USDA Natural Resources
Conservation Service

Ecological site R018XI164CA
Clayey Dissected Swales

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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, 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 characterized by low rolling hills composed of dissected erosional surfaces. This site occurs on swale positions on shallow to moderately deep soils originating from volcanic parent material or sandstone and often occurs in complexes with R018XI163CA which occurs on mound positions. Soil particle size class is clayey and a duripan is sometimes present. Precipitation typically ranges from 28 to 31 inches per year, and elevation ranges from 150 to 650 feet.

Low water balance and clayey soils prevent the establishment of woody vegetation and reduce production of the herbaceous plant component. However, these water receiving positions on the landscape make the land suitable for rangelands and dryland farming, given proper drainage. The main soil component associated with this ecological site is Peters. Peters is a clayey, smectitic, thermic, shallow Typic Haploxeroll.

This vegetation community consists of annual grasses and forbs. Dominant plants include soft brome (Bromus hordeaceus), wild oat (Avena fatua), fillaree (Erodium spp.), and occasional rushes and sedges.

Associated sites

R018XI163CA	**Thermic Low Rolling Hills** This site commonly occurs nearby.

Similar sites

R018XE101CA	**Very Deep Alkaline Alluvium** Site relationships being developed.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bromus hordeaceus* (2) *Avena fatua*

Physiographic features

This ecological site occurs in swale positions on low rolling hills in Foothills landscapes. The site is typically found on south and west aspects with elevations ranging from 150 to 650 feet.

Table 2. Representative physiographic features

Slope shape across	(1) Concave
Slope shape up-down	(1) Concave
Landforms	(1) Foothills > Hill > Swale
Runoff class	Medium
Flooding frequency	None
Ponding duration	Not specified
Ponding frequency	None
Elevation	46–198 m
Slope	2–9%
Ponding depth	0 cm
Aspect	W, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	30–366 m
Slope	0–15%
Ponding depth	0–5 cm

Climatic features

This ecological site is characterized by hot, dry summers and cool, wet winters, a typical Mediterranean climate. Mean annual precipitation ranges from 28 to 31 inches and usually falls from October to May. Mean annual temperature ranges from 60 to 63 degrees F with 212 to 237 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	212-237 days
Freeze-free period (characteristic range)	311-365 days
Precipitation total (characteristic range)	711-787 mm
Frost-free period (actual range)	210-248 days
Freeze-free period (actual range)	284-365 days
Precipitation total (actual range)	686-787 mm
Frost-free period (average)	226 days
Freeze-free period (average)	335 days
Precipitation total (average)	762 mm

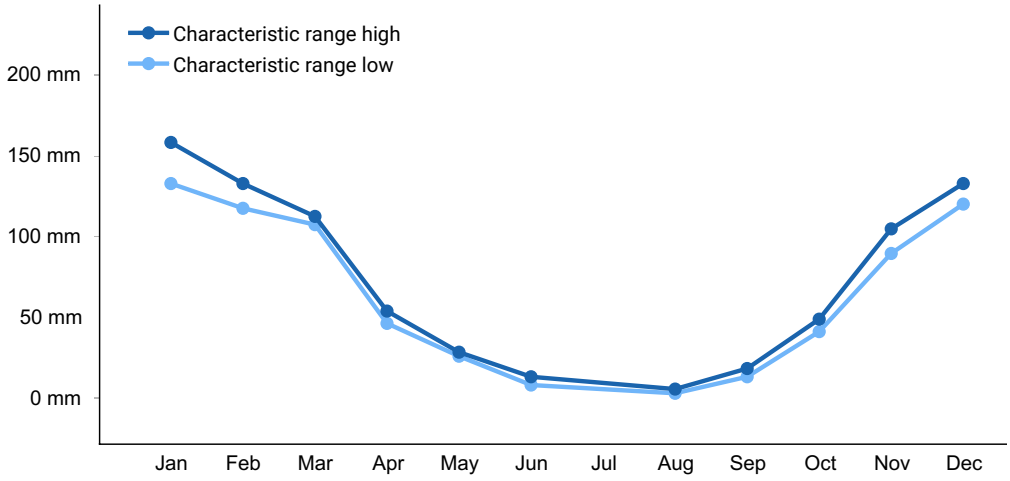


Figure 1. Monthly precipitation range

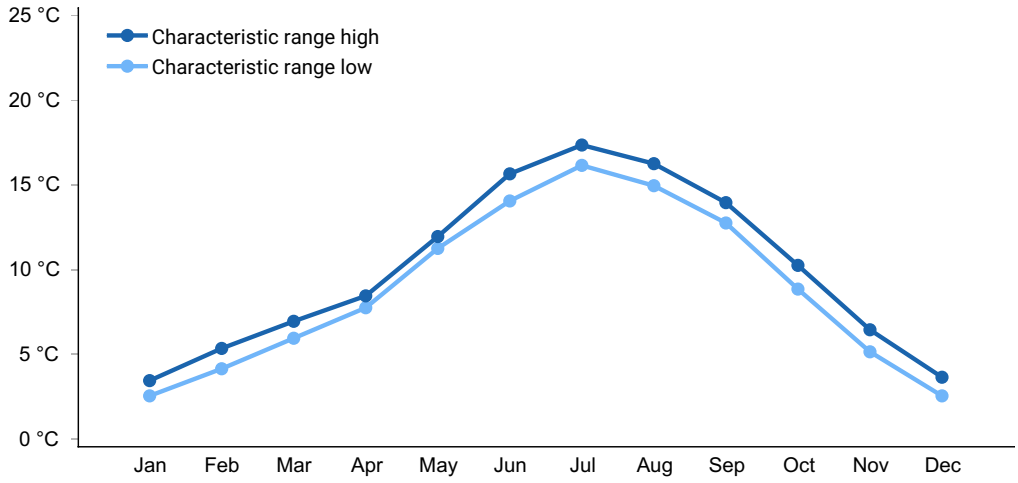


Figure 2. Monthly minimum temperature range

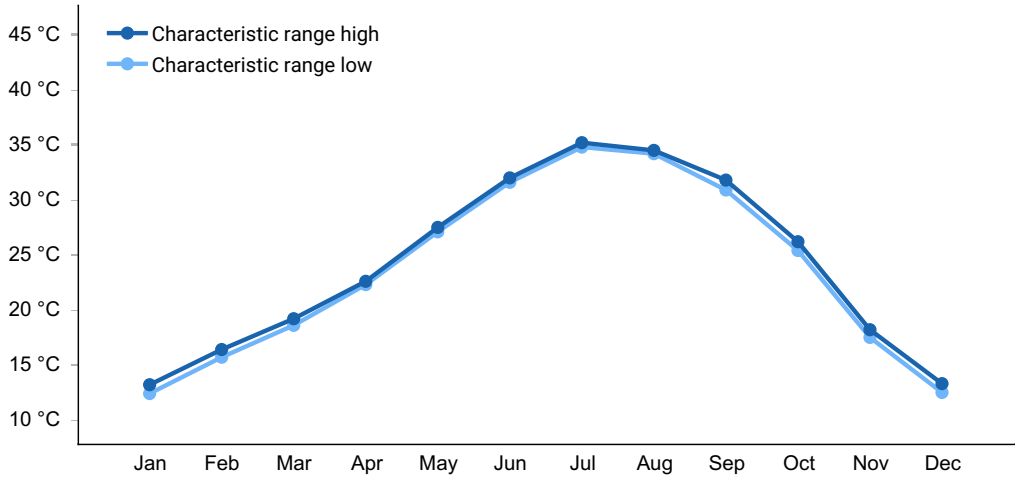


Figure 3. Monthly maximum temperature range

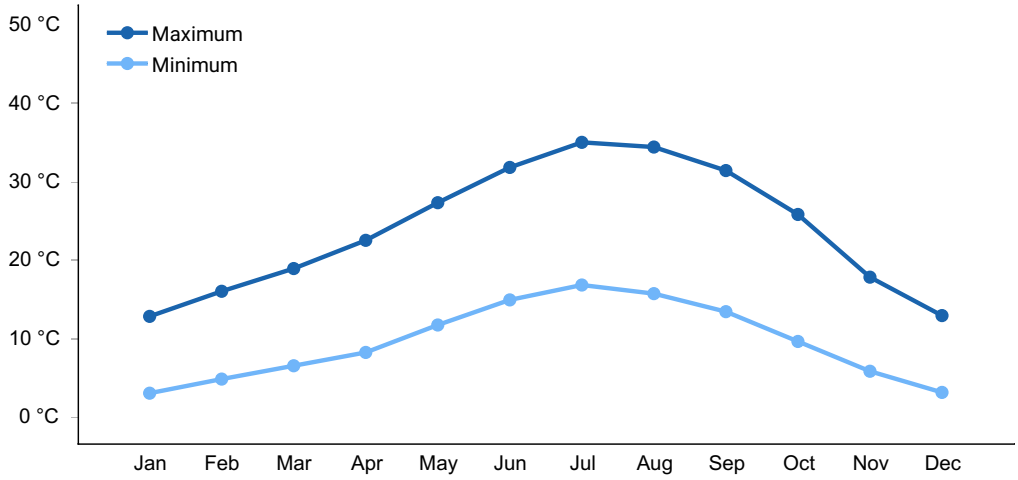


Figure 4. Monthly average minimum and maximum temperature

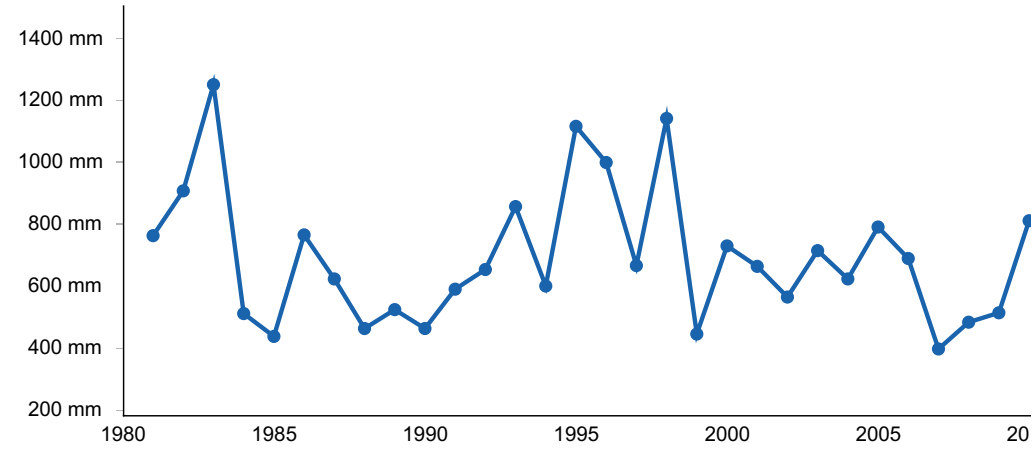


Figure 5. Annual precipitation pattern

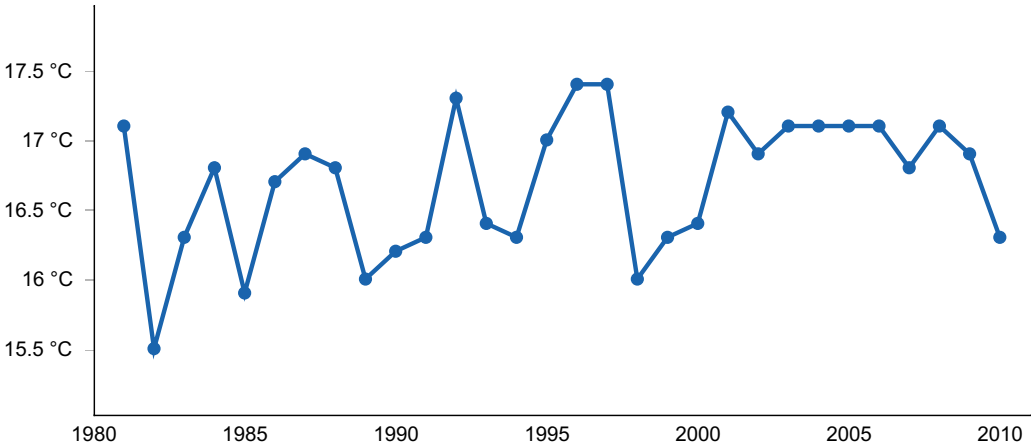


Figure 6. Annual average temperature pattern

Climate stations used

- (1) OROVILLE [USC00046521], Oroville, CA
- (2) OROVILLE MUNI AP [USW00093210], Oroville, CA
- (3) CHICO UNIV FARM [USC00041715], Chico, 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 colluvium or residuum derived from basic tuff. These soils are shallow and the particle size control section is clayey. Surface textures include silty clay loams, clays and cobbly clays. The bedrock is a paralithic

restrictive layer found between 14 and 19 inches of depth. Gravels (< 3 inch diameter) range between 0 to 7% cover and larger fragments (= 3 inch diameter) are between 0 and 6%. Within the soil profile gravels range between 3 to 16% volume and larger fragments make up 1 to 9% volume. The soils in this ecological site are well drained and the permeability class is moderately slow. Available Water Capacity (AWC) is between 1.9 and 3.1 inches and the soil pH in the top 10 inches is between 4.5 and 6.1 and in the sub-horizons between 5.8 and 7.1.

The most common soil correlated to this ecological site is Peters (Clayey, smectitic, thermic, shallow Typic Haploxerolls) derived from andesitic tuff that was deposited by wind, water or both, primarily associated with the Mehrten formation. The grain size distribution of these volcaniclastic rocks is dominantly sand sized, but there can be layers with volcanic conglomerate or andesitic coarse fragments.

Table 5. Representative soil features

Parent material	(1) Residuum–tuff (2) Colluvium–tuff (3) Alluvium–fanglomerate
Surface texture	(1) Cobbly clay (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow
Depth to restrictive layer	36–48 cm
Soil depth	36–48 cm
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	0–6%
Available water capacity (0-101.6cm)	4.83–7.87 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–6.1
Subsurface fragment volume <=3" (0-152.4cm)	3–16%
Subsurface fragment volume >3" (0-152.4cm)	1–9%

Table 6. Representative soil features (actual values)

Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to rapid

Depth to restrictive layer	10–102 cm
Soil depth	10–102 cm
Surface fragment cover <=3"	0–18%
Surface fragment cover >3"	0–16%
Available water capacity (0-101.6cm)	1.27–14.99 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–7.3
Subsurface fragment volume <=3" (0-152.4cm)	0–43%
Subsurface fragment volume >3" (0-152.4cm)	0–32%

Ecological dynamics

State and transition model

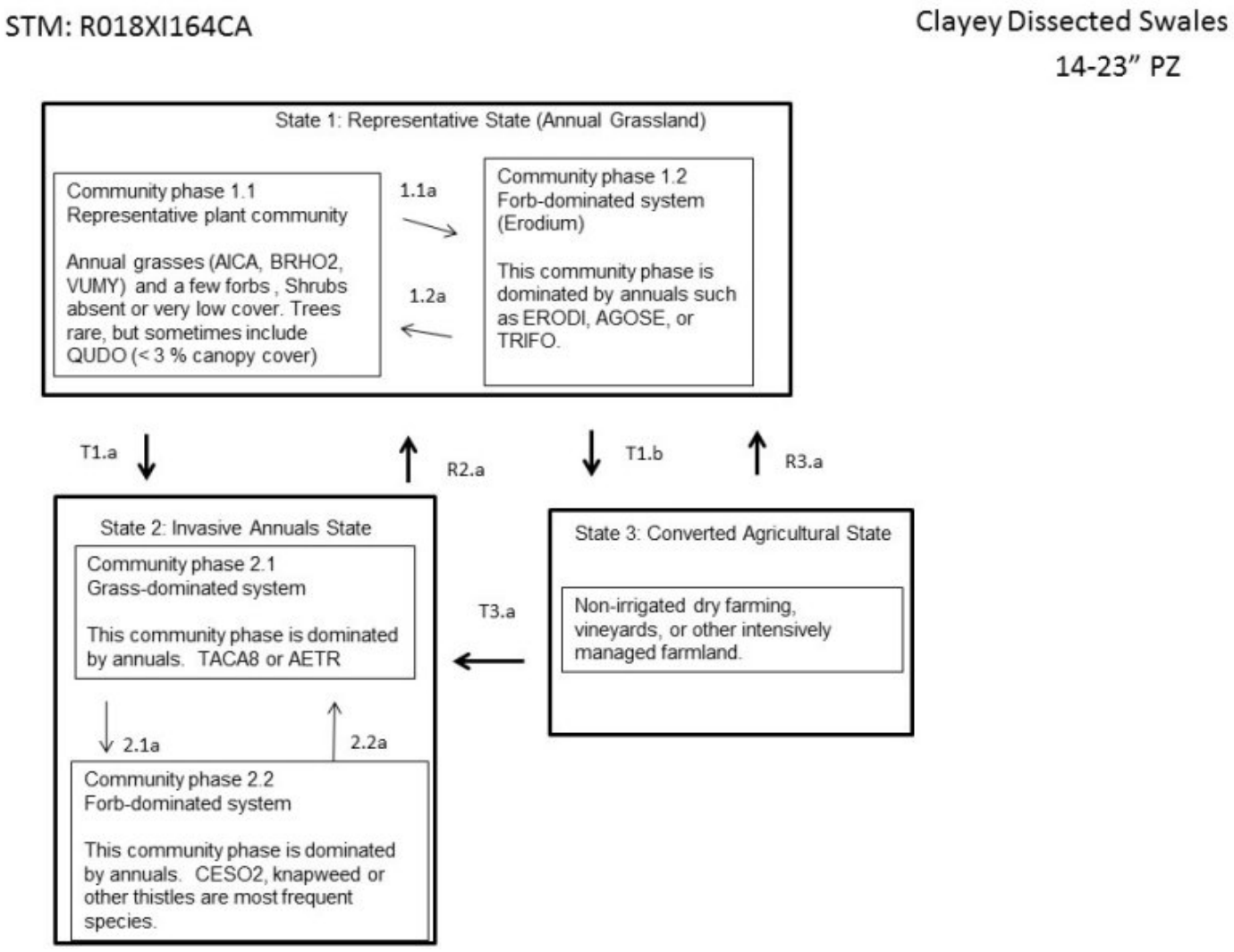


Figure 7. State and Transition Model.

Community pathways and Transitions

T1.a This transition occurs after invasive plants posing extreme economic/environmental issues become established.

T1.b This transition occurs after planting of commercial agriculture products. This transition can range from highly intensive operations that plow and disrupt the solum to no-till operations (dry farming or otherwise). The hydrology may also be significantly altered in this transition.

1.1a This community pathway occurs as forbs become more dominant, often following low winter precipitation and reduced litter layers.

1.2a This community pathway occurs as grasses become more dominant, often in response to higher litter levels.

R2.a This transition occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

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

2.2a This community pathway occurs as invasive grass species become dominant, often in response to high winter precipitation and greater cover of litter.

T3.a. This transition occurs after abandoning agricultural operations or mismanagement of farming that allows for noxious weeds to establish. The natural succession tends to produce plant communities of lesser economic importance or value.

R3.a This restoration pathway occurs with land use change to pasture land. This transition likely requires seeding of grasses and possibly weed management.

Figure 8. Community Pathways and Transitions.

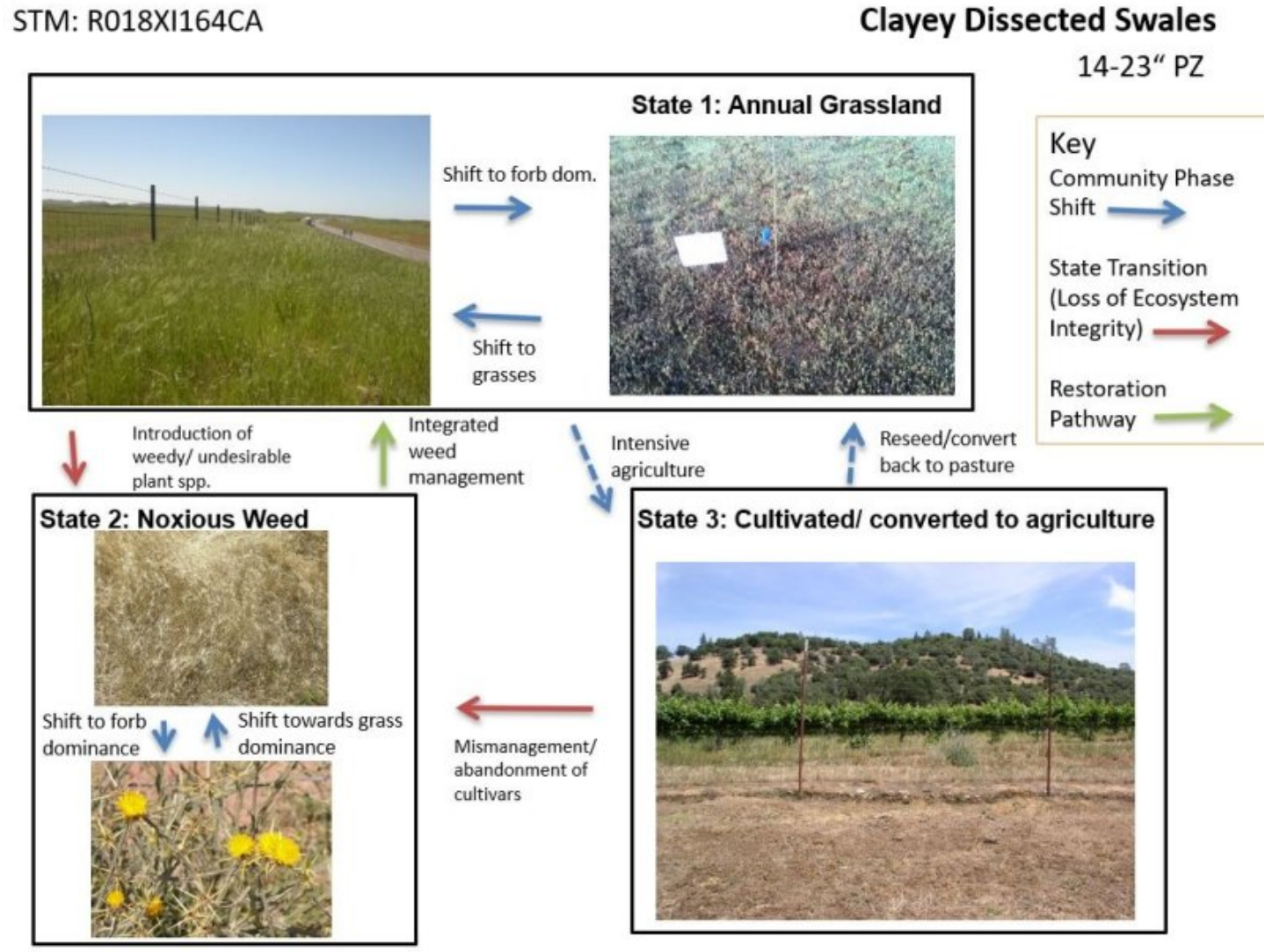


Figure 9. STM Photos.

State 1
Representative State (Annual Grassland)

Community 1.1
Representative plant community

Annual grasses (AICA, BRHO2, VUMY) and a few forbs , Shrubs absent or very low cover. Trees rare, but sometimes include QUDO (< 3 % canopy cover)

Community 1.2
Forb-dominated system (Erodium)

This community phase is dominated by annuals such as ERODI, AGOSE, or TRIFO.

Pathway 1.1a
Community 1.1 to 1.2

Representative plant community

Forb-dominated system (Erodium)

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

Pathway 1.2a
Community 1.2 to 1.1

Forb-dominated system (Erodium)

Representative plant community

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

State 2
Invasive Annuals State

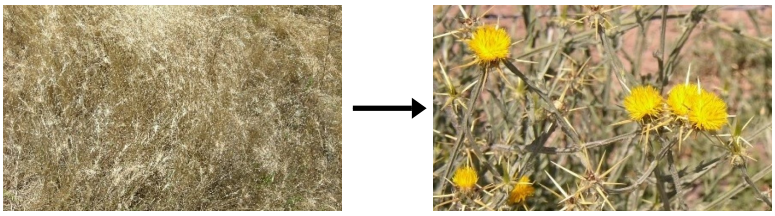
Community 2.1
Grass-dominated system

This community phase is dominated by annuals. TACA8 or AETR

Community 2.2
Forb-dominated system

This community phase is dominated by annuals. CESO2, knapweed or other thistles are most frequent species.

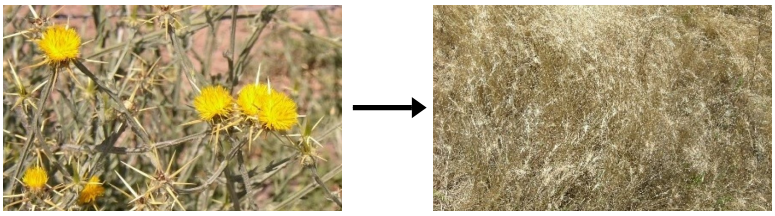
Pathway 2.1a
Community 2.1 to 2.2



Grass-dominated system | Forb-dominated system

This community pathway occurs as invasive forb species become dominant, often following low winter precipitation and reduced litter layers.

Pathway 2.2a
Community 2.2 to 2.1



Forb-dominated system | Grass-dominated system

This community pathway occurs as invasive grass species become dominant, often in response to high winter precipitation and greater cover of litter.

State 3
Converted Agricultural State

Community 3.1
Non-irrigated dry farming, vineyards, or other intensively managed farmland.

Transition T1.a
State 1 to 2

This transition occurs after invasive plants posing extreme economic/environmental issues become established.

Transition T1.b
State 1 to 3

This transition occurs after planting of commercial agriculture products. This transition can range from highly intensive operations that plow and disrupt the solum to no-till operations (dry farming or otherwise). The hydrology may also be significantly altered in this transition.

Restoration pathway R2.a
State 2 to 1

This transition occurs with integrated weed management. May require mowing, herbicides, and/or biological control.

Restoration pathway R3.a
State 3 to 1

This restoration pathway occurs with land use change to pasture land. This transition likely requires seeding of grasses and possibly weed management.

Restoration pathway T3.a
State 3 to 2

This transition occurs after abandoning agricultural operations or mismanagement of farming that allows for noxious weeds to establish. The natural succession tends to produce plant communities of lesser economic importance or value.

Additional community tables

Inventory data references

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

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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	05/21/2025
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):**

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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:**
