USDA Natural Resources
Conservation Service

Ecological site R030XA043CA
Calcareous Hill

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Accessed: 05/21/2025

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 Western Mojave Land Resource Unit (XA)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the arid portions of the Mojave where precipitation primarily occurs during the winter months (Hereford et. al 2004). The lack of summer precipitation as well as cooler temperatures allows cool season species to occupy sites at lower elevations than they do in the Eastern Mojave. For example, sandberg bluegrass, winterfat and spiny hopsage are common at lower elevations in the Western Mojave than they are in the Eastern Mojave. Warm season species like big galleta rarely occur in the Western Mojave. The Arid Western Mojave LRU is designated by the 'XA' symbol within the ecological site ID and is roughly equivalent to Western Mojave Basins and Western Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions.

Elevations range from 1650 to 4300 feet and precipitation is between 4 to 8 inches per year. The Arid Western Mojave LRU is distinguished from the Arid Eastern Mojave (XB) by the lack of summer precipitation which excludes many warm season plant species from occurring in this LRU. Vegetation includes creosote bush, rabbitbrush, shadscale saltbush, spiny hopsage, winterfat, Nevada jointfir, and Joshua tree. At the upper elevations of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub. The Arid Western Mojave LRU generally lacks the diversity of yucca, cacti and warm season species found in the Arid Eastern Mojave.

Classification relationships

NDDB/Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California - Mojave Creosote Bush Scrub.; J.O. Sawyer and T. Keeler-Wolf. 1995. Manual of California Vegetation - Creosotebush Series.

Ecological site concept

The Calcareous Hill ecological site is found among the hill and mountains landscape below 3000 feet (915 m) on rock pediments between 5 and 15 percent slope. Soils are shallow, have an argillic horizon and formed in residuum from granodiorite. The central concept for this ecological site is in the Soil Survey of Edwards Air Force Base, California,

Parts of Kern, Los Angeles, and San Bernardino Counties (SSA CA669) on the Sparkhule component of the Sparkhule gravelly sandy loam, 5 to 15 percent slopes gravelly sandy loam, 5 to 15 percent slopes map unit.

This is a group concept and provisional STM that also covers the following ecological sites: R030XA010CA.

Associated sites

R030XA009CA	**Alkali Flat 5-7** Alkali Flat 5-7
R030XA012CA	**Calcareous Loam 5-7** Calcareous Loam 5-7

Similar sites

R030XA012CA	**Calcareous Loam 5-7** Calcareous Loam 5-7
R030XA010CA	**Calcareous Hill 3-5** This is the same site. R030XA043CA was created to avoid duplicity with R030XA010NV in the event the

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata* (2) *Atriplex confertifolia*
Herbaceous	(1) *Achnatherum speciosum*

Physiographic features

This site occurs on hills and rock pediments on all exposures. Elevations are 1600 to 3000 feet. Slopes range from 5 to 15 percent.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Pediment
Elevation	1,600–3,000 ft
Slope	5–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate on this site is characterized by cool, relatively dry winters (30 to 60 degrees F) and hot, dry summers (70 to 100 degrees F). The average annual precipitation ranges from 3 to 7 inches with most falling as rain from November to March. Mean annual air temperature is 60 to 64 degrees F.

The average frost free period is 200 to 250 days.

Table 3. Representative climatic features

Frost-free period (average)	250 days
Freeze-free period (average)	223 days
Precipitation total (average)	5 in

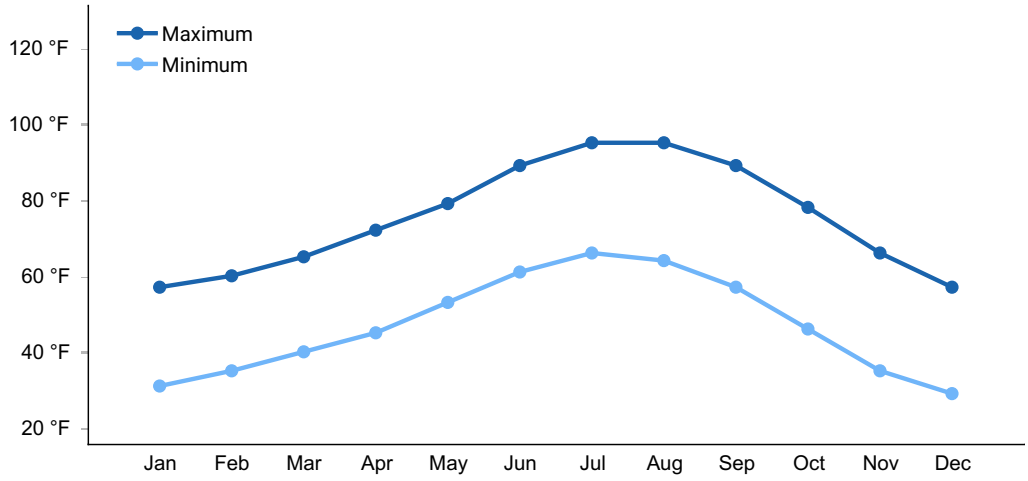


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

The plant community for this site is not influenced by water from a wetland or stream.

Soil features

The soils that characterize this site are shallow and well drained. They are formed in residuum from quartz monzonite. Surface textures are very gravelly sandy loams. Subsoils are sandy clay loams. Available water capacity is very low and the hazard of water erosion is moderate. Wind erosion hazard is moderate. Effective rooting depth is 0 to 20 inches. Water tables are greater than 60 inches.

Soil Map Units

142 Sparkhule gravelly sandy loam, 5-15% slopes

Table 4. Representative soil features

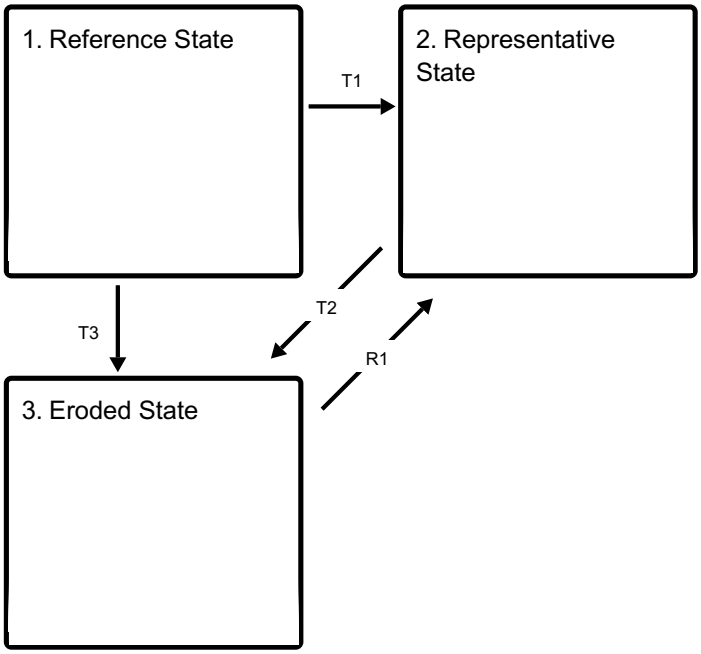
Surface texture	(1) Gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	17–20 in
Surface fragment cover <=3"	15%
Surface fragment cover >3"	5%
Available water capacity (0-40in)	0.1–0.13 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.7–8
Subsurface fragment volume <=3" (Depth not specified)	15%
Subsurface fragment volume >3" (Depth not specified)	5%

Ecological dynamics

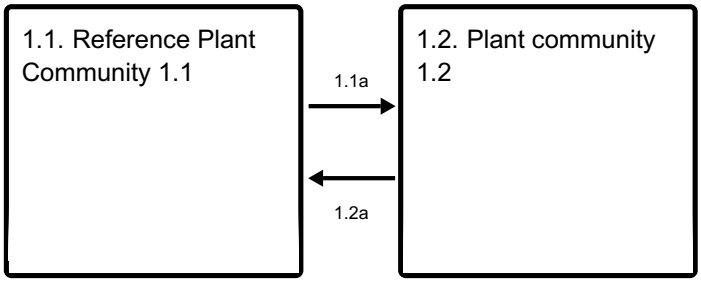
This is a very stable plant community so long as the site is undisturbed. Destructive impacts such as land clearing may reduce cover of shadscale, white bursage, long-lived creosotebush and the perennial grasses. Erosion will most likely increase. With a loss of perennial cover, non-native annual forbs and grasses such as red-stem filaree, red brome and Schismus will readily invade this site. Fire Effects - Desert communities are usually unaffected by fire due to low fuel loads. A year of exceptionally heavy winter rains can generate fuels by producing a heavy stand of annual forbs and grasses. When fires do occur, the effect on the ecosystem may be extreme because of the harsh environment and slow rate of recovery. Shadscale, white bursage and creosotebush possess limited sprouting ability, thus can be killed by fire. Desert needlegrass has persistent dead leaf bases, which make it susceptible to burning. A rapid cool fire may top-kill desert needlegrass, but may not burn into the root crown, allowing for resprouting.

State and transition model

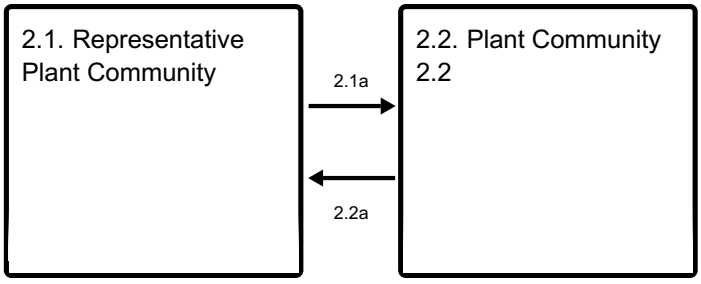
Ecosystem states



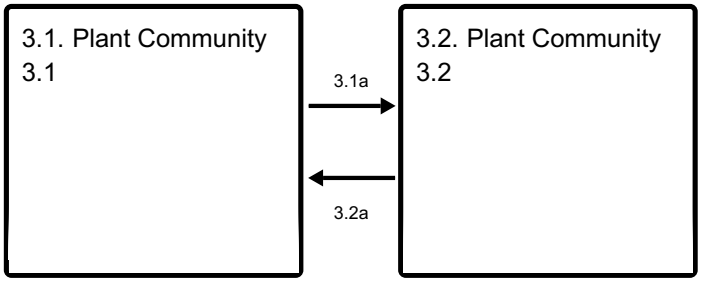
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

Community 1.1

Reference Plant Community 1.1

This site is the historic climax plant community. This community is characterized by widely spaced shrubs, 0.5 to 2 meters tall. Approximate ground cover (basal and crown) ranges from 5 to 15 percent. Creosotebush, shadscale and white bursage form the most characteristic association. Perennial grasses include desert needlegrass, Indian ricegrass and Sandberg bluegrass. Perennial forbs include desert trumpet and desert globemallow. The majority of the annuals are winter annuals which are especially abundant after winters of above average precipitation. The following table lists the major plant species and percentages by weight, air dry, of the total plant community that each contributes in an average production year. Fluctuations in species composition and relative production may change from year to year dependent upon abnormal precipitation or other climatic factors.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	40	120	200
Grass/Grasslike	5	15	25
Forb	5	15	25
Total	**50**	**150**	**250**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	4-12%
Grass/grasslike foliar cover	0-1%
Forb foliar cover	0-1%
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%

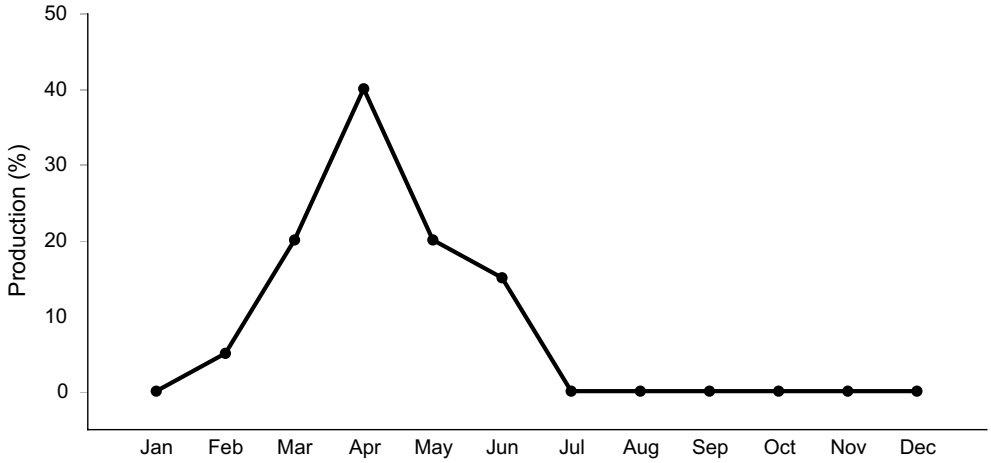


Figure 3. Plant community growth curve (percent production by month). CA3002, Creosote bush XY. Growth starts in early spring, flowering and seed set occur by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of growth..

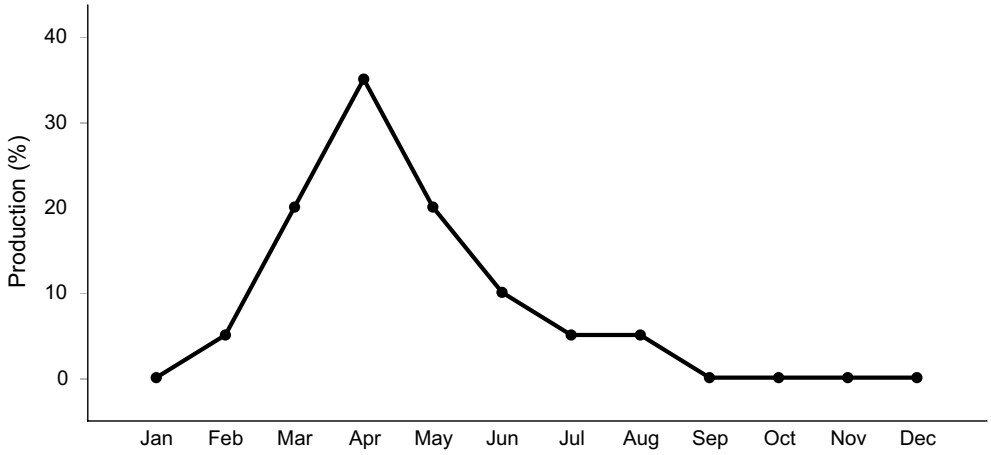


Figure 4. Plant community growth curve (percent production by month). CA3003, Shadscale. Growth starts in early spring. Flowering and seed set occur by July. Seeds stay on the shrub for several months. Dormancy occurs during the hot summer months..

Community 1.2
Plant community 1.2

This plant community is characteristic of a post-disturbance plant community. It is initially dominated by herbaceous vegetation, which may or may not be non-native, woody perennials are increasing. Sprouting shrubs quickly recover and provide favorable microsites for the establishment of shrubs seedlings.

Pathway 1.1a
Community 1.1 to 1.2

Wildfire, disease, prolonged drought, insect attack or any other type of incomplete vegetation removal.

Pathway 1.2a
Community 1.2 to 1.1

Absence from disturbance and natural regeneration over time.

State 2
Representative State

The Representative State is characterized by the presence of non-native annuals in the understory. Plant communities in this state function very similarly to the reference state, however, ecological resilience may be reduced by the presence of the non-natives. Introduced annuals such as red brome, Mediterranean grass and redstem filaree have invaded the reference plant community and have become a component of the herbaceous cover. These non-native annuals are highly flammable and promote wildfires where fires historically have been infrequent. Mature shrubs persists after this invasion by non-native annuals, however shrubs seedling and desirable grasses suffer reduced vigor and limited reproductive capability due to increased competition from non-natives.

Community 2.1
Representative Plant Community

This plant community is similar to the reference plant community with a trace of non-natives in the understory. Ecological function has been not compromised at this time. Ecological resilience is reduced by the presence of non-native species and this plant community phase will respond differently following a disturbance when compared to non-invaded plant communities.

Community 2.2
Plant Community 2.2

This plant community is characteristic of a post-disturbance plant community. It is initially dominated by herbaceous vegetation, woody perennials are increasing. Short lived and pioneering shrubs such as cattle saltbush, rabbit brush, California buckwheat, spiny hopsage, and burrobrush provide favorable microsites for the establishment of long lived shrub seedlings.

Pathway 2.1a
Community 2.1 to 2.2

Frequent and repeated surface disturbances, wildfire, disease, insect attack, or any other type of incomplete vegetation removal.

Pathway 2.2a
Community 2.2 to 2.1

Absence from disturbance and natural regeneration over time.

State 3
Eroded State

The eroded state is characterized by a loss of perennial vegetation and reduced soil stabilization. The loss of vegetation has reduced ecological resilience. Feedbacks keeping this state stable include reduced infiltration, increased runoff during precipitation events, and increased rodent activity. Vegetation removal increases soil surface temperatures, reduces soil moisture and limits establishment of native perennial vegetation.

Community 3.1
Plant Community 3.1

This plant community phase is dominated by non-native annuals. Soil stability is severely reduced and active erosion easily occurs, even during typical rainfall events. Ecological processes such as nutrient cycling and infiltration have been reduced.

Community 3.2
Plant Community 3.2

Short lived and pioneering shrubs such as cattle saltbush, rabbit brush, California buckwheat, spiny hopsage, and burrobrush are likely to thrive and provide favorable microsites for the establishment of long lived shrub seedlings.

Pathway 3.1a
Community 3.1 to 3.2

Absence from disturbance over several years allows the perennial vegetation to increase.

Pathway 3.2a
Community 3.2 to 3.1

Frequent and repeated surface disturbances, wildfire, disease, insect attack, or any type of vegetation removal.

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 T3
State 1 to 3

Repeated disturbance, including wildfire, removes perennial vegetation and decreases soil stability.

Transition T2
State 2 to 3

Repeated disturbance, including wildfire, removes perennial vegetation and decreases soil stability.

Restoration pathway R1
State 3 to 2

Over time, likely more than 25 years, perennial vegetation may resemble pre-disturbance conditions.

Additional community tables

Animal community

Wildlife Interpretations: This site provides suitable habitat for small mammals such as kangaroo rats and ground squirrels and game and fur mammals such as coyotes and black-tailed jackrabbits. Raptors and ravens also frequent this site. Common reptiles include side-blotched lizards and western whiptails. The soils on this site are poorly suited for burrowing reptiles such as the desert tortoise where depths are less than 10 inches.

Management for this site would be to protect it from excessive disturbance and maintain existing plant cover. Water developments would increase the species diversity.

This site has limited value for livestock grazing due to low forage production, lack of stockwater and the hazard of wind erosion. Grazing is limited to a few weeks in the spring when annual forbs and grasses produce additional forage in favorable years.

Pounds/acre AC/AUM
air dry
Normal Years 150 40-60

Hydrological functions

Runoff is medium. Hydrologic soil group D - soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly

impervious material. Hydrologic conditions: good - >70% ground cover (includes litter, grass and brush overstory); fair - 30 to 70% ground cover; poor - <30% ground cover.

Soil Series: Sparkhule
Hydrologic group: D
Hydrologic Conditions and Runoff Curves:
Good 84; Fair 86; Poor 88

Recreational uses

This site has value for open space, especially for off-road vehicle enthusiasts. Flowering wildflowers may also attract visitors in the spring.

Other information

Military Operations - Land clearing or other disturbances that destroys the vegetation and soil structure can result in increased erosion, soil blowing and barren areas. Off-road vehicles should be limited to existing roads and trails. Native species indigenous to this site are recommended for any revegetation efforts.

Inventory data references

Sampling technique

_3_ NV-ECS-1
___ SCS-Range 417
___ Other

Other references

Hereford, R., R.H. Webb and C. I. Longpre. 2004. Precipitation history of the Mojave Desert region, 1893-2001 (No. 117-03).

Hickman, J.C. (ed) 1995. The Jepson Manual Higher Plants of California.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). World map of the Köppen-Geiger climate classification updated. Meteorologische Zeitschrift, 15(3), 259-263.

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

Contributors

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Approval

Kendra Moseley, 3/11/2025

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	05/21/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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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:**

17. **Perennial plant reproductive capability:**