USDA Natural Resources
Conservation Service

Ecological site R018XC104CA
Thermic Free Face Foothills

Last updated: 4/24/2024
Accessed: 05/11/2025

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): 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 occurs on shallow to moderately deep soils on sideslopes of steep to very steep hills and ridges. It occurs on backslopes, shoulders, and summits in granitic parent material. Rock outcrops cover greater than 25% of the

area. Slopes typically range from 20 to 58%. Mean annual precipitation typically ranges from 15 to 25 inches, and elevation ranges from 1000 to 4300 feet.

Shallow soils with low available water capacity on steep, rocky terrain limit productivity at this site. Common soil components correlated to this site include Vista, Tunis and Tollhouse. Vista is moderately deep over grus and is classified as a coarse-loamy, mixed, superactive, thermic Typic Haploxerept. Tunis and Tollhouse are both shallow Haploxerolls. Tunis is thermic and Typic and Tollhouse is mesic (cooler) and Entic (no cambic horizon).

The dominant vegetation in this ecological site consists of annual grasses, forbs and stunted chaparral shrubs. Common species include brome (Bromus spp), squirreltail (Elymus elymoides), chamise (Adenostoma fasciculatum), manzanita (Arctostaphylos spp.) and Ceanothus (Ceanuthus spp.). Total annual production ranges between 600 and 1000 lbs/ac.

Similar sites

R018XC105CA	**Thermic Foothills** Site relationships being developed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Adenostoma fasciculatum* (2) *Arctostaphylos*
Herbaceous	(1) *Bromus hordeaceus* (2) *Elymus elymoides*

Physiographic features

This site occurs on elevations typically ranging from 1000 to 4300 feet and slopes typically ranging from 20 to 60%.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Hill (2) Foothills > Hillslope (3) Mountains > Mountain slope
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	1,000–4,300 ft
Slope	20–60%
Aspect	W, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	500–5,800 ft
Slope	10–75%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 13 to 22 inches and usually falls from October to May. Mean annual

temperature ranges from 60 to 64 degrees F with 157 to 227 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	157-227 days
Freeze-free period (characteristic range)	287-365 days
Precipitation total (characteristic range)	13-22 in
Frost-free period (actual range)	118-237 days
Freeze-free period (actual range)	199-365 days
Precipitation total (actual range)	12-24 in
Frost-free period (average)	189 days
Freeze-free period (average)	316 days
Precipitation total (average)	18 in

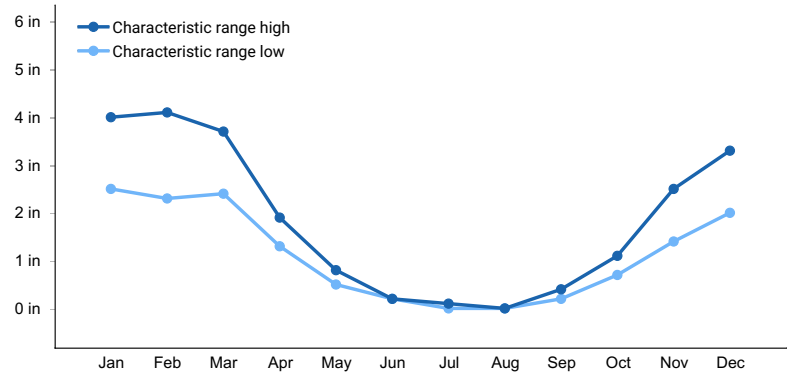


Figure 1. Monthly precipitation range

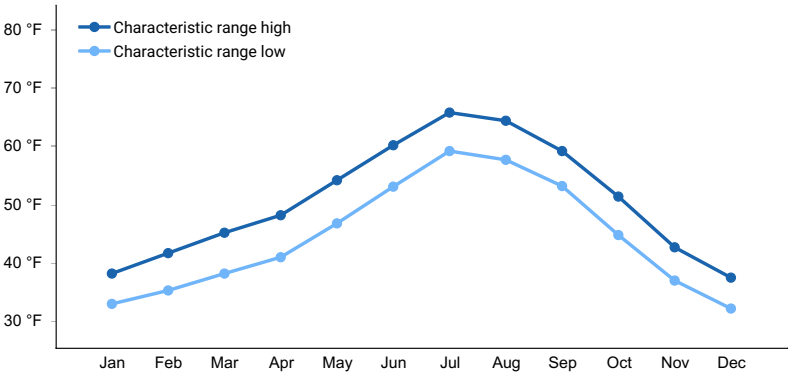


Figure 2. Monthly minimum temperature range

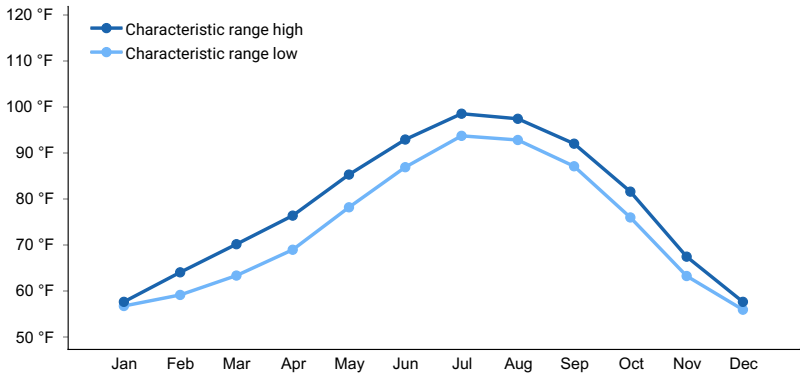


Figure 3. Monthly maximum temperature range

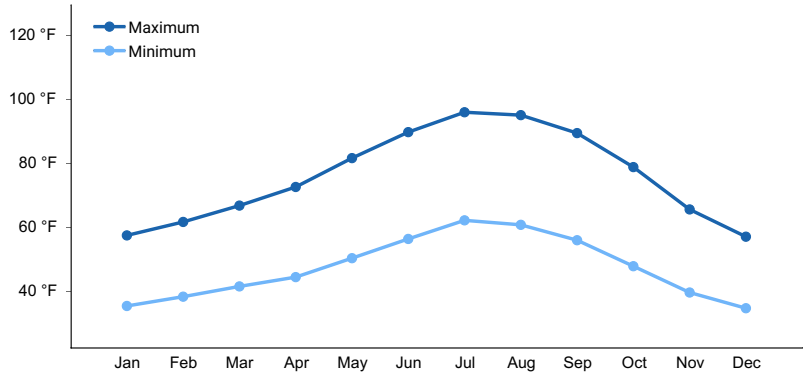


Figure 4. Monthly average minimum and maximum temperature

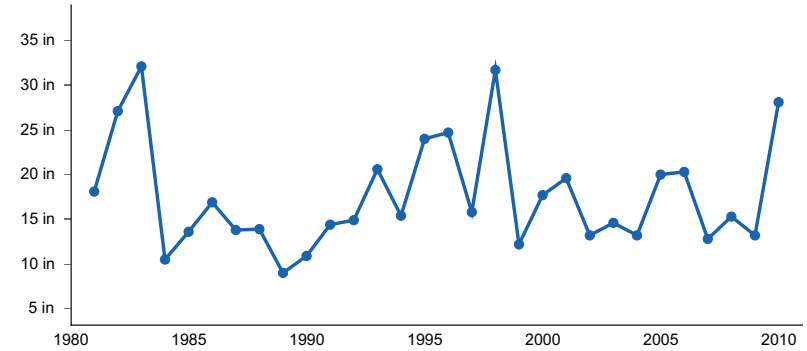


Figure 5. Annual precipitation pattern

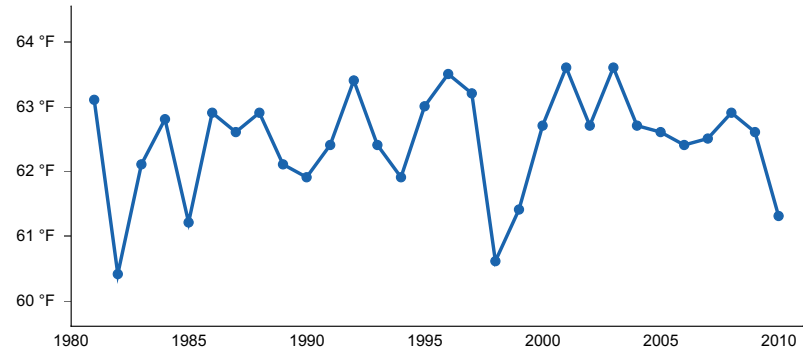


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GLENNVILLE [USC00043463], Glennville, CA
- (2) LEMON COVE [USC00044890], Woodlake, CA
- (3) PORTERVILLE [USC00047077], Porterville, CA
- (4) THREE RVRS EDISON PH 1 [USC00048917], Three Rivers, 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 from residuum of granitoid rock. The soils tend to be shallow, but may sometimes venture into moderately deep. The particle size control section is loamy (shallow soils) to coarse-loamy.

Surface texture is sandy loam, coarse sandy loam and fine sandy loam. The bedrock is a restrictive layer found between 15 and 21 inches of depth. Gravels (< 3 inch diameter) cover between 10 and 23% of the soil surface, while larger fragments (= 3 inch diameter) only cover up to 4% percent of the surface. Within in soil profile subsurface gravels make up between 6 to 13% of the soil volume while larger fragments are up to 3% profile volume. The soils in this ecological site are well to somewhat excessively drained and the permeability class is rapid. The Available Water Capacity (AWC) is 1.5 to 2.3 inches and the pH of the top 10 inches of the soil ranges from 6.1 to 7 throughout the profile.

Common soil components correlated to this site include Vista, Tunis and Tollhouse. Vista is moderately deep over grus and is classified as a coarse-loamy, mixed, superactive, thermic Typic Haploxerept. Tunis and Tollhouse are both shallow Haploxerolls. Tunis is thermic and Typic and Tollhouse is mesic (cooler) and Entic (no cambic horizon).

Table 5. Representative soil features

Parent material	(1) Residuum–granitoid
Surface texture	(1) Coarse sandy loam (2) Sandy loam (3) Fine sandy loam
Family particle size	(1) Loamy (2) Coarse-loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Rapid
Depth to restrictive layer	15–21 in
Soil depth	15–21 in
Surface fragment cover <=3"	10–23%
Surface fragment cover >3"	0–4%
Available water capacity (0-40in)	1.5–2.3 in
Soil reaction (1:1 water) (0-10in)	6.1–7
Subsurface fragment volume <=3" (0-60in)	6–13%
Subsurface fragment volume >3" (0-60in)	0–3%

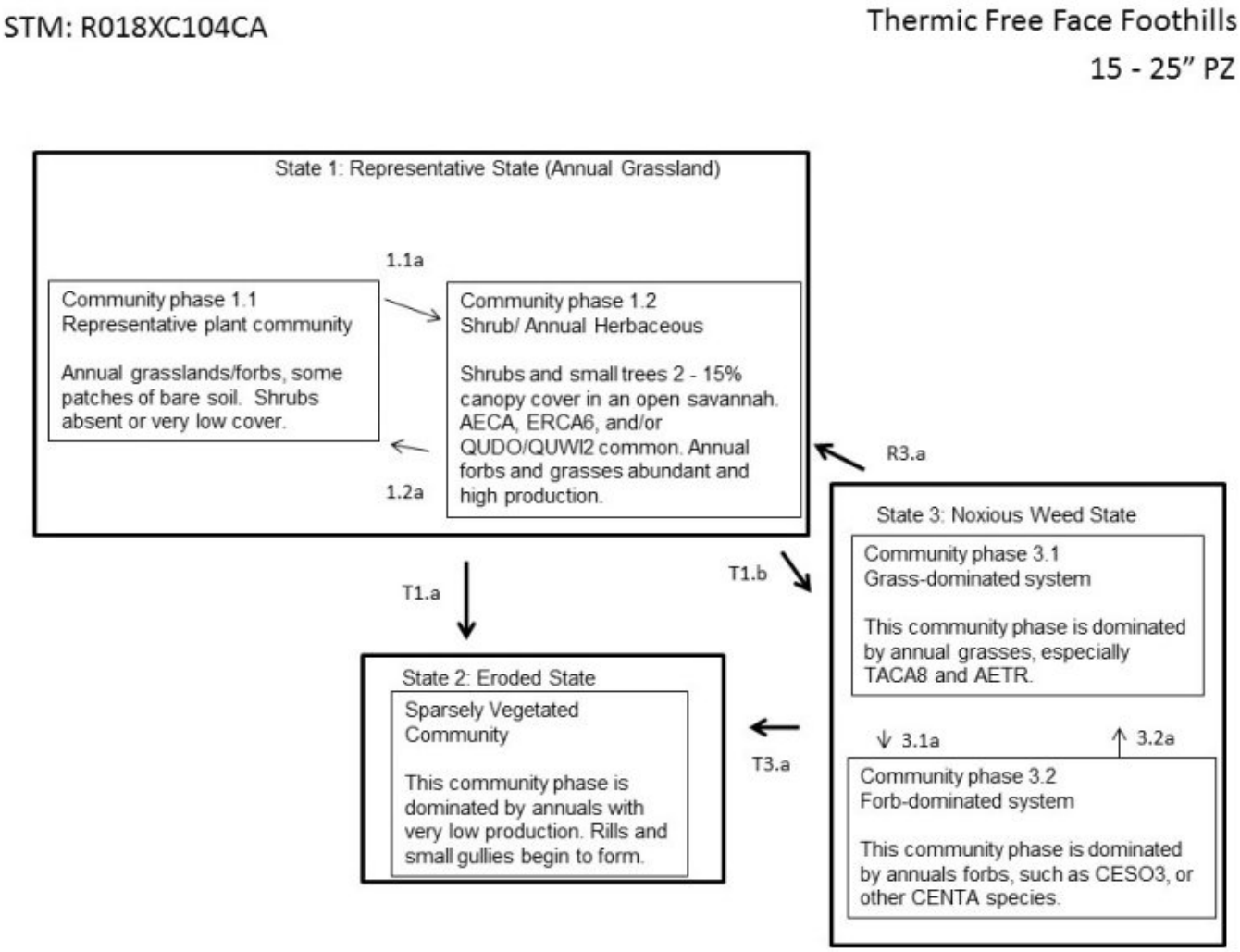
Table 6. Representative soil features (actual values)

Drainage class	Well drained to somewhat excessively drained
Permeability class	Rapid
Depth to restrictive layer	5–24 in
Soil depth	5–24 in
Surface fragment cover <=3"	0–55%
Surface fragment cover >3"	0–55%
Available water capacity (0-40in)	1.1–3 in
Soil reaction (1:1 water) (0-10in)	5.6–7.8
Subsurface fragment volume <=3" (0-60in)	0–36%

Subsurface fragment volume >3" (0-60in)	0–31%

Ecological dynamics

State and transition model



Community pathways and Transitions

T1.a This transition occurs when heavy or prolonged rainfall events occur following ground fires. Heavy winters make steep, un-vegetated surfaces vulnerable to erosion, rilling and gully formation, therefore the loss of soil and productivity.

T1.b This transition occurs when invasive plants considered to be noxious weeds reach a critical threshold and inundate the area.

1.1a This community pathway occurs with recruitment of trees and/or shrubs from adjacent sites.

1.2a This community pathway occurs with mortality of trees and/or shrubs.

T3.a This transition occurs when heavy or prolonged rainfall events occur following ground fires. Heavy winters make steep, un-vegetated surfaces vulnerable to erosion, rilling and gully formation, therefore the loss of soil and productivity.

R3.a This restoration pathway can occur with successfully executed weed management programs.

3.1a This community pathway occurs as invasive forb species become dominant.

3.2a This community pathway occurs as invasive grass species become dominant.

State 1
Representative State (Annual Grassland)

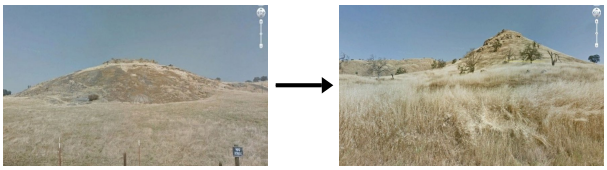
Community 1.1
Representative plant community

Annual grasslands/forbs, some patches of bare soil. Shrubs absent or very low cover.

Community 1.2
Shrub/ Annual Herbaceous

Shrubs and small trees 2 - 15% canopy cover in an open savannah. AECA, ERCA6, and/or QUDO/QUWI2 common. Annual forbs and grasses abundant and high production.

Pathway 1.1a
Community 1.1 to 1.2



Representative plant community

Shrub/ Annual Herbaceous

This community pathway occurs with recruitment of trees and/or shrubs from adjacent sites.

Pathway 1.2a
Community 1.2 to 1.1

Shrub/ Annual Herbaceous

Representative plant community

This community pathway occurs with mortality of trees and/or shrubs.

State 2
Eroded State

Community 2.1
Sparsely Vegetated Community

This community phase is dominated by annuals with very low production. Rills and small gullies begin to form.

State 3
Noxious Weed State

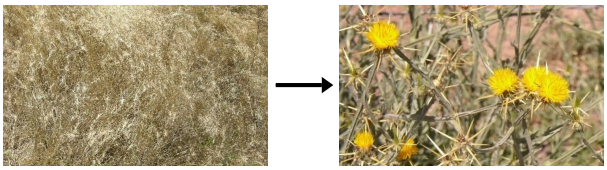
Community 3.1
Grass-dominated system

This community phase is dominated by annual grasses, especially TACA8 and AETR.

Community 3.2
Forb-dominated system

This community phase is dominated by annuals forbs, such as CESO3, or other CENTA species.

Pathway 3.1a
Community 3.1 to 3.2



Grass-dominated system | Forb-dominated system

This community pathway occurs as invasive forb species become dominant.

Pathway 3.2a
Community 3.2 to 3.1

Forb-dominated system | Grass-dominated system

This community pathway occurs as invasive grass species become dominant.

Transition T1.a
State 1 to 2

This transition occurs when heavy or prolonged rainfall events occur following ground fires. Heavy winters make steep, un-vegetated surfaces vulnerable to erosion, rilling and gully formation, therefore the loss of soil and productivity.

Transition T1.b
State 1 to 3

This transition occurs when invasive plants considered to be noxious weeds reach a critical threshold and inundate the area.

Restoration pathway R3.a
State 3 to 1

This restoration pathway can occur with successfully executed weed management programs.

Restoration pathway T3.a
State 3 to 2

This transition occurs when heavy or prolonged rainfall events occur following ground fires. Heavy winters make steep, un-vegetated surfaces vulnerable to erosion, rilling and gully formation, therefore the loss of soil and productivity.

Additional community tables

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

Michael Higgins

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	05/11/2025
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:**