Ecological site group F004BJ102CA
Dry, steep mountain slopes

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Key Characteristics

- Heavy coastal fog dominates the landscapes below 1500 ft.
- Soil moisture is ustic – LRU J
- 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 ESG occurs on uniform to convex summits and shoulders of broad ridges; and concave to convex positions of mountain slopes in LRU J. The mountain slopes are sloping to very steep reaching elevations just over 4000 ft.

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.

Although this is one of the wettest spots in California, precipitation-wise--the hot, dry, offshore summer winds of LRU J keep out the fog and make the King Range too dry to support a dominant overstory of redwoods, like that of the surrounding LRUs. The key difference between the redwood dominated slopes of this LRU and those of LRU I, is that when redwoods are harvested from LRU J, they will not re-establish on their own, they must be planted.

Soil features

Although Douglas-fir can grow on a variety of soils, the soils most associated with this concept are primarily comprised of colluvium and residuum materials derived from sandstone, metavolcanics, and sedimentary and metamorphic rocks, with soils that range from lithic and paralithic to very deep in some locations and are primarily well-drained.

Vegetation dynamics

This provisional ecological site concept attempts to describe the Douglas-fir dominated mountain slopes that can be found within LRU J. This concept is primarily supported through literature and available information online regarding these habitats. This provisional ecological site concept covers the mountains within the LRU that receive high amounts of precipitation and hot, dry, offshore summer winds that keep out the fog and make the King Range too dry to support a dominant overstory of redwoods, like that of the surrounding LRUs.

A vast amount of LRU J is dominated by this provisional ecological site concept, with the coastal redwood dominated site concept mainly on the stream terraces, protected foot slopes and toe slopes, and low elevation side slopes where fog still has an impact. 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.

Abiotic Factors

Pseudotsuga menzeisii (Douglas-fir) and *Notholithocarpus densiflorus* (tanoak) forests are extensive in this LRU and can be found in all topographic positions from summit to toe slope in the King Range and surrounding hills. Steep slopes and high winds restrict movement of fog inland, but do little to lessen rainfall totals. In fact, these abrupt mountain slopes that appear to rise directly out of the ocean encourage lifting and cooling of moist pacific air and result in locally higher average rainfall totals of up to 136 inches, falling almost entirely in late fall, winter and spring months (November - April). With lessening fog accumulation, coastal redwood is dramatically reduced in the forests communities of this LRU due to elevated summer evapotranspiration rates. This results in absence of coastal redwood in the overstory and very few occurrences where pockets of redwood persist in isolated understory stands near springs and seeps.

Douglas-fir is a large, coniferous, evergreen tree. The Douglas-fir near the coast is adapted to a moist, mild climate and 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. Despite the tendency of coastal Douglas-fir to reach greater sizes than inland varieties, stands that are directly adjacent o the coast experience high winds and often result in warped and stunted growth forms. Many 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 (Uchytil, 1991). 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. Although old-growth can occur in this LRU, frequent wildland fire and mass wasting events prohibit forests in the King Range from reaching their true potential and stands are often replaced well before old growth is established.

This ecological site is dominated by a multi-tiered canopy of Douglas-fir and tanoak and other hardwoods in mature stands, with coast redwood making up less than 1% of the stands basal area. Tanoak and other hardwoods, including shrubby chaparral species readily establish after disturbance and may dominate the overstory for several decades post-disturbance. Although chaparral species such as manzanita and ceanothus are common in MLRA 5, these shrubs rarely occur in MLRA 4B. However, chaparral stands are an important community phase of LRU J and occur post-fire, initiating the forest succession process. In some areas, it is not uncommon for chaparral scrub to dominate the upper third of topographic positions for decades and possibly longer should repeat stand-replacing fires occur. Adapted to resprout from root burls, these shrubs dominate coastal communities of LRU J until Doug-fir can take hold, eventually out-competing shade-intolerant chaparral species. These complex disturbance dynamics create a mosaic of cover-types throughout the King Range.

Primary Disturbances

Fire is the principal disturbance agent in both young-growth and old-growth stands. Fire in this LRU occurs from a mix of summer lightning storms and human ignitions. Few fire history studies have been conducted in this LRU, but fire regime research in adjacent LRUs (Viers, 1996) and the relatively dry climate of LRU J suggest fire would have been common, akin to drier areas further inland such as the Interior Coast Ranges or Klamath Mountains. Historically, tribes in the area used fire regularly to manage resources for various purposes, but especially to maintain grasslands, tanoak and deciduous oak forests, and early seral plant communities. Lightning-ignited fires are somewhat more common in this LRU than in the Northern Redwood LRUs I and A (Veirs, 1996). Perennial montane grasslands, deciduous oak woodlands, and valley grasslands of the King Range and greater LRU J were maintained through prescribed burning techniques implemented by native peoples for thousands of years. Without the continuation of these prescribed burns, many of these grasslands transition to forest. Tanoak, a significant tree in this ESG, remains a critically important tree to many Native American tribes in this LRU, and groves of tanoak were tended for many centuries with fire to limit competition with other trees and prolong their presence as dominant or codominant trees in the overstory and maintain wide, open crowns suitable for heavy masting and acorn harvest (Anderson, 2006, Bowcutt, 2013).

After Euro-American settlement and displacement of native people, burning continued on cutover logging lands (especially for the tanbark industry) and in the ranching community. Fire suppression increased substantially early to mid-20th century with changes to forest policy in California and shifts in land ownership patterns that saw the breakup of many large ranches. This resulted in a finely parceled private ownership configuration wherein confining prescribed fires to smaller areas is challenging and differences in land management philosophies of a more diverse land ownership base resulted in a socio-political climate less hospitable to widespread fall burning. As a result, much of this LRU has experienced a departure from the historic fire regime resulting in a fire deficit for most areas, though the time since that departure was initiated varies somewhat according to the timing of tribal displacement, land subdivision or acquisition by new owners that discontinued regular burning (e.g. purchase of the King Range by the BLM).

Fires in this ESG play a significant role in the development of stand structure and composition, stimulating reproductive responses of many species and opening up canopy gaps and sometimes large areas for young trees and young forest to develop. Fires also alter the composition of shrubs and forbs in the understory community. Fires expose soil and reduce competition from other plants, thereby increasing the establishment of many understory species, and help to facilitate the regeneration of many trees. Tanoak and other hardwood stems killed by fire resprout vigorously and outpace the growth of non-sprouting conifers such as Douglas-fir (McDonald, 1978, Fiske and DeBell, 1989). Larger stems of broadleaved trees may survive lower intensity fire with only basal wounding (Fryer, 2008). After a disturbance such as fire, a decrease in plant cover is common, but it is immediately followed by a rapid expansion of many resprouting stems from broadleaved trees and shrubs, and a gradual increase in cover of conifers over time as they infill the thick hardwood layer.

Other potential disturbances in this zone include winter storms that can cause top breakage and blowdown from wind and snow damage. This breakage may kill individual or groups of trees and create small openings from windfall (Noss, 1999). This would likely favor an infill of Douglas-fir in smaller gaps that retain some shade, and tanoaks and other hardwoods in less shaded, larger gaps.

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Major Land Resource Area

MLRA 004B
Coastal Redwood Belt

Stage

Provisional

Contributors

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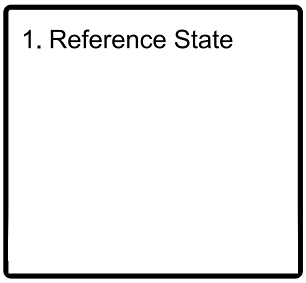
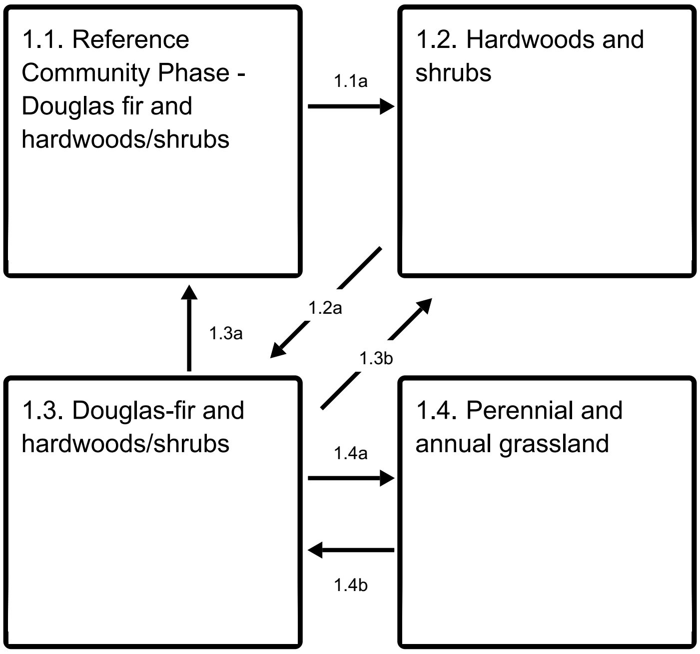
State and transition model

Ecosystem states



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 other hardwoods. *Sequoia sempervirens* (coast redwood) may still be present in the canopy, however in significantly lower amounts. *Arbutus menziesii* (Pacific madrone), *Chrysolepis chrysophylla* (giant chinquapin), and/or Umbellaria californica (California laurel) can also be found in the mix with tanoak in the subcanopy across much of this 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.

Community 1.1
Reference Community Phase - Douglas fir and hardwoods/shrubs

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 in the western portions of this provisional ecological site concept. The understory is sub canopy is also dominated by *Arbutus menziesii* (Pacific madrone), *Chrysolepis chrysophylla* (giant chinquapin), and/or Umbellaria californica (California laurel). 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 madrone (*Arbutus menziesii*), tree
- giant chinquapin (*Chrysolepis chrysophylla*), tree
- California laurel (*Umbellularia californica*), tree

Community 1.2
Hardwoods and shrubs

This community phase is dominated by tanoak and other hardwoods, including chaparral shrubs. On skeletal soils or shallow soils over fractured bedrock, chaparral species tend to form dense scrubland communities. Given the absence of a repeat burn, these chaparral communities persist until Douglas-fir can regenerate in openings. Conversely, in deeper soils with higher organic matter content, tanoak and associated hardwoods tend to out-compete shrubs. Tanoak grows rapidly in the created openings, and 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.

Community 1.3
Douglas-fir and hardwoods/shrubs

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.

Community 1.4
Perennial and annual grassland

This grassland community is a relic of past burning from native peoples and is maintained through grazing or management efforts. Should grazing pressure or management be removed, this community will revert back into a woody state.

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 may begin to re-establish from nearby seed sources in the western portions of this site concept and with time and no major disturbance, become a minor part of the canopy again.

Pathway 1.3b
Community 1.3 to 1.2

A stand-replacing fire or timber management clear cut will take out all the young Douglas-fir and redwood trees, taking the stand back to CP 1.2 with sprouting hardwoods and shrubs.

Pathway 1.4a
Community 1.3 to 1.4

Management in the form of woody removal, prescribed burning, grazing, or a combination of management efforts.

Pathway 1.4b
Community 1.4 to 1.3

Surrounding forest community acts as seed source and encourages woody encroachment.

Citations