Ecological site group F004BO100CA
Coastal Redwood Slopes

Key Characteristics

- Elevated coastal plains
- Not dissected coastal plateaus with high acidity -LRU O
- Protected, narrow, low elevation slopes

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.

Physiography

This ESG is generally found within LRU O, directly adjacent to the mountains of LRU N. This site is generally found below 1000 ft. on the low coastal plains and in the protected ravines. They are mostly confined to the protected ravines, footslopes, northerly aspects, and high stream terraces of the low-lying coastal plains and terraces where the coastal fog remains throughout the duration of the hot summers, unlike other parts of the LRU that do not experience fog throughout the summer months.

Climate

The average annual precipitation in this MLRA is 23 to 98 inches (585 to 2,490 millimeters), increasing with elevation inland. Most of the rainfall occurs as low-intensity, Pacific frontal storms. Precipitation is evenly distributed throughout fall, winter, and spring, but summers are dry. Snowfall is rare along the coast, but snow accumulates at the higher elevations directly inland. Fog is a significant variable that defines this MLRA from other similar MLRAs. Summer fog frequency values of greater than 35% are strongly correlated to the extent of coast redwood distribution, which is a primary indicator species in this MLRA. Nightime fog is approximately twice as common as daytime fog and seasonally, it reaches its peak frequency in early August, with the greatest occurrence of fog from June through September (Johnstone and Dawson 2010). The average annual temperature is 49 to 59 degrees F (10 to 15 degrees C). The freeze-free period averages 300 days and ranges from 230 to 365 days, decreasing inland as elevation increases.

The San Mateo Coastal Hills LRU have lower relief and elevations than the adjacent LRU N, with more coastal oak and scrub vegetation and coastal grasslands and areas of cultivation rather than the denser forest and woodland of the Santa Cruz Mountains. Pliocene sandstone and siltsone are the main rock types compared to the mix of geology in LRU N that includes older sedimentary and some igneous rocks. Marine terraces, coastal benches, and small valleys are the primary landforms. Mollisols are typical, with mostly thermic to isomesic temperature regimes. Soil moisture regimes are mostly xeric and ustic. Summer fog is common, and winters are cool and moist.

This ESG will exist primarily within the areas of LRU O that are the most moderate coastal temperatures, experiencing the least amount of heat stress during the summers within the LRU. This ESG differs from others in other LRUs due to the reduced duration and inland extent of fog and the impacts of warmer summer temperatures, given its proximity to the Southern California climatic influences.

Soil features

The soils of this provisional site concept are variable but will generally be found on fine to fine-loamy alluvial materials. The cooler, maritime temperatures and protected aspects allow for higher retention of soil moisture during the hotter summer days, and the fog influence provides key moisture to the redwood foliage and soil

moisture content as well. The soils are predominantly an isomesic soil temperature, meaning the soils have a mean annual soil temperatures of 8 °C or more, but a difference between mean summer and mean winter soil temperatures of less than 5 °C at 50 cm below the surface. This limited change in soil temperatures minimizes heat stress to the vegetation growing on these soils.

Vegetation dynamics

This provisional ecological site concept attempts to describe the small remaining areas of coastal redwoods of LRU O. This concept historically would have covered many other areas within this LRU, however land use (timber harvest, conversion to agriculture, and urban development being most typical) and increases in overall temperature over the past 100 years have made it difficult for coast redwood to re-establish into much of its previous habitat, confining it down to areas that are not conducive to urban sprawl and maintain protection from late afternoon heat in the summers. The primary factors that maintain these sites in coast redwood are the fog influence and protected slopes and northerly aspects that maintain higher soil moisture during the warm periods of the summer.

Primary Disturbances

Historically, the primary disturbances in this ecological site group were lightning and cultural fires, and grazing by native grazers and livestock. Lightning-ignited fires are relatively infrequent in the California Central Coast where LRU O occurs when compared to other regions in the state. However, lightning strikes are more common in dry summer and fall months than in winter (Van Wagtendonk and Cayan 2008), and dry lightning occurs in this region with enough regularity (Kalashnikov et al. 2022) for lightning fires to play an important role in vegetation dynamics alongside Native American burning. Fires in coastal California are typically wind driven over large areas and across many different soil and vegetation types (Varner and Jules 2017). Interactions of soil, landform, inter-annual climate variability, grazing patterns and fire regimes sustain a mosaic landscape where coast redwood forest exists alongside areas of coastal scrub and meadows; and expresses in various structural development stages depending on time since fire or other minor localized disturbances such as landslides or alluvial deposits. In combination with fires and periodic droughts, native and introduced grazers also play a role in limiting woody encroachment in areas with good soils and a climate that could otherwise often support trees.

Native American practices along these coastlines included frequent burning to maintain coastal prairies or balds, and it is likely that fires in these prairies burned into redwood areas. Without very frequent fire disturbance, many grassland openings in this ESG will transition to forest. Further expansion of pre-existing openings and development of new openings for homesteading occurred in redwood forests of this ESG during the settlement period (approximately 1830-1900). Additional clearing to develop pasture and for other uses has occurred in some areas after the settlement period as well.

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Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

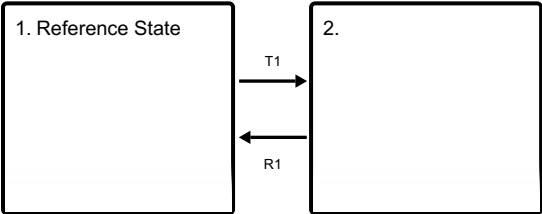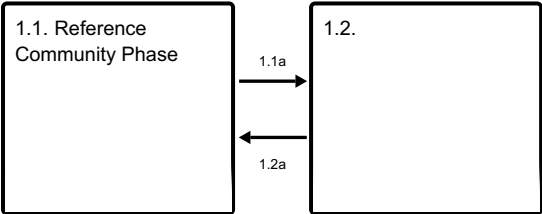
Stage

Provisional

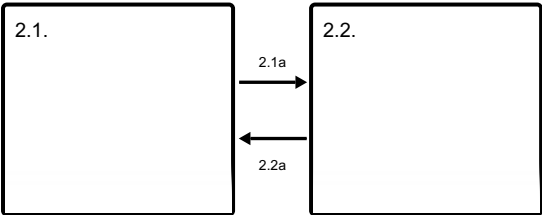## Contributors

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State and transition model

Ecosystem states

| 1. Reference State | →T1→ | 2. |
| | ←R1← | |

State 1 submodel, plant communities

| 1.1. Reference Community Phase | →1.1a→ | 1.2. |
| | ←1.2a← | |

State 2 submodel, plant communities

| 2.1. | →2.1a→ | 2.2. |
| | ←2.2a← | |

State 1

Reference State

The dynamics described below are general to the level that the site concept has been developed for provisional ecological site concept identification and further investigation purposes only. It is meant to give a general overview of the ecological dynamics of the system and should not be viewed as a model for a specific ecological site level management. It is supported by the current available literature that was reviewed for a general understanding of the system and basic understanding of the abiotic and biotic drivers. Further investigations and soil-site data collection and analysis should be conducted before specific land management can be applied at the ecological site specific scale. This STM only serves to explain the general ecology and dynamics. Reference State (State 1) – This reference state includes a simple dynamic between the coast redwood forest and patchwork of coastal scrub dominated shrublands and coastal prairie. These communities are confined primarily to areas protected from the heavy coastal winds and winter storms that are common to this LRU, and within the lower elevation areas that commonly experience fog in the summer time. Historically, this reference state would have been primarily represented by Community Phase 1.1, but today it is mostly reflected by either Community Phase 1.2 or Community Phase 2.1.

Community 1.1
Reference Community Phase

This community phase represents the areas of LRU O that have coast redwood dominated forest. It is dominated primarily by Sequioa sempervirens (coast redwood), with the occasional Pseudotsuga menzeisii (Douglas-fir) and a second canopy of hardwoods such as *Notholithocarpus densiflorus* (tanoak) and Arbutus menzeisii (Pacific madrone). The understory is varied, however the dominant species are *Vaccinium ovatum* (California huckleberry), *Polystichum munitum* (swordfern) and *Oxalis oregana* (redwood-sorrel).

Community 1.2

This community phase represents the coastal scrub and coastal prairie vegetation. This community phase is most common on the flatter coastal plains where grazing practices assist in maintaining the herbaceous cover. Historically, the community phase was also maintained by more frequent fires by the Native Americans living along the coastline that were dependent on the food and materials the herbaceous communities provided. This community is currently dominated by either coastal scrub species, such as *Baccharis pilularis* (coyotebrush), *Toxicodendron diversilobum* (poison oak), *Scrophularia californica* (California figwort), *Polystichum munitum* (swordfern), *Artemisia californica* (Califonia sagebrush). The coastal prairie expression would include native perennial grasses such as *Danthonia californica* (California oatgrass), Bromus californica (California brome), Nasella pulchra (purple needlegrass), and *Leymus triticoides* (creeping wildrye). Other species will include *Polystichum munitum* (swordfern), and a variety of perennial and annual forbs—many of which are endemic and disappearing due to loss of habitat and invasive species pressures.

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurs after harvesting or a fire that is sufficient enough to remove most of the woody species and open the canopy and soil resources to the coastal scrub and herbaceous species.

Pathway 1.2a
Community 1.2 to 1.1

This pathway occurs over time as the redwoods re-establish or encroach into the grasslands where fire and grazing have been removed. This pathway may also be hastened during periods of excessive moisture that favor the trees over the herbaceous plants.

State 2

This state represents the community phases that have been invaded by non-native species. This ESG is highly susceptible to non-natives and invasives, especially in the Reference State in Community Phase 1.2, given the current types of pressures from human use in this LRU. Non-natives and invasives are able to capitalize quickly on available resources much better than the native species can, especially during years that are hotter and drier than

average. This state is based on limited observational information and should be further investigated in the field for better data and refinement of the concepts and dynamics.

Community 2.1

This community phase represents the Douglas-fir-redwood forest that dominates this State. Redwood no longer is the dominant overstory species, due to the current stresses and pressures on this confined and limited site within LRU O. Although redwood may return to the site over time, conditions are not conducive to redwoods re-asserting dominance in the overstory.

Community 2.2

The community phase represents all the different community expressions of an invaded state. The primary annual grass species include *Bromus diandrus* (ripgut brome) and *Avena fatua* (wild oat), and the most common forbs include Carduus pycnocephala (Italian plumeless thistle), *Silybum marianum* (milk thistle), *Hirschfeldia incana* (shortpod mustard), and *Raphanus raphanistrum* (wild radish). This community phase may also be a mixture of native and non-natives, perennials and annuals, depending on the site and soil conditions.

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs after harvesting or a fire that is sufficient enough to remove most of the woody species and open the canopy and soil resources to the coastal scrub and herbaceous species.

Pathway 2.2a
Community 2.2 to 2.1

This pathway occurs over time as the Douglas-fir and redwoods re-establish or encroach into the grasslands where fire and grazing have been removed. This pathway may also be hastened during periods of excessive moisture that favor the trees over the herbaceous plants.

Transition T1
State 1 to 2

This transition occurs when the seed source is introduced to the ecological site. This ecological site is not highly resistant to outside pressures like invasive species, and in Community Phase 1.2 the site is most at-risk of this type of invasion. The threshold is crossed when feedback mechanisms shift from natural dynamics to feedback mechanisms that cater to the invasive species.

Restoration pathway R1
State 2 to 1

This restoration pathway occurs through the planting of redwoods and the control of invasive species that can potentially restore this ecological site to its reference state. It is more likely that the invasions are minimized and controlled, but complete removal of the invasives may not be possible without significant time and money inputs and repeated treatments.

Citations