USDA Natural Resources Conservation Service

Ecological site R018XA103CA
Shallow Thermic Volcanic Ridges

Last updated: 4/24/2024
Accessed: 05/06/2024

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 generally ranges between 250 and 2000 feet above sea level, 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 mudflow breccia and other volcanic rocks. It occurs on undulating to hilly volcanic ridges and sideslopes of hills. The soil temperature regime is thermic. Slope gradient typically ranges from 5 to 40%. Mean annual precipitation typically ranges from 31 to 44 inches, and elevation

ranges from 460 to 2050 feet.

The overriding abiotic factors on this site controlling vegetation expression are shallow, sometimes rocky soils with very low available water capacity (< 3 inches). These conditions prevent the establishment of woody vegetation and the vegetation community is dominated by annual herbaceous plants. Common soil components for this ecological site include the Inks and Toomes series. Inks soils (Loamy-skeletal, mixed, superactive, thermic, shallow Ultic Argixerolls) are shallow soils formed in material weathered from consolidated or cemented sediments from volcanic rocks. Toomes (Loamy, mixed, superactive thermic Lithic Haploxerepts) are very shallow and shallow soils formed in material weathered from tuff breccia, basalt, and andesite.

This vegetation community consists of annual grasses and forbs with very few trees or shrubs. Occasional blue oak (Quercus douglasii) occur, but they are most common in deeper soils. Dominant plants for this site include soft brome (Bromus hordeaceus), wild oat (Avena fatua), and Italian ryegrass (Lolium perenne spp. multiflorum). Annual production data is lacking for this site, but seems to be heavily skewed towards greatest production of herbaceous annual plants (especially annual grasses).

Associated sites

F018XA201CA	**Deep Thermic Hillslopes** This site commonly occurs nearby.
F018XA202CA	**Deep Mesic Mountain Slopes & Summits** This site commonly occurs nearby.

Similar sites

R018XA101CA	**Basalt Flow Plateaus** Site relationships being developed.

Table 1. Dominant plant species

Tree	(1) *Quercus douglasii*
Shrub	Not specified
Herbaceous	(1) *Bromus hordeaceus* (2) *Avena fatua*

Physiographic features

This site occurs at elevations ranging from 460 to 2050 feet on slopes with gradient ranging from 5 to 40%.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Geomorphic position, hills	(1) Side Slope
Landforms	(1) Foothills > Ridge (2) Foothills > Hill
Runoff class	High
Flooding frequency	None
Ponding duration	Not specified
Ponding frequency	None
Elevation	140–625 m
Slope	5–40%
Ponding depth	0 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium to very high
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to frequent
Elevation	43–1,308 m
Slope	1–50%
Ponding depth	0–8 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 31 to 44 inches and usually falls from October to May. Mean annual temperature is 58 to 60 degrees F with 164 to 198 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	164-198 days
Freeze-free period (characteristic range)	249-269 days
Precipitation total (characteristic range)	787-1,118 mm
Frost-free period (actual range)	156-206 days
Freeze-free period (actual range)	245-273 days
Precipitation total (actual range)	711-1,219 mm
Frost-free period (average)	181 days
Freeze-free period (average)	259 days
Precipitation total (average)	965 mm

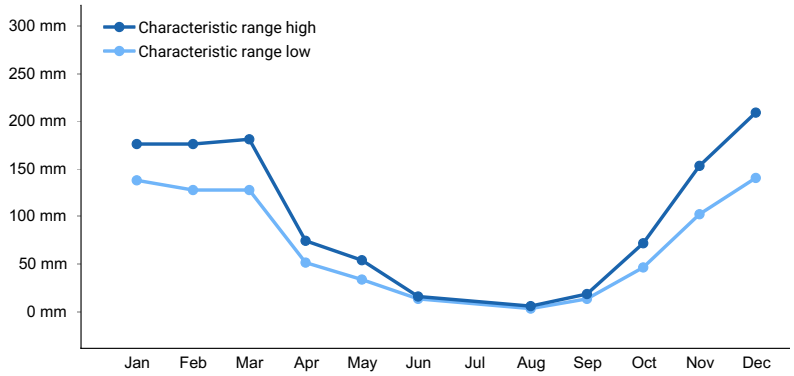


Figure 1. Monthly precipitation range

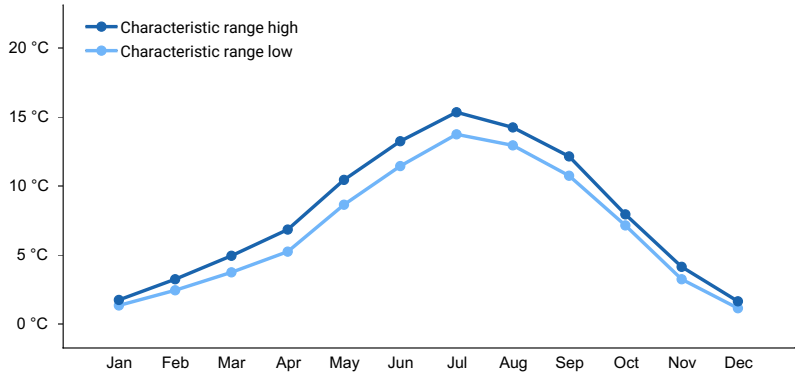


Figure 2. Monthly minimum temperature range

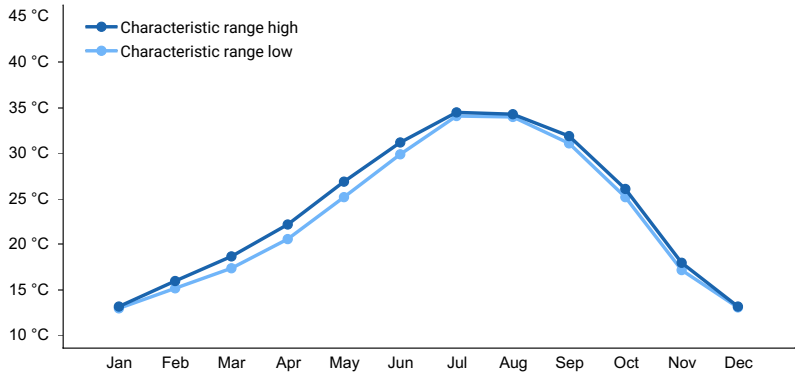


Figure 3. Monthly maximum temperature range

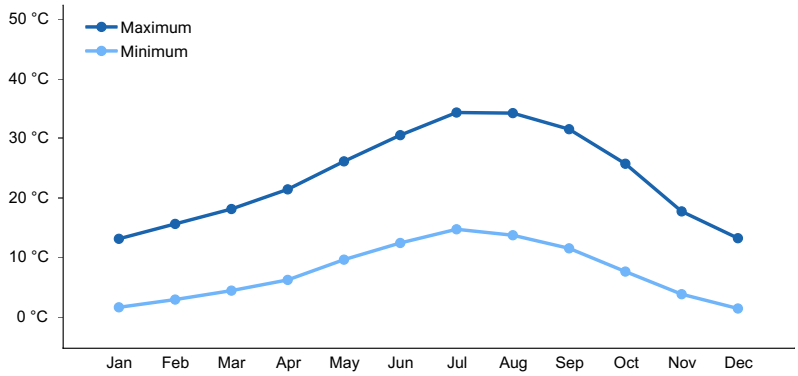


Figure 4. Monthly average minimum and maximum temperature

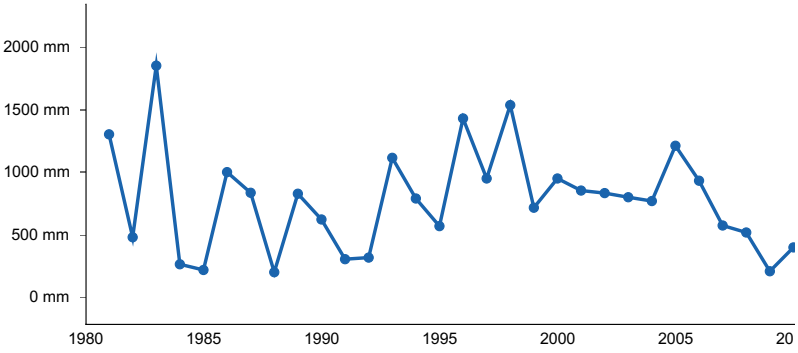


Figure 5. Annual precipitation pattern

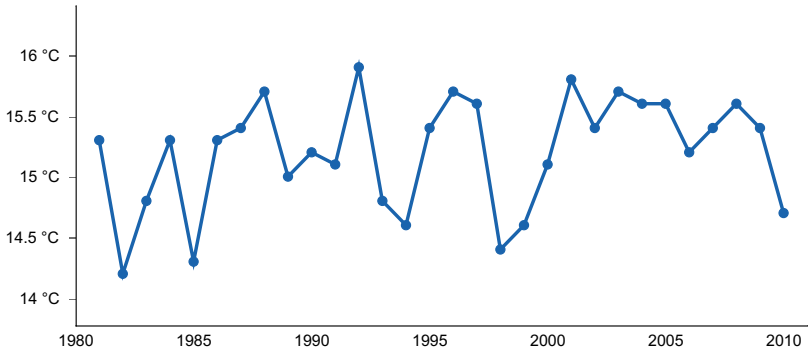


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

Due to the topographic position, this site does not have water features.

Wetland description

N/A

Soil features

The soils in this ecological site are formed in colluvium and residuum weathered from volcanic rocks on or adjacent to volcanic ridges. The typical depth range is very shallow to shallow, with some areas in the moderately deep depth class. These soils are generally 4 to 24 inches deep to restrictive bedrock. Deeper soils (20 to 40 inches) occur in colluvium deposits in footslope and toeslope positions. The particle size control section is Loamy or Loamy-skeletal. Surface textures include very stony loam, gravelly loam and gravelly clay loam. Gravels on the soil surface range from 0 to 5% cover and larger fragments range from 5 to 40% cover. Gravels (<3 inch diameter) range from 10 to 20% by volume throughout the profile; and larger fragments (=3 inch diameter) range from 0 to 20% by volume throughout the profile. Soils in this ecological site range are generally well drained. Available Water Storage (AWS) in the profile generally ranges from 0.5 to 3 inches. Surface pH ranges from 6 to 6.8 and subsurface pH range from 5.9 to 6.7. Common soils correlated to this ecological site include Toomes (Loamy, mixed, superactive, thermic Lithic Haploxerepts) and Inks (Loamy-skeletal, mixed, superactive, thermic, shallow Ultic Argixerolls)

Table 5. Representative soil features

Parent material	(1) Colluvium–volcanic rock (2) Residuum–volcanic rock
Surface texture	(1) Gravelly clay loam (2) Very cobbly loam (3) Gravelly loam
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	10–61 cm
Soil depth	10–61 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	5–40%
Available water capacity (0-101.6cm)	1.27–7.62 cm

Soil reaction (1:1 water) (0-25.4cm)	6–6.8
Subsurface fragment volume <=3" (0-152.4cm)	10–20%
Subsurface fragment volume >3" (0-152.4cm)	0–20%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained to well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	5–102 cm
Soil depth	5–102 cm
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–85%
Available water capacity (0-101.6cm)	0.76–13.46 cm
Soil reaction (1:1 water) (0-25.4cm)	5.6–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–40%
Subsurface fragment volume >3" (0-152.4cm)	0–60%

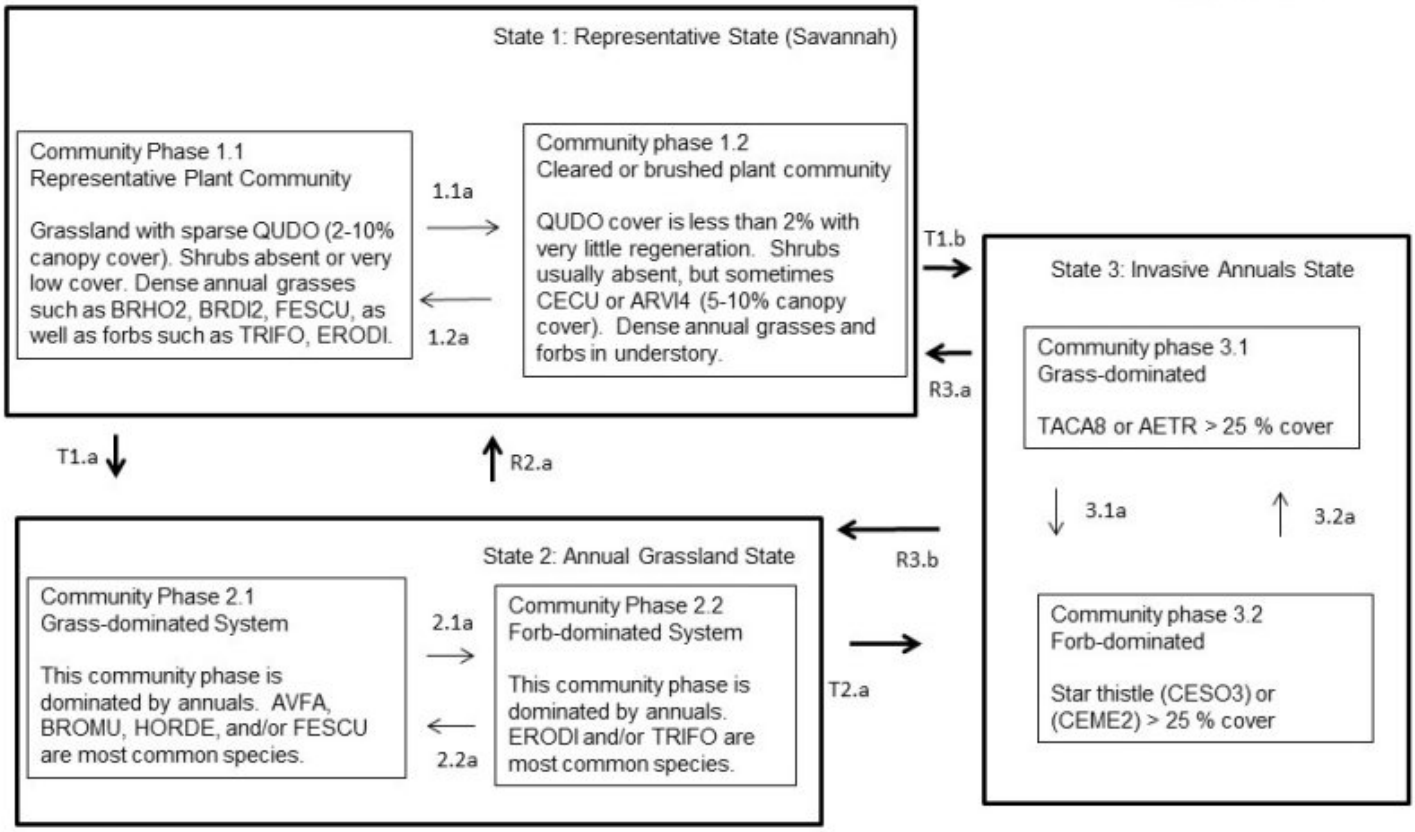
Ecological dynamics

State and transition model

STM: R018XA103CA

Shallow Thermic Volcanic Ridges

30-40" PZ



Community pathways and Transitions

T1.a This transition occurs after repeated fires and/or mechanical clearing, sometimes followed with grazing management, that results in loss of oak and acorn (seed) source.

T1.b This transition occurs when undesirable invasive plants become established leading to economic losses.

1.1a Moderately severe fire where some oaks remain on site.

1.2a This community pathway occurs with natural regeneration and often requires a nearby acorn source.

T2.a This transition occurs after invasive plants causing economic and ecological deleterious effects become established on the site.

R2.a This transition occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

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.

R3.a. This restoration pathway occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

R3.b This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful This also may require integrated weed management to reduce the seedling's competition from annual invasive species.

3.1a This community pathway occurs as invasive forbs become more dominant, often following low winter precipitation and reduced litter layers.

3.2a This community pathway occurs as invasive grass species become dominant, often in response to increases in litter following high winter precipitation years.

State 1
Representative State (Blue oak grassland savannah)

Dominant plant species

- blue oak (*Quercus douglasii*), tree
- soft brome (*Bromus hordeaceus*), grass
- wild oat (*Avena fatua*), grass

Community 1.1
Representative plant community (Grassland, very sparse QUDO).

Grassland with sparse QUDO (=2% canopy cover). Shrubs absent or very low cover. Dense annual grasses such

as BRHO2, BRDI2, FESCU, as well as forbs such as TRIFO, ERODI

Dominant plant species

- blue oak (*Quercus douglasii*), tree
- soft brome (*Bromus hordeaceus*), grass
- purple false brome (*Brachypodium distachyon*), grass
- longbeak stork's bill (*Erodium botrys*), grass

Community 1.2
Cleared or brushed plant community

QUDO cover is less than 2% with very little regeneration. Shrubs usually absent, but sometimes CECU or ARVI4 (5-10% canopy cover). Dense annual grasses and forbs in understory.

Dominant plant species

- soft brome (*Bromus hordeaceus*), grass
- longbeak stork's bill (*Erodium botrys*), grass

Pathway 1.1a
Community 1.1 to 1.2

Representative plant community (Grassland, very sparse QUDO).

Cleared or brushed plant community

1.1a Moderately severe fire where some oaks remain on site.

Pathway 1.2a
Community 1.2 to 1.1

Cleared or brushed plant community

Representative plant community (Grassland, very sparse QUDO).

1.2a This community pathway occurs with natural regeneration and often requires a nearby acorn source.

State 2
Annual Grassland

Dominant plant species

- soft brome (*Bromus hordeaceus*), grass

Community 2.1
Grass-dominated system

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

Dominant plant species

- wild oat (*Avena fatua*), grass
- soft brome (*Bromus hordeaceus*), grass
- barley (*Hordeum*), grass

Community 2.2
Forb-dominated system

This community phase is dominated by annuals. ERODI and/or TRIFO are most common species.

Dominant plant species

- longbeak stork's bill (*Erodium botrys*), grass

Pathway 2.1a
Community 2.1 to 2.2

Grass-dominated system | Forb-dominated system

2.1a 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

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

State 3
Invasive Annuals State

Community 3.1
Grass-dominated plant community

This community phase is dominated by annuals: TACA8 or AETR > 25% canopy cover.

Dominant plant species

- medusahead (*Taeniatherum caput-medusae*), grass
- barbed goatgrass (*Aegilops triuncialis*), grass

Community 3.2
Forb-dominated plant community

This community phase is dominated by invasive annuals forbs such as star thistle (CESO3) or (CEME2) > 25 % cover. .

Pathway 3.1a
Community 3.1 to 3.2

Grass-dominated plant community

Forb-dominated plant community

3.1a This community pathway occurs as invasive forbs become dominant, often following lower winter precipitation and reduced litter cover.

Pathway 3.2a
Community 3.2 to 3.1

Forb-dominated plant community

Grass-dominated plant community

3.2a This community pathway occurs as invasive grass species become dominant, often in response to increases in litter following high winter precipitation years.

Transition T1.a
State 1 to 2

T1.a This transition occurs after repeated fires and/or mechanical clearing, sometimes followed with grazing management, that results in loss of oak and acorn (seed) source.

Transition T1.b
State 1 to 3

T1.b This transition occurs when undesirable invasive plants become established leading to economic losses.

Restoration pathway R2.a
State 2 to 1

R2.a This transition occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

Transition T2.a
State 2 to 3

T2.a This transition occurs after invasive plants causing economic and ecological deleterious effects become established on the site.

Restoration pathway R3.a
State 3 to 1

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 integrated weed management to reduce the seedling's competition from annual invasive species.

Restoration pathway R3.b
State 3 to 2

R3.b This restoration pathway occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

Additional community tables

Inventory data references

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

References

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Other references

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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	05/06/2024
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:**
