USDA Natural Resources Conservation Service

Ecological site R018XA104CA
Shallow Mesic Volcanic Ridges

Last updated: 4/24/2024
Accessed: 05/19/2024

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): 018X–Sierra Nevada Foothills

Major Land Resource Area (MLRA) 18, Sierra Nevada Foothills is located entirely in California and runs north to south adjacent to and down-slope of the west side of the Sierra Nevada Mountains (MLRA 22A). MLRA 18 includes rolling to steep dissected hills and low mountains, with several very steep river valleys. Climate is distinctively Mediterranean (xeric soil moisture regime) with hot, dry summers, and relatively cool, wet winters. Most of the precipitation comes as rain; average annual precipitation ranges from 15 to 55 inches in most of the area (precipitation generally increases with elevation and from south to north). Soil temperature regime is thermic; mean annual air temperature generally ranges between 52 and 64 degrees F. Geology is rather complex in this region; there were several volcanic flow and ashfall events, as well as tectonic uplift, during the past 25 million years that contributed to the current landscape.

LRU notes

The Tuscan Flows LRU is the northernmost Land Resource Unit in MLRA 18. It occurs down slope of and is geologically related to the southern Cascades; however, its inclusion in MLRA 18 stems from the ecosystem's close resemblance to other Sierra Nevada Foothill systems. This LRU is situated on a low elevation volcanic plateau at the northeast end of the Sacramento Valley. The geology includes, but not limited to late Pliocene and Quartenary basalt, andesite and andesitic lahars (mudflows). Several cinder cones dot the landscape and active fluvial processes are occurring in the larger canyons. Elevation ranges between 250 and 2000 feet above sea level on the main plateau, but can range as high as 3000 feet on the highest hills. Precipitation is among the highest in MLRA 18, ranging from 30 to 55 inches annually. Mean annual air temperature ranges between 56 and 62 F. Frost free days (generally exhibiting an inverse relationship with elevation) range from 184 to 282 days.

Classification relationships

CLASSIFICATION RELATIONSHIPS
This site is located within M261F, the Sierra Nevada Foothills Section, (McNab et al., 2007) of the National Hierarchical Framework of Ecological Units (Cleland et al., 1997), M261Fa, the Tuscan Flows Subsection.

Level III and Level IV ecoregions systems (Omernik, 1987, and EPA, 2011) are: Level III, Central California Foothills and Coastal Mountains and Level IV, Ecoregion 6a, Tuscan Flows.

Ecological site concept

This site is characterized by shallow soils derived from residuum on volcanic breccia. It occurs on narrow volcanic

ridges and steep sideslopes of hills, mountains, and canyons. The soil temperature regime is mesic. Slope gradient typically ranges from 5 to 45%. Mean annual precipitation typically ranging from 36 to 54 inches, and elevations range from 1285 to 1800 feet.

The overriding abiotic factors on this site are shallow, rocky soils which restrict the establishment of coniferous forests, even though the effective precipitation in the area is favorable to timber production. The most common soil correlated to this ecological site is Rockstripe (Loamy-skeletal, mixed, active, nonacid, mesic Lithic Xerorthents). Rockstripe soils are very shallow, somewhat poorly drained soils which formed in residuum derived from volcanic mudflow breccia. Due to very shallow depth and poor drainage, shrub and tree densities are usually lower than in adjacent, well drained soils.

This vegetation community consists of annual grasses and forbs, oak savannahs with low to moderate densities of scrub oak (Quercus berberdifolia) and canyon live oak (Quercus chrysolepis), and in the absence of disturbance, chaparral. Dominant annual grasses for this site include soft brome (Bromus hordeaceus), wild oat (Avena fatua), and bristly dogtail grass (Cynosurus echinata). Forbs include pink (Silene spp.) and fillaree (Erodium spp.). Common shrubs include manzanita species (Arctostaphylos spp.), ceanothus species, and poison oak (Toxicodendron diversilobum).

Associated sites

F018XA202CA	**Deep Mesic Mountain Slopes & Summits** This site commonly occurs nearby.

Table 1. Dominant plant species

Tree	(1) *Quercus berberidifolia* (2) *Quercus chrysolepis*
Shrub	(1) *Ceanothus* (2) *Arctostaphylos*
Herbaceous	(1) *Bromus hordeaceus* (2) *Cynosurus echinatus*

Physiographic features

This site occurs on elevations ranging from 1285 to 1800 feet on slopes with gradient typically ranging from 5 to 45%.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Ridge (2) Foothills > Canyon
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	392–549 m
Slope	5–45%
Water table depth	Not specified
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Very high
Flooding frequency	None
Ponding frequency	None

Elevation	134–792 m
Slope	2–50%
Water table depth	5–51 cm

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 36 to 54 inches and usually falls from October to May. Mean annual temperature ranges from 59 to 62 degrees F with 175 to 216 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	175-216 days
Freeze-free period (characteristic range)	256-329 days
Precipitation total (characteristic range)	914-1,372 mm
Frost-free period (actual range)	159-220 days
Freeze-free period (actual range)	246-356 days
Precipitation total (actual range)	737-1,448 mm
Frost-free period (average)	194 days
Freeze-free period (average)	294 days
Precipitation total (average)	1,143 mm

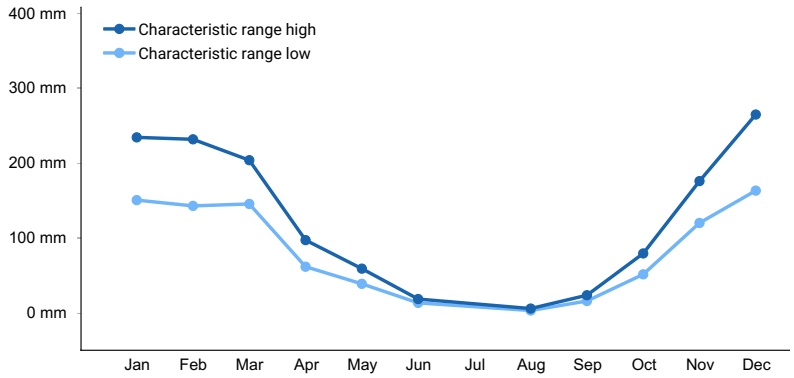


Figure 1. Monthly precipitation range

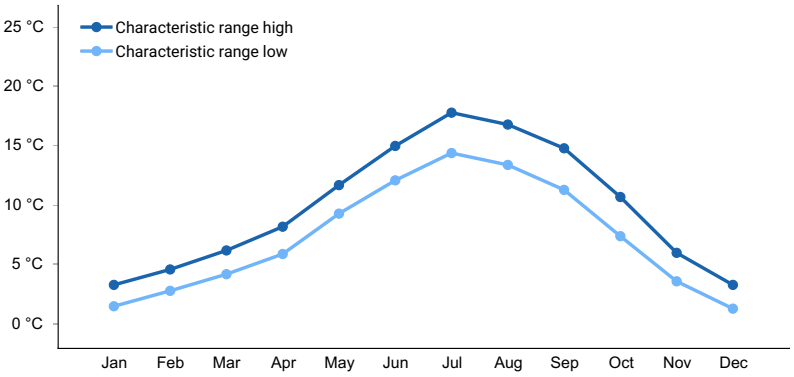


Figure 2. Monthly minimum temperature range

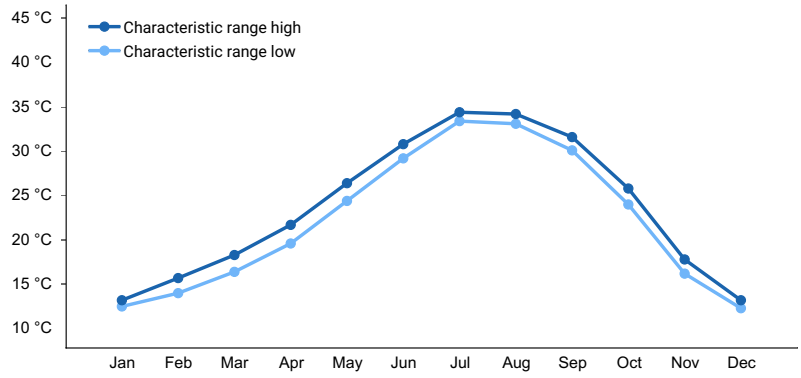


Figure 3. Monthly maximum temperature range

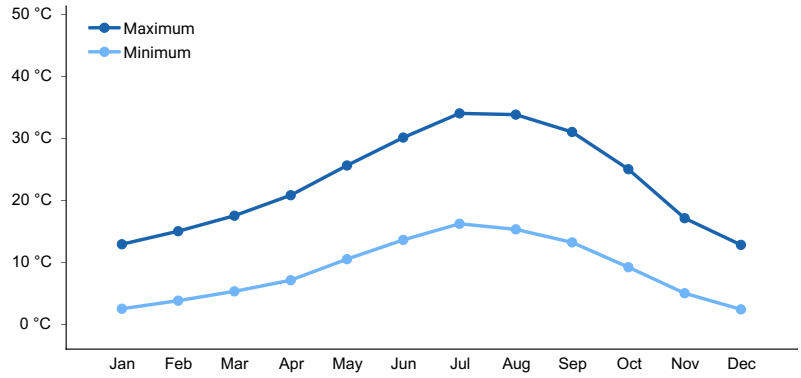


Figure 4. Monthly average minimum and maximum temperature

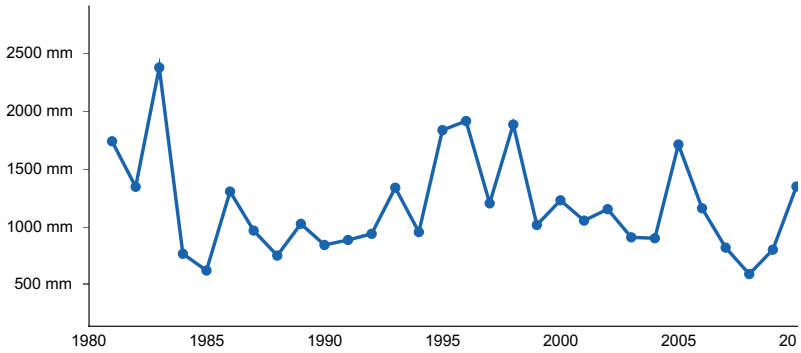


Figure 5. Annual precipitation pattern

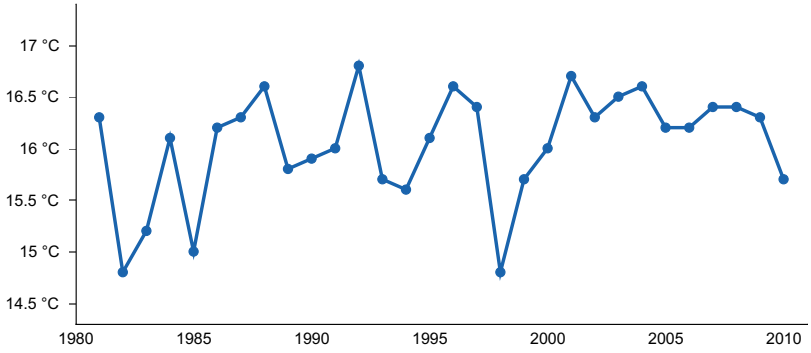


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DOBBINS 1 S [USC00042456], Dobbins, CA
- (2) PARADISE [USC00046685], Chico, CA
- (3) CHICO UNIV FARM [USC00041715], Chico, CA

Influencing water features

The very shallow and shallow soils correlated to this ecological site have somewhat poorly drained drainage class due to impermeability of underlying bedrock. A low permeability substratum can create a seasonal perched water table in the soil profile that persists while water drains laterally off of the volcanic ridges.

Wetland description

N/A

Soil features

The soils in this ecological site are on ridges and formed from colluvium and residuum from volcanic rocks. The typical soil depth is very shallow or shallow with total depth ranging from 4 to 10 inches deep to restrictive bedrock. The particle size control section is Loamy-skeletal. Surface texture is usually very gravelly loam. Gravels (<3 inch diameter) range from 15 to 25% by volume throughout the profile; and larger fragments (=3 inch diameter) range from 5 to 20% by volume throughout the profile. Gravels on the soil surface range from 4 to 10% cover and larger fragments range from 5 to 10% cover. Soils in this ecological site are generally somewhat poorly drained--this is because of the (very) shallow depth to impermeable bedrock; in some cases leading to a seasonal shallow (perched) water table. Available Water Storage (AWS) in the profile generally ranges from 1.1 to 1.6 inches. Surface pH ranges from 6.2 to 6.4. The most common soil correlated to this ecological site is Rockstripe (Loamy-skeletal, mixed, active, nonacid, mesic Lithic Xerorthents).

Table 5. Representative soil features

Parent material	(1) Residuum–volcanic breccia
Surface texture	(1) Very gravelly loam
Drainage class	Somewhat poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	10–25 cm
Soil depth	10–25 cm
Surface fragment cover <=3"	4–10%
Surface fragment cover >3"	5–10%
Available water capacity (0-101.6cm)	2.79–4.06 cm
Soil reaction (1:1 water) (0-25.4cm)	6.2–6.4
Subsurface fragment volume <=3" (0-152.4cm)	5–35%
Subsurface fragment volume >3" (0-152.4cm)	5–20%

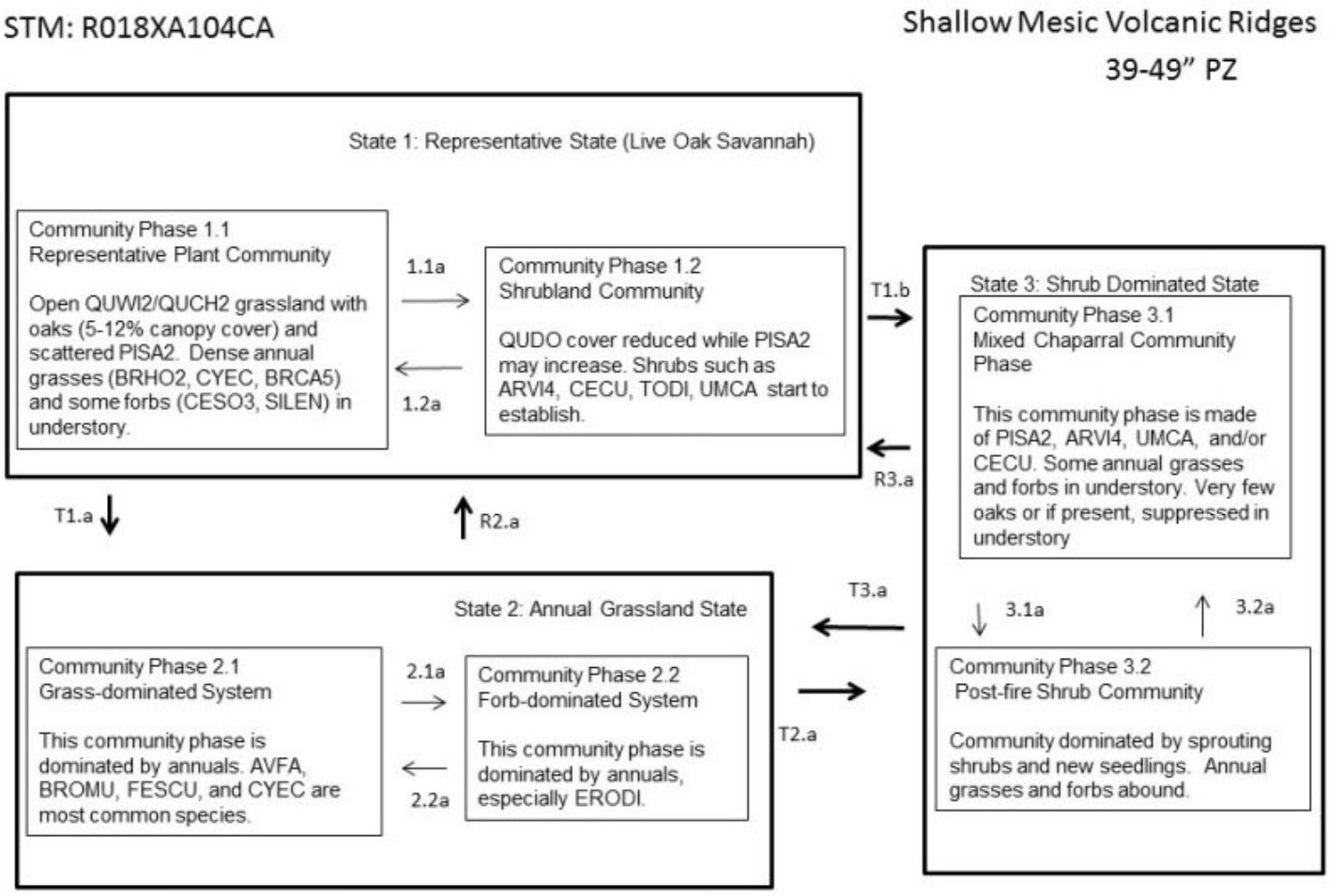
Table 6. Representative soil features (actual values)

Drainage class	Somewhat poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	5–51 cm
Soil depth	5–51 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–50%
Available water capacity (0-101.6cm)	0.76–7.11 cm

Soil reaction (1:1 water) (0-25.4cm)	5.9–7
Subsurface fragment volume <=3" (0-152.4cm)	0–40%
Subsurface fragment volume >3" (0-152.4cm)	0–85%

Ecological dynamics

State and transition model



Community pathways and Transitions

T1.a This transition occurs after repeated high severity fires or combination of mechanical clearing and grazing, resulting in loss of tree and shrub component.

T1.b This transition occurs after tand replacing fire in areas where closed shrublands are establishing. Higher rates of survival of drought tolerant shrubs such as whiteleaf manzanita (which can withstand very low water potentials) and ceanothus, than the oak component leads to chaparral communities.

1.1a This community pathway occurs with absence of disturbance and/or management, and introduction of nearby seed source of chaparral shrubs.

1.2a This community pathway occurs with low intensity fire. Sometimes mechanical clearing and/or slash treatment of shrub species can produce the same result.

T2.a This transition occurs after seed source of chaparral shrubs is established from adjacent sites.

R2.a This restoration pathway occurs with oak planting (natural regeneration events are episodic & rarely occur). Low intensity fire can also result in resprouting of oaks.

2.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

2.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

T3.a This transition occurs after very hot burning fires that kill burls of the manzanita species.

R3.a This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful. This also may require brush management to reduce chaparral component.

3.1a High severity fire that favors sprouting shrubs & germination of fire adapted species.

3.2a This community pathway occurs over time without management or disturbance.

State 1
Representative State (Live Oak Savannah)

Community 1.1
Representative Plant Community

Open QUWI2/QUCH2 grassland with oaks (5-12% canopy cover) and scattered PISA2. Dense annual grasses (BRHO2, CYEC, BRCA5) and some forbs (CESO3, SILEN) in understory.

Community 1.2
Shrubland Community

QUDO cover reduced while PISA2 may increase. Shrubs such as ARVI4, CECU, TODI, UMCA start to establish.

Pathway 1.1a
Community 1.1 to 1.2

Representative Plant Community

Shrubland Community

This community pathway occurs with absence of disturbance and/or management, and introduction of nearby seed source of chaparral shrubs.

Pathway 1.2a
Community 1.2 to 1.1

Shrubland Community

Representative Plant Community

This community pathway occurs with low intensity fire. Sometimes mechanical clearing and/or slash treatment of shrub species can produce the same result.

State 2
Annual Grassland State

Community 2.1
Grass-dominated System

This community phase is dominated by annuals. AVFA, BROMU, FESCU, and CYEC are most common species.

Community 2.2
Forb-dominated System

This community phase is dominated by annuals, especially ERODI.

Pathway 2.1a
Community 2.1 to 2.2

Grass-dominated System **Forb-dominated System**

This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

Pathway 2.2a
Community 2.2 to 2.1

Forb-dominated System **Grass-dominated System**

This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

State 3
Shrub Dominated State

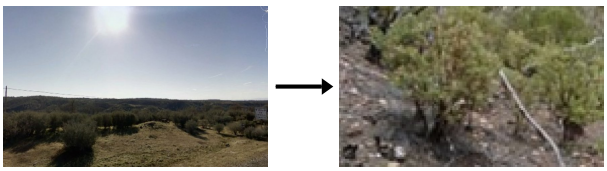
Community 3.1
Mixed Chaparral Community Phase

This community phase is made of PISA2, ARVI4, UMCA, and/or CECU. Some annual grasses and forbs in understory. Very few oaks or if present, suppressed in understory

Community 3.2
Post-fire Shrub Community

Community dominated by sprouting shrubs and new seedlings. Annual grasses and forbs abound.

Pathway 3.1a
Community 3.1 to 3.2

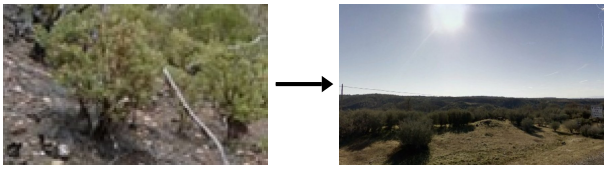


Mixed Chaparral Community Phase

Post-fire Shrub Community

High severity fire that favors sprouting shrubs & germination of fire adapted species.

Pathway 3.2a
Community 3.2 to 3.1



Post-fire Shrub Community

Mixed Chaparral Community Phase

This community pathway occurs over time without management or disturbance.

Transition T1.a
State 1 to 2

This transition occurs after repeated high severity fires or combination of mechanical clearing and grazing, resulting in loss of tree and shrub component.

Transition T1.b
State 1 to 3

This transition occurs after tand replacing fire in areas where closed shrublands are establishing. Higher rates of survival of drought tolerant shrubs such as whiteleaf manzanita (which can withstand very low water potentials) and ceanothus, than the oak component leads to chaparral communities.

Restoration pathway R2.a
State 2 to 1

This restoration pathway occurs with oak planting (natural regeneration events are episodic & rarely occur). Low intensity fire can also result in re-sprouting of oaks.

Transition T2.a
State 2 to 3

This transition occurs after seed source of chaparral shrubs is established from adjacent sites.

Restoration pathway R3.a
State 3 to 1

This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful. This also may require brush management to reduce chaparral component

Restoration pathway T3.a
State 3 to 2

This transition occurs after very hot burning fires that kill burls of the manzanita species.

Additional community tables

Inventory data references

Inventory data to be collected using future projects based on priorities.

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Contributors

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Approval

Kendra Moseley, 4/24/2024

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	05/19/2024
Approved by	Kendra Moseley
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:**
