Ecological site group F004BK101CA
Fog-influenced, stream terraces

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Key Characteristics

- Not like the previous LRUs – LRU K
- Hydrologically-influenced, flood-dominated riverine
- Riverine, flooding is either rare or not occurring

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 on the stream terraces within LRU K but nearest to LRU L that still receive a significant amount of coastal fog influence, given their location and proximity to the coast. This site is generally found below 1000 ft. and the primary factors that maintain these sites in coast redwood are the fog influence, low elevation stream terrace locations, and protected nature of the tighter canyons of LRU K that protect the sites from later afternoon solar radiation. The cooler, maritime temperatures and protected aspects allow for higher retention of soil moisture and fog retention in the redwoods during the hotter summer days.

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.

Unlike the conifer-dominated forests of LRU I to the north, these central redwood forests in LRU K are typically more a mixture of conifers and hardwoods. Vegetation includes a multi-story canopy of redwood, Douglas-fir, tanoak, bigleaf maple, evergreen shrubs, and various grasses. The near-coastal part of the region that is influenced more by fog has more redwoods and similarities to LRU I to the north, however the drier summers and more limited duration of coastal fog limits the competitive advantage of the coastal redwoods in LRU K. This creates limited areas that remain dominated by coast redwood and a larger portion of the LRU dominated by Douglas-fir and other hardwoods, with some redwoods near the lower parts of the mountain slopes where fog still has some influence or the drainages are narrower and remain cooler in the summers, limiting evapotranspiration losses. This LRU differs from LRU L due to the ustic-isomesic soil temperatures in LRU L and a decrease in fog days in the summer due to the inland locations and direction of the mountain slopes.

Soil features

The soils of this provisional site concept are typically isomesic, typic, coarse-loamy tropofluvents on alluvium derived from sandstone.

Vegetation dynamics

This provisional ecological site concept attempts to describe the small areas of stream terraces that are dominated by coastal redwood in LRU K. They are not a significant landform within this LRU, but they are the most productive redwood sites in the LRU. This concept historically would have covered many other areas within this LRU, however land use 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 ustic-isomesic soil climate regime of this LRU is mainly at elevations between 500 and 2,000 feet. It is within the zone of moderate marine influence. The fog influence is less pronounced than in the udic moisture regime, but some moisture is added to the soil where the tree canopy causes water to precipitate from the fog. The fog is less dense and does not blanket this zone as frequently as in the wetter zone at the lower elevations. The soils are dry for part of the summer, and there is little variation between summer and winter soil temperatures at a depth of 20 inches. The first continuous north-south range of mountains inland from the coast that reaches 2,000 feet forms an effective barrier to the encroachment of marine air. In some drainageways, such as the Noyo River watershed, this zone extends inland 20 miles or more. In other areas, such as along Elkhorn Ridge 7 miles north of Branscomb, the marine influence stops within 8 miles of the coast.

Primary Disturbances

Historically, the primary disturbances to this provisional ecological site concept were lightning-ignited fires, timber harvesting to feed growth of San Francisco and surrounding cities, and Native American burning. Lightning-ignited fires do occur in many parts of coastal California (Van Wagtendonk and Cayan, 2008, Kalashnikov et al 2022), and Native American burning likely played a major role as fires from neighboring grasslands and hardwood forests in the interior passed into the redwood zone (Greenlee and Langenheim, 1990, Veirs, 1996). These coastal zone fires can easily be wind driven in summer and fall during periods of foehn and Santa Ana winds over large areas and across many different soil and vegetation types (Varner and Jules 2016). The mean fire return interval for redwood forests is quite variable across its range. In some areas, old-growth stands show evidence of three or more severe fires each century, and the distribution of fires appears as a natural pattern of several short intervals between fires followed by one or more long interval (Stuart 1987, Jacobs et al. 1985). Fire regime research in areas just north of San Francisco Bay (e.g. Jacobs et al. 1985, Greenlee and Langenheim, 1990) are suggestive of a natural fire interval for this redwood ecological site on the more frequent end of the variability across redwood's range, with fire returning every few decades. Previous harvesting and the use of fire to treat logging slash has also changed species composition on many formerly redwood-dominated sites (Noss et al, 2000).

Timber harvesting during the gold mining era in California removed a lot of the redwoods that surrounded San Francisco. It's strong, straight wood and height made it a prime species for harvest. Historically, this ecological site would likely have been much more extensive before the harvesting of trees that were as easily accessible as the redwoods in this ecological site would have been. As the fires became less and less frequent and harvesting slowed, the redwood was able to re-establish dominance in areas that were not as heavily impacted by the coastal winds and winter storms.

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Van Wagtendonk, J. W., & Cayan, D. R. (2008). Temporal and spatial distribution of lightning strikes in California in relation to large-scale weather patterns. Fire Ecology, 4, 34-56.

Varner, J. M., & Jules, E. S. (2017). The enigmatic fire regime of coast redwood forests and why it matters. Gen. Tech. Rep. PSW-GTR-258. Albany, CA: US Department of Agriculture, Forest Service, Pacific Southwest Research Station: 15-18, 258, 15-18.

Veirs, S. D. 1996. Ecology of the coast redwood. In J. LeBlanc (technical coordinator) Proceedings of the conference on coast redwood forest ecology and management (pp. 9-12).

Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

Stage

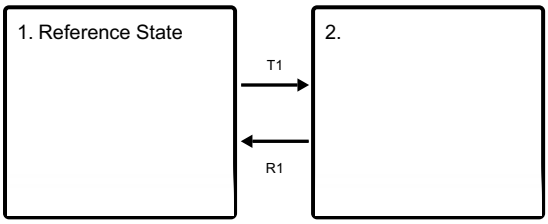
Provisional

Contributors

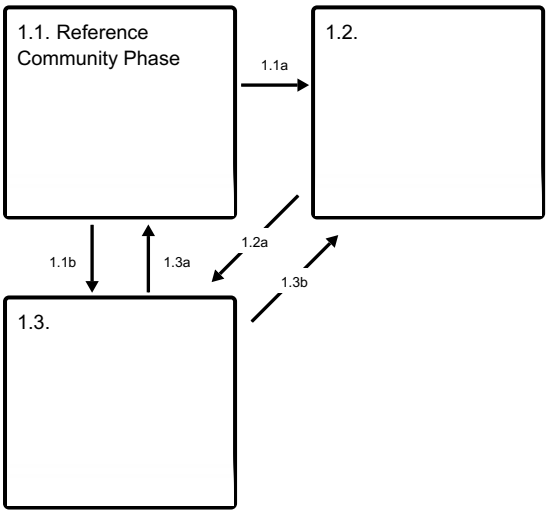
Kendra Moseley

State and transition model

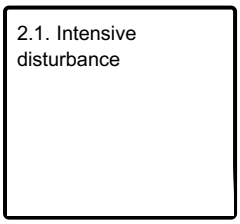
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



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) – At this very general scale, this reference state only really captures the generalities related to the functional groups that are most dominant and does not capture the more specific dynamics and patterns that would be found at the more detailed and refined ecological site scale that focuses on specific abiotic factors that drive some of these various complex plant expressions. More data and refinement is needed to capture the information needed in order to make specific land management decisions at the ecological site-component scale.

Community 1.1
Reference Community Phase

The reference plant community for this site is considered to be the most iconic expression of redwood forest, with some of the biggest coast redwoods in the state dominating the overstory canopy. *Sequoia sempervirens* (redwood) dominates the overstory, with *Tsuga heterophylla* (western hemlock) as a significant associate. The estimated tree age for this site ranges from 75 to 200+ years. *Picea sitchensis* (Sitka spruce) and *Abies grandis* (grand fir) occasionally occur in the understory canopy. The understory is dominated by *Polystichum munitum* (western swordfern) and *Oxalis oregana* (redwood-sorrel) and on some sites *Blechnum spicant* (deerfern) may also be common. Western hemlock and redwood seedlings are also commonly found in the understory. Windthrow from winter storms or small partial cuts can create small gaps which will maintain the redwood dominance and increase the swordfern cover and potentially increase the cover of shrubs as well, which may include *Vaccinium ovatum* (California huckleberry), *Rubus spectabilis* (salmonberry), *Vaccinium parvifolium* (red huckleberry), and *Gaultheria shallon* (salal).

Community 1.2

Red alder, salmonberry, and western swordfern may rapidly establish the site after a disturbance with redwood seedlings present. Redwood-sorrel may also increase in cover. The red alder/redwood plant community evolves after the initial red alder invasion. Redwood sprouts may be dominated by alder for a period of 25 years or more. The estimated tree age for this site ranges from 0 to 40 years. Salmonberry, western swordfern, and redwood-sorrel persist in the understory.

Community 1.3

The red alder-redwood community evolves after the initial red alder establishment. Redwood sprouts may be dominated by alder for a period of 25 years or more. The estimated tree age for this site ranges from 20 to 40 years. Salmonberry, western swordfern, and redwood-sorrel persist in the understory. Over time, redwood continues to grow and responds by filling in canopy gaps. The estimated tree age for this site ranges from 35 to 70 years. Remnants of salmonberry remain, but have less cover due to canopy closure. Western swordfern and redwood-sorrel remain the dominant forb cover.

Pathway 1.1a
Community 1.1 to 1.2

The reference state may transition to Community Phase 1.2 following a significant windthrow event, a substantial fire or large acreage block harvest.

Pathway 1.1b
Community 1.1 to 1.3

Following a smaller windthrow event or timber harvest practice that selectively removes some but not all redwoods, red alder rapidly establishes where the canopy has opened transitioning this community to Community Phase 1.3. Western swordfern will also infill.

Pathway 1.2a
Community 1.2 to 1.3

With no management, red alder dominates this site for 25 years or more, redwood sprouts slowly grow in height to become part of the canopy along with red alder.

Pathway 1.3a
Community 1.3 to 1.1

With continued growth and no significant disturbance over several hundred years, this community phase could be expected to return to the multi-storied redwood reference community seen in Community Phase 1.1.

Pathway 1.3b
Community 1.3 to 1.2

Smaller windthrow events or a partial cutting of Sitka spruce and/or redwood may cause red alder to re-dominate the openings for a time, moving the community back to Community Phase 1.3.

State 2

This state represents the intensive land uses that have significantly altered this ecological site due to urban developments, recreational activities, and agriculture. More information about this state is needed to flesh out the various impacts these types of land uses/alterations have had on the ecological site in order to better understand how to better manage of these areas or potentially attempt restoration of these areas where possible.

Community 2.1
Intensive disturbance

This community phase represents all the varied land uses that significantly alter this ecological site. This is an extremely varied community phase that includes all types of alterations that so significantly alter the ecological site that it is permanently changed and no longer has typical or even representative ecological dynamics.

Transition T1
State 1 to 2

This transition is caused by significant human alterations that force this ecological site over a threshold and change the function and structure of this site in extensive ways.

Restoration pathway R1
State 2 to 1

This restoration pathway occurs only when significant time and money inputs are focused on areas that have not been permanently altered by urban developments.

Citations