Ecological site F018XC203CA
Cool Thermic Slopes

Last updated: 4/24/2024
Accessed: 05/10/2025

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 is characterized by deep to very deep soils occurring on steep to very steep foothills and mountains formed from granitic parent material. It generally occurs on broadly concave slopes (simple slopes), most often on backslope positions. Slopes typically range from 35 to 65%. Annual precipitation typically ranges from 25 to 31 inches per year. Elevation typically ranges from 2000 to 3500 feet.

The Andregg series is a common component correlated to this site. This soil is well drained, moderately deep and classifed as a coarse-loamy, mixed, active, thermic Ultic Haploxeralf.

Vegetation includes closed oak woodland with interior live oak (Quercus wislizeni), California buckeye (Aesculus californica) and canyon live oak (Quercus chrysolepis) occurring at the higher elevations. Poison oak (Toxicodendron diversilobum) and California bay (Umbellularia californica) are common shrubs in the understory. Herbaceous annuals such as soft chess (Bromus hordeaceus), ripgut brome, (Bromus diandrus), wild oat (Avena fatua), and common vetch (Vicia sativa) may occur in the understory, especially where there are canopy gaps, but herbaceous production is low (1000 to 1500 lbs per acre) due to low amounts of sunlight penetrating to the woodland floor.

Associated sites

R018XC107CA	**Thermic Granitic Foothills south-facing** This site commonly occurs nearby.

Similar sites

F018XC201CA	**Thermic Granitic Foothills** Site relationships being developed.

Table 1. Dominant plant species

Tree	(1) *Quercus wislizeni* (2) *Aesculus californica*
Shrub	(1) *Toxicodendron diversilobum* (2) *Umbellularia californica*
Herbaceous	(1) *Bromus hordeaceus* (2) *Avena fatua*

Physiographic features

This site is characterized by deep to very deep soils occurring on steep to very steep foothills and mountains formed from granitic parent material. It generally occurs on broadly concave slopes (simple slopes), most often on backslope positions. Elevation typically ranges from 2000 to 3500 feet. Slopes typically range from 35 to 65%.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope
Slope shape up-down	(1) Concave
Landforms	(1) Foothills > Hillslope
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,000–3,500 ft
Slope	33–65%
Aspect	W, NW, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium to very high

Flooding frequency	None
Ponding frequency	None
Elevation	800–7,000 ft
Slope	15–100%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 23 to 30 inches and usually falls from October to May. Mean annual temperature is 59 to 62 degrees F with 148 to 193 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	148-193 days
Freeze-free period (characteristic range)	194-365 days
Precipitation total (characteristic range)	23-30 in
Frost-free period (actual range)	116-195 days
Freeze-free period (actual range)	176-365 days
Precipitation total (actual range)	21-32 in
Frost-free period (average)	167 days
Freeze-free period (average)	278 days
Precipitation total (average)	26 in

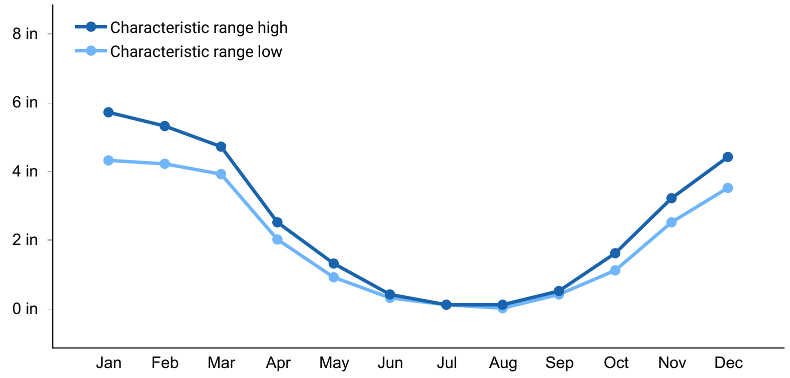


Figure 1. Monthly precipitation range

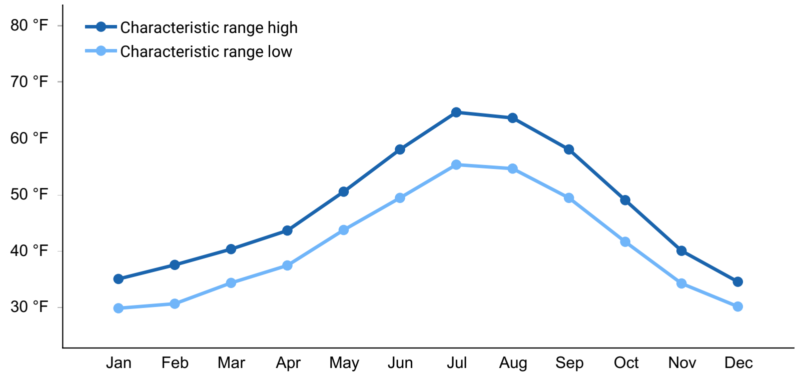


Figure 2. Monthly minimum temperature range

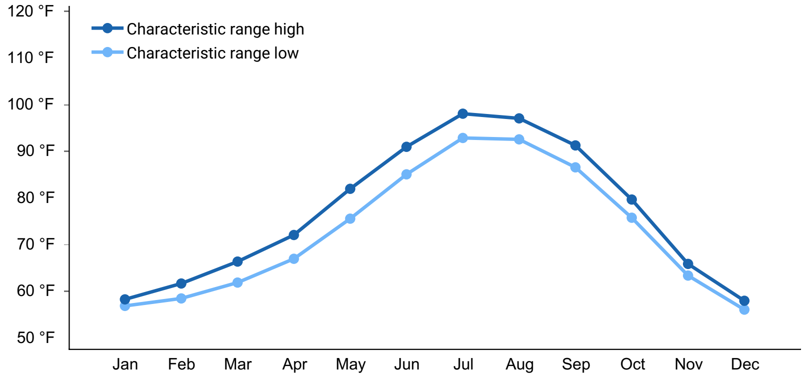


Figure 3. Monthly maximum temperature range

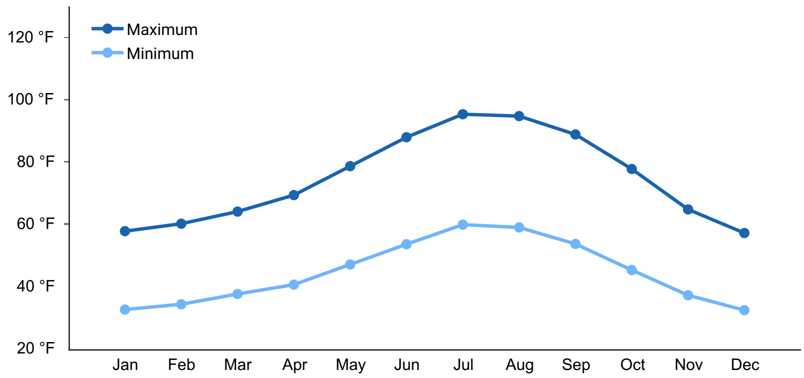


Figure 4. Monthly average minimum and maximum temperature

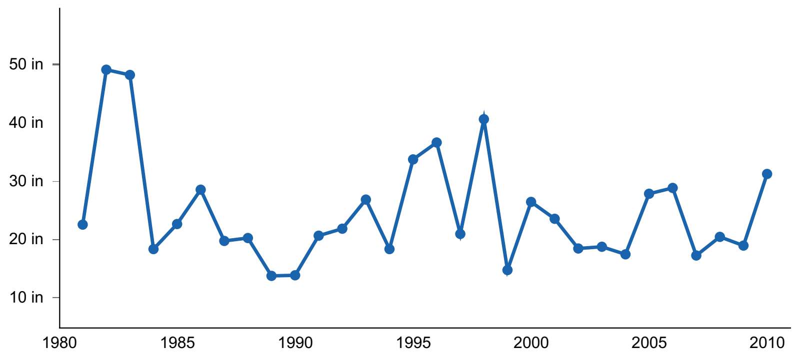


Figure 5. Annual precipitation pattern

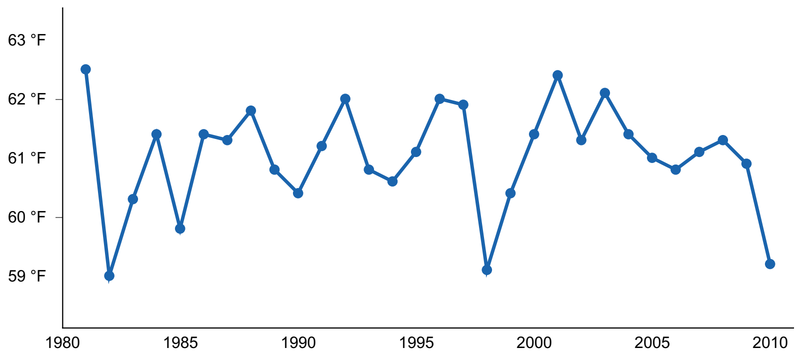


Figure 6. Annual average temperature pattern

Climate stations used

- (1) NORTH FORK RS [USC00046252], North Fork, CA
- (2) ASH MTN [USC00040343], Three Rivers, CA
- (3) THREE RVRS EDISON PH 1 [USC00048917], Three Rivers, CA

- (4) GLENNVILLE [USC00043463], Glennville, 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 and colluvium derived from granitoid rocks. The depth ranges from moderately to very deep, and the particle size control section is typically coarse-loamy. Surface texture is coarse sandy loam, loam, or gravelly sandy loam, and the bedrock is a restrictive layer found between 21 and 57 inches of depth. Gravels (< 3 inch diameter) cover up to 5% of the soil surface, and larger fragments (= 3 inch diameter) also cover between 0 and 5% percent of the surface. Subsurface gravels make up between 0 to 25% of the soil volume while larger fragments are 0 to 4% of the profile volume. The soils in this ecological site are well drained and the permeability class is moderate to rapid. The Available Water Capacity (AWC) is 2.6 to 6.6 inches and the pH of the top 10 inches of the soil ranges from 6.3 to 7 while in the subsoil the range is from 6 to 7.

Andregg is a common soil correlated to this ecological site. It is moderately deep, well drained and formed in material weathered mainly from granodiorite. It classifies as coarse-loamy, mixed, active, thermic Ultic Haploxeralfs.

Table 5. Representative soil features

Parent material	(1) Residuum–granitoid (2) Colluvium–granitoid
Surface texture	(1) Coarse sandy loam (2) Gravelly sandy loam (3) Loam
Family particle size	(1) Coarse-loamy
Drainage class	Well drained
Permeability class	Moderate to rapid
Depth to restrictive layer	21–57 in
Soil depth	21–57 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	2.6–6.6 in
Soil reaction (1:1 water) (0-10in)	6.3–7
Subsurface fragment volume <=3" (0-60in)	0–25%
Subsurface fragment volume >3" (0-60in)	0–4%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Slow to rapid
Depth to restrictive layer	20–64 in
Soil depth	20–64 in

Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–13%
Available water capacity (0-40in)	1.6–8.8 in
Soil reaction (1:1 water) (0-10in)	5.1–7.8
Subsurface fragment volume <=3" (0-60in)	0–37%
Subsurface fragment volume >3" (0-60in)	0–14%

Ecological dynamics

This ecological site exists along the higher elevations of the Sierra Nevada Foothills and consists of closed interior live-woodlands with few annual grasses and forbs in the understory. Interior live oak flourishes in the Mediterranean climate, but these trees tend to occur in greater densities in slightly wetter conditions (Pavlik et. al., 1991) than the blue oak. Blue oak woodland is the most extended hardwood cover in California (Bolsinger, 1988) and is usually a part of these ecosystems. Historically, many native forbs and some perennial bunchgrasses (Bartolome, 1987) may have been found on this site, however the herbaceous plant component plays less of a role in this ecological site due to the shading of the dense overstory vegetation. This includes the introduced grasses of Mediterranean origin.

Disturbance Dynamics:

Fire: Fire has been shaping the landscape of the Sierra Nevada Foothills for millennia. Native indigenous groups along the entire length of the Sierra Nevada Foothills practiced setting fires for centuries before European establishment. Burning was done for several reasons, including, but not limited to, vegetation management (clearing underbrush) for increased hunting opportunities, and also to improve crop yields (Stewart, 2002).

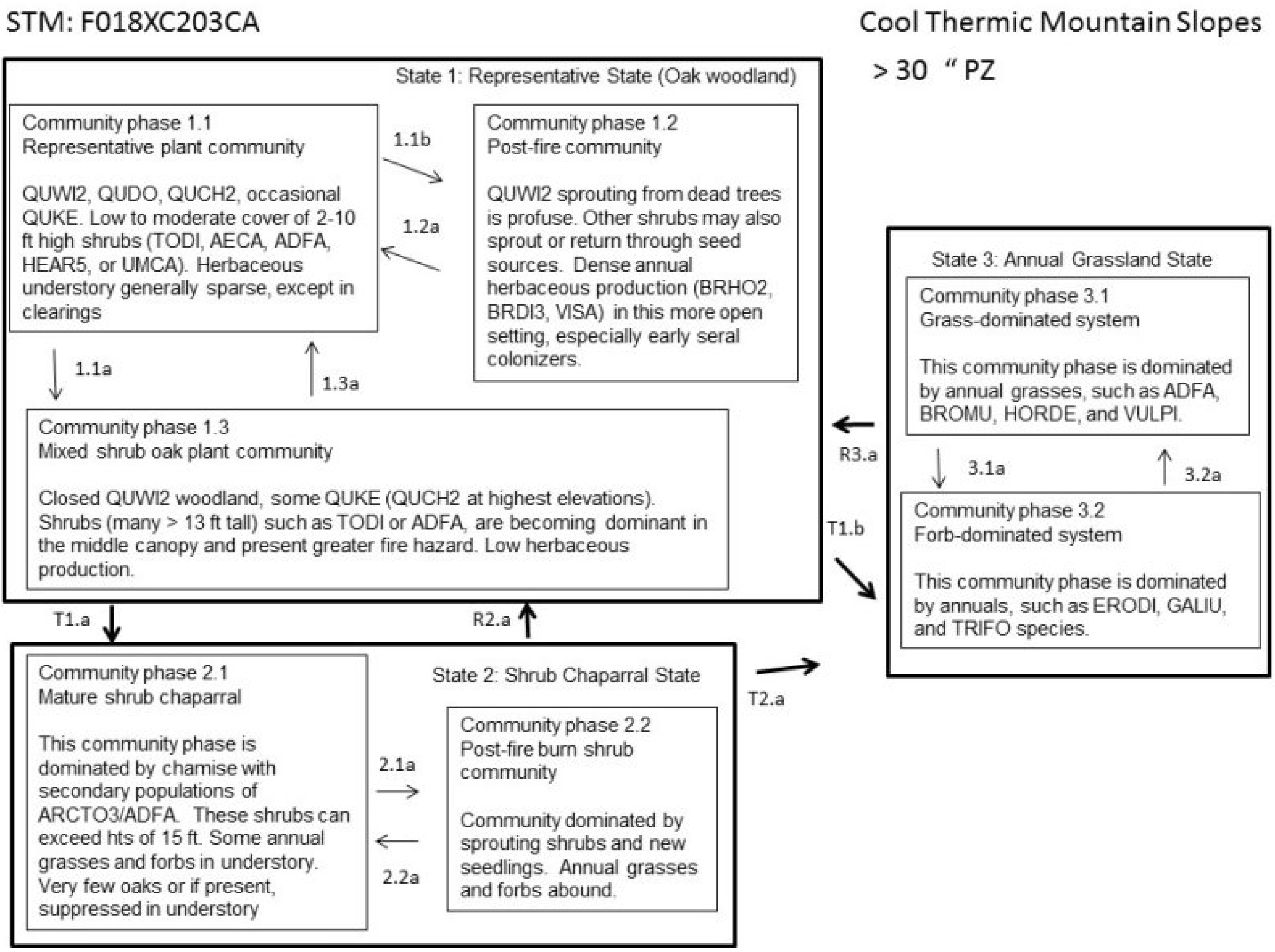
Interior live oak are top-killed by high-intensity fire (Green, 1980), although low to moderate severity pose little threat to mature trees. Contrastingly, the bark of blue oak is much thinner and even low intensity fire can cause mortality (Fryer, 2007). Both species will sprout back after a fire, and younger aged oaks are better suited to sprouting after top-kill (Tietje et al., 2001). In a multi-County study Swiecki et al.(1997) found a positive link between fire and blue oak sapling recruitment.

Grazing: Livestock grazing has occurred for at least 200 years and has likely contributed to the spread of Mediterranean annual grasses such as Bromus, Avena genus (Jackson, 1985). As stated earlier, these grasses generally are absent or in reduced densities, except in clearings or in the post-fire plant community. Mechanical clearing is another disturbance factor that often works in tangent with domestic livestock operations. The mature live oak woodland has very little forage and therefore openings are needed for successful cattle operations, often in addition to the regular dieback and windthrow (gap) dynamics. Mechanical clearing is sometimes implemented for multi-uses; for example, to create fire breaks or to generate firewood.

Disease and Pathogens: Some diseases of blue oak damage the heartwood of the trunk and large limbs (McDonald, 1990). Several fungi cause wood decay in the limbs and trunks of oaks (Hickman et al., 2011). Sulphur conk, (Laetiporus sulphureus), hedgehog fungus (Hydnum erinaceum) and the artist's fungus (Ganoderma applanatum) can cause significant damage to living oaks (i.e. heartwood rot). Fire scars are thought to be a port-of-entry to some heart-rot species (Fryer, 2012). Other diseases such as, shoestring fungus rot (Armillaria mellea), gradually weaken trees at the base until they fall. Diseases of California foothill pine include western gall rust (Periderium harknessii) and dwarf-mistletoe (*Arceuthobium occidentale* and *A. campylopodum* forma campylopodum) (Howard, 1992).

Drought: Interior live oak may have an edge over blue oak in drought tolerance (Fryer, 2012). It was shown to regenerate more successfully in the southern Sierra Nevada Foothills and even occupy drier sites than the blue oak (Staniford et al., 1997).

State and transition model



Community pathways and Transitions

T1.a This transition occurs after decades of little to no disturbance to the canopy layers, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire will then trigger a shift towards chaparral vegetation communities. Shrubs adapted to the new fire regime, sprout and seed at a much higher rate than the tree component.

T1.b This transition occurs after repeated fires or active brush management/chemical treatment to produce an open savannah.

1.1a Time without fire or other natural disturbance to the forest canopy (or vegetation management).

1.1b This community pathway occurs with low to moderately severe fire promoting a sprouting response from the trees top-killed by the fire (normal fire return interval ~ 25 years).

1.2a Normal growth and progression without disturbance.

1.3a This community pathway occurs with moderate intensity, often patchy, fire. Mid canopy layers and shrubs are killed, creating a more open woodland. This community pathway also can result with firewood cutting, or shrub clearing.

T2.a This transition occurs with active brush management; chemical treatment, and repeated prescribed burning.

R2.a This restoration pathway occurs after active brush management, chemical treatment, followed up with tree planting.

2.1a This community pathway occurs following a high intensity wildfire.

2.2a This community pathway occurs over time with no management action.

R3.a This restoration pathway occurs with tree planting, often requires shade screens, and seedling protection from browsers to be successful.

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

3.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

State 1
Representative State (Oak woodland)

Community 1.1
Representative plant community

QUWI2, QUDO, QUCH2, occasional QUKE. Low to moderate cover of 2-10 ft high shrubs (TODI, AECA, ADFA, HEAR5, or UMCA). Herbaceous understory generally sparse, except in clearings.

Community 1.2
Post-fire community

QUWI2 sprouting from dead trees is profuse. Other shrubs may also sprout or return through seed sources. Dense annual herbaceous production (BRHO2, BRDI3, VISA) in this more open setting, especially early seral colonizers.

Community 1.3
Mixed shrub oak plant community

Closed QUWI2 woodland, some QUKE (QUCH2 at highest elevations). Shrubs (many > 13 ft tall) such as TODI or ADFA, are becoming dominant in the middle canopy and present greater fire hazard. Low herbaceous production.

Pathway 1.1b
Community 1.1 to 1.2

Representative plant community

Post-fire community

1.1b This community pathway occurs with low to moderately severe fire promoting a sprouting response from the trees top-killed by the fire (normal fire return interval ~ 25 years).

Pathway 1.1a
Community 1.1 to 1.3

Representative plant community

Mixed shrub oak plant community

1.1a Time without fire or other natural disturbance to the forest canopy (or vegetation management).

Pathway 1.2a
Community 1.2 to 1.1

Post-fire community

Representative plant community

1.2a Normal growth and progression without disturbance.

Pathway 1.3a
Community 1.3 to 1.1

Mixed shrub oak plant community

Representative plant community

1.3a This community pathway occurs with moderate intensity, often patchy, fire. Mid canopy layers and shrubs are killed, creating a more open woodland. This community pathway also can result with firewood cutting, or shrub clearing.

State 2
Shrub Chaparral State

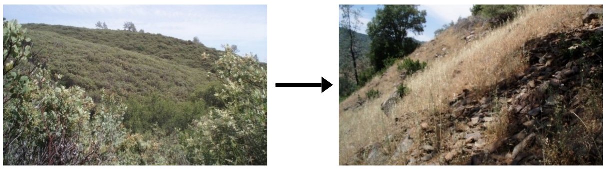
Community 2.1
Mature shrub chaparral

This community phase is dominated by chamise with secondary populations of ARCTO3/ADFA. These shrubs can exceed hts of 15 ft. Some annual grasses and forbs in understory. Very few oaks or if present, suppressed in understory.

Community 2.2
Post-fire burn shrub community

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

Pathway 2.1a
Community 2.1 to 2.2

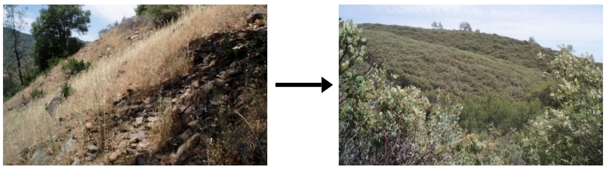


Mature shrub chaparral

Post-fire burn shrub community

2.1a This community pathway occurs following a high intensity wildfire.

Pathway 2.2a
Community 2.2 to 2.1



Post-fire burn shrub community

Mature shrub chaparral

2.2a This community pathway occurs over time with no management action.

State 3
Annual Grassland State

Community 3.1
Grass-dominated system

This community phase is dominated by annual grasses, such as ADFA, BROMU, HORDE, and VULPI.

Community 3.2
Forb-dominated system

This community phase is dominated by annuals, such as ERODI, GALIU, and TRIFO species.

Pathway 3.1a
Community 3.1 to 3.2

Grass-dominated system

Forb-dominated system

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

Pathway 3.2a
Community 3.2 to 3.1

Forb-dominated system

Grass-dominated system

3.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

Transition T1.a
State 1 to 2

T1.a This transition occurs after decades of little to no disturbance to the canopy layers, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire will then trigger a shift towards chaparral vegetation communities. Shrubs adapted to the new fire regime, sprout and seed at a much higher rate than the tree component.

Transition T1.b
State 1 to 3

T1.b This transition occurs after repeated fires or active brush management/chemical treatment to produce an open savannah.

Restoration pathway R2.a
State 2 to 1

R2.a This restoration pathway occurs after active brush management, chemical treatment, followed up with tree planting.

Transition T2.a
State 2 to 3

T2.a This transition occurs with active brush management; chemical treatment, and repeated prescribed burning.

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.

Additional community tables

Inventory data references

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

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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	05/10/2025
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):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**
