Ecological site group F004BI106CA
High precipitation mountain slopes

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Key Characteristics

- Heavy coastal fog dominates the landscapes below 1500 ft.
- Soil moisture is udic – LRU I
- All other mountain 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 provisional ecological site concept covers the mountains within LRU I that are furthest from the coast and receive the least amount of fog-influence. Slopes are gently sloping to very steep reaching elevations just over 3000 ft, and the site is limited to areas of high annual precipitation and a cool, maritime climate that provides fog drip and sufficient summer moisture to mollify evapotranspiration rates in the summers to allow redwoods to maintain co-dominance in the ecological site. It occurs on uniform to convex summits and shoulders of broad ridges; and concave to convex positions of mountain slopes. These mountain slopes are sloping to very steep.

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 low mountains of the Northern Franciscan Redwood Forest LRU I, lie entirely within the coastal fog zone and are characteristically covered by fog-dependent coast redwoods and Douglas-fir. Historically, unbroken redwood forests occurred and moderated local climate by trapping coastal fog and producing shade. The combination of shade, root competition, young soils with a deep organic debris layer on the soil surface, occasional fire, and silting by floods limits the number of plant species that occur here. The region extends north only about 10 miles into Oregon near Brookings. Dominated by conifers, the region also includes Sitka spruce, western hemlock, western redcedar, Port Orford cedar, and grand fir. Hardwoods such as red alder, Pacific rhododendron, and tanoak commonly occur. This LRU also includes the areas known as the Bald Hills that have been maintained for over 100 years as prairies and oak woodlands through prescribed fire. These hills are dominated by Oregon white oak and perennial and annual native and non-native grasses and forbs but are actively encroached by Douglas-fir and redwood. Fine and fine-loamy, udic, isomesic, Ultisols and Alfisols are typical. In some factors, this region has more similarities to the temperate rain forests of the Oregon and Washington Coast Ranges, however since it does not receive winter snow and colder temperatures and still maintains the distinct presence and dominance of coast redwood make this LRU unique to MLRA 4B.

Soil features

Although Douglas-fir can grow on a variety of soils, the soils most associated with this concept are primarily found on colluvium and residuum materials derived from sandstone, conglomerate and mudstone, with soils that range from very deep to lithic that are primarily well-drained, and are moderately to strongly acidic at 40 inches. They have a dominantly loamy subsurface rock content ranging from non-gravelly to extremely gravelly.

Vegetation dynamics

This provisional ecological site concept attempts to describe the Douglas-fir dominated mountain slopes that can be found within this LRU. This concept is primarily supported through literature and available information from the Redwood National and State Park Soil Survey. Future work will need to be done to better understand the soil and site characteristics that drive the vegetation expression for this provisional ecological site concept.

Pseudotsuga menzeisii (Douglas-fir) forests are limited in this LRU due to the competitive dominance of the coast redwood. Douglas-fir is a large, coniferous, evergreen tree. Adapted to a moist, mild climate, it grows bigger and more rapidly than the inland variety. Trees 5 to 6 feet (150-180 cm) in diameter (150-180 cm) and 250 feet (76 m) or more in height are common in old-growth stands. These trees commonly live more than 500 years and occasionally more than 1,000 years. Old individuals typically have a narrow, cylindric crown beginning 65 to 130 feet (20-40 m) above a branch-free bole. It often takes 77 years

for the bole to be clear to a height of 17 feet (5 m) and 107 years to be clear to a height of 33 feet (10 m). In wet coastal forests, nearly every surface of old-growth Douglas-fir in this ecological site is often covered by epiphytic mosses and lichens (FEIS, 2018). This tree's rooting habit is not particularly deep. The roots of young Douglas-fir tend to be shallower than roots of many of the same aged conifers like ponderosa pine, sugar pine, or incense-cedar. Some roots are commonly found in organic soil layers or near the mineral soil surface.

This ecological site group is dominated by a multi-tiered canopy of Douglas-fir and tanoak, with coast redwood making up less than 10-20% of the stands basal area and Douglas-fir and other hardwoods accounting for between 60-90%. Tanoak readily establishes after disturbance and may dominate the overstory for several decades post-disturbance. Fallen logs are an essential part of this ecological site, providing significant habitat for wildlife species and conifer recruits.

Primary Disturbances

Fire is the principal disturbance agent in these Douglas-fir dominated forests, however, fire regimes within the larger Northern Redwood Region remain enigmatic (Varner and Jules, 2016). Historic timber harvesting and the use of fire to treat logging slash in this area has also greatly affected stand structure and composition for much of this ESG (Noss, 1999). The dominance of Douglas-fir in this provisional ecological site concept indicates a regular occurrence of fire since Douglas-fir requires exposed soil to successfully regenerate and canopy gaps to persist (Agee 1993). Lightning-ignited fires would likely spread due to the winds that are frequent within this LRU, especially at upper elevations. Native American burning also played a major role (Veirs, 1996). Natural fire intervals were relatively frequent as much of the mixed conifer and redwood zone of this LRU evolved within a low to moderate natural disturbance regime (Veirs, 1996, Norman et al. 2009). Overall, the fire history studies conducted in adjacent redwood forests consistently show frequent fires that contrast sharply with the notion of a rainforest ecosystem (Varner and Jules, 2016). Given the higher elevations of this site and closer proximity to inland prairies, it is likely that fires were fairly frequent in this ESG.

Tanoak, a major component of this ESG, can re-sprout following fire. After fire, tanoak will sprout from the root crown, root collar, lower part of the stem and underground burls (McDonald and Tappeiner 1987). Tanoak seedlings and sapling-sized stems are often top-killed by surface fire, while larger stems may survive with only basal wounding (Fryer, 2008). Despite susceptibility of small tanoak stems to fire, it often is persistent in Douglas-fir understories (Tappeiner and McDonald, 1984). Tanoak residing in a shaded understory responds vigorously after fire or logging that removes the overstory. It resprouts with rapid growth in higher light environments to claim canopy space, often for many decades. Fires are also critical for Douglas-fir regeneration in this ESG as exposed soil greatly improved Douglas-fir regeneration and canopy gaps opened by moderate intensity fires provide space for young Douglas-fir to recruit to the overstory (Veirs, 1980, Agee, 1993). Chinquapin is also common in this ESG and occupies a similar ecological role as tanoak

with the ability to resprout and form dense young stands and occupy a subdominant or codominant canopy layer alongside Douglas-fir. It, however, is much less shade-tolerant than tanoak, and requires canopy gaps and disturbance to persist.

Fires will also alter the composition of shrubs and forbs in the understory community. *Vaccinium ovatum* (evergreen huckleberry) is a common species in both moist and dry Douglas-fir and redwood environments. It is normally a fire-dependent shrub species, but little is known concerning its adaptation to fire under low to moderate fire return intervals (Tirmenstein, 1990). Following a fire, evergreen huckleberry will often re-sprout and recover rapidly. *Rhododendron macrophyllum* (Pacific rhododendron) is considered sensitive to fire. Following a surface fire, it may reestablish seedlings by sprouting from the root crown or stem base (Duchac, 2021). After a disturbance such as fire, a decrease in plant cover is common, and will be followed by a gradual increase in cover over time.

Another important disturbance in this ESG is winter storms that can cause top breakage and blowdown. This breakage may kill individual or groups of trees and create small openings from windfall (Noss, 1999). These gaps likely favor the reestablishment of Douglas-fir as opposed to hardwoods, unless storm damage is able to cause extensive areas canopy loss.

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Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

Subclasses

- F004BX105CA–Douglas-fir/tanoak/California huckleberry, ridge-tops, schist, red clay
- F004BX112CA–Oregon White Oak/Perennial And Annual Grasses, lower mountain slopes, sandstone and mudstone, silty clay loam
- F004BX113CA–Douglas-fir/giant chinquapin/California huckleberry, ridgetops, soft sandstone, clay loam
- F004BX114CA–Oregon white oak/perrenial and annual grasses, mountain slopes, sandstone and mudstone, clay loam
- F004BX123CA–Douglas-fir-tanoak/tanoak, upper mountain slopes, clay loam

Stage

Provisional

Contributors

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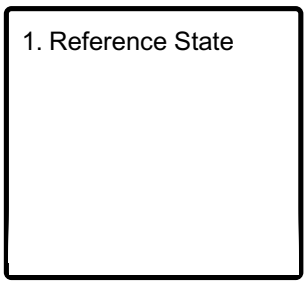
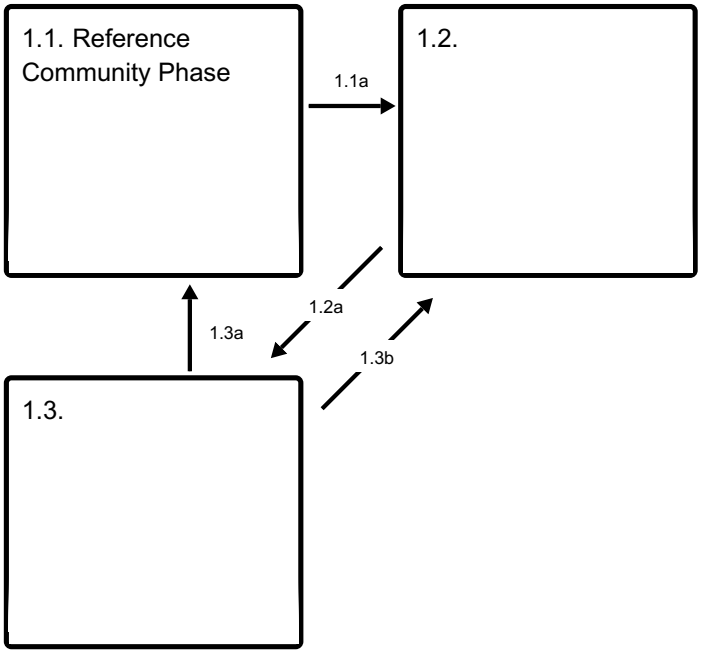
State and transition model

Ecosystem states



State 1 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. No alternative states were found during the literature review, however that does not mean they do not exist and more time should be spent determining whether or not this model captures all the dynamics of this system, especially once more is known about the soil-site characteristics of this LRU and ecological site concept. Reference State (State 1) – The reference state for this provisional ecological site concept is dominated by Pseudotsuga menzeisii (Douglas-fir), with a significant component of *Notholithocarpus densiflorus* (tanoak) and *Sequoia sempervirens* (coast redwood) may still be present in the canopy, in lower amounts. On the drier end near the transition between MLRA 4B and MLRA 5, *Arbutus menziesii* (Pacific madrone) or *Chrysolepis chrysophylla* (giant chinquapin) can be found in the mix with tanoak in the subcanopy, however this is a small area and a transitional area and not representative of the bulk of this large-scale, provisional ecological site concept. The ecological dynamics represented in the reference state are driven primarily by periodic fires that create the complex dynamics and plant expressions reflected by the community phases described. Depending on the intensity, severity, timing, and weather conditions associated with each fire and which community phase is impacted by the fire, this ecological site will respond to varying degrees. 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.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- tanoak (*Notholithocarpus densiflorus*), tree
- redwood (*Sequoia sempervirens*), tree
- Pacific madrone (*Arbutus menziesii*), tree

Community 1.1
Reference Community Phase

The reference community phase is characterized by an overstory community dominated by Douglas-fir, with a cover of tanoak in the sub-canopy and redwood is generally present in significantly lesser amounts. The understory is shrub-dominated and generally *Vaccinium ovatum* (California huckleberry), *Rhododendron macrophyllum* (Pacific rhododendron), and a minor amount of *Gaultheria shallon* (salal) are the dominant species. Cover of grass and forbs are very low. Douglas-fir needs disturbance and enough

sunlight to reproduce successfully.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- tanoak (*Notholithocarpus densiflorus*), tree
- redwood (*Sequoia sempervirens*), tree
- Pacific rhododendron (*Rhododendron macrophyllum*), shrub
- California huckleberry (*Vaccinium ovatum*), shrub
- salal (*Gaultheria shallon*), shrub

Community 1.2

This community phase is dominated by tanoak, woody shrubs, and a variety of pioneering species. Tanoak grows rapidly in the created openings. If the site is left to develop over time, tanoak will form a tree layer and Douglas-fir will begin to infill from surrounding seed sources. Tanoak is fast growing and will dominate the site and compete with regenerating Douglas-fir for decades.

Dominant plant species

- tanoak (*Notholithocarpus densiflorus*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree

Community 1.3

Over several decades, Douglas-fir will successfully exceed the height of the hardwoods and become firmly established in the overstory. Following several decades of growth, Douglas-fir will dominate the overstory of this community phase and tanoak will occupy the subcanopy and understory.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- tanoak (*Notholithocarpus densiflorus*), tree

Pathway 1.1a
Community 1.1 to 1.2

The reference community may transition to Community Phase 1.2 following a significant fire that removes the conifers and hardwoods from the canopy and allows the understory shrubs to dominate for a time as the hardwoods re-establish.

Pathway 1.2a
Community 1.2 to 1.3

With time, Douglas-fir should gradually re-establish and will eventually take over dominance once again in the upper most canopy layer.

Pathway 1.3a
Community 1.3 to 1.1

As the Douglas-fir creates a heavier shaded canopy, redwood will begin to re-establish from nearby seed sources and with time and no major disturbance, become a part of the canopy again.

Pathway 1.3b
Community 1.3 to 1.2

This community phase may transition to Community Phase 1.2 following a significant fire that removes the conifers and hardwoods from the canopy and allows the understory shrubs to dominate for a short time as the conifers and hardwoods attempt to re-establish.

Citations