

# Ecological site R018XI163CA

## Thermic Low Rolling Hills

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

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### 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, on 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 and Stockton, 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 characterized by low rolling hills composed of dissected erosional surfaces occurring over shallow (occasionally moderately deep) loamy soils of volcanic (tuffaceous) or metasedimentary (slate) origin. This site often occurs in complexes with R018XI164CA (Clayey Dissected Swales), on the upland, or mound positions. Precipitation typically ranges from 26 to 30 inches per year and elevation ranges from 50 and 1550 feet.

Low water balance and acidic, shallow soils prevent the establishment of woody vegetation, particularly at lower elevations of the foothills where precipitation is very low. Pentz, Whiterock and Daulton are among the most common soil components that are correlated to this ecological site. These soils are shallow. Pentz a shallow Ultic Haploxeroll, is a dark, loamy soil formed from andesitic tuffaceous sediments. Whiterock is, as the name implies, a much lighter in color, poorly developed, lithic xerorthent, formed from metasedimentary rock. Daulton is also a lithic xerorthent but Daulton soils are formed from dark colored slates.

This vegetation community consists of annual grasses and forbs. Dominant plants include soft brome (*Bromus hordeaceus*), wild oat (*Avena fatua*), and fillaree (*Erodium* spp.) with 60 to 70% of the annual production made up of these and other grasses.

## Associated sites

R018XI164CA	<b>Clayey Dissected Swales</b> This site commonly occurs nearby.
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## Similar sites

R018XI107CA	<b>Shallow, Undulating Volcanic Hills</b> Site relationships being developed.
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**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Bromus hordeaceus</i> (2) <i>Avena fatua</i>

## Physiographic features

This ecological site occurs on low rolling hills in foothill landscapes where it is typically found on south and west aspects with elevations ranging from 50 to 1550 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Foothills > Hill
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	50–1,550 ft
Slope	4–40%
Water table depth	0 in
Aspect	W, SE, S, SW

**Table 3. Representative physiographic features (actual ranges)**

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	20–3,000 ft
Slope	0–50%
Water table depth	0 in

## Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 26 to 30 inches and usually falls from October to May. Mean annual temperature ranges from 60 to 63 degrees F with 207 to 306 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	207-306 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	26-30 in
Frost-free period (actual range)	203-350 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	24-31 in
Frost-free period (average)	261 days
Freeze-free period (average)	365 days
Precipitation total (average)	28 in

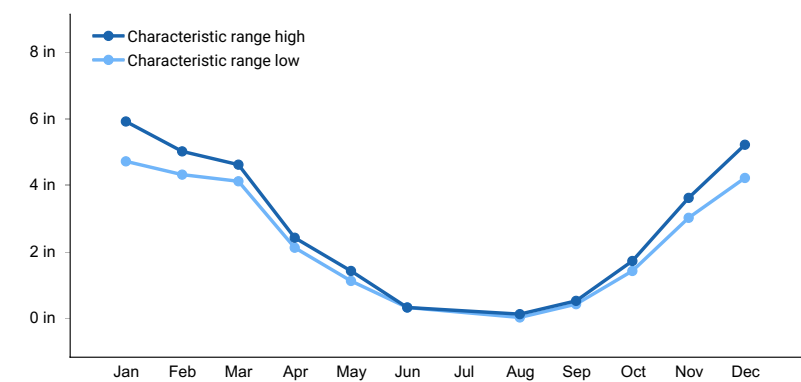


Figure 1. Monthly precipitation range

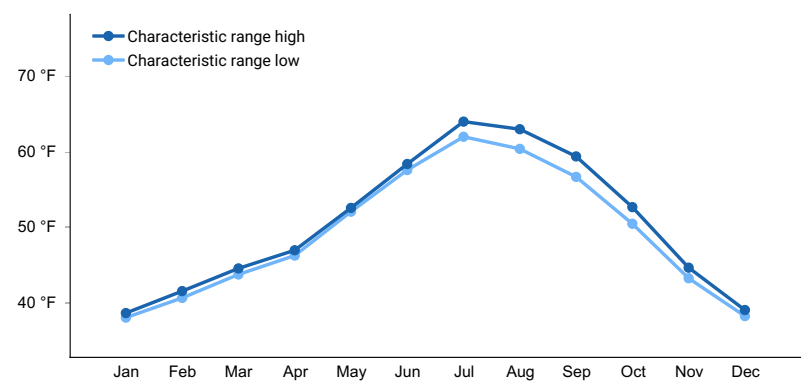
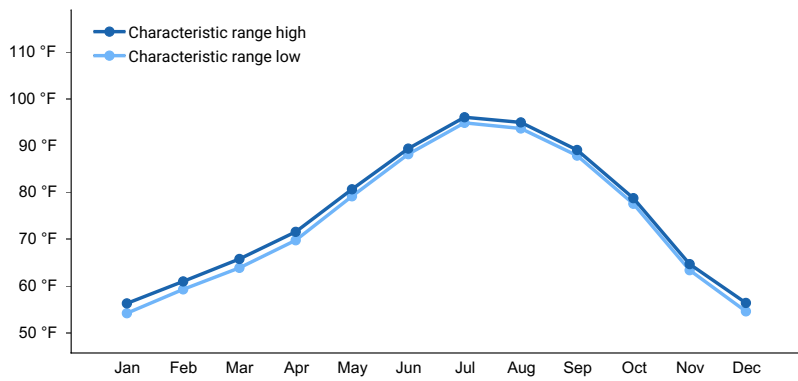
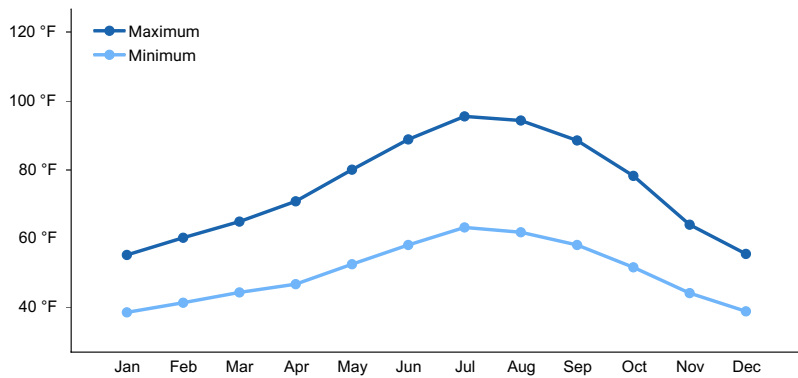


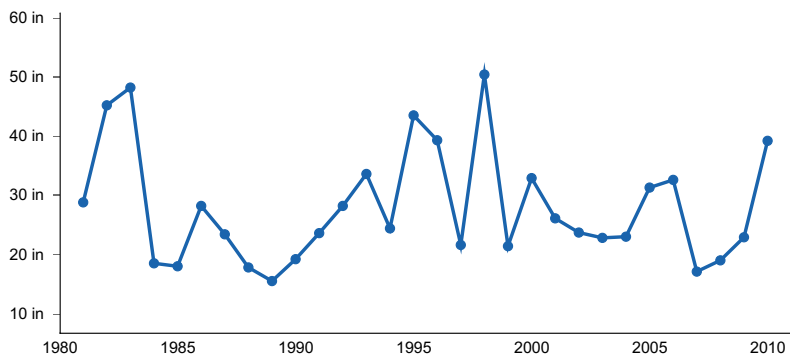
Figure 2. Monthly minimum temperature range



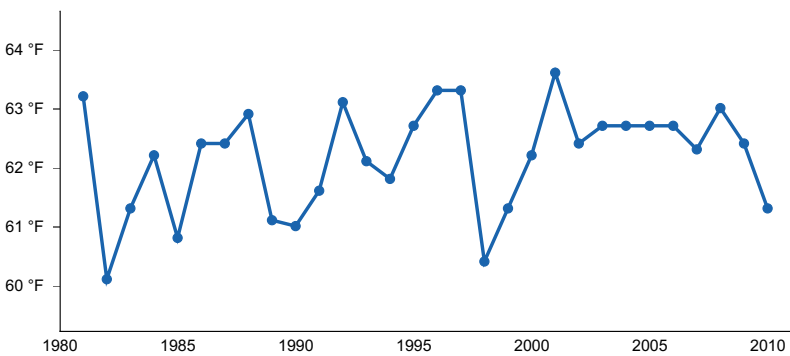
**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) NEW MELONES DAM HQ [USC00046174], Angels Camp, CA
- (2) CAMP PARDEE [USC00041428], Valley Springs, CA
- (3) OROVILLE [USC00046521], Oroville, CA

## Influencing water features

Due to the topographic position, this site does not have water features or wetlands.

## Wetland description

N/A

## Soil features

The soils in this ecological site are formed from the colluvium and residuum of tuffaceous and metasedimentary rock. These soils range from very shallow to moderately deep. The particle size control sections are to loamy, and surface textures include loams, gravelly loams and silt loams. The bedrock is a restrictive layer found between 4 and 26 inches of depth. Gravels (< 3 inch diameter) range from between 3 to 16 % cover, and larger fragments (= 3 inch diameter) range between 0 to 22%. Within the soil profile gravels range from 6 to 25% by volume and larger fragments occupy 0 to 3% volume. The soils in this ecological site are well drained and the permeability class ranges from moderately rapid to rapid. Available Water Capacity (AWC) is between 1 and 3.4 inches and the soil pH in the top 10 inches is between 5.4 and 6.7 and in the sub-horizons the pH is between 5 and 6.7.

Pentz, Whiterock and Daulton are shallow to bedrock and among the most common soil components that are correlated to this ecological site. Pentz a shallow Ultic Haploxeroll, is a dark, loamy soil over weakly consolidated basic tuff. Whiterock, much lighter in color, is a lithic xerorthent, over highly fractured and vertically tilted metasedimentary rock. Daulton is also a lithic xerorthent but Daulton soils are formed from dark colored slates.

**Table 5. Representative soil features**

Parent material	(1) Residuum–metavolcanics (2) Residuum–volcanic sandstone (3) Residuum–slate (4) Colluvium–metavolcanics
Surface texture	(1) Gravelly loam (2) Silt loam (3) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	4–26 in
Soil depth	4–26 in
Surface fragment cover <=3"	3–16%
Surface fragment cover >3"	0–22%
Available water capacity (0-40in)	1–3.4 in
Soil reaction (1:1 water) (0-10in)	5.4–6.7
Subsurface fragment volume <=3" (0-60in)	6–25%
Subsurface fragment volume >3" (0-60in)	0–3%

**Table 6. Representative soil features (actual values)**

Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid

Depth to restrictive layer	4–60 in
Soil depth	4–60 in
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0–60%
Available water capacity (0-40in)	0.2–7 in
Soil reaction (1:1 water) (0-10in)	4.5–7.3
Subsurface fragment volume <=3" (0-60in)	0–74%
Subsurface fragment volume >3" (0-60in)	0–39%

## Ecological dynamics

### State and transition model

STM: R018XI163CA

Thermic Low Rolling Hills

14-22" PZ

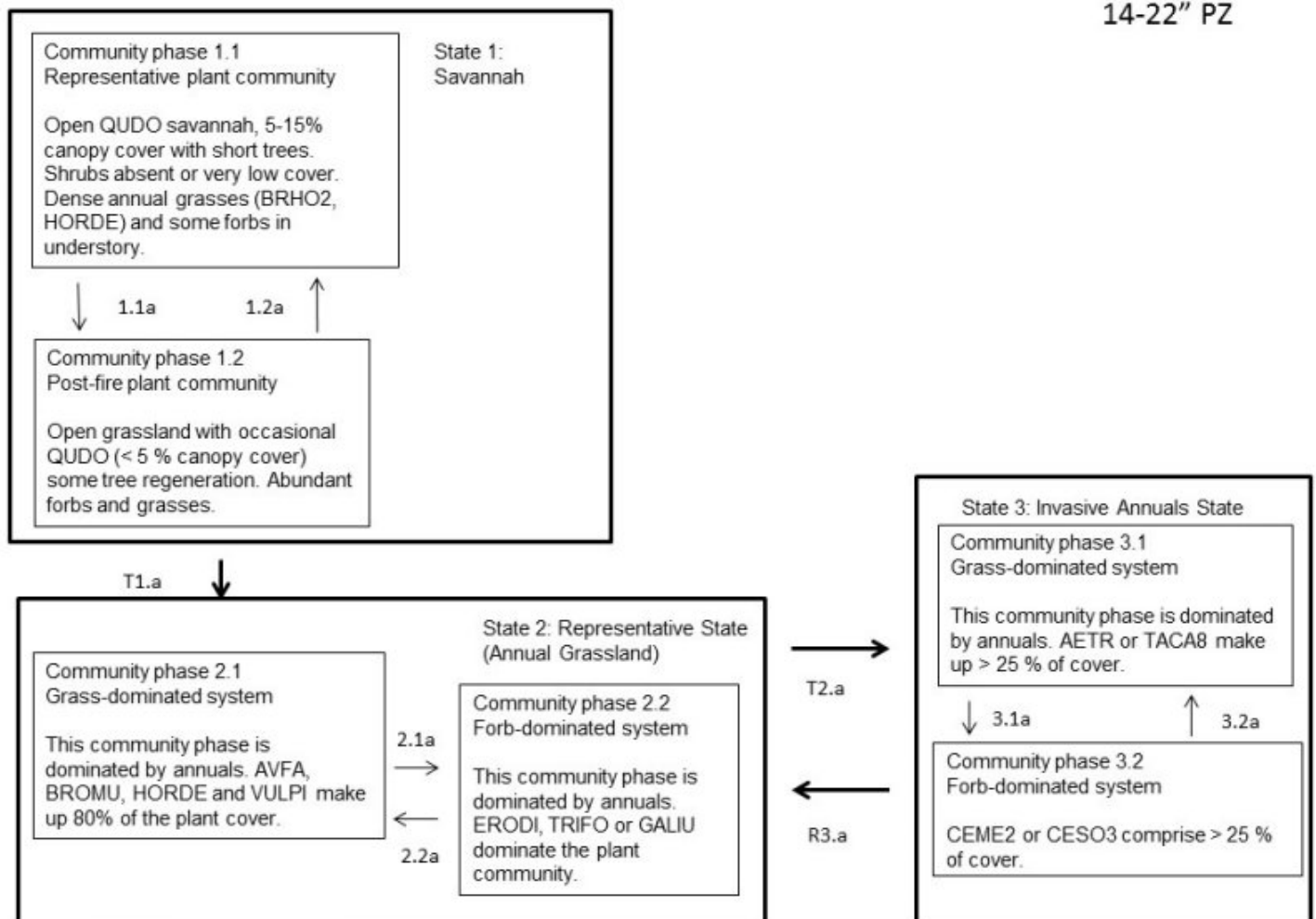


Figure 7. State and Transition Model.

## Community pathways and Transitions

T1.a This transition occurs after mechanical clearing and/or grazing management that results in loss of oak and acorn (seed) source.

1.1a Moderate to light intensity fire, resulting in mortality of some of the overstory trees. Mechanized clearing of some of the trees can also promote this community phase pathway.

1.2a This community pathway occurs over time as young oaks mature. Grazing dynamics often help maintain this state relatively open.

T2.a This transition occurs when undesirable invasive plants become established.

2.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

2.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

R3.a. This restoration pathway occurs with integrated weed management and may require mowing, herbicides, and/or biological control.

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

3.2a This community path occurs as invasive grass species become dominant, often in response to increases in litter following high winter precipitation years.

**Figure 8. Community Pathways and Transitions.**

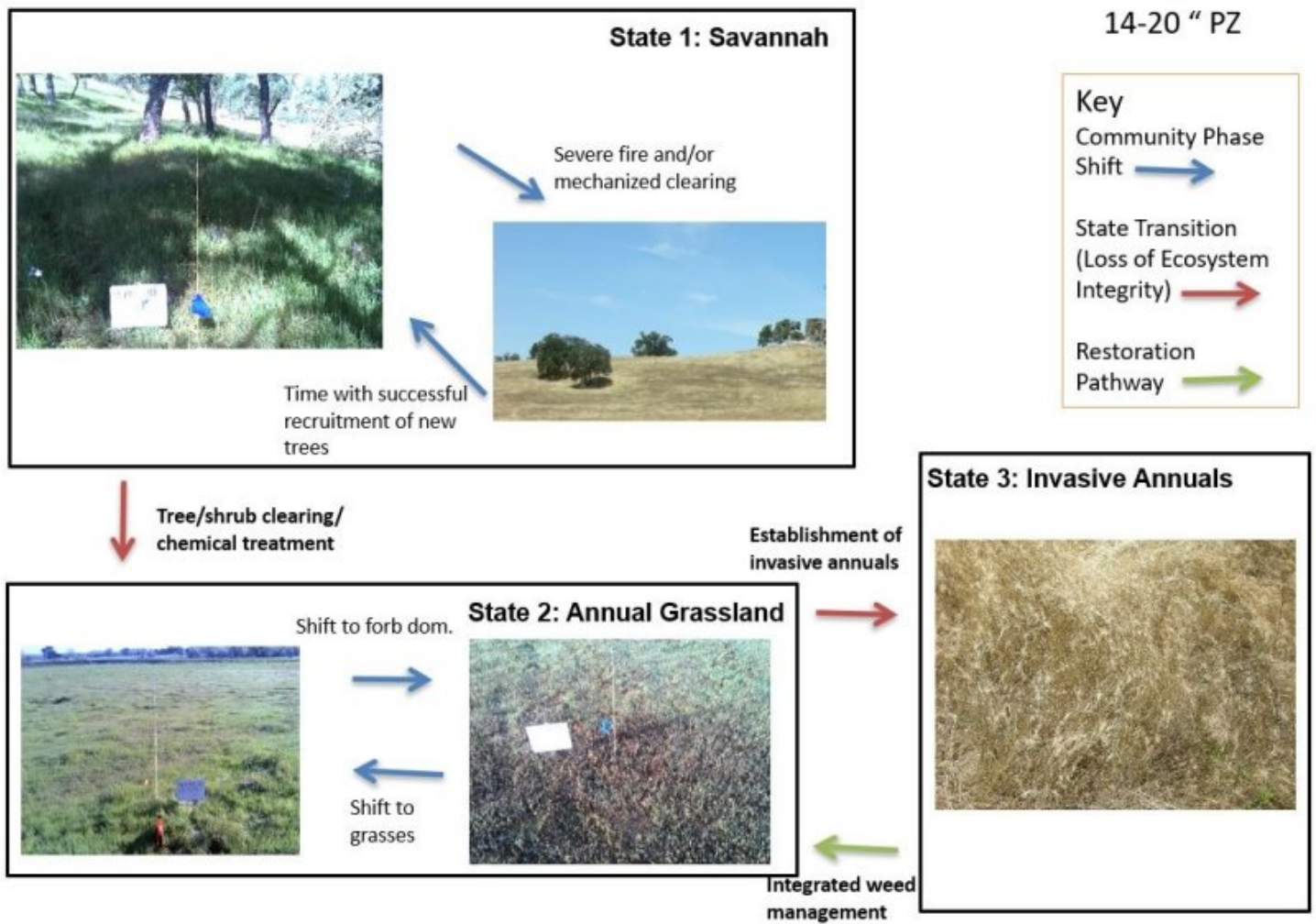


Figure 9. STM Photos

## State 1 Savannah

### Community 1.1 Representative plant community



Open QUDO savannah, 5-15% canopy cover with short trees. Shrubs absent or very low cover. Dense annual grasses (BRHO2, HORDE) and some forbs in understory.

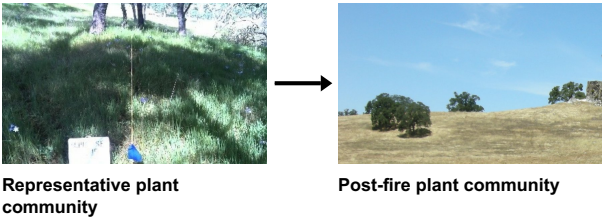
### Community 1.2 Post-fire plant community





Open grassland with occasional QUDO (< 5 % canopy cover) some tree regeneration. Abundant forbs and grasses.

**Pathway 1.1a**  
**Community 1.1 to 1.2**



Moderate to light intensity fire, resulting in mortality of some of the overstory trees. Mechanized clearing of some of the trees can also promote this community phase pathway.

**Pathway 1.2a**  
**Community 1.2 to 1.1**



This community pathway occurs over time as young oaks mature. Grazing dynamics often help maintain this state relatively open.

**State 2**  
**Annual Grassland**

**Community 2.1**  
**Grass-dominated system**



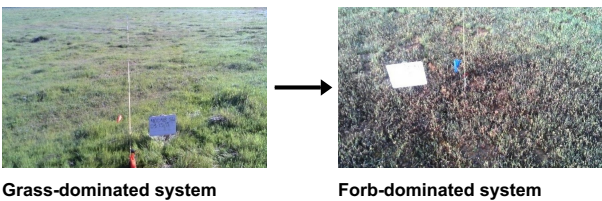
This community phase is dominated by annuals. AVFA, BROMU, HORDE and VULPI make up 80% of the plant cover.

**Community 2.2**  
**Forb-dominated system**



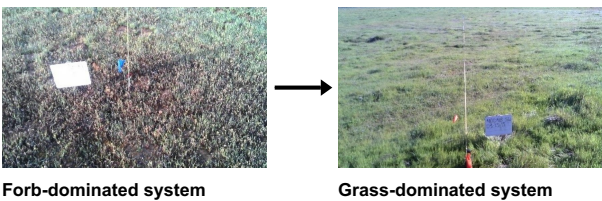
This community phase is dominated by annuals. ERODI, TRIFO or GALIU dominate the plant community.

**Pathway 2.1a**  
**Community 2.1 to 2.2**



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

**Pathway 2.2a**  
**Community 2.2 to 2.1**



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

### **State 3**

#### **Invasive Annuals State**

#### **Community 3.1**

##### **Grass-dominated system**



This community phase is dominated by annuals. AETR or TACA8 make up > 25 % of cover.

#### **Transition T1.a**

##### **State 1 to 2**

This transition occurs after mechanical clearing and/or grazing management that results in loss of oak and acorn (seed) source.

#### **Transition T2.a**

##### **State 2 to 3**

This transition occurs when undesirable invasive plants become established.

#### **Restoration pathway R3.a**

##### **State 3 to 2**

This restoration pathway occurs with integrated weed management and may require mowing, herbicides, and/or biological control.

### **Additional community tables**

#### **Inventory data references**

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

### **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	05/10/2025
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:**

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