USDA Natural Resources
Conservation Service

Ecological site F018XA202CA
Deep Mesic Mountain Slopes & Summits

Last updated: 4/24/2024
Accessed: 05/21/2025

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

The Tuscan Flows LRU is the northernmost Land Resource Unit in MLRA 18. It occurs down slope of and is geologically related to the southern Cascades; however, its inclusion in MLRA 18 stems from the ecosystem's close resemblance to other Sierra Nevada Foothill systems. This LRU is situated on a low elevation volcanic plateau at the northeast end of the Sacramento Valley. The geology includes, but is not limited to late Pliocene and Quartenary basalt, andesite and andesitic lahars (mudflows). Several cinder cones dot the landscape and active fluvial processes are occurring in the larger canyons. Elevation ranges between 250 and 2000 feet above sea level on the main plateau, but can range as high as 3000 feet on the highest hills. Precipitation is among the highest in MLRA 18, ranging from 30 to 55 inches annually. Mean annual air temperature ranges between 56 and 62 F. Frost free days (generally exhibiting an inverse relationship with elevation) range from 184 to 282 days.

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), M261Fa, the Tuscan Flows 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 6a, Tuscan Flows.

Ecological site concept

The Deep Mesic Mountain Slopes & Summits Ecological Site is on shallow to deep soils on summit and shoulder hillslope positions of hills and mountains on volcanic tuff/breccia parent material. Slopes range from 15 to 80%. Precipitation typically ranges from 51 to 56 inches per year, and elevation ranges from 1075 to 2400 feet. The soil temperature regime is mesic.

Cool soil temperatures occurring at the highest elevations of the LRU support closed oak woodlands and shrublands. Mollic epipedons are often associated with the dense vegetative growth and high organic matter inputs at this site. The most common soil correlated to this ecological site is Supan (fine-loamy, mixed, superactive, mesic Pachic Argixerolls). Supan soils weathered from volcanic rock, such as andesitic or basaltic tuff breccia, and have a thick, dark A horizon.

Vegetation includes dense chaparral species such as whiteleaf manzanita (Arctostaphylos viscida), deerbrush (Ceanothus integerimus), and oak species such as California black oak (Quercus kellogii), canyon live oak (Quercus chrysolepis), and lesser numbers of blue oak (Quercus douglasii). Both ponderosa (Pinus ponderosa) and grey pine (Pinus sabiniana) can be found on this site. Generally, the forb and grass components are suppressed due to the excessive shading of overstory trees and shrubs. Shrub production is likely greater than 50% of the total annual production; tree production may be as high as 40%, while herbaceous production is generally less than 5%.

Associated sites

R018XA103CA	**Shallow Thermic Volcanic Ridges** This site commonly occurs nearby.

Similar sites

F018XA201CA	**Deep Thermic Hillslopes** Site relationships being developed.

Table 1. Dominant plant species

Tree	(1) *Quercus chrysolepis* (2) *Quercus kelloggii*
Shrub	(1) *Arctostaphylos viscida* (2) *Ceanothus integerrimus*
Herbaceous	Not specified

Physiographic features

This site occurs on moderately deep to deep soils on summit and shoulder hillslope positions of hills and mountains on volcanic tuff/breccia geology. Elevation generally ranges from 1075 to 2400 feet. Slopes gradient ranges from 15 to 80%.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder
Landforms	(1) Foothills > Ridge (2) Foothills > Canyon (3) Foothills > Hillslope
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	450–2,000 ft
Slope	4–60%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None

Elevation	250–2,600 ft
Slope	2–70%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 51 to 56 inches and usually falls from October to May. Mean annual temperature is 57 to 60 degrees F with 220 to 245 frost-free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	220-245 days
Freeze-free period (characteristic range)	267-341 days
Precipitation total (characteristic range)	51-56 in
Frost-free period (actual range)	175-260 days
Freeze-free period (actual range)	249-359 days
Precipitation total (actual range)	49-58 in
Frost-free period (average)	230 days
Freeze-free period (average)	304 days
Precipitation total (average)	54 in

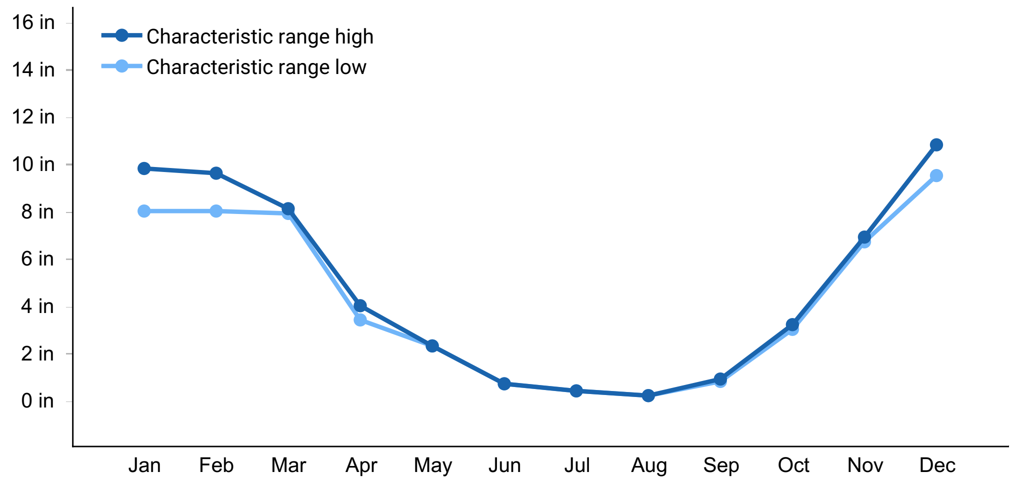


Figure 1. Monthly precipitation range

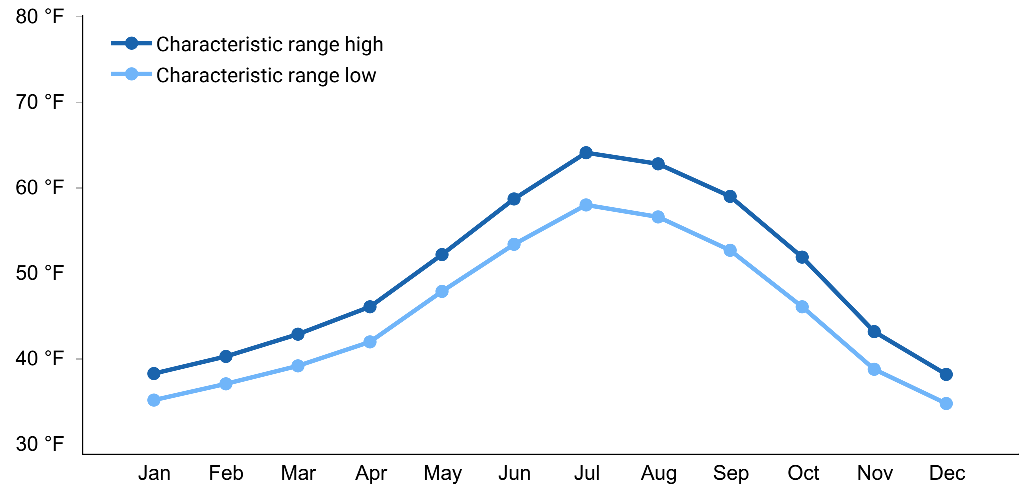


Figure 2. Monthly minimum temperature range

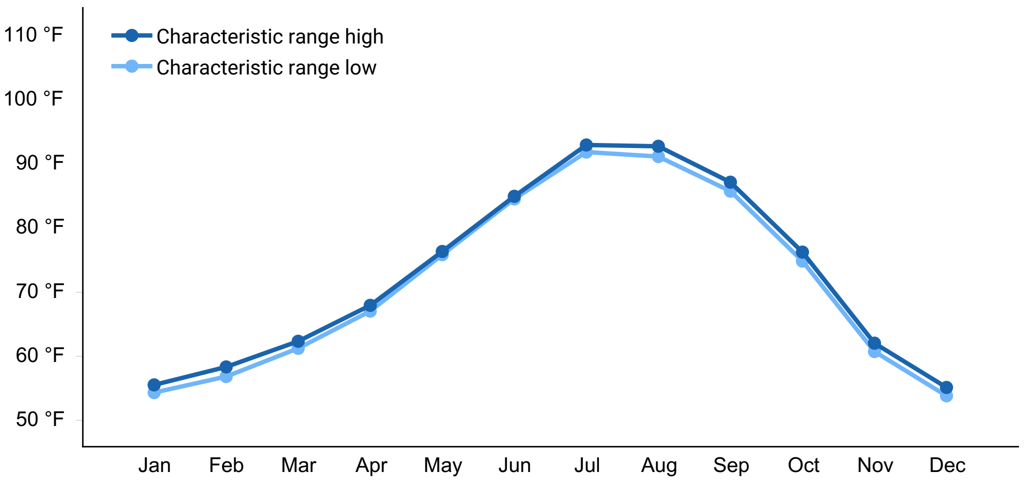


Figure 3. Monthly maximum temperature range

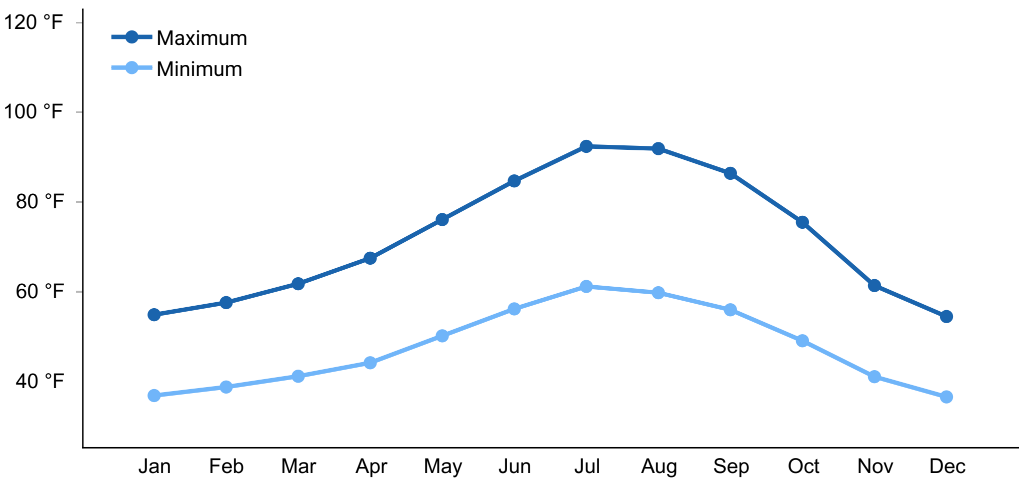


Figure 4. Monthly average minimum and maximum temperature

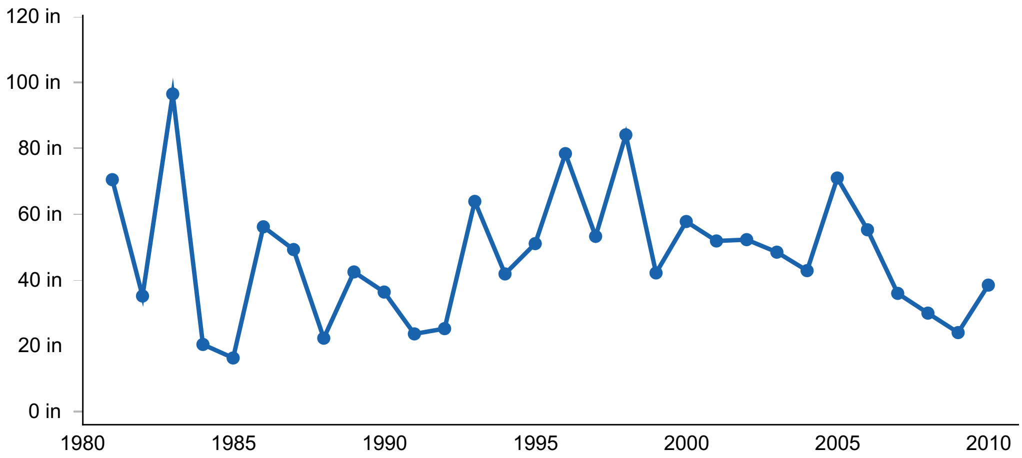


Figure 5. Annual precipitation pattern

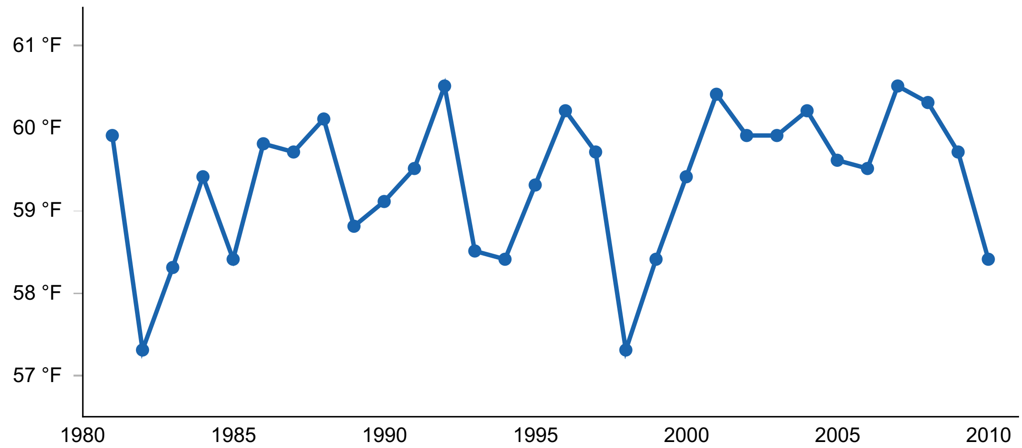


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PARADISE [USC00046685], Chico, CA
- (2) DOBBINS 1 S [USC00042456], Dobbins, 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 colluvium and residuum from volcanic rocks. The typical depth range is moderately deep to deep; generally soils are 20 to 50 inches deep to a contact with restrictive bedrock. Deeper soils occur in areas where colluvium has accumulated from upslope. Shallower areas occur where bedrock topography is very irregular or where significant erosion has occurred. The particle-size control section is fine-loamy, and surface textures include gravelly, very gravelly or stony loam. Gravels (<3 inch diameter) on the soil surface range from 0 to 20% cover and larger fragments (≥3 inch diameter) range from 5 to 15% cover. In the soil profile gravels range from 10 to 20% by volume and larger fragments range from 0 to 20% by volume. The soils associated with this ecological site are well drained. Permeability is moderately slow to moderate. Available Water Storage (AWS) in the profile ranges from 3 to 6 inches. Surface pH ranges from 6.3 to 7 while subsurface reaction is from 6.3 to 6.7. The most common soils correlated to this ecological site are Supan (fine-loamy, mixed, superactive, mesic Pachic Argixerolls), and Ultic Haploxeralfs.

Table 5. Representative soil features

Parent material	(1) Colluvium–volcanic rock (2) Residuum–volcanic breccia
Surface texture	(1) Stony loam (2) Gravelly loam (3) Very stony loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	20–50 in
Soil depth	20–50 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	5–15%
Available water capacity (0-40in)	2–6.4 in
Soil reaction (1:1 water) (0-10in)	6.3–7
Subsurface fragment volume <=3" (0-60in)	5–20%
Subsurface fragment volume >3" (0-60in)	0–20%

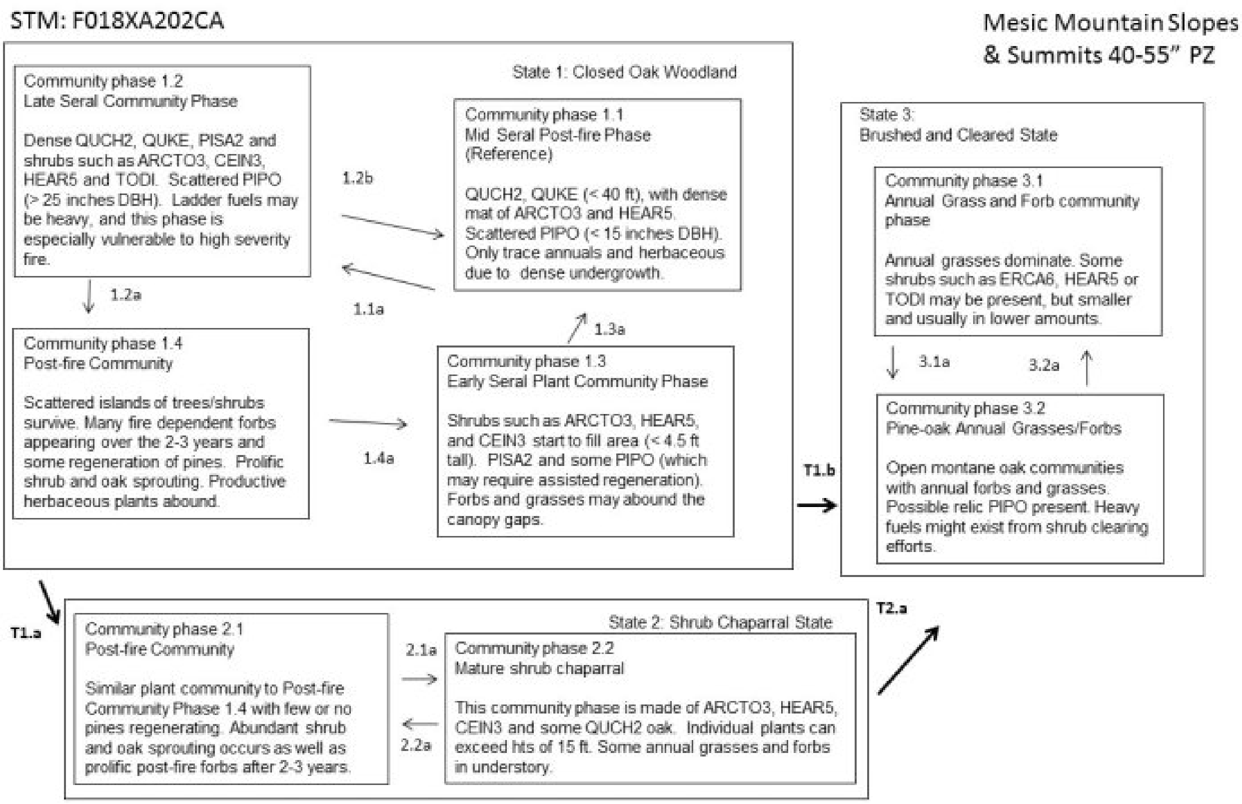
Table 6. Representative soil features (actual values)

Drainage class	Somewhat poorly drained to well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	2–60 in
Soil depth	2–60 in

Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–60%
Available water capacity (0-40in)	0.3–8 in
Soil reaction (1:1 water) (0-10in)	6.1–7.8
Subsurface fragment volume <=3" (0-60in)	0–50%
Subsurface fragment volume >3" (0-60in)	0–85%

Ecological dynamics

State and transition model



Community pathways and Transitions

T1.a This transition occurs after decades of little to no disturbance agents, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire then results in a system dominated by shrubs and other fire-adapted plant species, upon revegetating. Shrubs adapted to this system sprout and seed at a much higher rate than the tree component, leading to chaparral dominated systems.

T1.b This transition occurs after repeated fires or active brush management and enough browsing/grazing pressure to maintain an open shrub free system.

1.1a This community pathway occurs after several growing seasons without disturbance and/or fuels (alternatively vegetation management).

1.2a This community pathway occurs after a moderate severity fire. Conditions are favorable to the germination of conifers over the following 5 to 10 years post-fire.

1.2b This community pathway occurs after wind throw (alternatively fuels/vegetation management) of woody species, resulting in more open conditions.

1.3a This community pathway occurs over time with no disturbances or management actions. Some self-thinning may occur of the conifers.

1.4a This community pathway occurs with normal growth and progression and active (or assisted) recruitment of young ponderosa pine trees.

T2.a This transition occurs after repeated fires or active brush management and enough browsing/grazing pressure to maintain an open shrub free system.

2.1a This community pathway occurs over time with no management action.

2.2a This community pathway occurs following a high intensity fire.

3.1a This community pathway occurs over time without disturbance and /or removal of grazing pressure allows seedlings to establish, returning to a more open pine/chaparral community.

3.2a This community pathway occurs with high intensity fire or ongoing brush management and/or active grazing management.

State 1
Closed Oak Woodland

Community 1.1
Mid Seral Post-fire Phase (Reference)

QUCH2, QUKE (< 40 ft), with dense mat of ARCTO3 and HEAR5. Scattered PIPO (< 15 inches DBH). Only trace annuals and herbaceous due to dense undergrowth.

Community 1.2
Late Seral Community Phase

Dense QUCH2, QUKE, PISA2 and shrubs such as ARCTO3, CEIN3, HEAR5 and TODI. Scattered PIPO (> 25 inches DBH). Ladder fuels may be heavy, and this phase is especially vulnerable to high severity fire.

Community 1.3
Early Seral Plant Community Phase

Shrubs such as ARCTO3, HEAR5, and CEIN3 start to fill area (< 4.5 ft tall). PISA2 and some PIPO (which may require assisted regeneration). Forbs and grasses may abound the canopy gaps.

Community 1.4
Post-fire Community

Scattered islands of trees/shrubs survive. Many fire dependent forbs appearing over the 2-3 years and some regeneration of pines. Prolific shrub and oak sprouting. Productive herbaceous plants abound.

Pathway 1.1a
Community 1.1 to 1.2

Mid Seral Post-fire Phase (Reference)

Late Seral Community Phase

1.1a This community pathway occurs after several growing seasons without disturbance and/or fuels (alternatively vegetation management).

Pathway 1.2b
Community 1.2 to 1.1

Late Seral Community Phase

Mid Seral Post-fire Phase (Reference)

1.2b This community pathway occurs after wind throw (alternatively fuels/vegetation management) of woody species, resulting in more open conditions.

Pathway 1.2a
Community 1.2 to 1.4

Late Seral Community Phase

Post-fire Community

1.2a This community pathway occurs after a moderate severity fire. Conditions are favorable to the germination of conifers over the following 5 to 10 years post-fire.

Pathway 1.3a
Community 1.3 to 1.1

Early Seral Plant Community Phase

Mid Seral Post-fire Phase (Reference)

1.3a This community pathway occurs over time with no disturbances or management actions. Some self-thinning may occur of the conifers.

Pathway 1.4a
Community 1.4 to 1.3

Post-fire Community

Early Seral Plant Community Phase

1.4a This community pathway occurs with normal growth and progression and active (or assisted) recruitment of young ponderosa pine trees.

State 2
Shrub Chaparral State

Community 2.1
Post-fire Community

Similar plant community to Post-fire Community Phase 1.4 with few or no pines regenerating. Abundant shrub and oak sprouting occurs as well as prolific post-fire forbs after 2-3 years.

Community 2.2
Mature shrub chaparral

This community phase is made of ARCTO3, HEAR5, CEIN3 and some QUCH2 oak. Individual plants can exceed hts of 15 ft. Some annual grasses and forbs in understory

Pathway 2.1a
Community 2.1 to 2.2

Post-fire Community **Mature shrub chaparral**

2.1a This community pathway occurs over time with no management action.

Pathway 2.2a
Community 2.2 to 2.1

Mature shrub chaparral **Post-fire Community**

2.2a This community pathway occurs following a high intensity fire.

State 3
Brushed and Cleared State

Community 3.1
Annual Grass and Forb community phase

Annual grasses dominate. Some shrubs such as ERCA6, HEAR5 or TODI may be present, but smaller and usually in lower amounts.

Community 3.2

Pine-oak Annual Grasses/Forbs

Open montane oak communities with annual forbs and grasses. Possible relic PIPO present. Heavy fuels might exist from shrub clearing efforts.

Pathway 3.1a
Community 3.1 to 3.2

Annual Grass and Forb community phase

Pine-oak Annual Grasses/Forbs

3.1a This community pathway occurs over time without disturbance and /or removal of grazing pressure allows seedlings to establish, returning to a more open pine/chaparral community.

Pathway 3.2a
Community 3.2 to 3.1

Pine-oak Annual Grasses/Forbs

Annual Grass and Forb community phase

3.2a This community pathway occurs with high intensity fire or ongoing brush management and/or active grazing management.

Transition T1.a
State 1 to 2

T1.a This transition occurs after decades of little to no disturbance agents, resulting in a build up of fuels and higher density of live vegetation (especially shrubs). A high severity, stand replacing fire then results in a system dominated by shrubs and other fire-adapted plant species, upon re-vegetating. Shrubs adapted to this system sprout and seed at a much higher rate than the tree component, leading to chaparral dominated systems.

Transition T1.b
State 1 to 3

T1.b This transition occurs after repeated fires or active brush management and enough browsing/grazing pressure to maintain an open shrub free system.

Transition T2.a
State 2 to 3

T2.a This transition occurs after repeated fires or active brush management and enough browsing/grazing pressure to maintain an open shrub free system.

Additional community tables

Inventory data references

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

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Contributors

Andrew Conlin

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	05/21/2025
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:**