USDA Natural Resources
Conservation Service

Ecological site F004BX108CA
Redwood, western swordfern, mountain slopes, sandstone and schist, 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

F004BX103CA	**Redwood-Douglas-fir/Pacific rhododendron, mountain slopes, sandstone, clay loam** Farther inland, the redwood-Douglas-fir site F004BX103CA may be found in conjunction with this site.
F004BX110CA	**Sitka spruce-red alder/salmonberry/western swordfern, hills, sandstone and mudstone, clay loam** The Sitka spruce-red alder site F004BX110CA is found on the coast adjacent to this ecological site.
F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** F004BX111CA may be found in conjunction with this ecological site.

Similar sites

F004BX107CA	**Redwood/western swordfern, hills, soft sandstone, clay loam** Ecological site F004BX107CA, also named SESE3/POMU, is found on the Prairie Creek formation.
F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** Ecological site F004BX111CA, named SESE3/POMU-OXOR, is found on alluvial terraces.

Table 1. Dominant plant species

Tree	(1) *Sequoia sempervirens*

Shrub	Not specified
Herbaceous	(1) *Polystichum munitum*

Physiographic features

This ecological site is found in close proximity to the coast throughout the survey area. It occurs on uniform to slightly convex summits and shoulders of broad ridges; and slightly concave to convex positions of mountain slopes. These mountain slopes are gently sloping to very steep.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	5–565 m
Slope	5–75%
Water table depth	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. Mean annual temperatures range from 50 to 55 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)	300 days
Freeze-free period (average)	300 days
Precipitation total (average)	2,286 mm

Influencing water features

Research in the redwood region (Dawson 1998) has indicated that fog drip and direct fog uptake by foliage may contribute significant amounts of moisture to the forest during summer months and over the course of the year. Coastal fog also ameliorates the effects of solar radiation on conifer transpiration rates.

Soil features

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

Soils that have been tentatively correlated to this ecological site include the following.
Soil Survey Area: CA605 - Redwood National Park

Mapunit Soil

553 Ladybird
553 Stonehill

554 Ladybird
554 Buzzini
590 Footstep
590 Sasquatch
590 Yeti
591 Ladybird
591 Sasquatch
591 Sisterrocks
592 Footstep
592 Sasquatch
592 Sisterrocks
523 Buzzini
524 Buzzini

Table 4. Representative soil features

Surface texture	(1) Loam (2) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to slow
Soil depth	102–203 cm
Surface fragment cover <=3"	0–30%
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)	4.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	10–65%

Ecological dynamics

The historical origins of fires within the northern Redwood Region remain unknown. Lightning-ignited fires are considered rare. However, Native American burning is thought to have played a major role by burning fires from the interior into the redwood zone (Veirs, 1996). Natural fire intervals ranged from 500 to 600 years on the coast, 150 to 200 years on intermediate sites, and 50 years on inland sites. The northern range of redwoods evolved within a low to moderate natural disturbance regime. (Veirs, 1979).

Surface fires likely modified the tree species composition by favoring the thicker-barked redwood (*Sequoia sempervirens*) and killing western hemlock (*Tsuga heterophylla*), tanoak (Lithocarpus densiflorus) and grand fir (*Abies grandis*) (Veirs, 1979). Western hemlock's shallow roots and thin bark make it susceptible to fire damage (Arno, 2002). The establishment of a western hemlock understory is increased by surface fires. This is due to the exposure of mineral-rich soil and the reduction of other plant competition (Veirs, 1979, Williamson, 1976). Tanoak seedlings and sapling-sized stems are often top-killed by surface fire, though larger stems may survive with only basal wounding (Tappeiner, 1984).

Both redwood and tanoak have the ability to re-sprout following fire (Veirs, 1996). After fire, redwood may sprout from the root crown or from dormant buds located under the bark of the bole and branches (Noss, 2000). The sprouting ability of redwood is most vigorous in younger stands and decreases with age. Frequent fire reduces tanoak's sprouting ability and tends to keep understories open (Arno, 2002). Fire exclusion would allow for the gradual increase of tanoak in the understory (McMurray, 1989).

Red alder (*Alnus rubra*) produces a large amount of seed that rapidly colonizes a site following disturbance. Several thousand red alder per acre initially outgrow and dominate any other conifer that may become established through sprouting or via seed.

Other potential disturbances in the redwood zone include winter storms that can cause top breakage. This breakage may kill individual or groups of trees and create small openings from windfall (Noss, 2000). This would likely favor the establishment of redwood and other shade tolerant conifers.

Salmonberry (*Rubus spectabilis*), California huckleberry (*Vaccinium ovatum*) and salal (*Gaultheria shallon*) generally sprout following fire or other types of disturbance (Termenstein 1989). Western swordfern (*Polystichum munitum*) reproduction is primarily through wind-born spores, though mature plants may reproduce vegetatively (Crane, 1989).

Past harvesting and the use of fire as a slash treatment has altered species composition on many sites (Noss, 2000). Within many areas of the park, aerial seeding of Douglas-fir has led to a 10:1 ratio of Douglas-fir to redwood (Noss, 2000).

Redwood's interior range is largely contained within the coastal fog belt. Coastal fog ameliorates the effects of solar radiation on conifer transpiration rates (Daniel, 1942). Research in the redwood 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.

State and transition model

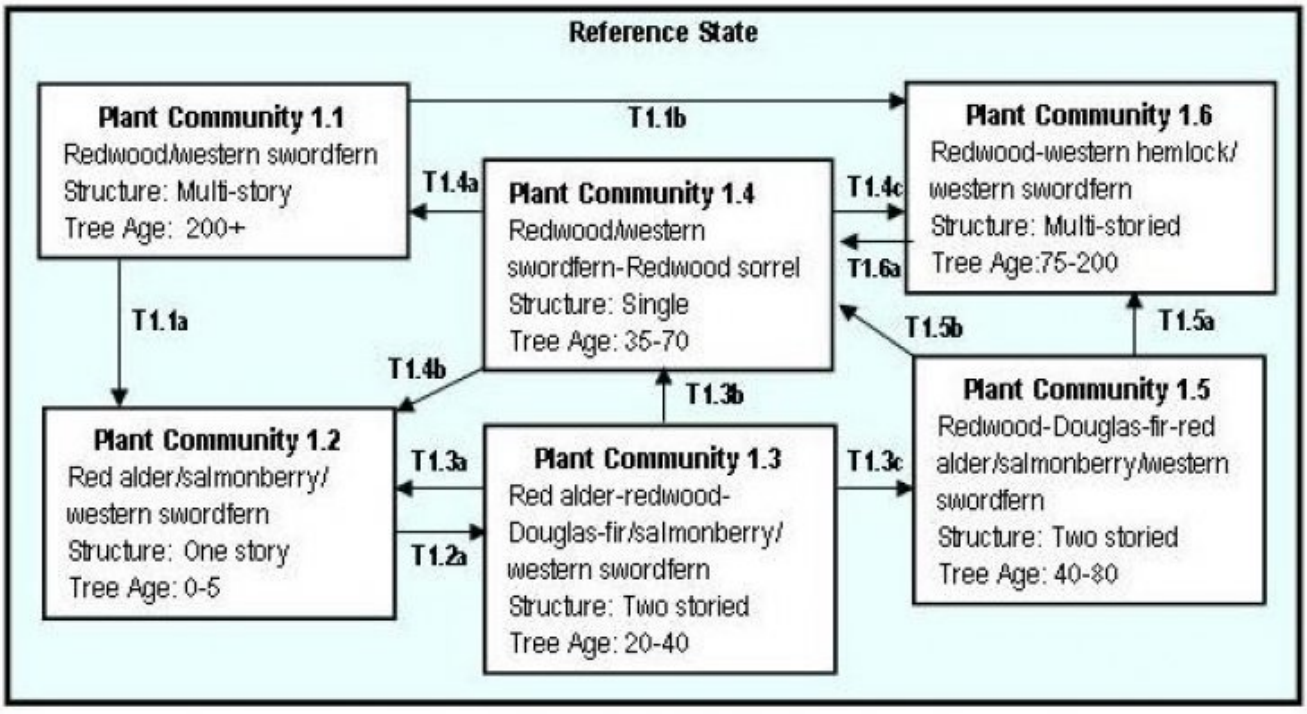

Figure 4. Redwood/Western swordfern model

State 1
Reference State - Plant Community 1.1

Community 1.1
Reference State - Plant Community 1.1

The characteristic plant community is the reference plant community. The overstory is dominated by redwood (*Sequoia sempervirens*) with lesser amounts of Douglas-fir (*Pseudotsuga menziesii*) on some sites. Near the coast, Sitka spruce (*Picea sitchensis*) is often the more common minor species. Both western hemlock (Tsuga heterophyllia) and red alder (*Alnus rubra*) may be found in small amounts on these sites. The understory is dominated by western swordfern (*Polystichum munitum*) and redwood-sorrel (Oxalis oregano). Occasional patches of California huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*), and salal (*Gaultheria shallon*) brush thickets may be found. Partial cutting or windthrowing would tend to perpetuate the redwood plant community. Small openings in the canopy allow for a natural regeneration of redwood through sprouting or infill. T1.1a – Following block harvesting, mineral soil will be exposed. This could lead to a rapid invasion of red alder and salmonberry if there is a seed source present. Red alder, a prolific seeder, establishes and grows rapidly on disturbed sites (Uchytil, 1989). Salmonberry sprouts may grow under the red alder canopy for many years and may form small brushfields, especially in areas that stay very moist (Tirmenstein, 1989). Salal populations may increase through sprouting and layering (Tirmenstein, 1990). Western swordfern may swiftly colonize logged or burned areas (Page, 1979) See PC#1.2. T1.1b – Without natural fire or burning, there could be gradual infill of shade tolerant western hemlock. Partial cutting could have a similar effect. See PC#1.6.

Forest overstory. The overstory is dominated by redwood, with small areas of Douglas-fir or Sitka spruce near the coast. Western hemlock may be found in the sub-canopy on some sites. Minor amounts of tanoak or red alder may also be found in the sub-canopy.

Overstory canopy cover

Redwood (Sequoia sempervirens)
80-90%
Douglas-fir (Pseudotsuga menziesii) 0-15%
Sitka Spruce (Picea sitchensis)
0-5%
Western hemlock (Tsuga heterophyllia) 0-5%
Red alder (Alnus rubra) 0-10%
Tanoak (Lithocarpus densiflorus) 0-5%

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

Understory cover

Salmonberry (Rubus spectabilis)
0-15%
Salal (Gaultheria shallon)0-15%
California huckleberry (Vaccinium ovatum) 5-15%
Western swordfern (Polystichum munitum) 50-80%

Table 5. Ground cover

Tree foliar cover	80-90%
Shrub/vine/liana foliar cover	15-40%
Grass/grasslike foliar cover	0%
Forb foliar cover	40-80%
Non-vascular plants	0%
Biological crusts	0%

Litter	10-20%
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	–	–	–	–
>0.6 <= 1.4	–	–	–	20-40%
>1.4 <= 4	–	20-50%	–	–
>4 <= 12	0-5%	–	–	–
>12 <= 24	0-5%	–	–	–
>24 <= 37	0-10%	–	–	–
>37	80-95%	–	–	–

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

This plant community is dominated by red alder and salmonberry, with western swordfern and redwood-sorrel in the forb layer. T1.2a – Without management, red alder may dominate a site for 20 to 40 years, slowing the infill and growth of conifers. See PC#1.3.

State 3
Plant Community 1.3

Community 3.1
Plant Community 1.3

Red alders dominate the overstory. A few Douglas-firs may be present if there is a seed source at the time of disturbance. Redwood sprouts grow underneath the redwood canopy. Salmonberry sprouts will grow under the red alder canopy for many years and may form small brushfields, especially in areas that stay very moist. Salal and California huckleberry populations may increase through sprouting. T1.3a – Red alder could be block harvested to set the community back to an early seral condition. See PC#1.2. T1.3b – The time period of red alder dominance could be reduced with hardwood management. As the red alder stand matures, partial cutting or chemical treatment could release redwood from competition. See PC#1.4. T1.3c – Without management, red alder may dominate a site for 20 to 40 years, slowing the infill and growth of conifers. After approximately 40 years, redwood and Douglas-fir would overtop the red alder canopy and dominate the overstory. See PC#1.5.

State 4
Plant Community 1.4

Community 4.1

Plant Community 1.4

Following hardwood management, a plant community primarily dominated by redwood may develop. T1.4a – Left to develop without disturbance, the plant community would eventually become a mature multi-storied redwood stand. See PC#1.1. T1.4b – In the event of a block harvest, the redwood plant community would be set back to an alder/salmonberry/western swordfern plant community. See PC#1.2 T1.4c – Fire exclusion or a lack of disturbance from these sites could lead to a larger component of western hemlock in the sub-canopy. See PC#1.6.

State 5
Plant Community 1.5

Community 5.1
Plant Community 1.5

Conifers have overtopped the red alder and now dominate the overstory. T1.5a – With fire exclusion or lack of disturbance, western hemlock successfully regenerates in the understory to become a more significant component of the sub-canopy. Red alder begins to senesce and eventually dies as the canopy closes, after about 60 years. See PC#1.6. T1.5b – Partial cutting of Douglas-fir and red alder would lead to a redwood dominated plant community. See PC#1.4.

State 6
Plant Community 1.6

Community 6.1
Plant Community 1.6

After many years, redwood height growth will surpass that of Douglas-fir. If no further disturbance occurs, Douglas-fir will not regenerate, and will slowly become a minor component of the site. Western hemlock continues to regenerate and becomes a more significant part of the overstory. T1.6a - Fire or harvest of the Douglas-fir and/or western hemlock will return the plant community to PC#1.4.

Additional community tables

Animal community

The Redwood forest provides habitat for many species of mammals and native birds. Predators include black bear, fisher and marten, mountain lion, fox and bobcat. Ungulates included deer and elk, which use the forested areas for foraging and cover.

Many bird species use the redwood forest on a seasonal basis. Bird species include warblers, tanagers, sparrows, blackbirds, the Marbeled Murrelet, the Northern spotted owl and the Bald Eagle.

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

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

Hydrological functions

Runoff class is medium to high.

The hydrologic groups, hydrologic conditions and runoff curves for each soil series are:

553 Ladybird--C
554 Ladybird--C
590 Footstep--C
590 Yeti--D
591 Ladybird--C

591 Sasquatch--C
591 Sisterrocks--C
592 Footstep--C
592 Sisterrocks--C
553 Stonehill--C

Refer to the Soil Survey Manuscript for further information.

Recreational uses

Limitations to recreational uses and development may occur due to slope considerations, the amount of rock fragments, or soil permeability.

Wood products

Redwood is a highly valued lumber because of its resistance to decay. Uses of redwood include house siding, paneling, trim and cabinetry, decks, hot tubs, fences, garden structures, and retaining walls. Other uses include fascia, molding and industrial storage and processing tanks.

Douglas-fir is employed in residential structures and light commercial timber-frame construction. It is also used for solid timber heavy duty construction such as pilings, wharfs, bridge components and warehouse construction.

Other products

Redwood burls are used for tabletops, veneers, bowls and other turned products. Redwood bark is widely used as garden mulch.

Douglas-fir is a very desirable Christmas tree; branches and cones are also used as materials for Christmas wreaths.

Foliage of the California huckleberry is used by florists in floral arrangements and to make Christmas decorations.

Other information

Roosevelt elk utilize the lower slopes of this ecosite for hiding and resting cover.

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
redwood	*SESE3*	160	195	239	358	–	–	–	
Douglas-fir	*PSME*	145	180	152	191	–	–	–	

Inventory data references

Data for this site was obtained from NRCS Wood-5 forms collected at forest soil pits and from transects that were conducted within similar map units. See transects 2, 3 and 4.

Data was collected at the following soil pits and/or soil note locations:

MU Component Plot or Note #

553 Ladybird 01-004 6008
01-001
554 Ladybird 01-005

590 Footstep 05-0 41
6039
6054
590 Sasquatch 02-14
05-39
590 Yeti 05-20
591 Ladybird 6009
6042
591 Sasquatch 04-127 05-93-1
6036
6037
591 Sisterrocks 04-125 05-019
05-042 6038
05-93-2
592 Footstep 04-129
592 Sasquatch 05-053
592 Sisterrocks 05-089
6055
553 Stonehill 04-019

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	TT11N RR1E S26
UTM zone	N
UTM northing	4573175
UTM easting	0414090
General legal description	Transect #4 takes off from a skid trail off the Bald Hills road below the Ladybird Johnson grove and runs down the ridge through mapunits 591 and 590.

Other references

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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:**

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

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

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:

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

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

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

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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:**

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17. **Perennial plant reproductive capability:**
