# Ecological site group F004BI100CA Fluventic, Salt-Affected, Marine Terraces and Floodplains

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#### **Key Characteristics**

- Heavy coastal fog dominates the landscapes below 1500 ft.
- Soil moisture is udic LRU I
- Under 500 ft elevation and within sea spray zone
- Rarely flooded, fluventic alluvial floodplains

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 typically found in LRU I on rarely flooded, alluvial plains, low elevation mountains (under 200 feet), and flood plains across low slopes 0-5% and varied aspects within the areas of highest salt-spray impacts from the ocean and ocean storms. The sites are often on moist, uniform to slightly convex summits, shoulders, and backslopes of hills and debris slide areas. These hills are moderately steep to very steep and can tolerate the salty ocean spray of seaside dunes, headlands, and beaches, and the brackish water of bogs.

#### 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, and 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. Nighttime 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 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.

*Picea sitchensis* (Sitka spruce) forests are unique in this MLRA in their ability to dominate the stabilized younger sediments along the coastline that are heavily impacted by the coastal winds, winter storms, and significant sea salt spray. Sitka spruce is limited to areas of high annual precipitation, cool, maritime climate that provides fog drip and sufficient summer moisture to mollify evapotranspiration rates in the summers, and low elevation slopes that are within 5-6 miles of the ocean.

#### Soil features

Soils are variable, but will be dominated by fine-loamy or fine-silty textures in alluvium derived from mixed sources. They are found primarily within the Entisols and Inceptisols families, that are either oxyaquic or fluventic and slightly saline. They will generally have water at depths from 0-55 inches, and range from moderately well to poorly drained and rarely experience flooding events.

Representative soils include Ferndale and Canalschool.

#### **Vegetation dynamics**

This provisional ecological site concept attempts to describe the *Picea sitchensis* (Sitka spruce) dominated forests of LRU I. Fragments of Sitka spruce forests exist along the North Coast of California where the climate and soils are just right for their growth, however LRU I is the most dominant portion of the southern distribution of Sitka spruce, existing primarily along the lowest marine terraces and upper stream terraces closest to the coastline before coast redwoods dominate the overstory.

This concept is primarily supported through literature and available information from Redwood National Park Soil Survey. This provisional ecological site group covers the stabilized, yet fluventic soils close to the coastline that are most impacted by sea salt spray, 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.

#### **Primary Disturbances**

Sitka spruce ecological site has evolved with a low natural disturbance regime in coastal areas with a fog influence. Its close proximity to the coastal zone has caused the site to evolve with small to moderate disturbances from wind events. This is the primary disturbance to these Sitka spruce forests. Windthrow can account for up to 80 percent of the mortality within stands. Regeneration from gap phase replacement, however, is rapid (Griffiths, 1992). Winter winds from the northwest can be extreme and repeated disturbance by wind is evidenced by a hummocky ground appearance caused by fallen trees and root wads (Agee, 1993). Rarely, more severe wind events could lead to larger amounts of windthrow. *Alnus rubra* (red alder) will often establish dominance in these openings that are created during these wind events that open the canopy and knock down the Sitka spruce trees.

Small disturbance events that leave wind-created openings are likely to favor the establishment of shade-tolerant species including: Sitka spruce, Tsuga heterophyllia (western hemlock) and in rare cases, *Sequoia sempervirens* (coast redwood). Colonization of areas by Sitka spruce or red alder may occur in areas subject to debris flow. Larger disturbances, though rare, may favor the establishment of shade-intolerant species such as *Pseudotsuga menziesii* (Douglas-fir) (Agee, 1993).

*Rubus spectabilis* (salmonberry) and *Gaultheria shallon* (salal) may become very dense following a disturbance and can potentially form large brushfields (Tirmenstien, 1989). Both species can reproduce vegetatively. Though these brush species are most prevalent in early to mid-seral successional stages, they persist in the openings of reference Sitka stands. *Baccharis pilularis* (coyotebrush) and Rubus discolor (Himalayan blackberry) may occur more frequently where fire has been previously utilized. Windborne spores from *Polystichum munitum* (western swordfern) may also rapidly infill new openings. It is found throughout successional communities and will increase over time to become dominant (Zinke, 1977).

Sitka spruce seed will germinate on almost any substrate, although mineral soil or a mixture of mineral soil and organic soil are considered the best seedbeds. The "nurse log syndrome" has a key role in the regeneration of Sitka spruce in its wetter environments, such as this LRU. Germination and seedling survival are greater on rotting logs then on the forest floor. Seedling establishment and growth can be enhanced with the inoculation of the mycorrhizal fungi, Thelephora terrestris. Sitka spruce shows strong trends in hardiness and growth in relation to geographic origination. These trends can be used to increase growth rate, but they can also have adverse effects on survival.

Fire is rare in Sitka spruce forests due to the constant high humidity in this zone and relatively high annual precipitation. Its thin bark and a shallow root system make it very susceptible to fire damage (Griffiths, 1992). Natural fire intervals very near the ocean where Sitka spruce grows are generally very long, ranging from 250 to 500 years. If fires occur in this ESG, they are typically very intense and usually result in total stand replacement at very

infrequent intervals.

Sitka spruce may also rapidly invade adjacent coastal prairies that have been managed through burning or farming (Franklin and Dyrness, 1973). Red alder will also invade disturbed areas and form dense even-aged stands. The persistence of red alder on this site is thought to be related to the frequent soil movement and natural disturbance found along the coastal areas. Red alder fixes nitrogen which results in a higher availability of nitrogen in the soil (Uchytil, 1991).

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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 2 submodel, plant communities

2.1.			

## 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 plant community for this site is dominated by *Picea sitchensis* (Sitka spruce) in the overstory, with *Alnus rubra* (red alder) occurring in patches throughout the plant community. Windthrow from winter storms or small partial cuts can create small gaps which will maintain the Sitka spruce/red alder plant community. Both salmonberry and western swordfern are maintained in the understory.

#### Community 1.1 Reference Community Phase

This reference plant community for this site is dominated by *Picea sitchensis* (Sitka spruce) in the overstory, with *Alnus rubra* (red alder) occurring in patches throughout the plant community. *Sequoia sempervirens* (coast redwood) is a rare associate in some locations more well protected from the winds and salt spray. Sitka spruce and red alder often occur in a mosaic pattern due to frequent small disturbances. *Tsuga heterophylla* (Western hemlock) and occasionally *Pseudotsuga menziesii* (Douglas-fir) may also occur on this site, but this is very rare. The understory is dominated by *Rubus spectabilis* (salmonberry) and *Polystichum munitum* (western swordfern). On some sites *Gaultheria shallon* (salal) may co-exist with only salmonberry.

### Community 1.2

This community phase occurs from a significant windthrow event or a rare, stand-replacing fire. Block cutting and post-harvest burning will also reduce the cover of salal, but its ability to colonize open areas in changing canopy gaps allows it to recover quickly. Small slumping areas may be invaded following disturbance, which is particularly common on slopes close to the coast. Salmonberry is a prolific seeder and sprouts following disturbance. The estimated shrub age for this community ranges from 0 to 10 years.

### **Community 1.3**

Red alder dominates the plant community. It is a prolific seeder and colonizer which allows for rapid growth. Sitka spruce that became established at the same time as the alder will be quickly overtopped. The estimated tree age for this community is 15 to 40 years.

### Community 1.4

Red alder and Sitka spruce co-dominate the canopy, while salmonberry and salal may be patchier and will exist primarily in openings caused by windfall. The estimated tree age for this community is 40 to more than 80 years. Western swordfern remains the dominant ground cover.

## Pathway 1.1a Community 1.1 to 1.2

The reference state may transition to Community Phase 1.2 following a rare stand-replacing fire or significant block harvesting and post-harvest burning. The remnants of salmonberry and salal in the shrub community may rapidly expand and colonize an area. Swordfern may also be present in sites with more moisture.

## Pathway 1.1b Community 1.1 to 1.3

Following a significant windthrow event or timber harvest practice, red alder can rapidly establish and dominate the site, transitioning this community to Community Phase 1.3. Western swordfern may also infill.

## Pathway 1.1c Community 1.1 to 1.4

A minor windthrow event or timber harvesting practice that opens the canopy enough to allow red alder to reestablish co-dominance transitioning this community to Community Phase 1.3. Western swordfern may also infill.

#### Pathway 1.2a Community 1.2 to 1.3

If there is a seed source, red alder will infill, transitioning this community to Community Phase 1.3. Salmonberry and salal will also increase in population.

## Pathway 1.3b Community 1.3 to 1.2

Over time or with hardwood management, the dominance of red alder over conifers could be reduced, and the community could transition back to Community Phase 1.2.

### Pathway 1.3a Community 1.3 to 1.4

With no management, red alder may dominate a site for 25 years or more, slowing the growth of conifers. Over time, Sitka spruce infill that occurred at the time of disturbance becomes equal in height to the red alder, and the community shifts to Community Phase 1.4. Salmonberry and salal remain in the understory. Western swordfern continues to dominate the ground cover.

#### Pathway 1.4a Community 1.4 to 1.1

With continued growth and no significant disturbance Community Phase 1.4 will transition to Community Phase 1.1. Sitka spruce continues to grow in height and will eventually overtop the red alder to become the dominate species in the canopy. Red alder is still part of the site but is no longer the dominant tree cover.

### Pathway 1.4b Community 1.4 to 1.3

Smaller windthrow events or a partial cutting of Sitka spruce 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

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. This may not be a feasible transition due to the specific growing conditions required that may not be replicable due to the alterations to the site that had occurred.

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