USDA Natural Resources Conservation Service

Ecological site R018XC101CA
Thermic Clayey Terraces and Hills

Last updated: 4/24/2024
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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): 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

LRU 18XC is located on moderate to steep mountains and hills in the Sierra Nevada Foothills east of Fresno, CA. The major differences between the southern and northern foothills are the dryer climate (12 to 37 inches of annual precipitation), greater summer/winter temperature variation, and steeper topography of the southern foothills. The geology of this region is predominately granitoid. The elevation ranges between 300 and 4100 feet above sea level. Warmer temperatures and lower precipitation (than at higher latititudes) allow for blue oak grasslands to exist at higher elevations. The soil temperature regime is primarily thermic, however some mesic soils are found at higher elevations of 18XC. At these upper elevations, the break in soil temperature regime (between thermic and mesic) is highly aspect dependent. Southern and western aspects at the steep, high elevations promote chamise-yucca plant assemblages. Buckeye is common in the concave positions. Riparian trees that are generally absent from the northern LRU’s include California Sycamore (Plantanus racemosa) and lemon scented gum (Eucalyptus citriodora).

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), M261Fc, the Lower Granitic Foothills and M261Fd, Southern Granitic Foothills Subsections.

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 6c, Southern Sierran Foothills.

Ecological site concept

This site is characterized by shallow to deep, fine-textured soils occurring on toeslopes and footslopes of hills, alluvial fans, and dissected terraces. These soils have high shrink-swell properties and can form in alluvium and

residuum weathered from metavolcanic and igneous rock. Slopes typically range from 2 to 20%. Precipitation typically ranges from 12 to 20 inches per year, and elevation ranges from 550 to 1500 feet.

The overriding abiotic factors controlling vegetation expression on this site include high clay percent (40% or more) and smectitic mineralogy. These soil properties create conditions in which the soil is said to have a high shrink-swell capacity: swelling when wet and shrinking as the soil dries. This prevents the establishment of woody vegetation and lowers the productivity of range plants. Infiltration of water is limited; roots may not be able to exploit the entire profile depth due to seasonal cracking during drying cycles. Common soils correlated to this ecological site include Raynor (Fine, smectic, thermic Typic Chromoxererts) and Keefers (Clayey-skeletal, smectitic, thermic Mollic Haploxeralfs). These soils occur in relatively water-gathering positions and are likely to have more water passing through the soil profile than in Cibo soils occurring on very steep hills (as in R018XC102).

This vegetation community consists of annual grasses and forbs. Dominant plants include soft brome (Bromus hordeaceus), wild oat (Avena fatua), redstem stork's bill (Erodium cicutarium), bur clover, (Medicago hispida), and ripgut brome (Bromus diandrus).

Associated sites

R017XY902CA	**Duripan Vernal Pools** This site commonly occurs nearby.

Similar sites

R018XC102CA	**Steep Thermic Clayey Shallow** Site relationships being developed.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on elevations typically ranging from 550 to 1500 feet on slopes typically ranging from 2 to 20%.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Hill (2) Foothills > Terrace
Runoff class	Medium
Elevation	550–1,500 ft
Slope	2–20%
Water table depth	0 in
Aspect	SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Elevation	300–2,500 ft
Slope	0–30%
Water table depth	0 in

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 18 to 27 inches and usually falls from October to May. Mean annual temperature ranges from 60 to 64 degrees F with 204 to 303 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	204-303 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	18-27 in
Frost-free period (actual range)	202-349 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	16-29 in
Frost-free period (average)	258 days
Freeze-free period (average)	365 days
Precipitation total (average)	23 in

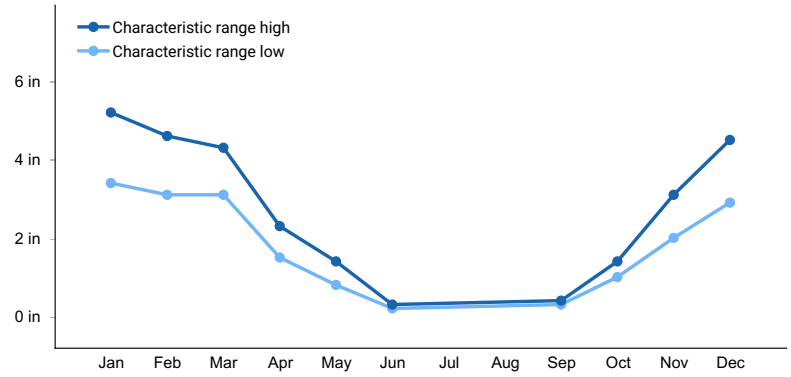


Figure 1. Monthly precipitation range

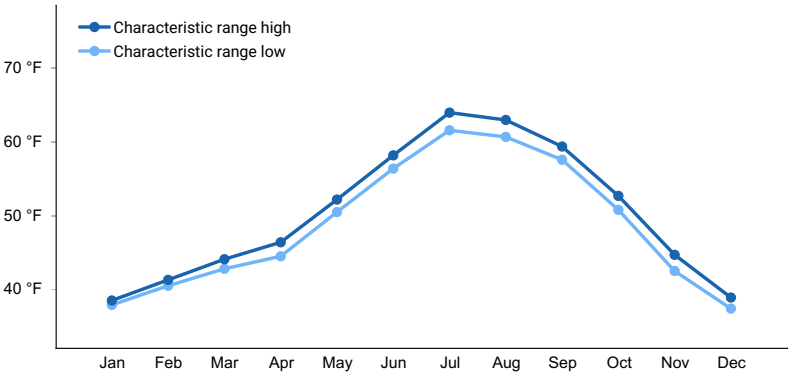


Figure 2. Monthly minimum temperature range

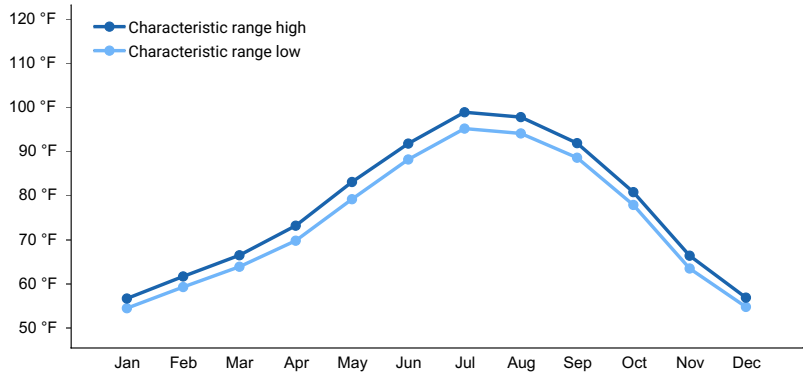


Figure 3. Monthly maximum temperature range

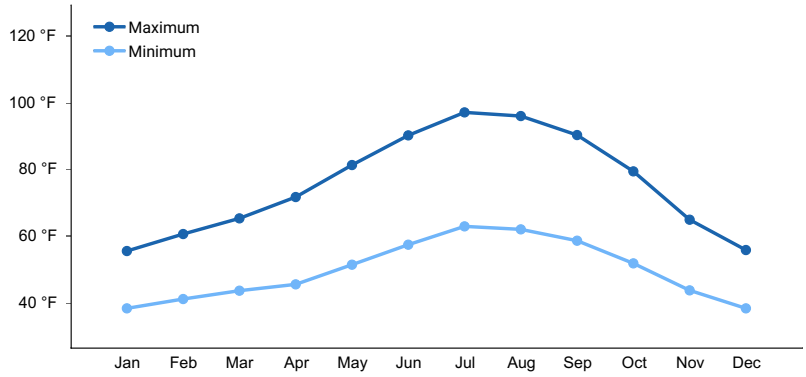


Figure 4. Monthly average minimum and maximum temperature

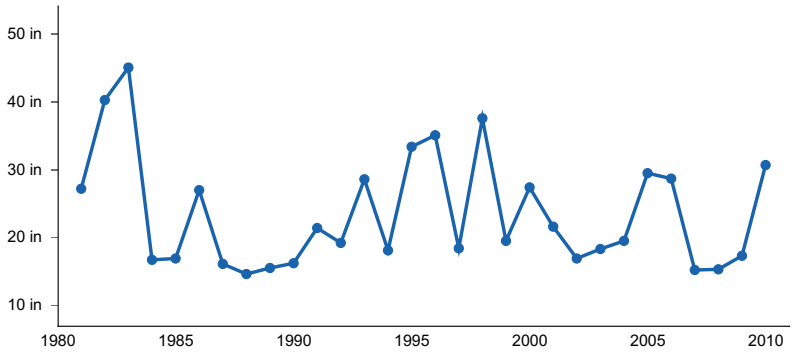


Figure 5. Annual precipitation pattern

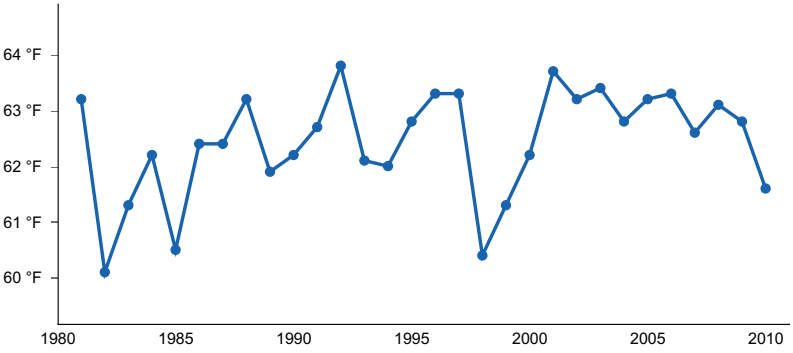


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CAMP PARDEE [USC00041428], Valley Springs, CA
- (2) NEW MELONES DAM HQ [USC00046174], Angels Camp, CA
- (3) FRIANT GOVERNMENT CAMP [USC00043261], Friant, CA

Influencing water features

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

Wetland description

N/A

Soil features

The soils in this ecological site are formed in colluvium or residuum from sedimentary, metamorphic and igneous rocks. The typical depth range includes soils in moderately deep to very deep depth classes. These soils are generally 34 to 42 inches deep to a restrictive layer. The particle size control section is Fine or Clayey-skeletal. Surface textures include clay and cobbly clay. Gravels (<3 inch diameter) may cover up to 20% of the soil surface and larger fragments (=3 inch diameter) may also cover up to 20% of the surface. Gravels range from 0 to 15% by volume throughout the profile, and larger fragments range from 0 to 20% by volume throughout the profile. Available Water Storage (AWS) in the profile generally ranges from 5 to 6 inches. Surface pH ranges from 6.3 to 7.5 and subsurface pH ranges from 6.7 to 7.9. Common soils correlated to this ecological site include Raynor (Fine, smectic, thermic Typic Chromoxererts) and Keefers (Clayey-skeletal, smectitic, thermic Mollic Haploxeralfs).

Table 5. Representative soil features

Parent material	(1) Colluvium–igneous rock (2) Residuum–metavolcanics (3) Residuum–sedimentary rock
Surface texture	(1) Clay (2) Cobbly clay
Family particle size	(1) Fine (2) Clayey-skeletal
Drainage class	Well drained
Permeability class	Moderately slow
Depth to restrictive layer	9–42 in
Soil depth	9–42 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–20%
Available water capacity (0-40in)	0.9–5.8 in
Soil reaction (1:1 water) (0-10in)	6.3–8.4
Subsurface fragment volume <=3" (0-60in)	0–20%
Subsurface fragment volume >3" (0-60in)	0–20%

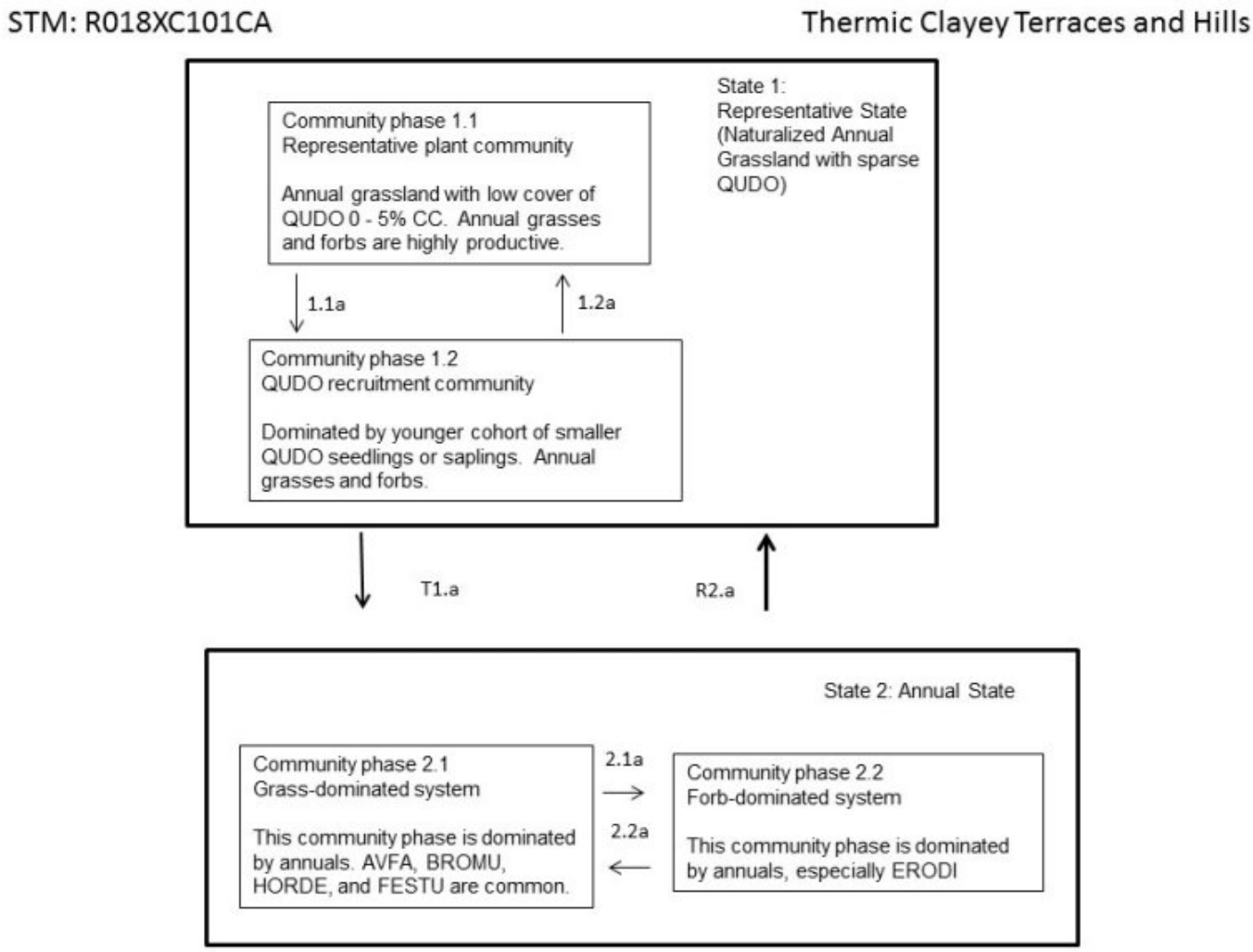
Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	9–60 in
Soil depth	9–60 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–25%

Available water capacity (0-40in)	0.7–6.2 in
Soil reaction (1:1 water) (0-10in)	4.5–8.4
Subsurface fragment volume <=3" (0-60in)	0–35%
Subsurface fragment volume >3" (0-60in)	0–30%

Ecological dynamics

State and transition model



Community pathways and Transitions

T1.a This transition occurs after mechanical clearing that results in loss of oak and acorn source. Grazing management also can be used to create/maintain an annual dominated state.

1.1a This community pathway occurs with episodic oak regeneration events (rarely occur) or low intensity fire or clearing that results in resprouting of oaks.

1.2a This community pathway occurs due to lack of disturbance management with aging and death of individual tree stems.

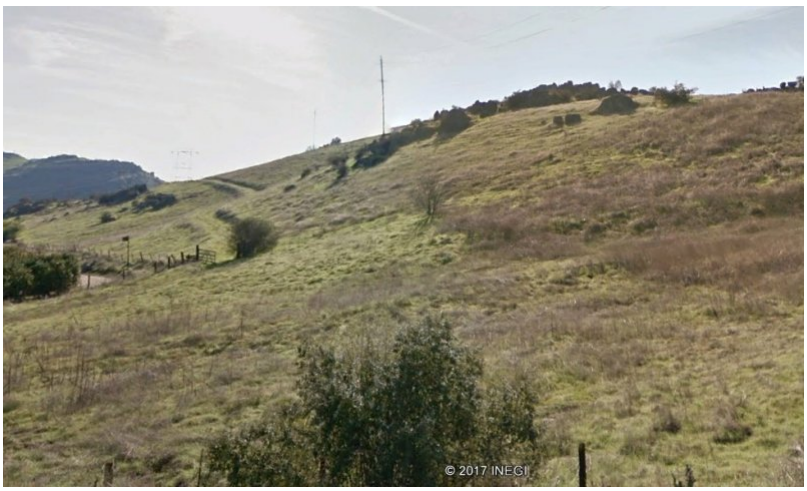
R2.a This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

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.

State 1
Representative State (Naturalized Annual Grassland with sparse QUDO)

Community 1.1
Representative plant community



Annual grassland with low cover of QUDO 0 - 5% CC. Annual grasses and forbs are highly productive.

Community 1.2
QUDO recruitment community .

Dominated by younger cohort of smaller QUDO seedlings or saplings. Annual grasses and forbs.

Pathway 1.1a
Community 1.1 to 1.2

Representative plant community

QUDO recruitment community .

This community pathway occurs with episodic oak regeneration events (rarely occur) or low intensity fire or clearing that results in re-sprouting of oaks.

Pathway 1.2a
Community 1.2 to 1.1

QUDO recruitment community .

Representative plant community

This community pathway occurs due to lack of disturbance management with aging and death of individual tree stems.

State 2
Annual State

Community 2.1
Grass-dominated system

This community phase is dominated by annuals. AVFA, BROMU, HORDE, and FESTU are common.

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

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

Transition T1.a
State 1 to 2

This transition occurs after mechanical clearing that results in loss of oak and acorn source. Grazing management also can be used to create/maintain an annual dominated state.

Restoration pathway R2.a
State 2 to 1

This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

Additional community tables

Inventory data references

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

References

Natural Resources Conservation Service. . National Ecological Site Handbook.

Other references

Other References

Bartolome, J. W. 1987. California annual grassland and oak savannah. Rangelands 9:122-125.

Harrison, S. 1999. Native and alien species at the local and regional scales in a grazed California grassland. Oecologica 121: 99-106.

Harrison, S., Inouye, B. and H. Safford. 2003. Ecological heterogeneity in the effects of grazing and fire on grassland diversity. Conservation Biology 17: 837-845.

Hobbs, R.J., Yates, S. and H.A. Mooney. 2007. Long-term data reveal complex dynamics in relation to climate and disturbance. Ecological Monographs 77: 545-568.

Jackson, L. 1985. Ecological origins of California's Mediterranean grasses. Journal of Biogeography 12:349-361.

Keeley, J. E., Lubin, D. and Fotheringham, C. J. 2003. Fire and grazing impacts on plant diversity and alien plant invasions in the southern Sierra Nevada. Ecological Applications 13:1355-1374.

McDonald, P.M. 1990. Quercus douglasii Hook & Arn. Blue oak. In: Burns, Russell M; Honkala, Barbara H, tech. cords. Silvics of North America. Vol. 2: Hardwoods. Agricultural Handbook 654. Washington DC: USDA, Forest Service: 631-639.

Perakis, S.S. and C.H. Kellogg. 2007. Imprint of oaks on nitrogen availability and delta N-15 in California grassland-savanna: a case of enhanced N inputs? Plant Ecology 191: 209-220.

Seabloom, E., Borer, E., Boucher, V., Burton, R., Cottingham, K., Goldwasser, L., Gram, W., Kendall, B. and F. Micheli. 2003. Competition, seed limitation, disturbance, and reestablishment of California native annual forbs. Ecological Applications 13: 575-592.

Stewart, O. C., H. T. Lewis (ed.) and M. K. Anderson (ed.) 2002. Forgotten fires: Native Americans and the transient wilderness. University of Oklahoma Press: Norman, OK.

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	05/20/2024
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:**

17. **Perennial plant reproductive capability:**