USDA Natural Resources Conservation Service

Ecological site F018XE201CA
Granitic Hills and Mountains

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 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 18XE is located on moderate to steep mountains and hills in the Tehachapi Foothills east of Bakersfield. This LRU covers the lower slopes around the southern end of the Greenhorn Mountains, the western sides of Breckenridge Mountain and the Tehachapi Mountains. The elevation ranges from 500 to 6500 feet above sea level and the geology of the region is predominately granitoid (both unaltered and metamorphosed). Similar to LRU 18XC to the north, vegetation series include blue oak, needlegrass and annual grasslands, as well as chamise, ceanothus, mixed oaks, and foothill pine, although this LRU tends to be more arid than with an annual precipitation range of only 8 to 31 inches per year. The lower precipitation and higher evaporative losses mean that these soils may not be able to completely leach excess salts, leading to a build-up of calcium and/or sodium in the subsoil. The soil temperature regime in this LRU is thermic and the soil moisture regimes are both xeric and aridic.

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 6ae, Tehachapi Foothills.

Ecological site concept

This site is characterized by shallow to deep soils occurring on steep hills and mountains formed from granitic or schist parent material. Slopes typically range from 10 to 63%. Annual precipitation typically ranges from 12 to 17 inches per year. Elevation typically ranges from 3600 to 5000 feet. Generally, this concept occurs at the interface

between thermic and mesic soil temperature regimes; this site generally occurs at the interface between the thermic and mesic areas, and it includes both cool thermic and warm mesic areas.

The main drivers of plant communities in this site (relative to the ecological sites found at lower elevations) are the high available water capacity associated with the deeper soils, and cooler soil temperatures associated with borderline mesic soil temperature regimes. These conditions support closed-canopy oak woodlands with a high diversity of trees and shrubs. Common soil series correlated to this ecological site include Tweedy (Fine-loamy, mixed, superactive, mesic Typic Argixerolls), Edmundston (Coarse-loamy, mixed, superactive, mesic Pachic Haploxerolls) and Sorrell (Coarse-loamy, mixed, superactive, mesic Typic Argixerolls)

Vegetation includes closed oak woodland with interior live oak (Quercus wislizeni), California buckeye (Aesculus californica), California foothill pine (Pinus sabiniana) and blue oak (Quercus douglasii). Buckbrush (Ceanothus cuneatus), rubber rabbitbrush (Ericameria nauseosa), and alderleaf mahogany (Cercocarpus montanus) are common shrubs in the understory. Herbaceous plants such as soft chess (Bromus hordeaceus), cheatgrass (Bromus tectorum), blue grass (Poa spp.), and California buckwheat (Eriogonum fasciculatum) may occur in the understory, especially where there are canopy gaps, but herbaceous production is low (1000 to 2000 lbs per acre) due to low amounts of sunlight penetrating to the woodland floor. Understory production may be higher at the low end of the elevation range for this site where the canopy cover is more open.

Associated sites

F022AW003CA	**Shallow Mesic Mountains <40"ppt** This site commonly occurs nearby.

Table 1. Dominant plant species

Tree	(1) *Quercus wislizeni* (2) *Pinus sabiniana*
Shrub	(1) *Ceanothus cuneatus* (2) *Ericameria nauseosa*
Herbaceous	(1) *Bromus hordeaceus* (2) *Bromus tectorum*

Physiographic features

This ecological site generally occurs at elevations ranging from 3600 to 5000 feet, on slopes with gradient generally ranging from 20 to 55%.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Hillslope (2) Foothills > High hill (3) Foothills > Mountain slope (4) Foothills > Mountain valley
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	3,600–5,000 ft
Slope	20–55%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Low to high
Flooding frequency	None

Ponding frequency	None
Elevation	1,200–8,000 ft
Slope	2–75%

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 12 to 17 inches and usually falls from October to May. Mean annual temperature ranges from 53 to 55 degrees F with 114 to 141 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	114-141 days
Freeze-free period (characteristic range)	176-192 days
Precipitation total (characteristic range)	12-17 in
Frost-free period (actual range)	107-148 days
Freeze-free period (actual range)	171-197 days
Precipitation total (actual range)	12-20 in
Frost-free period (average)	128 days
Freeze-free period (average)	184 days
Precipitation total (average)	15 in

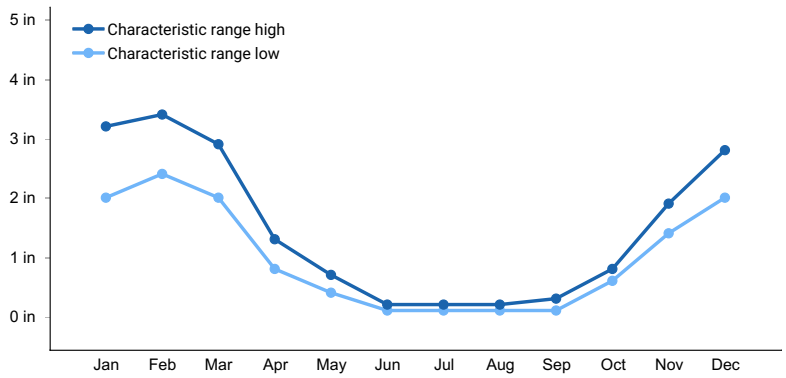


Figure 1. Monthly precipitation range

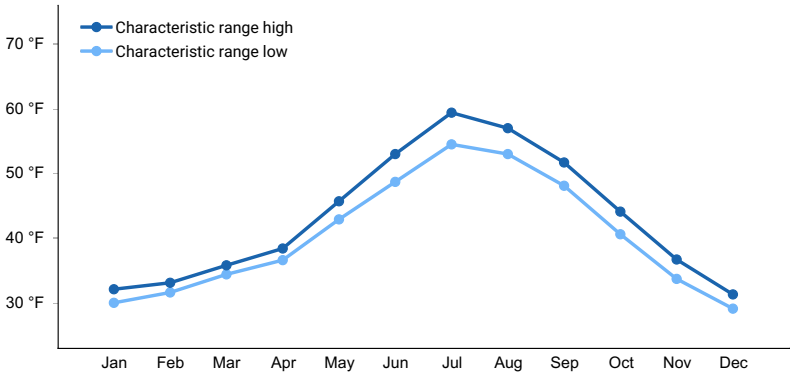


Figure 2. Monthly minimum temperature range

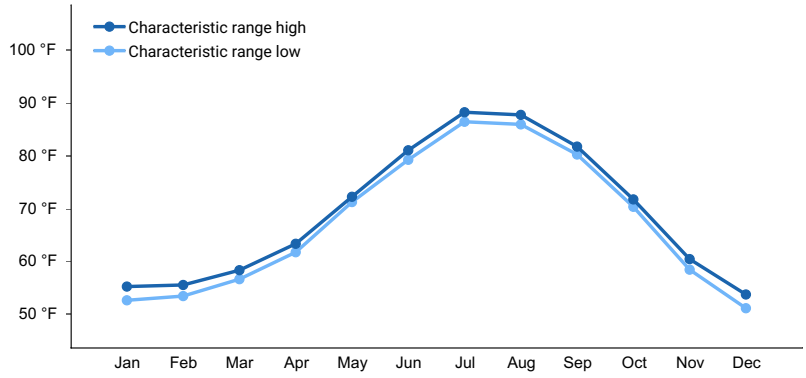


Figure 3. Monthly maximum temperature range

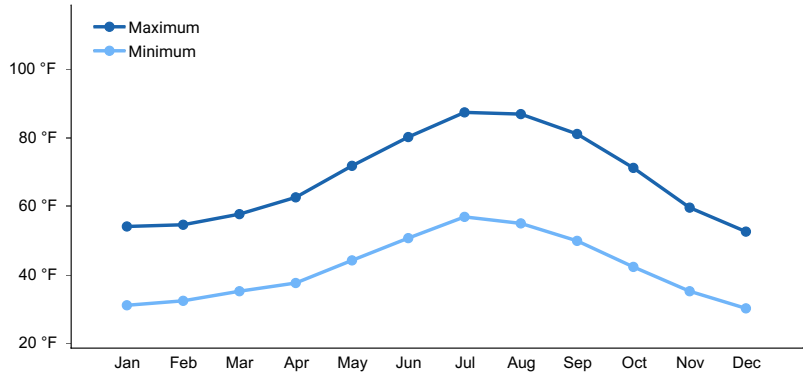


Figure 4. Monthly average minimum and maximum temperature

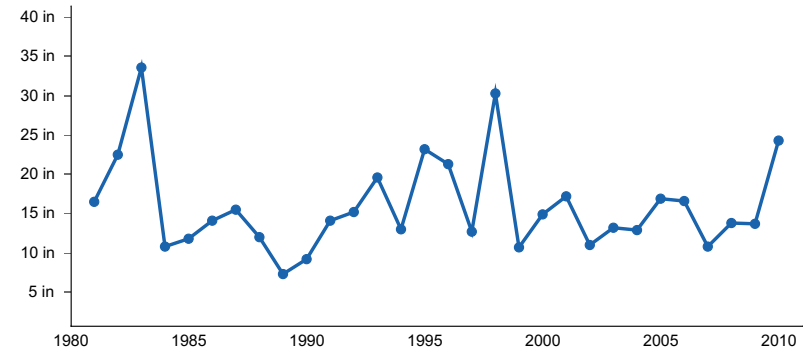


Figure 5. Annual precipitation pattern

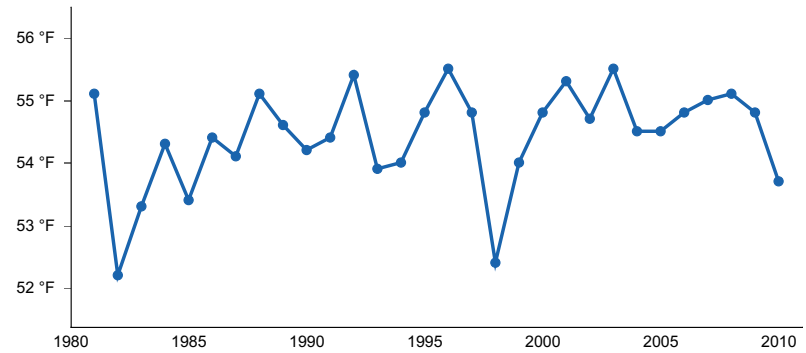


Figure 6. Annual average temperature pattern

Climate stations used

- (1) TEHACHAPI 4 SE [USC00048829], Tehachapi, CA
- (2) TEHACHAPI [USC00048826], Tehachapi, CA
- (3) 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 occur on cool thermic to mesic mountain slopes and in mountain valleys. They are formed in residuum from granitic rocks or mica schist. The soil depth class ranges from moderately deep to deep to restrictive bedrock. The particle size control section is generally coarse-loamy or fine-loamy; the surface texture is sandy loam, gravelly sandy loam, or bouldery loamy coarse sand. Gravels (<3 inch diameter) on the soil surface range from 5 to 60% cover and larger fragments (=3 inch diameter) range from 0 to 30% cover. Gravels range from 5 to 20% by volume throughout the profile, and larger fragments range from 0 to 10% by volume throughout the profile. Available Water Storage (AWS) in the profile generally ranges from 2 to 6 inches. Surface pH ranges from 6.5 to 7.5 and subsurface pH ranges from 6.5 to 7.6. Common soils correlated to this ecological site include Tweedy (Fine-loamy, mixed, superactive, mesic Typic Argixerolls) and Edmunston (Coarse-loamy, mixed, superactive, mesic Pachic Haploxerolls).

Table 5. Representative soil features

Parent material	(1) Residuum–granitoid (2) Residuum–mica schist
Surface texture	(1) Sandy loam (2) Gravelly sandy loam (3) Bouldery loamy coarse sand
Drainage class	Well drained
Permeability class	Moderate to rapid
Depth to restrictive layer	16–60 in
Soil depth	16–60 in
Surface fragment cover <=3"	5–60%
Surface fragment cover >3"	0–30%
Available water capacity (0-40in)	2–6 in
Soil reaction (1:1 water) (0-10in)	6.5–7.5
Subsurface fragment volume <=3" (0-60in)	5–20%
Subsurface fragment volume >3" (0-60in)	0–10%

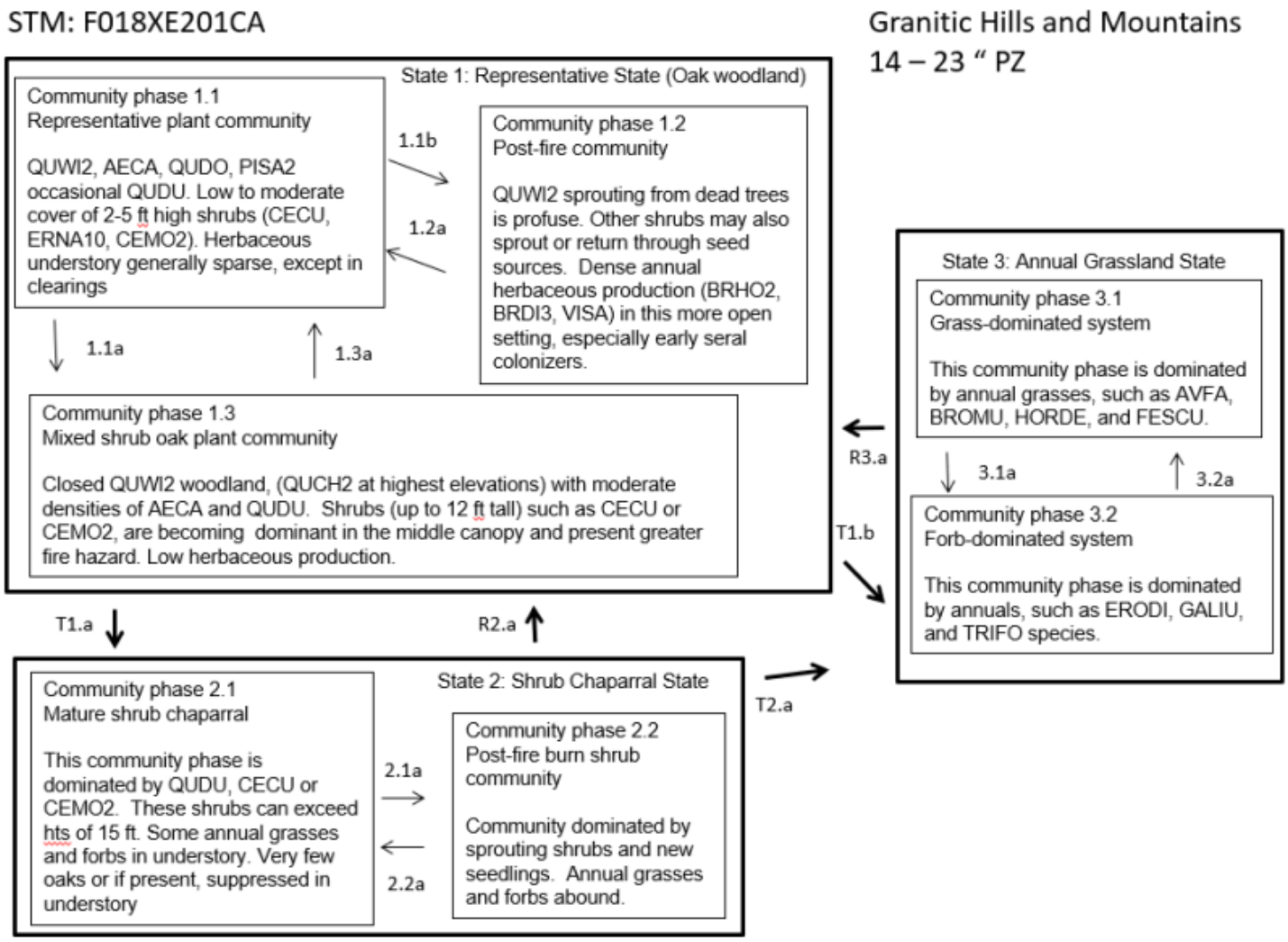
Table 6. Representative soil features (actual values)

Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to rapid
Depth to restrictive layer	10–60 in
Soil depth	0–60 in
Surface fragment cover <=3"	0–80%
Surface fragment cover >3"	0–50%

Available water capacity (0-40in)	0.7–7 in
Soil reaction (1:1 water) (0-10in)	5.4–8.4
Subsurface fragment volume <=3" (0-60in)	0–45%
Subsurface fragment volume >3" (0-60in)	0–35%

Ecological dynamics

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, AECA, QUDO, PISA2 occasional QUDU. Low to moderate cover of 2-5 ft high shrubs (CECU, ERNA10, CEMO2). Herbaceous understory generally sparse, except in clearings

Dominant plant species

- California foothill pine (*Pinus sabiniana*), tree
- interior live oak (*Quercus wislizeni*), tree
- California buckeye (*Aesculus californica*), tree
- coastal sage scrub oak (*Quercus dumosa*), tree
- buckbrush (*Ceanothus cuneatus*), shrub
- rubber rabbitbrush (*Ericameria nauseosa*), shrub
- alderleaf mountain mahogany (*Cercocarpus montanus*), shrub

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.

Dominant plant species

- interior live oak (*Quercus wislizeni*), tree
- soft brome (*Bromus hordeaceus*), grass
- ripgut brome (*Bromus diandrus*), grass
- garden vetch (*Vicia sativa*), grass

Community 1.3
Mixed shrub oak plant community

Closed QUWI2 woodland, (QUCH2 at highest elevations) with moderate densities of AECA and QUDU. Shrubs (up to 12 ft tall) such as CECU or CEMO2, are becoming dominant in the middle canopy and present greater fire hazard. Low herbaceous production.

Dominant plant species

- interior live oak (*Quercus wislizeni*), tree
- canyon live oak (*Quercus chrysolepis*), tree
- California buckeye (*Aesculus californica*), tree
- coastal sage scrub oak (*Quercus dumosa*), tree

Pathway P1.1b
Community 1.1 to 1.2

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 P1.1a
Community 1.1 to 1.3

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

Pathway P1.2a
Community 1.2 to 1.1

Normal growth and progression without disturbance.

Pathway P1.3a
Community 1.3 to 1.1

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.

Pathway P1.3b
Community 1.3 to 1.2

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).

State 2
Shrub Chaparral State

Community 2.1
Mature shrub chaparral

This community phase is dominated by QUDU, CECU or CEMO2. These shrubs can exceed hts of 15 ft. Some annual grasses and forbs in understory. Very few oaks or if present, suppressed in understory

Dominant plant species

- coastal sage scrub oak (*Quercus dumosa*), shrub
- buckbrush (*Ceanothus cuneatus*), shrub
- alderleaf mountain mahogany (*Cercocarpus montanus*), shrub

Community 2.2
Post-fire burn shrub community

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

Dominant plant species

- coastal sage scrub oak (*Quercus dumosa*), shrub
- buckbrush (*Ceanothus cuneatus*), shrub
- alderleaf mountain mahogany (*Cercocarpus montanus*), shrub

Pathway P2.1a
Community 2.1 to 2.2

This community pathway occurs following a high intensity wildfire.

Pathway P2.2a
Community 2.2 to 2.1

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 AVFA, BROMU, HORDE, and FESCU.

Dominant plant species

- wild oat (*Avena fatua*), grass
- soft brome (*Bromus hordeaceus*), grass
- cheatgrass (*Bromus tectorum*), grass
- barley (*Hordeum*), grass
- fescue (*Vulpia*), grass

Community 3.2
Forb-dominated system

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

Dominant plant species

- stork's bill (*Erodium*), other herbaceous
- bedstraw (*Galium*), other herbaceous
- clover (*Trifolium*), other herbaceous

Pathway P3.1a
Community 3.1 to 3.2

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

Pathway P3.2a
Community 3.2 to 3.1

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

Transition T1.b
State 1 to 2

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

Transition T1.b
State 1 to 3

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

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

Transition T2.a
State 2 to 3

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

Restoration pathway R3.a
State 3 to 1

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

Restoration pathway R3.b
State 3 to 2

This transition occurs after shrub encroachment into grassland

Additional community tables

Inventory data references

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

References

Natural Resources Conservation Service. . National Ecological Site Handbook.

Other references

Other References
Abrams, M.D. 1990. Adaptations and responses to drought in Quercus species of North America. Tree Physiology 7(1-4): 227-238.

Bartolome, J. W. 1987. California annual grassland and oak savannah. Rangelands 9:122-125.

Bolsinger, C. L. 1988. The hardwoods of Califonia's timberlands, woodlands, and savannas. Portland, OR: Pacific Northwest Forest and Range Experiment Station, Forest Service, USDA.

Callaway, R.M. 1992. Morphological and physiological responses of three California oak species to shade. International Journal of Plant Science. 153(3): 434-441.

Hickman, G.W., Perry, E.J. and R.M. Davis. 2011. Wood Decay Fungi in Landscape Trees. University of California. Integrated Pest Management Program. Agriculture and Natural Resources. Pest Notes 74109.

Howard, J.L. 1992. Pinus sabiniana. In: Fire Effects Information System. (Online) USDA, Forest Service Rocky Mountain Research Station, Fire Sciences Lab (Producer). Accessed: http://www.fs.fed.us/database/feis/[April 20, 2017]

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.

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.

USDA, Forest Service, Missoula Fire Sciences Laboratory. 2012. Information from LANDFIRE on fire regimes of California oak woodlands. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/fire_regimes/CA_oak_woodlands/all.html[2018, March 21].

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:**

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2. **Presence of water flow patterns:**

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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):**

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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:**
