USDA Natural Resources Conservation Service

Ecological site F004BX110CA
Sitka spruce-red alder/salmonberry/western swordfern, hills, sandstone and mudstone, clay loam

Accessed: 05/13/2025

General information

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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Associated sites

F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** This ecological site slowly transitions into Redwood/Western swordfern-Redwood sorrel ecosite, F004BX110CA.

Table 1. Dominant plant species

Tree	(1) *Picea sitchensis* (2) *Alnus rubra*
Shrub	(1) *Rubus spectabilis* (2) *Polystichum munitum*
Herbaceous	Not specified

Physiographic features

This ecological site is found along the coast throughout the survey area. It occurs on moist, uniform to slightly convex summits, shoulders, and backslopes of hills and debris slide areas. These hills are moderately steep to very steep.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Debris flow (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	2–294 m
Slope	15–75%
Water table depth	76–152 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the diurnal range in temperatures. Summertime temperatures range from 42 to 70 degrees F. Mean annual precipitation ranges from 65 to 90 inches and usually falls from October to May.

Table 3. Representative climatic features

Frost-free period (average)	325 days
Freeze-free period (average)	325 days
Precipitation total (average)	2,286 mm

Influencing water features

There are no influencing water features on this site.

Soil features

These well-drained, very deep soils are developed from colluvium and residuum derived from sandstone and mudstone. They are moderately to very strongly acidic at 40 inches with a dominantly loamy subsurface, and a rock content ranging from non-gravelly to very gravelly. Some soils on moderately steep summit positions may have a clayey subsurface texture group with minimal rock content.

Soils that have been tentatively correlated to this ecological site include the following:

Soil Survey Area: CA605 - Redwood National and State Parks

Map Unit Component

Sasquatch 593
Sisterrocks 593
Yeti 593
Sisterrocks 594
Houda 594
Sasquatch 599

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Loam (3) Clay loam

Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–60%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Sitka spruce (*Picea sitchensis*) occupies a thin band along the northern coast of California, as well as following drainages inland from the coast for short distances. Red alder (*Alnus rubra*) is a common associate, and may temporarily dominate sites that have been disturbed.

This site is largely contained within the coastal fog belt. Coastal fog ameliorates the effects of solar radiation on conifer transpiration rates (Daniel, 1942). Research in this region (Dawson 1998) has indicated that fog drip and direct fog uptake by foliage may contribute significant amounts of moisture to the forest floor during summer months and over the course of the year.

The Sitka spruce/red alder ecological site has evolved with a low natural disturbance regime in coastal areas with a fog influence. Natural fire intervals near the ocean range from 250 to 500 years; they are rare and of low intensity. Its close proximity to the coastal zone has caused the site to evolve with small to moderate disturbances from wind events. However, winter winds from the northwest can be extreme. Most commonly, winter windstorms cause broken tops and windthrow. 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.

Sitka spruce may rapidly invade adjacent coastal prairies that have been managed through burning or farming (Franklin and Dyrness, 1984). Red alder may also rapidly 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, 1989).

Small disturbance events that leave wind-created openings are likely to favor the establishment of shade-tolerant species including: Sitka spruce, western hemlock (Tsuga heterophyllia) and in rare cases, redwood (*Sequoia sempervirens*). 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 Douglas-fir (*Pseudotsuga menziesii*) (Agee, 1993).

Salmonberry (*Rubus spectabilis*) and salal (*Gaultheria shallon*) may become very dense following a disturbance and can potentially form large brushfields (Tirmenstien,1989). Both species can reproduce vegetatively following

timber harvesting or fire. Though these brush species are most prevalent in early to mid-seral successional stages, they persist in the openings of climax stands. Coyotebrush (*Baccharis pilularis*) and Himalayan blackberry (Rubus discolor) may occur more frequently where fire has been previously utilized. Windborne spores from western swordfern (*Polystichum munitum*) may also rapidly infill new openings. It is found throughout successional communities, and will increase over time to become dominant (Zinke,1977).

State and transition model

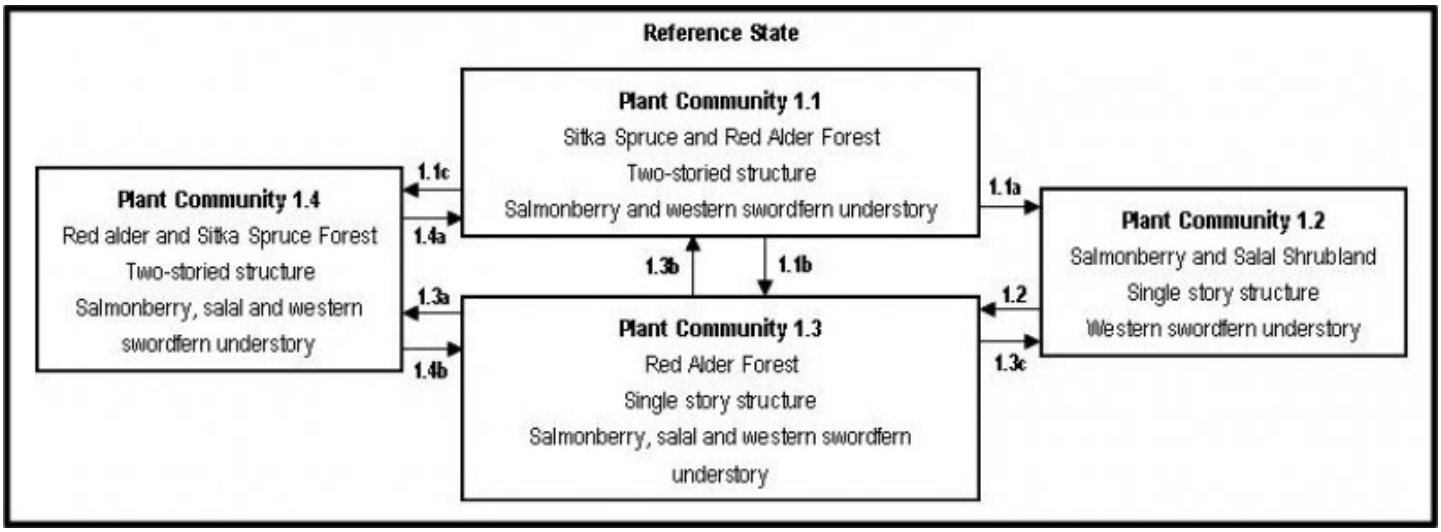

Figure 4. State and Transition Model

State 1
Reference State: Plant Community 1.1 - Sitka Spruce-Red Alder Forest

Community 1.1
Reference State: Plant Community 1.1 - Sitka Spruce-Red Alder Forest

The reference plant community for this site is presumed to be similar to the historic plant community*. Sitka spruce (*Picea sitchensis*) dominates the overstory, with red alder (*Alnus rubra*) occurring in patches throughout the plant community. Redwood (*Sequoia sempervirens*) is a rare associate on some sites. Sitka spruce and red alder often occur in a mosaic pattern due to frequent small disturbances. Western hemlock (*Tsuga heterophylla*) and occasionally Douglas-fir (*Pseudotsuga menziesii*) may occur on this site, but this is rare. The understory is dominated by salmonberry (*Rubus spectabilis*) and western swordfern (*Polystichum munitum*). On some sites salal (*Gaultheria shallon*) may co-exist with only salmonberry. 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 Pathway 1.1a: The reference state may transition to PC 1.2 following 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. Community Pathway 1.1b: If there is a seed source present, red alder can rapidly colonize the openings left by block harvesting, transitioning this community to PC 1.3. Western swordfern may also infill. Community Pathway 1.1c: Partial cutting in mature stands could allow for the establishment of patches of red alder and Sitka spruce; moving this community towards PC 1.4. *No transects were established in old growth stands and the reference plant community is based on professional judgment and observations in other locations, therefore, the reference community described is considered conceptual until more information can be collected.

Forest overstory. Sitka spruce dominates the overstory, with red alder occurring in patches throughout the plant community. Redwood is a rare associate. Western hemlock, and occasionally Douglas-fir, may also occur as an associate on some sites, but this is not common.

Overstory canopy cover

Sitka spruce (Picea sitchensis) 80-100%
Red alder (Alnus rubra) 0-15%

Forest understory. The understory is dominated by salmonberry, salal, and western swordfern. On some sites, salmonberry may co-exist with only western swordfern.

Understory canopy cover

Salmonberry (Rubus spectabilis) 15-35%
Salal (Gaultheria shallon) 5-25%
Western swordfern (Polystichum munitum) 25-35%

Table 5. Ground cover

Tree foliar cover	80-100%
Shrub/vine/liana foliar cover	25-60%
Grass/grasslike foliar cover	0%
Forb foliar cover	5-35%
Non-vascular plants	0%
Biological crusts	0%
Litter	30-40%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 6. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	–	–	0-5%
>0.6 <= 1.4	–	5-15%	–	15-35%
>1.4 <= 4	–	15-35%	–	–
>4 <= 12	5-20%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	80-100%	–	–	–

State 2
Plant Community 1.2 - Salmonberry-Salal Shrubland

Community 2.1
Plant Community 1.2 - Salmonberry-Salal Shrubland

Block cutting and post-harvest burning will 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 Pathway 1.2a: If there is a seed source, red alder will infill, transitioning this community to PC 1.3. Salmonberry and salal will also increase in population.

State 3
Plant Community 1.3 - Red Alder Forest

Community 3.1
Plant Community 1.3 - Red Alder Forest

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 Pathway 1.3a: 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 PC 1.4. Salmonberry and salal remain in the understory. Western swordfern continues to dominate the ground cover. Community Pathway 1.3b: With hardwood management, the dominance of red alder over conifers could be reduced, and the community could transition back to PC 1.1. Community Pathway 1.3c: Hardwood management or disease and mass die off of the red alder may transition this community back to PC 1.2.

State 4
Plant Community 1.4 - Red Alder-Sitka Spruce Forest

Community 4.1
Plant Community 1.4 - Red Alder-Sitka Spruce Forest

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. Community Pathway 1.4a: With continued growth and no significant disturbance PC 1.1 will transition to PC 1.2. 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. See PC 1.1. Community Pathway 1.4b: Partial cutting of Sitka spruce may cause red alder to re-dominate the openings for a time, moving the community to PC 1.3.

Additional community tables

Animal community

The redwood forest provides habitat for 61 species of mammals. Predators include the black bear, fisher and marten, mountain lion, fox, and bobcat. Ungulates include deer and elk.

Approximately 100 native bird species use the redwood forest on a seasonal basis. Common bird species include warblers, tanagers, sparrows, and blackbirds. Other bird species include the Marbeled Murrelet, the Northern spotted owl, and the Bald Eagle.

Common reptiles found in forested areas include the alligator lizard and garter snake.

Amphibians are mostly associated with riparian and wetland areas; however the northwest salamander and two newt species spend much of their lives in upland habitat.

Salmonberry provides cover and a source of food for birds and mammals.

Hydrological functions

Soils have a moderate infiltration rate when thoroughly wet.

The site is subject to erosion where adequate vegetative cover is not maintained. Road building, timber harvest, and site preparation for planting may increase surface erosion and potential for mass wasting.

Hydrologic Group

Map Unit Component

593 Sasquatch--B
593 Sisterrocks--C
593 Yeti--D
594 Sisterrocks--C
594 Houda--C

Recreational uses

Recreational development and use may be limited by slopes ranging from 15 to 50 percent.

Wood products

Sitka spruce is used as saw timber, wood pulp and plywood. It has a high weight to strength ratio which is valuable for use as masts for sail boats, oars, boats and racing sculls. It is also valued for use in making guitars and for piano sounding boards.

Other products

Salmonberries are eaten fresh or preserved. They are an important food source for birds and other animals.

Table 7. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Sitka spruce	*PISI*	176	200	265	300	–	–	–	

Inventory data references

Forestry data was collected at the following soil pits and soil notes:

Component Map unit Plot #

Sasquatch 593 05-018, 05-021, 05-026,
05-027, 05-001
Sisterrocks 593 05-024
Sisterrocks 594 05-022, 05-025, 05-034,
6052
Yeti 593 05-028
Sasquatch 599 09-052, 09-053, 09-055

Type locality

Location 1: Del Norte County, CA	
Township/Range/Section	T14N R1E S19
UTM zone	N
UTM northing	4605028
UTM easting	0408251
General legal description	Coastal Trail, between hidden beach and Lagoon Creek.

Other references

Agee,James K., 1993. Fire Ecology of Northwest Forests. P 187-225.

Noss, Reed, F., editor. 2000. The Redwood Forest. 377 pages.

Silvics of North America. 1990. USDA Handbook 654

Steinburg, (Coyotebrush)

Viers, Stephen D. 1996. Ecology of the Coast Redwood. Conference on Coast Redwood Forest Ecology and Management. P 9-12.

Griffith, Randy Scott. 1992 *Picea sitchensis*
In: Fire Effects Information System, [Online]. U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Labratory (Producer). Available: http//www.fs.fed.us/database/feis [2006, February 8]

Uchytil, Ronald J. 1989. *Alnus rubra*. In: FIre Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/

Contributors

Judy Welles

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not**

bare ground):

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**