USDA Natural Resources
Conservation Service

Ecological site R018XI111CA
Low Gradient, Concave Depressions

Last updated: 4/24/2024
Accessed: 05/20/2025

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 in drainageways, depressions or otherwise concave positions on nearly level to strongly sloping hills where water tends to accumulate. Soils are moderately deep to deep and formed from alluvium or residuum from granitic, metavolcanic, and metasedimentary origin. Soils generally tend to have redox depletions or some evidence of aquic conditions for part of the year during normal years. Mean annual precipitation typically ranges from 27 to 34 inches. Elevation ranges from 1000 to 2000 feet.

Ephemeral channels may be associated with this site, containing water during the winter, spring, and early summer months. However, obligate wetland species are generally absent because the soils generally dry out during years of normal precipitation during the dry season (May through October). Most of the soils correlated to this site are at the family level (Aquic or Aeric subgroups). Shenandoah is one series commonly correlated to this site. Shenandoah soils are fine, smectitic, thermic Aquic Palexeralfs occurring on granitic parent material.

Vegetation consists of annual grasses, especially bulbous bluegrass (Poa bulbosa), rushes (Juncus spp.), sedges (Carex spp.), and forbs, such as western buttercup (Ranunculus occidentalis) and clover (Trifolium spp.). Sparse blue oak (Quercus douglasii) cover is sometimes found, but usually is limited to the drier upland surfaces.

Associated sites

F018XI200CA	**Low Elevation Foothills** This site commonly occurs nearby.
F018XI205CA	**Thermic Granitic Foothills** This site commonly occurs nearby.
F018XI208CA	**Deep Low Rolling Hills and Terraces** This site commonly occurs nearby.

Table 1. Dominant plant species

Tree	(1) *Quercus douglasii*
Shrub	Not specified
Herbaceous	(1) *Juncus* (2) *Poa bulbosa*

Physiographic features

This site is found in foothill landscapes on drainageways, depressions or otherwise concave positions on nearly level to strongly sloping hills where water tends to accumulate.

Table 2. Representative physiographic features

Slope shape across	(1) Concave
Landforms	(1) Foothills > Depression (2) Foothills > Drainageway
Runoff class	Medium
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to occasional
Elevation	305–610 m
Slope	1–9%
Water table depth	58–89 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Very brief (4 to 48 hours)
Ponding frequency	None to occasional
Elevation	61–823 m
Slope	0–15%
Water table depth	38–102 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 27 to 34 inches and usually falls from October to May. Mean annual temperature ranges from 58 to 62 degrees F with 170 to 299 frost free days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	170-299 days
Freeze-free period (characteristic range)	279-365 days
Precipitation total (characteristic range)	686-864 mm
Frost-free period (actual range)	155-349 days
Freeze-free period (actual range)	236-365 days
Precipitation total (actual range)	610-864 mm
Frost-free period (average)	239 days
Freeze-free period (average)	317 days
Precipitation total (average)	762 mm

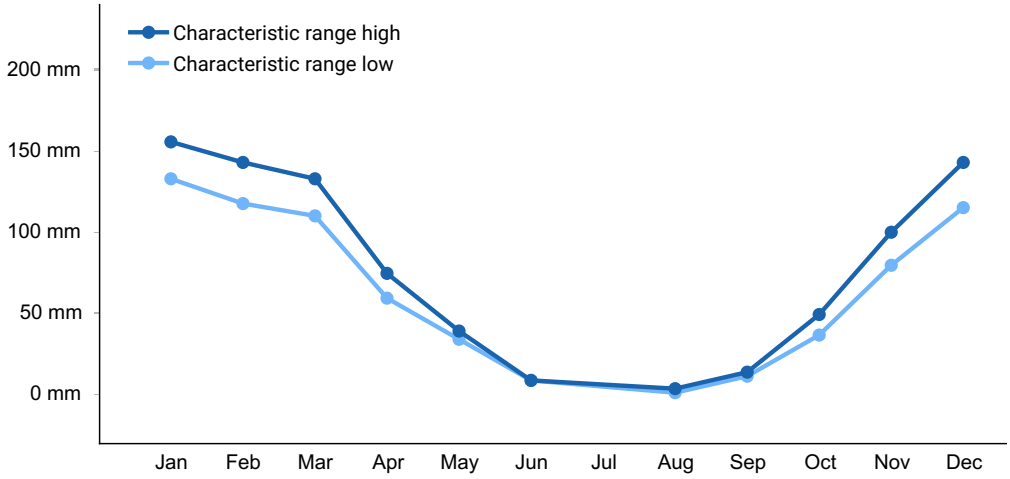

Figure 1. Monthly precipitation range

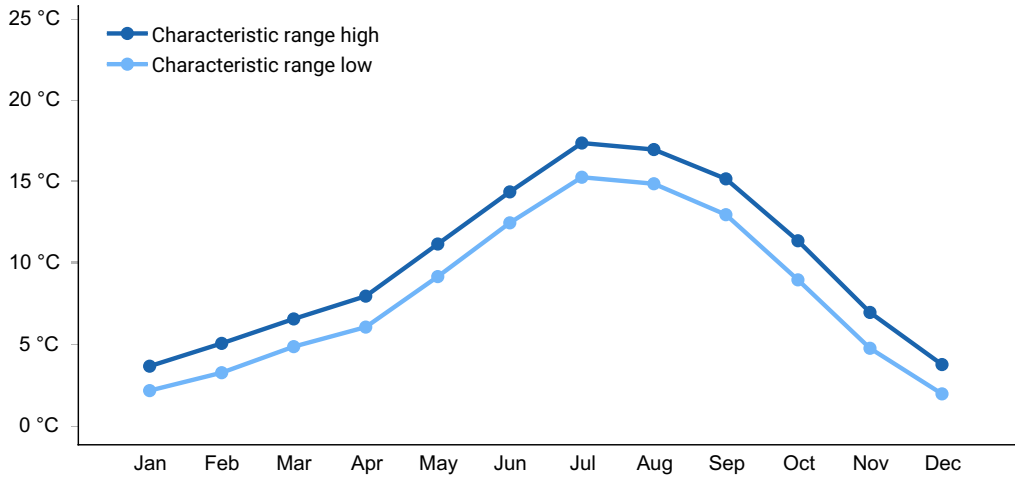

Figure 2. Monthly minimum temperature range

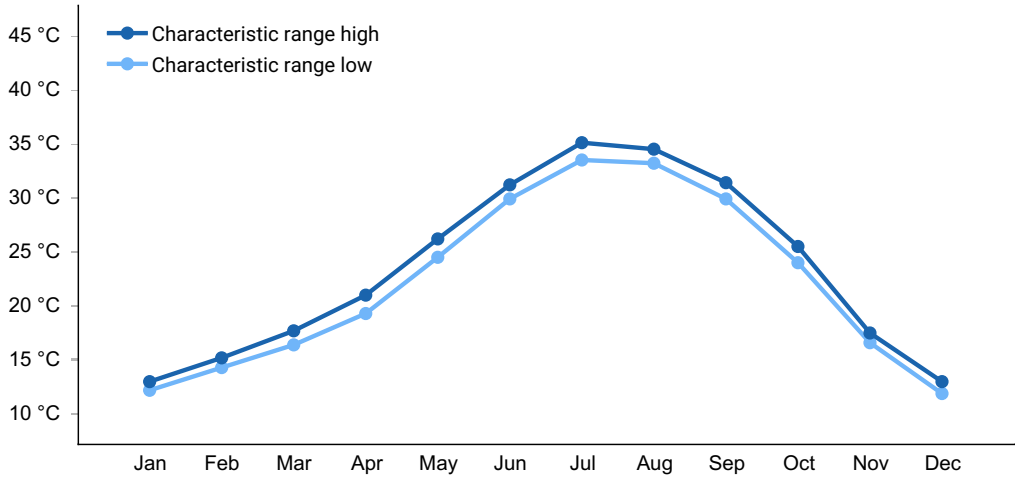

Figure 3. Monthly maximum temperature range

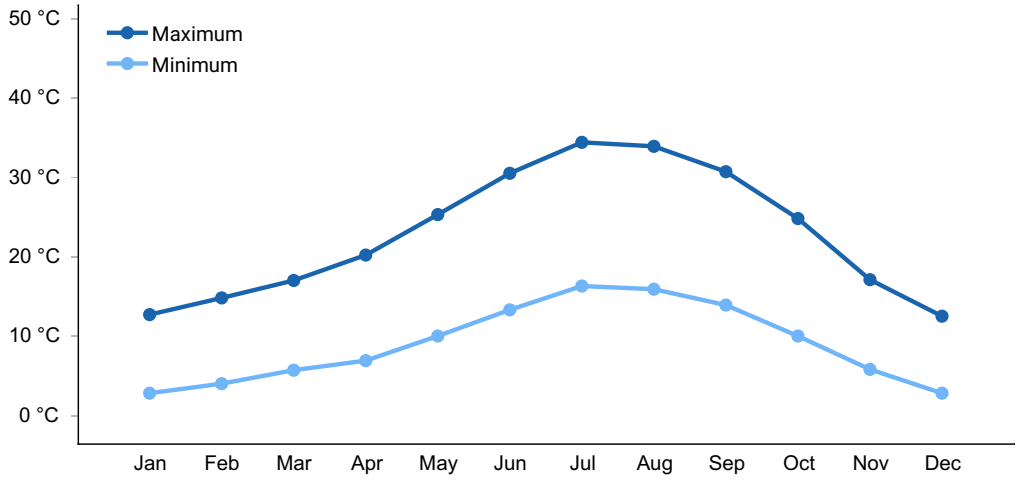

Figure 4. Monthly average minimum and maximum temperature

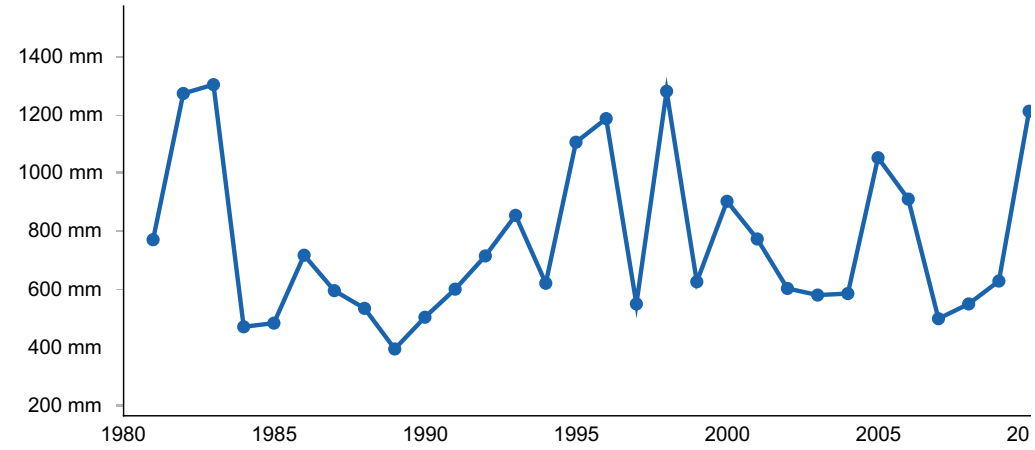

Figure 5. Annual precipitation pattern

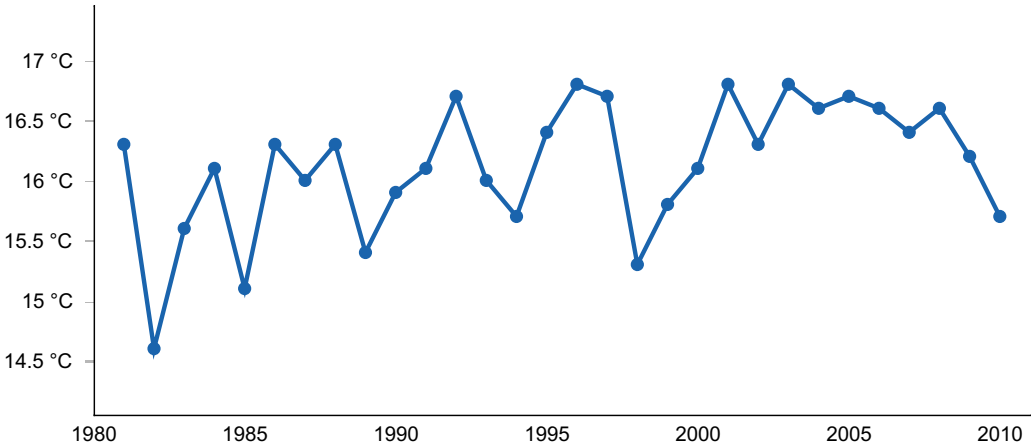

Figure 6. Annual average temperature pattern

Climate stations used

- (1) 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

Influencing water features

Ephemeral channels may be associated with this site, with water during the winter, spring, and early summer months. However, obligate wetland species are generally absent because the soils generally dry out during years of normal precipitation during the dry season (May through October).

Wetland description

N/A

Soil features

The soils in this ecological site are formed from alluvium or residuum from granitic, metavolcanic, and metasedimentary origin. The typical depth range is from moderately to very deep, the particle size control sections are fine to fine-loamy, and surface textures tend to be either sandy loams or loams. The bedrock is a restrictive layer typically found between 28 and 43 inches of depth. Gravels (< 3 inch diameter) range between 0 and 3% cover, while larger fragments (= 3 inch diameter) rarely occur. Within the soil profile gravels range between 0 to 23% and larger fragments occupy 0 to 4% by volume. The soils in this ecological site range from poorly to moderately well drained and the permeability class is moderately slow. Available Water Capacity (AWC) is between 4 and 6.3 inches and the soil pH in the top 10 inches is between 5.4 and 6.3 and in the sub-horizons between 5.6 and 6.3.

Most of the soils correlated to this site are at the family level, with Aquic Haploxeralfs being the most common. Shenandoah has also been correlated to this site. Shenandoah soils are fine, smectitic, thermic Aquic Palexeralfs occurring on granitic parent material.

Table 5. Representative soil features

Parent material	(1) Alluvium–metavolcanics (2) Residuum–granite (3) Alluvium–metasedimentary rock (4) Alluvium–granite (5) Residuum–metavolcanics (6) Residuum–metasedimentary rock
Surface texture	(1) Loam (2) Sandy loam
Drainage class	Poorly drained to moderately well drained
Permeability class	Moderately slow
Depth to restrictive layer	71–109 cm
Soil depth	71–109 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.16–16 cm
Soil reaction (1:1 water) (0-25.4cm)	5.4–6.3
Subsurface fragment volume <=3" (0-152.4cm)	0–23%
Subsurface fragment volume >3" (0-152.4cm)	0–4%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained to moderately well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	51–150 cm
Soil depth	51–150 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	6.1–20.32 cm
Soil reaction (1:1 water) (0-25.4cm)	5.1–7.8
Subsurface fragment volume <=3" (0-152.4cm)	0–42%
Subsurface fragment volume >3" (0-152.4cm)	0–37%

Ecological dynamics

State and transition model

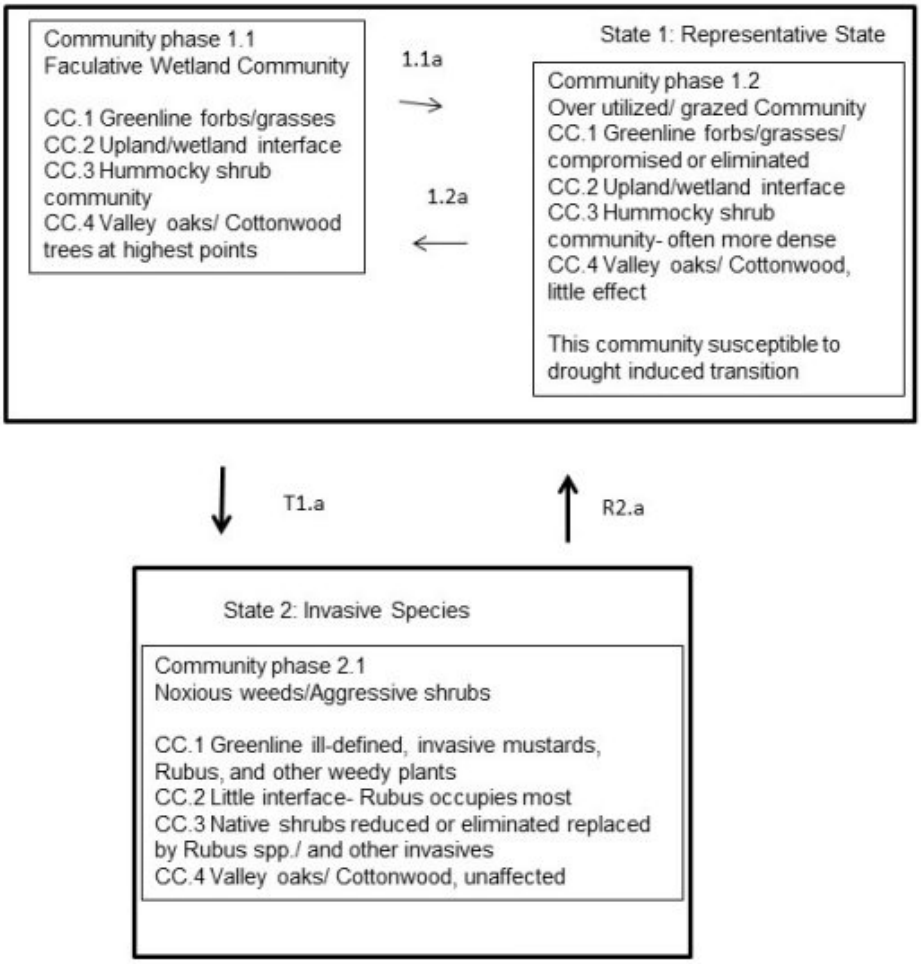

Figure 7. State and Transition Model

Community Pathways and Transition

T1.a This transition occurs when Himalayan blackberries (*Rubus armeniacus*) become established in the site, often following disturbances (flooding, fire, etc.). Once established, they quickly spread through all CC's within this ecological site. RUAR reproduces both sexually and vegetatively (sprouting vigorously following fire), they also can tolerate periods of inundation. The poplars and valley oak components in the upland (CC4) can generally persist, as they occupy a different stata, however regeneration may not be able to be established given the pervasive nature of RUAR.

1.1a Changes to plant communities based on mismanagement of livestock (sheep, cows, horses, etc.) grazing operations. These changes may vary on the degree and type of mismanagement (i.e. livestock density exceeding carrying capacity, continuous grazing with no rest periods, or allowing livestock in vernal pool areas during critical life stages (i.e. late winter, early spring) of flora/fauna). Changes also vary by community type. The greenline plant community (CC1) is especially vulnerable due to hoof action, and many of the natives in this community phase are replaced by invasive species. The woody vegetation communities (CC's 3 & 4) are less impacted, and some willow species may actually increase.

1.2a Return to more resilient ecosystems, due to conservation practices applied to the livestock operation. Note that total cessation of grazing does not always lead to maximum biodiversity, especially after domestic livestock has been part of the system for a considerable time period. Therefore, it is imperative that land managers/livestock producers carefully consider options in order to strike a favorable balance to the ecosystem, yet take advantage of seasonal forage.

R2.a Usually blackberry eradication is costly and may require several treatments. Chemical treatment with conjunction with hand pulling can be effective, but it is time intensive. Mowing or burning to reduce the larger vines can be followed up with goat grazing during the spring (goats generally will not touch the thick, thorny and woody material, but may go for green shoots).

Figure 8. Community Pathways and Transitions

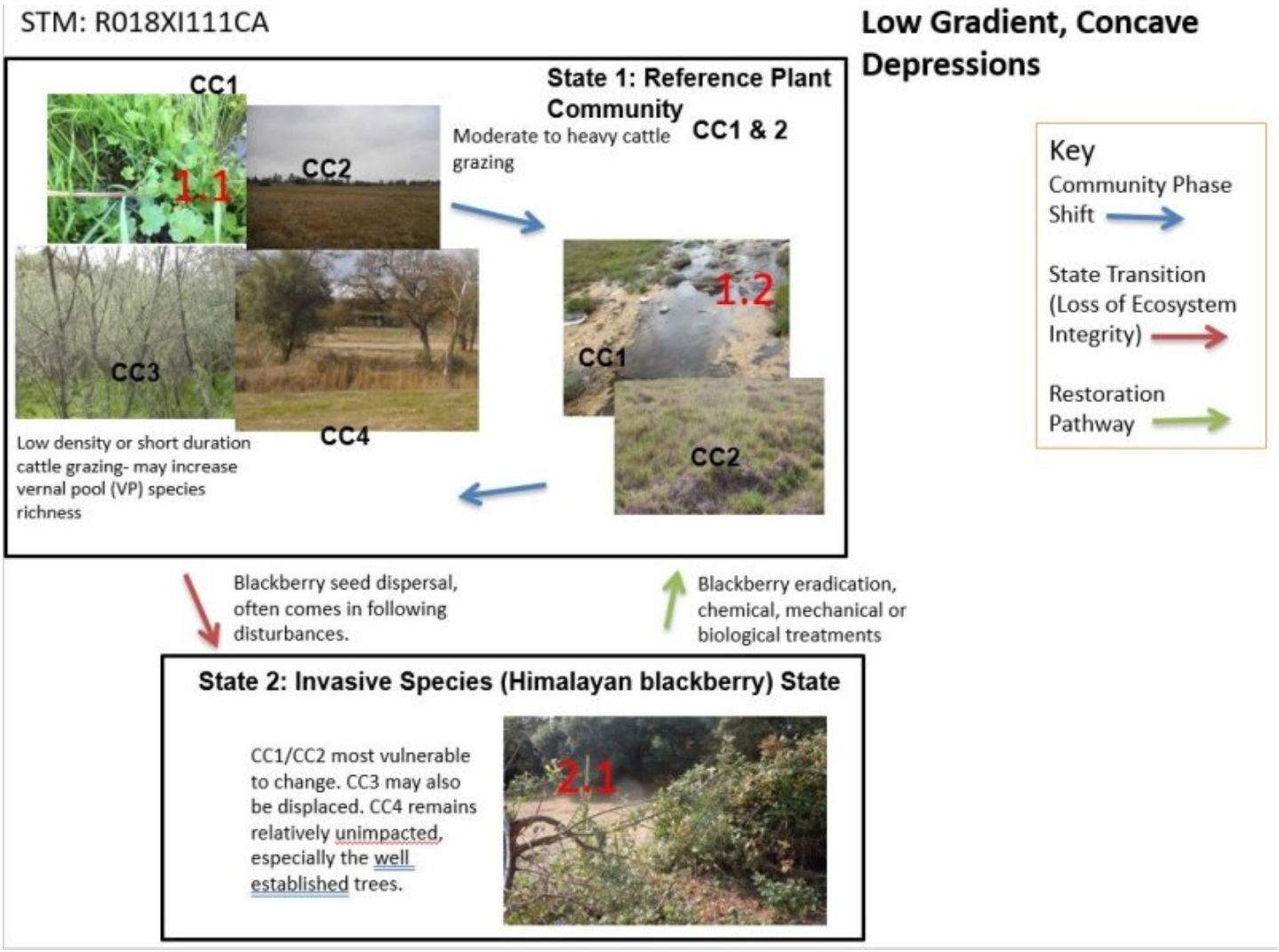

Figure 9. STM Photos

State 1
Representative State

Community 1.1
Faculative Wetland Community

Figure 10. CC1

Figure 11. CC2

Figure 12. CC3

Figure 13. CC4

CC.1 Greenline forbs/grasses CC.2 Upland/wetland interface CC.3 Hummocky shrub community CC.4 Valley oaks/ Cottonwood trees at highest points

Community 1.2
Over utilized/ grazed Community

Figure 14. 1.2 CC1

Figure 15. 1.2CC2

CC.1 Greenline forbs/grasses/ compromised or eliminated CC.2 Upland/wetland interface CC.3 Hummocky shrub community- often more dense CC.4 Valley oaks/ Cottonwood, little effect This community susceptible to drought induced transition

Pathway 1.1a
Community 1.1 to 1.2

Faculative Wetland Community

Over utilized/ grazed Community

Changes to plant communities based on mismanagement of livestock (sheep, cows, horses, etc.) grazing operations. These changes may vary on the degree and type of mismanagement (i.e. livestock density exceeding carrying capacity, continuous grazing with no rest periods, or allowing livestock in vernal pool areas during critical life stages (i.e. late winter, early spring) of flora/fauna). Changes also vary by community type. The greenline plant community (CC1) is especially vulnerable due to hoof action, and many of the natives in this community phase are replaced by invasive species. The woody vegetation communities (CC's 3 & 4) are less impacted, and some willow species may actually increase.

Pathway 1.2a
Community 1.2 to 1.1

Over utilized/ grazed Community

Faculative Wetland Community

Return to more resilient ecosystems, due to conservation practices applied to the livestock operation. Note that total cessation of grazing does not always lead to maximum biodiversity, especially after domestic livestock has been part of the system for a considerable time period. Therefore, it is imperative that land managers/livestock producers carefully consider options in order to strike a favorable balance to the ecosystem, yet take advantage of seasonal forage.

State 2
Invasive Species

Community 2.1
Noxious weeds/Aggressive shrubs

Figure 16. 2.1

CC.1 Greenline ill-defined, invasive mustards, Rubus, and other weedy plants CC.2 Little interface- Rubus occupies most CC.3 Native shrubs reduced or eliminated replaced by Rubus spp./ and other invasives CC.4 Valley oaks/ Cottonwood, unaffected

Transition T1.a
State 1 to 2

This transition occurs when Himalayan blackberries (*Rubus armeniacus*) become established in the site, often following disturbances (flooding, fire, etc.). Once established, they quickly spread through all CC’s within this ecological site. RUAR reproduces both

sexually and vegetatively (sprouting vigorously following fire), they also can tolerate periods of inundation. The poplars and valley oak components in the upland (CC4) can generally persist, as they occupy a different stata, however regeneration may not be able to be established given the pervasive nature of RUAR

Restoration pathway R2.a
State 2 to 1

Usually blackberry eradication is costly and may require several treatments. Chemical treatment with conjunction with hand pulling can be effective, but it is time intensive. Mowing or burning to reduce the larger vines can be followed up with goat grazing during the spring (goats generally will not touch the thick, thorny and woody material, but may go for green shoots).

Additional community tables

Inventory data references

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

References

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Other references

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Contributors

K. Moseley
John Proctor
Nathan Roe
Dave Evans

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	05/20/2025
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):**

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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:**
