot and arid with warm, moist winters and hot, dry summers. Average annual precipitation is 5 to 7 inches with up to 20 percent of the total precipitation occurring as summer rainfall during the period July through September. Mean annual air temperature is 56 to 60 degrees F. The average growing season is about 190 to 220 days. There is no available climate station for this site.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (average) | 220 days |
| Freeze-free period (average) | |
| Precipitation total (average) | 178 mm |

## Influencing water features

There are no influencing water features associated with this site.

## Soil features

The soils associated with this site are shallow to deep. Surface cover of rock fragments is typically greater than 60 percent with gravel-sized fragments comprising at least 80 percent of the total rock cover. Runoff is very low to very high. This site is well drained with permeability ranging from slow to moderately rapid. The soil series associated with this site include Lanip, Peskah, and Tenwell.

**Table 4. Representative soil features**

| | |
|---|---|
| Surface texture | (1) Extremely gravelly loam<br>(2) Extremely gravelly fine sandy loam<br>(3) Very gravelly fine sandy loam |
| Family particle size | (1) Loamy |
| Drainage class | Well drained |
| Permeability class | Slow to moderately rapid |
| Soil depth | 51–152 cm |
| Surface fragment cover <=3" | 50–70% |
| Surface fragment cover >3" | 7–8% |
| Available water capacity (0-101.6cm) | 4.83–13.72 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0–15% |
| Electrical conductivity (0-101.6cm) | 0–4 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0–12 |

| | |
|---|---|
| Soil reaction (1:1 water) (0-101.6cm) | 7.9–9 |
| Subsurface fragment volume <=3" (Depth not specified) | 9–70% |
| Subsurface fragment volume >3" (Depth not specified) | 0–9% |

## Ecological dynamics

Blackbrush communities are most prevalent in the transitional zone between the Mojave Desert and Great Basin and are commonly associated with creosotebush. Blackbrush is a paleoendemic species as originally postulated by Stebbins and Major (1965). Blackbrush is a transitional species that occupies a boundary that has shifted in recent geologic time. Analysis of packrat middens suggests a 50–100-m downward movement of the blackbrush zone along elevational gradients in the Mojave (Cole and Webb, 1985; Hunter and McAuliffe,1994). The plant communities of this site are dynamic in response to changes in disturbance regimes and weather patterns. Community phase changes are primarily driven by long term drought. Reproduction and recruitment are episodic, based on favorable environmental conditions (Pendleton and Meyer 2004). Very old stands of blackbrush may have established hundreds to thousands of years ago under very different climatic conditions and will take a considerable amount of time to recover following disturbances.

Blackbrush is a long-lived and generally considered a climax species. It is a non-sprouter; regeneration depends on wind pollinated seed and heavy winter precipitation, and is therefore slow to re-colonize burned areas (Anderson 2001). Blackbrush recruitment is episodic, like many shrubs in arid systems, when conditions are favorable large seed crops are produced and the rest of the time is characterized by minimal seed output (Pendleton and Meyer 2004). Blackbrush seeds are frequently cached away by rodents, until conditions areconducive for germination. Typically, germination occurs during the winter and early spring, given the proper moisture conditions and cool soil temperatures (Pendleton 2008). Seeds require cold stratification before germination and the survival of seedlings following germination is dependent on the availability of spring time moisture (Pendleton 2008).

On undisturbed sites, blackbrush dominates the landscape and species diversity is generally low. Undisturbed blackbrush communities are fairly resistant to invasion by non-natives (Brooks and Matchett 2003). Mature blackbrush plants are well adapted to persist under less than optimal conditions, and individuals' may live as long as 400 years (Pendleton and Meyer 2004). Communities are characterized by a flammable shrub architecture allowing fire to easily spread, thus these communities experience stand replacing fire regimes. The short-lived seed of blackbrush is readily destroyed by fire and it may take upwards of 60 years for blackbrush to reestablish. There is frequently 100 percent mortality of blackbrush following fire (Brooks and Matchett 2003).

Fire Ecology:
Most fires in the Mojave Desert are infrequent and of low severity because production of annual and perennial herbs seldom provides a fuel load capable of sustaining fire. Historic fire return intervals, for blackbrush communities, appear to have been on the order of centuries, allowing late seral blackbrush stands to establish. 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 and is generally removed from the site for an extended period.

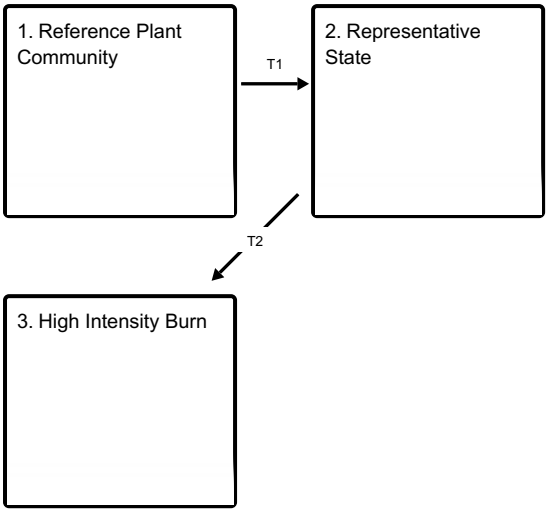
Creosotebush is poorly adapted to fire, due to its limited sprouting ability. It is able to survive low severity, patchy fires. Damage to big galleta from fire varies. If big galleta is dry, damage may be severe. However, when plants are green, fire will tend to be less severe and damage may be minimal, with big galleta recovering quickly. 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.

Under current environmental conditions in the Mojave Desert, it is common to see disturbed blackbrush sites dominated by the semi-erect, evergreen, Mojave buckwheat. Eriogonum species are frequently pioneering species following natural disturbance (Meyer 2008). Following severe fires resprout success of Mojave buckwheat is limited. Most regeneration is from seeds(Montalvo and Beyers 2010). The seedbank of Mojave buckwheat will not persist under a frequent fire regime. Under an unnaturally high fire frequency herbaceous communities are favored over

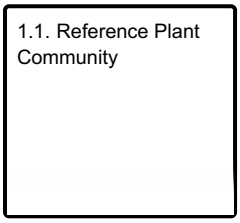
woody dominated plant communities, which cause habitat degradation.

## State and transition model

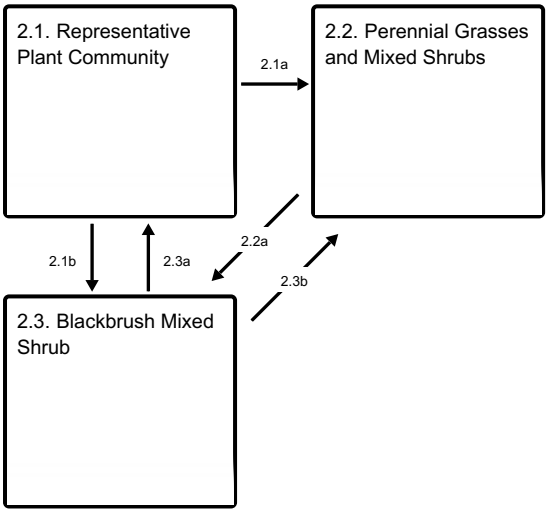
**Ecosystem states**



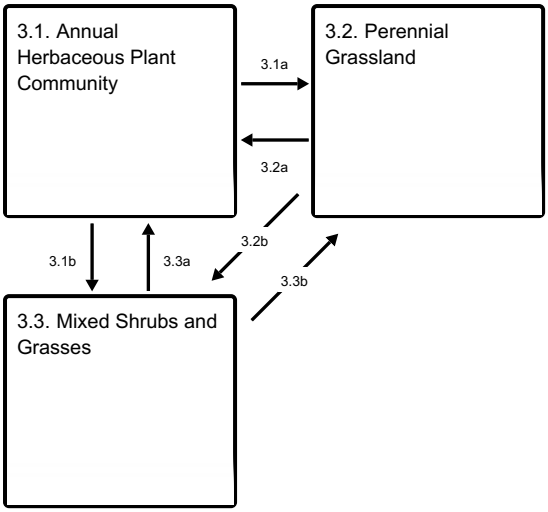

**State 1 submodel, plant communities**




**State 2 submodel, plant communities**



**State 3 submodel, plant communities**




## State 1
## Reference Plant Community

### Community 1.1
### Reference Plant Community

The reference plant community is dominated by white bursage and big galleta. Range ratany and ephedra are important species associated with this site. Potential vegetative composition is about 70% grasses, 10% annual and perennial forbs and 20% shrubs. Approximate ground cover (basal and crown) is 10 to 20 percent.

**Table 5. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 353 | 549 | 785 |
| Shrub/Vine | 101 | 157 | 224 |
| Forb | 50 | 78 | 112 |
| **Total** | **504** | **784** | **1121** |

## 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

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### Community 2.2
### Perennial Grasses and Mixed Shrubs

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
### Blackbrush Mixed Shrub

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

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

### Pathway 2.1b
### Community 2.1 to 2.3

Disturbance removes long lived shrubs which are replaced by short lived shrubs.

### Pathway 2.2a
### Community 2.2 to 2.3

Changes in management remove disturbance and allow woody species to regenerate. Fast growing, short-lived woody species with high reproductive ability such as snakeweed, brittlebush and Eastern Mojave buckwheat will increase and become nurse plants for other species. Blackbrush will begin to reestablish provided favorable climatic conditions and available seed source.

### Pathway 2.3a
### Community 2.3 to 2.1

Many years without 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.

### Pathway 2.3b
### Community 2.3 to 2.2

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

## 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
### Annual Herbaceous Plant Community

This plant community 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
### Perennial Grassland

This plant community is dominated by perennial grasses. Shrubs able to sprout from the root crown following fire, are scattered throughout. Other herbaceous plants, including non-native annuals, are common and wide spread.

### Community 3.3
### Mixed Shrubs and Grasses

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 perennial grasses become established.

### Pathway 3.1b
### Community 3.1 to 3.3

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

Disturbance, like a low intensity fire, removes woody vegetation and promotes growth of perennial grasses.

### Pathway 3.3b
### Community 3.3 to 3.2

Large disturbance, like a high intensity 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.

### Transition T2
### State 2 to 3

Large scale high intensity fire in combination with insufficient climatic conditions for germination and establishment of blackbrush. This is the lower elevation of blackbrush habitat. Reestablishment of blackbrush within these areas should not be expected.

## Additional community tables

**Table 6. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Primary Perennial Grasses** | | | 472–628 | |
| | big galleta | PLRI3 | *Pleuraphis rigida* | 471–588 | – |
| | bush muhly | MUPO2 | *Muhlenbergia porteri* | 1–39 | – |
| 2 | **Secondary Perennial Grasses** | | | 16–78 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 4–24 | – |
| | desert needlegrass | ACSP12 | *Achnatherum speciosum* | 4–24 | – |
| | threeawn | ARIST | *Aristida* | 4–24 | – |
| | low woollygrass | DAPU7 | *Dasyochloa pulchella* | 4–24 | – |
| | slim tridens | TRMU | *Tridens muticus* | 4–24 | – |
| 3 | **Annual Grasses** | | | 1–24 | |
| **Forb** | | | | | |
| 4 | **Primary Perennial forbs** | | | 16–39 | |
| | desert globemallow | SPAM2 | *Sphaeralcea ambigua* | 16–39 | – |
| 5 | **Perennial forbs** | | | 16–39 | |
| | burrobush | AMDU2 | *Ambrosia dumosa* | 62–185 | – |
| | water jacket | LYAN | *Lycium andersonii* | 4–24 | – |
| | desertsenna | SEAR8 | *Senna armata* | 4–24 | – |
| 6 | **Annual forbs** | | | 1–157 | |
| | Nevada jointfir | EPNE | *Ephedra nevadensis* | 16–39 | – |
| | creosote bush | LATR2 | *Larrea tridentata* | 4–24 | – |
| | Schott's yucca | YUSC | *Yucca ×schottii* | 4–24 | – |
| | Virgin River brittlebush | ENVI | *Encelia virginensis* | 4–24 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Primary shrubs** | | | 93–263 | |
| | burrobush | AMDU2 | *Ambrosia dumosa* | 62–185 | – |
| | Nevada jointfir | EPNE | *Ephedra nevadensis* | 16–39 | – |
| 8 | **Secondary shrubs** | | | 16–63 | |
| | Virgin River brittlebush | ENVI | *Encelia virginensis* | 8–24 | – |
| | creosote bush | LATR2 | *Larrea tridentata* | 8–24 | – |
| | water jacket | LYAN | *Lycium andersonii* | 8–24 | – |
| | desertsenna | SEAR8 | *Senna armata* | 8–24 | – |
| | Mojave woodyaster | XYTO2 | *Xylorhiza tortifolia* | 8–24 | – |
| | Mojave yucca | YUSC2 | *Yucca schidigera* | 8–24 | – |

## Animal community

Livestock Interpretations:
This site is suited to livestock grazing. Grazing management should be keyed to big galleta. Big galleta is considered a valuable forage plant for cattle and domestic sheep. Its coarse, rigid culms make it relatively resistant to heavy grazing and trampling. White bursage is an important browse species. Browsing pressure on white bursage is particularly heavy during years of low precipitation, when production of winter annuals is low. White

bursage is of intermediate forage value. It is fair to good forage for horses and fair to poor for cattle and sheep. However, because there is often little other forage where white bursage grows, it is often highly valuable to browsing animals.

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:
White bursage is an important browse species for wildlife. Big galleta is an important forage species for several wildlife species.

## Hydrological functions

Runoff is very low to very high. Permeability is slow to moderately rapid.

## Other products

White bursage is a host for sandfood, a parasitic plant with a sweet, succulent, subterranean flowerstalk. Sandfood was a valuable food supply for Native Americans.

## Other information

Big galleta's clumped growth form stabilizes blowing sand. White bursage may be used to revegetate disturbed sites in southwestern deserts.

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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 | 05/12/2025 |
| 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):**

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

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

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

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

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

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

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:**

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