USDA Natural Resources Conservation Service

Ecological site R018XC106CA
Thermic Ultramafic Foothills

Last updated: 4/24/2024
Accessed: 05/20/2024

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

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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 18 to 40 inches in most of the area (precipitation generally increases with elevation and from south to north). 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. Due to extreme latitudinal differences in MLRA 18, Land Resource Units (LRUs) were designated to group the MLRA into similar land units.

LRU notes

LRU Description:

The Southern Sierra Foothills is defined by extensive granite (diorite, and other intrusive volcanic rocks) geology. Soil temperature regime is thermic (in most southerly and lower elevations, can be hyperthermic). Elevation ranges between about 500 and 3200 feet above sea level. Maximum elevations increase towards the southern end, where precipitation is considerably lower. Precipitation ranges from 14 to 32 inches annually. Most precipitation falls between the months of November and March in the form of rain. Mean annual air temperature ranges between 58 to 64 F. Frost free days range between 195 and 282 days. Dominant vegetation includes annual grasslands, blue oak, interior live oak, chamise (Adenostoma fasciculatum), buckbrush (Ceanothus cuneatus), and foothill pine. At the highest elevations of the LRU, canyon live oak (Quercus chrysolepis), Interior live oak, and California bay (Umbelullaria californica) can be found in the steep drainages. Chamise-yucca plant assemblages can be found on steep, south-facing slopes. Buckeye is common in the concave positions at lower elevations. Riparian trees that are generally absent from the northern LRU’s include California Sycamore (Plantanus racemosa) and lemon scented gum (Eucalyptus citriodora). Histories of livestock grazing and settlement due to mining activity have shaped the current landscape.

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 defined by soil formed from ultramafic bedrock on steep to very steep hills. These soils are characterized by low Ca:Mg ratios (generally < 2 in the subsurface horizons) and high heavy metal concentrations (Cr, Ni, Zn, Cu, Fe, Co, Cd). Slopes typically range from 40 to 60%. Precipitation is around 15 inches per year. Elevation ranges from 1650 to 2100 feet.

The overriding abiotic factor controlling this site is the serpentinite-derived, magnesic soils with low Ca:Mg ratios. These soils also have very high concentrations of heavy metals, which are toxic to many plants, causing stunted growth or reduced productivity. Generally, this site has strikingly different plant assemblages than adjacent, non-serpentinite sites. A secondary abiotic factor is the relatively low precipitation, in comparison to other ultramafic ecological sites in the Sierra Nevada Foothills. The low precipitation results in large areas with barren ground or very little vegetation. The most common soil components on this site are Fancher and Delpiedra. Fancher soils are moderately deep, well-drained soils developed in hydrothermally altered, ultramafic rock. They have relatively high Ca:Mg ratios compared to other ultramafic soils (1 to 2). They are classified as fine, magnesic, superactive, thermic Mollic Haploxeralfs. Delpiedra soils are also Mollic Haploxeralfs, only they are shallow and loamy and typically have lower Ca:Mg ratios (< 1).

Vegetation expression on soils formed in serpentinite varies from completely barren ground to chaparral (Lazarus et al., 2011) with altered species composition, depending on the chemical composition and degree of alteration of the parent material, and the climate and topography of affected soils. This site is dominated by chamise (Adenostoma fasciculatum), buckbrush (Ceanothus cuneatus), squirreltail (Elymus elymoides), soft chess (Bromus hordeaceus), and foxtail fescue (Festuca megalura).

Associated sites

F018XC201CA	**Thermic Granitic Foothills** This site commonly occurs nearby.

Similar sites

R018XI102CA	**Thermic Ultramafic Foothills Extremely High Magnesium Content (Ca:Mg Ratio Less Than 0.5)** Site relationships being developed.
R018XI103CA	**Thermic Ultramafic Foothills Moderately High Magnesium Content (Ca:Mg Ratio 0.5 To 2)** Site relationships being developed.

Table 1. Dominant plant species

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

Physiographic features

This site occurs of elevations typically ranging from 1650 to 2100 feet on slopes typically ranging from 40 to 60%.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Hill (2) Foothills > Ridge
Runoff class	Very high
Flooding frequency	None

Ponding frequency	None
Elevation	1,650–2,100 ft
Slope	40–60%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	500–3,200 ft
Slope	30–70%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation is around 15 inches and usually falls from October to May. Mean annual temperature ranges from 61 to 65 degrees F with 211 to 215 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	211-215 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	15 in
Frost-free period (actual range)	209-217 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	15 in
Frost-free period (average)	213 days
Freeze-free period (average)	365 days
Precipitation total (average)	15 in

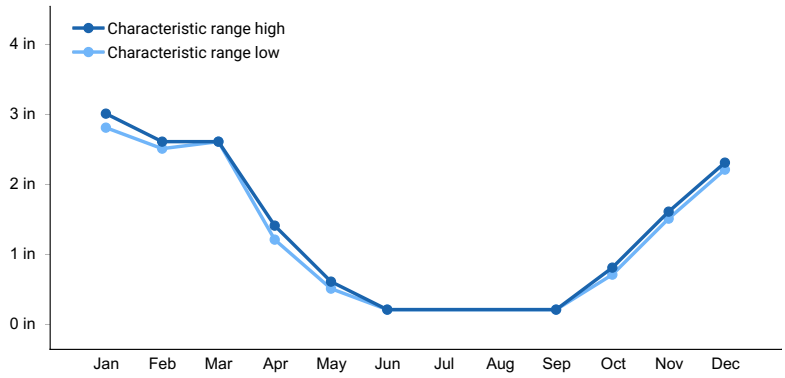


Figure 1. Monthly precipitation range

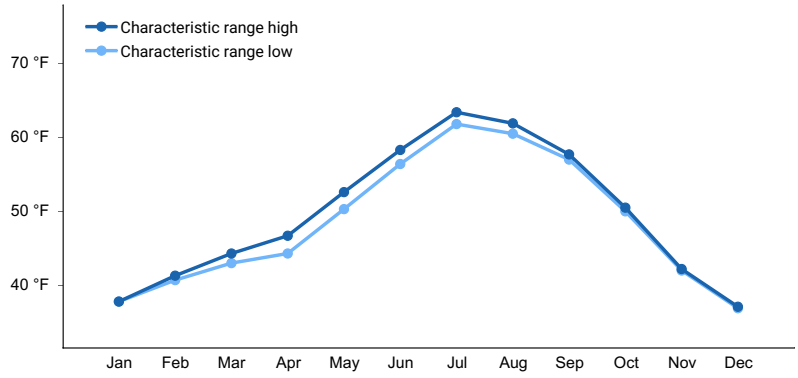


Figure 2. Monthly minimum temperature range

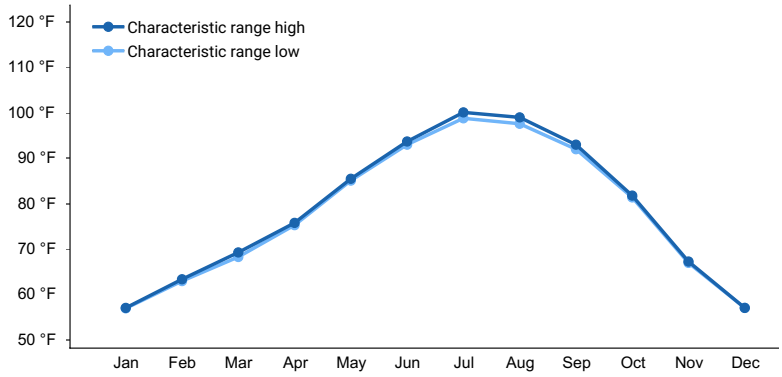


Figure 3. Monthly maximum temperature range

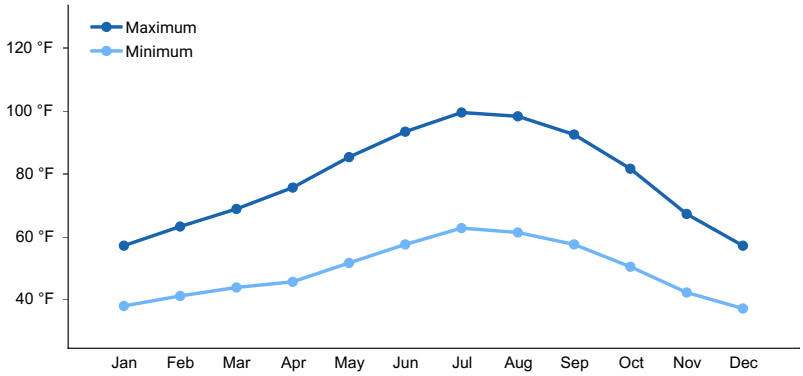


Figure 4. Monthly average minimum and maximum temperature

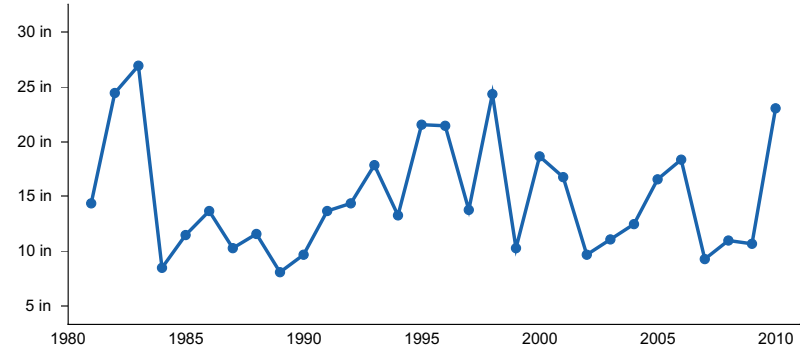


Figure 5. Annual precipitation pattern

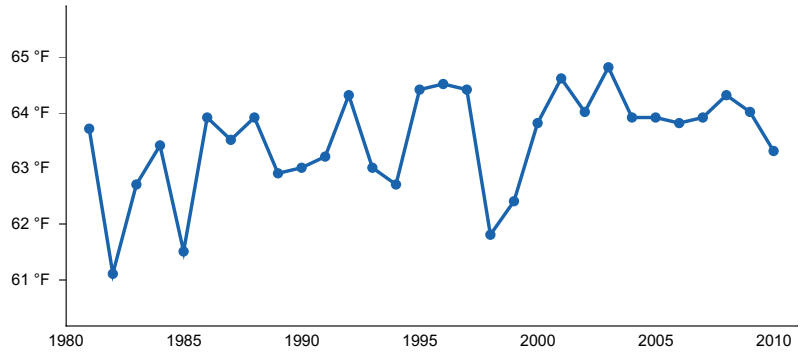


Figure 6. Annual average temperature pattern

Climate stations used

- (1) FRIANT GOVERNMENT CAMP [USC00043261], Friant, CA
- (2) LEMON COVE [USC00044890], Woodlake, 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 serpentinite rock. The typical depth range is from shallow to moderately deep, the particle size control sections ranges from loamy to fine, and surface textures include loams and gravelly loams. The bedrock is a restrictive layer found between 12 and 25 inches of depth. Gravels (< 3 inch diameter) occupy between 0 and 5% of the soil surface, and larger fragments (= 3 inch diameter) cover between 10 to 14%. Within the soil profile gravels range between 17 and 26% by volume, and larger fragments occupy between 4 and 7% of the profile volume. The soils in this ecological site are well drained and the permeability class ranges from moderately slow to moderately rapid. Available Water Capacity (AWC) is between 1.4 and 2.7 inches and the soil pH in the top 10 inches is between 6.9 and 7, while in the sub-horizons the range is between 6.9 and 7.2.

The most common soil components on this site are Fancher and Delpiedra. Fancher soils are moderately deep, well-drained soils developed in hydrothermally altered, ultramafic rock. They have relatively high Ca:Mg ratios compared to other ultramafic soils (1 to 2). They are classified as fine, magnesic, superactive, thermic Mollic Haploxeralfs. Delpiedra soils are also Mollic Haploxeralfs, only they are shallow and loamy and typically have lower Ca:Mg ratios (< 1).

Table 5. Representative soil features

Parent material	(1) Residuum–serpentinite
Surface texture	(1) Gravelly loam (2) Loam
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	12–25 in
Soil depth	12–25 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	10–14%

Available water capacity (0-40in)	1.4–2.7 in
Soil reaction (1:1 water) (0-10in)	6.9–7
Subsurface fragment volume <=3" (0-60in)	17–26%
Subsurface fragment volume >3" (0-60in)	4–7%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	10–40 in
Soil depth	10–40 in
Surface fragment cover <=3"	0–9%
Surface fragment cover >3"	4–24%
Available water capacity (0-40in)	1.1–3.1 in
Soil reaction (1:1 water) (0-10in)	6.4–7.6
Subsurface fragment volume <=3" (0-60in)	10–38%
Subsurface fragment volume >3" (0-60in)	0–11%

Ecological dynamics

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 ersosion, rilling and gully formation, therefore the loss of soil and productivity.

1.1a This community pathway occurs after low to moderate intensity fire.

1.1b This community pathway occurs with introduction of serpentine tolerant shrubs.

1.2a This community pathway occurs after several years of post-fire recovery.

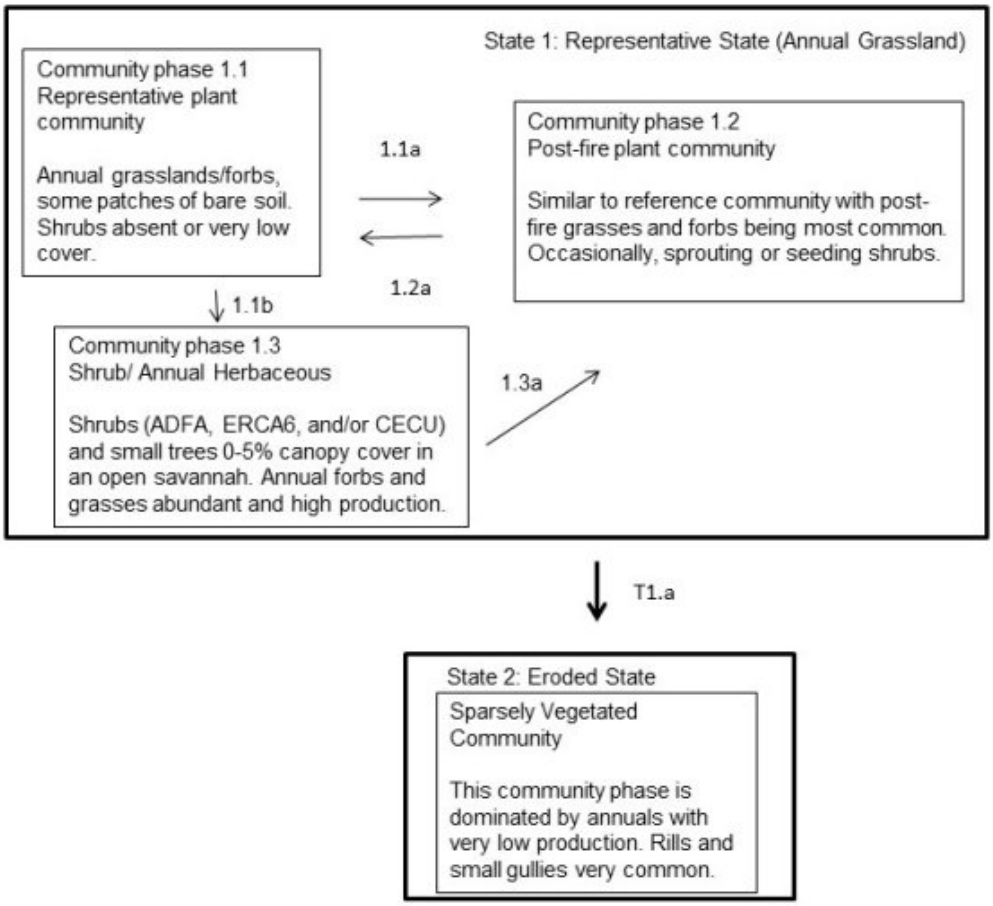
1.3a This community pathway occurs after low to moderate intensity fire.

State and transition model

STM: R018XC106CA

Thermic Ultramafic Foothills

15 - 21" PZ



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State 1
Representative State (Annual Grassland)

Dominant plant species

- chamise (*Adenostoma fasciculatum*), shrub
- California yerba santa (*Eriodictyon californicum*), shrub
- buckbrush (*Ceanothus cuneatus*), shrub
- squirreltail (*Elymus elymoides*), grass
- soft brome (*Bromus hordeaceus*), grass

Dominant resource concerns

- Sheet and rill erosion

Community 1.1
Representative plant community

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

Community 1.2
Post-fire plant community

Similar to reference community with post-fire grasses and forbs being most common. Occasionally, sprouting or seeding shrubs.

Community 1.3

Shrub/ Annual Herbaceous

Shrubs (ADFA, ERCA6, and/or CECU) and small trees 0-5% canopy cover in an open savannah. Annual forbs and grasses abundant and high production.

Pathway 1.1a
Community 1.1 to 1.2

This community pathway occurs after low to moderate intensity fire.

Pathway 1.1b
Community 1.1 to 1.3

This community pathway occurs with introduction of serpentine tolerant shrubs.

Pathway 1.2a
Community 1.2 to 1.1

This community pathway occurs after several years of post-fire recovery.

Pathway 1.3a
Community 1.3 to 1.2

This community pathway occurs after low to moderate intensity fire.

State 2
Eroded State

Considerable soil loss has occurred. Rills and small gullies are common. Vegetation productivity has been greatly reduced.

Dominant plant species

- soft brome (*Bromus hordeaceus*), other herbaceous
- squirreltail (*Elymus elymoides*), other herbaceous

Dominant resource concerns

- Sheet and rill erosion

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 ersosion, rilling and gully formation, therefore the loss of soil and productivity.

Constraints to recovery. Significant amounts of soil have been removed.

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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Nathan Roe

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:**