USDA Natural Resources Conservation Service

Ecological site R018XI106CA
Steep Thermic Hillslopes and Canyon Walls

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

This LRU (designated XI) is located on moderate to steep hills in the Sierra Nevada Foothills east of Sacramento, Stockton, and Modesto, CA. Various geologies occur in this region: metavolcanics, granodiorite, slate, marble, argillite, schist and quartzite, as well as ultramafic bands to a limited and localized extent. It includes mesa formations from volcanic flows, where vernal pool habitats occur. Soil temperature regime is thermic and soil moisture regime is xeric. Elevation ranges between 300 and 3400 feet above sea level. Precipitation ranges from 14 to 42 inches annually. Most precipitation falls between the months of November and March in the form of rain. Dominant vegetation includes annual grasslands, blue oak (Quercus douglasii), interior live oak (Quercus wislizeni), chamise (Adenostoma fasciculatum), buckbrush (Ceanothus cuneatus), and foothill pine (Pinus sabiniana).

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), M261Fb, the Lower Foothills Metamorphic Belt 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 6b, Northern Sierran Foothills, Ecoregion 6c, Comanche Terraces.

Ecological site concept

This site is found on steep to very steep hills and canyon walls (20 to 70% slopes), often on south-facing aspects. It occurs on summits, shoulders and backslopes in metasedimentary or granitic parent material. Soils are shallow to moderately deep and the particle size class is generally loamy or loamy-skeletal (rarely fine-loamy). Mean annual precipitation typically ranges from 27 to 33 inches. These sites are exclusively in thermic temperature regimes.

Droughty, water shedding landscape positions associated with this site produces dense chaparral vegetation. The typical soil components tied to this ecological site are Priestgrade and Moccasinhill soils. Both of these soils are loamy-skeletal, Typic Haploxerepts, but differ in the soil depth class. Priestgrade soils are shallow and Moccasinhill are moderately deep. This site occasionally occurs on deeper soils, but only on south-facing aspects.

Vegetation communities are dominated by chamise (Adenostoma fasciculatum) stands with very little herbaceous cover. Lower densities of California yerba santa (Eriodictyon californicum) and manzanita (Arctostaphylos spp.) sometimes occur. Occasional live oak will occur in microsite positions that retain water for longer periods. Annual production is generally 95% or more shrubs.

Similar sites

R018XI105CA	**Mesic Steep Convex Slopes bordering thermic** Site relationships being developed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Adenostoma fasciculatum* (2) *Arctostaphylos viscida*
Herbaceous	Not specified

Physiographic features

This site is found on low elevation hills/foothills on steep to very steep hills and canyon walls, often on south-facing aspects.

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Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Slope shape up-down	(1) Convex (2) Linear
Slope shape across	(1) Convex
Landforms	(1) Foothills > Hill (2) Foothills > Canyon wall (3) Foothills > Ridge
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	850–1,890 ft
Slope	20–70%
Aspect	SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None

Elevation	120–3,500 ft
Slope	2–90%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 30 to 37 inches and usually falls from October to May. Mean annual temperature ranges from 60 to 62 degrees F with 170 to 267 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	170-267 days
Freeze-free period (characteristic range)	336-365 days
Precipitation total (characteristic range)	30-37 in
Frost-free period (actual range)	155-341 days
Freeze-free period (actual range)	251-365 days
Precipitation total (actual range)	25-39 in
Frost-free period (average)	227 days
Freeze-free period (average)	336 days
Precipitation total (average)	33 in

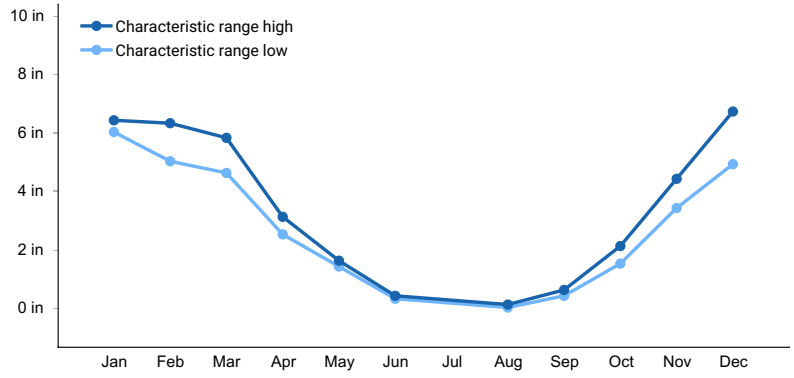

Figure 1. Monthly precipitation range

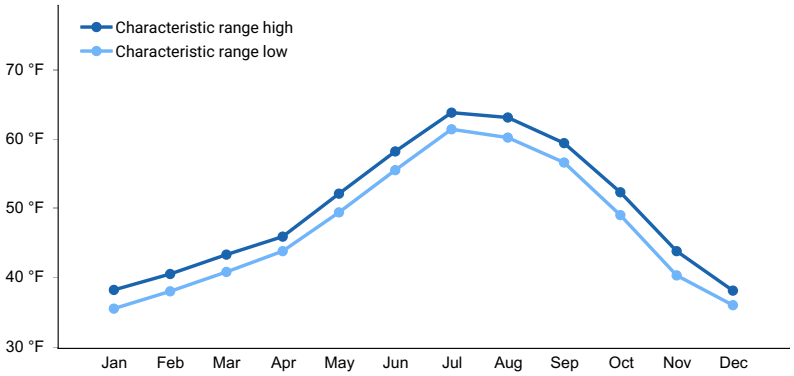

Figure 2. Monthly minimum temperature range

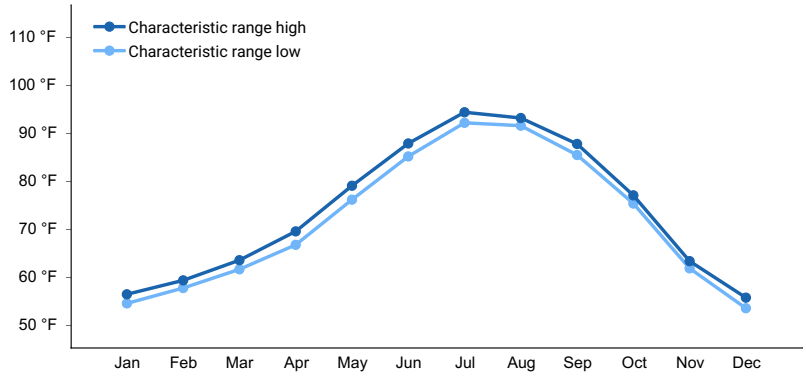

Figure 3. Monthly maximum temperature range

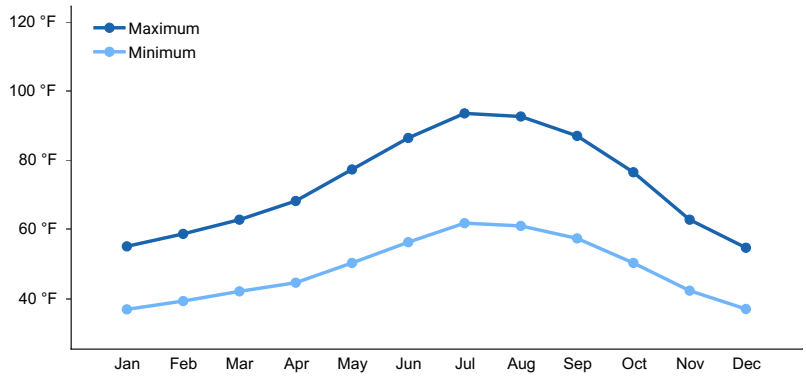

Figure 4. Monthly average minimum and maximum temperature

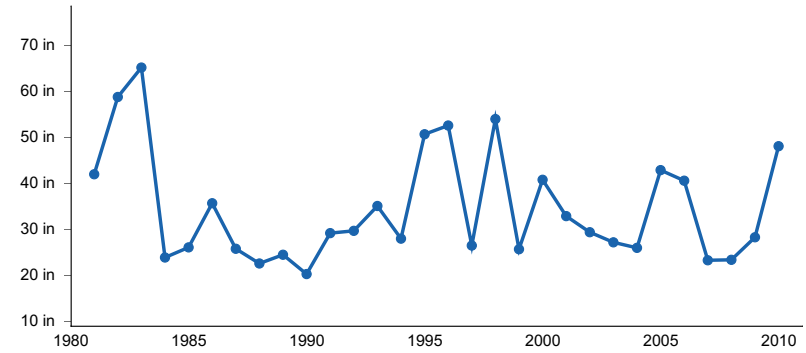

Figure 5. Annual precipitation pattern

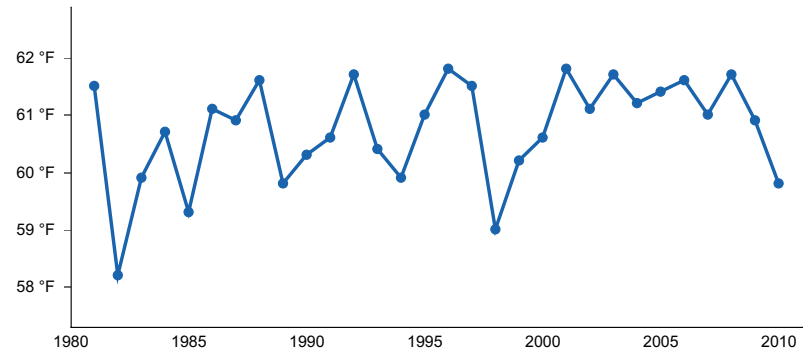

Figure 6. Annual average temperature pattern

Climate stations used

- (1) SONORA [USC00048353], Jamestown, CA
- (2) NEW MELONES DAM HQ [USC00046174], Angels Camp, CA
- (3) CAMP PARDEE [USC00041428], Valley Springs, CA

- (4) SUTTER HILL CDF [USC00048713], Jackson, CA
- (5) PLACERVILLE [USC00046960], Diamond Springs, CA
- (6) AUBURN [USC00040383], Auburn, 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 the colluvium and residuum of metasedimentary, metavolcanic and basic igneous rock. The typical depth range is from shallow to moderately deep, with bedrock as the restrictive layer found between 15 and 36 inches of depth. The particle size control sections are loamy, fine-loamy and loamy-skeletal, and surface textures range from loams and gravelly loams, to silt loams. Gravels (< 3 inch diameter) range between 0 to 5% cover, while larger fragments (= 3 inch diameter) range from between 1 and 6% cover. Within the soil profile gravels range between 0 to 20% and larger fragments occupy 0 to 38% by volume. The soils in this ecological site are well drained and the permeability class ranges is moderately rapid. Available Water Capacity (AWC) is between 1.5 and 6 inches and the soil pH in the top 10 inches is between 6 and 6.6 and in the sub-horizons it is between 6 and 6.5.

Common soil components in this ecological site include Auburn, Blasingame and Jasperpeak. Auburn is a loamy, mixed, superactive, thermic Lithic Haploxerepts, Blasingame is a moderately deep, fine-loamy, mixed, superactive, thermic Typic Haploxeralfs and Jasperpeak is a loamy-skeletal, mixed, superactive, thermic Lithic Haploxeralfs.

Table 5. Representative soil features

Parent material	(1) Residuum–metavolcanics (2) Colluvium–metavolcanics (3) Residuum–metasedimentary rock (4) Colluvium–metasedimentary rock (5) Residuum–igneous rock (6) Colluvium–igneous rock
Surface texture	(1) Loam (2) Gravelly loam (3) Silt loam
Family particle size	(1) Loamy (2) Fine-loamy (3) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	12–55 in
Soil depth	12–55 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	1.5–6 in
Soil reaction (1:1 water) (0-10in)	6–6.6
Subsurface fragment volume <=3" (0-60in)	0–20%

Subsurface fragment volume >3" (0-60in)	0–28%

Table 6. Representative soil features (actual values)

Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	6–59 in
Soil depth	6–59 in
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	0.4–7.3 in
Soil reaction (1:1 water) (0-10in)	5.1–7.8
Subsurface fragment volume <=3" (0-60in)	0–36%
Subsurface fragment volume >3" (0-60in)	0–28%

Ecological dynamics

State and transition model

R018XI105CA Steep Convex Slopes 31-40 PZ (bordering mesic)

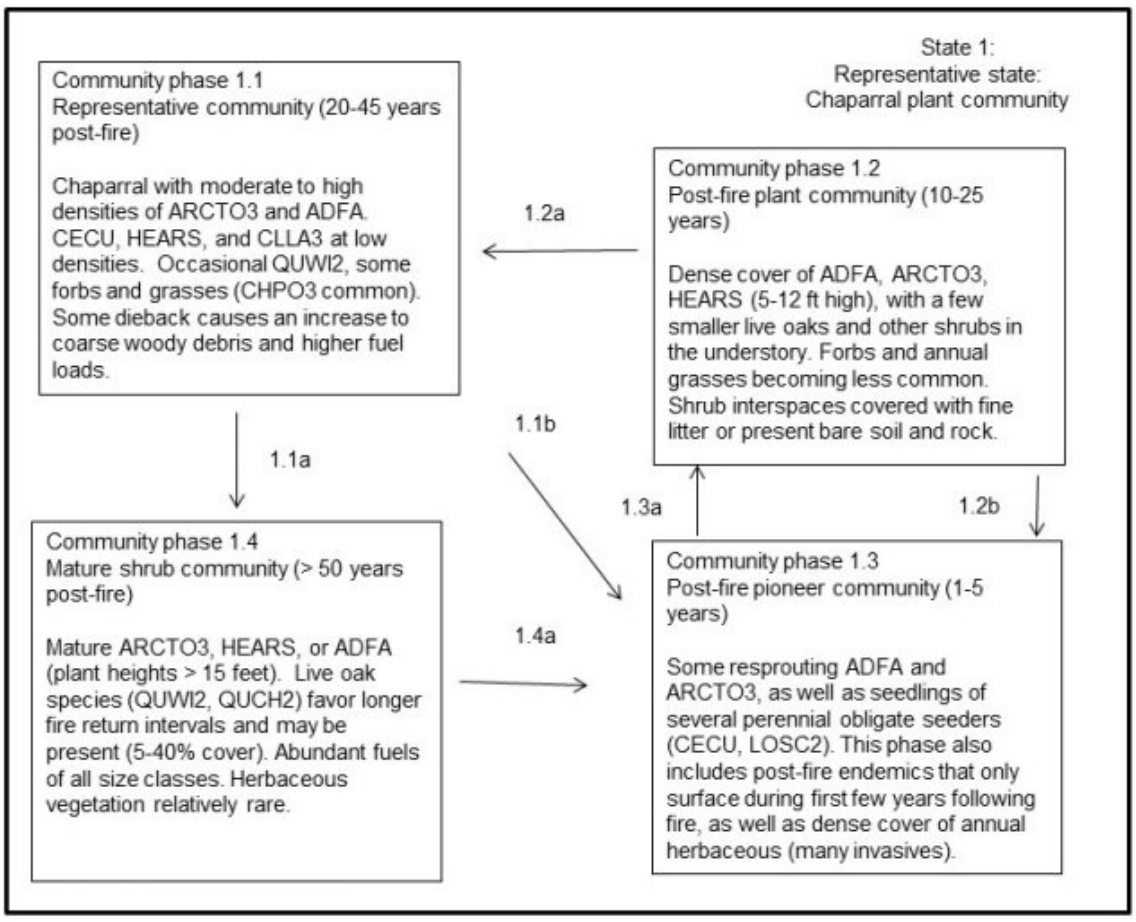

Figure 7. State and Transition Model

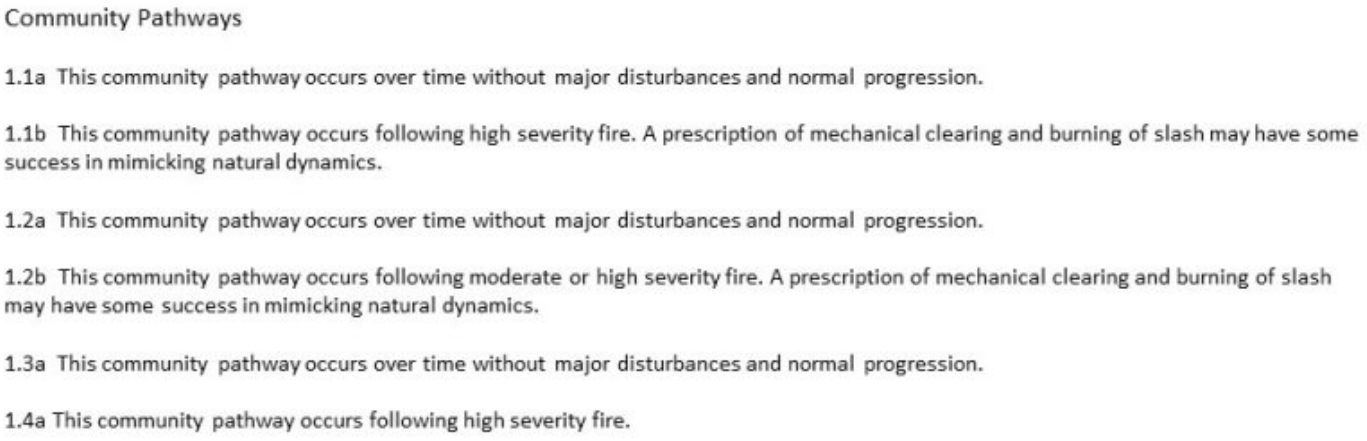

Figure 8. Community Pathways

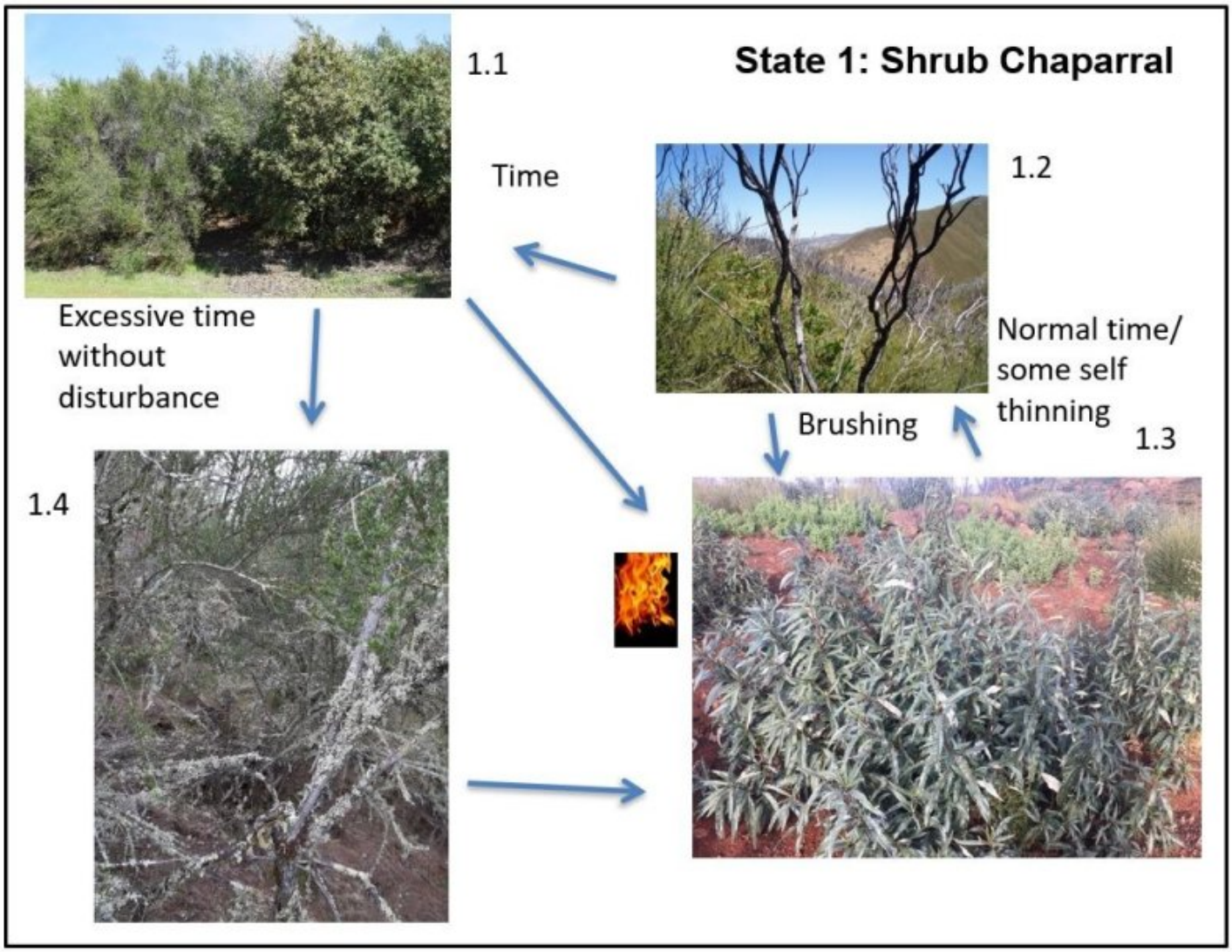

Figure 9. State 1: Shrub Chaparral

State 1
Representative state: Chaparral plant community

Community 1.1
Representative community (20-45 years post-fire)

ADFA monocultures with very low production of other shrubs such as CECU or ERCA6. Small live oak (QUBE5, QUWI2) rare (mostly understory). Forbs and grasses trace to none. Some dieback causes an increase to coarse woody debris and higher fuel loads.

Community 1.2
Post-fire plant community (10-25 years)

Dense cover of ADFA (5-12 ft high), with a few smaller live oaks and other shrubs (ERCA6, ARCTO3) in the understory. Forbs and annual grasses becoming less common. Shrub interspaces covered with fine litter or present bare soil and rock.

Community 1.3
Post-fire pioneer community (1-5 years)

Some resprouting ADFA, ARCTO3 ERCA6, as well as seedlings of several perennial obligate seeders (CECU). This phase also includes post-fire endemics that only surface during first few years following fire, as well as dense cover of annual herbaceous (many invasives).

Community 1.4
Mature shrub community (> 50 years post-fire)

Mature ADFA (plant heights > 15 feet) and CECU. QUWI2 favor longer fire return intervals and may be present (5-25% cover). Abundant fuels of all size classes. Herbaceous vegetation relatively rare.

Pathway 1.2a
Community 1.1 to 1.2

Representative community (20-45 years post-fire)

Post-fire plant community (10-25 years)

This community pathway occurs over time without vegetation management or major disturbances.

Pathway 1.1b
Community 1.1 to 1.3

Representative community (20-45 years post-fire)

Post-fire pioneer community (1-5 years)

This community pathway occurs following a high severity fire. A prescription of mechanical clearing and burning of slash may also produce the same results.

Pathway 1.1a
Community 1.1 to 1.4

Representative community (20-45 years post-fire)

Mature shrub community (> 50 years post-fire)

This community pathway occurs over time without vegetation management or major disturbances.

Pathway 1.2b
Community 1.2 to 1.3

Post-fire plant community (10-25 years)

Post-fire pioneer community (1-5 years)

This community pathway occurs following a moderate to high severity fire. A prescription of mechanical clearing and burning of slash may have some success in mimicking natural dynamics.

Pathway 1.3a
Community 1.3 to 1.2

Post-fire pioneer community (1-5 years)

Post-fire plant community (10-25 years)

This community pathway occurs over time and normal progression.

Pathway 1.4a
Community 1.4 to 1.3

Mature shrub community (> 50 years post-fire)

Post-fire pioneer community (1-5 years)

This community pathway occurs following a high severity fire.

Additional community tables

Other references

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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	05/11/2025
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:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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):**

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:**