USDA Natural Resources
Conservation Service

Ecological site F004BX107CA
Redwood/western swordfern, hills, soft sandstone, clay loam

Accessed: 05/12/2025

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

F004BX106CA	**Redwood/Douglas-fir/California huckleberry/western swordfern, hills, soft sandstone, very gravelly loam** F004BX106CA is found in conjunction with F004BX107CA as they are found in the same geographic location and on associated landforms.
F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** F004BX111CA is found in conjunction with F004BX107CA but occurs along stream terraces and alluvial fans.

Similar sites

F004BX106CA	**Redwood/Douglas-fir/California huckleberry/western swordfern, hills, soft sandstone, very gravelly loam** F004BX106CA may resemble or be confused with F004BX107CA because the two sites are found in association with each other and the vegetation may initially appear similar. In F004BX106CA the shrub layer of California huckleberry dominates the understory, and in F004BX107CA, the forb layer of western swordfern dominates the understory. Ecological site 107 is also a more productive site due to soil factors and slope position.

Table 1. Dominant plant species

Tree	(1) *Sequoia sempervirens*
Shrub	Not specified
Herbaceous	(1) *Polystichum munitum*

Physiographic features

This ecological site is found along the coast and inland between Goldbluffs beach and Prairie Creek, with areas northeast of Orick and east of Prairie Creek. It occurs on uniform to slightly convex summits, shoulders and backslopes of hills and steep mountain slopes. These hills are strongly sloping to steep.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	6–593 m
Slope	9–50%
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. Summer temperatures range from 65 to 70 degrees F. Mean annual precipitation ranges from 60 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 developed from colluvium and residuum derived from weakly consolidated sandstone and a conglomerate of the Prairie Creek Formation. They are very strongly to strongly acidic at 40 inches, with a dominantly loamy subsurface and rock content ranging from non-gravelly to extremely gravelly.

This ecological site occurs on the following soil components and map units:

Map Unit Soil Component

291 Ossagon
292 Ossagon

293 Ossagon
294 Ossagon
291 Squashan
292 Squashan
293 Squashan
294 Squashan

Table 4. Representative soil features

Surface texture	(1) Loam (2) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–22.86 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)	0–60%
Subsurface fragment volume >3" (Depth not specified)	0%

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).

A moderate fire could lead towards more of a mosaic in regeneration patterns. Patches of trees would be killed leaving others slightly damaged or unharmed. Douglas-fir (*Pseudotsuga menziesii*) regeneration would be favored in the large gaps that are created following a moderate fire, potentially leading to a larger proportion of Douglas-fir to redwood for several centuries (Agee, 1993). Without these gaps caused by fire, Douglas-fir regeneration is unsuccessful, and with continued lack of disturbance it may slowly be replaced by redwood as the dominant canopy species (Veirs, 1979, 1996).

California huckleberry (*Vaccinium ovatum*) is normally a fire-dependent shrub species; little is known concerning it's adaptation to fire under low to moderate fire return intervals (Tirmenstein, 1990). It is a common species in both moist and dry redwood environments. Sprouting is widespread following fire and recovery may be rapid.

Red alder is present as a minor component on these sites. Red alder is a pioneering hardwood tree species that may quickly invade disturbed areas. It has been suggested that its historical distribution was more restricted than it is today (Franklin, 1981).

Pacific rhododendron (*Rhododendron macrophyllum*) is considered sensitive to fire and may sprout from the rootcrown or stembase following surface fire (Crane, 1990). After disturbance a decrease in plant cover is common, followed by a gradual increase over time.

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. On alluvial sites with periodic flooding, redwood may dominate, along with other colonizing hardwoods (Veirs, 1996). Where existing redwoods are inundated, new roots develop in newly deposited silt (Veirs, 1996).

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

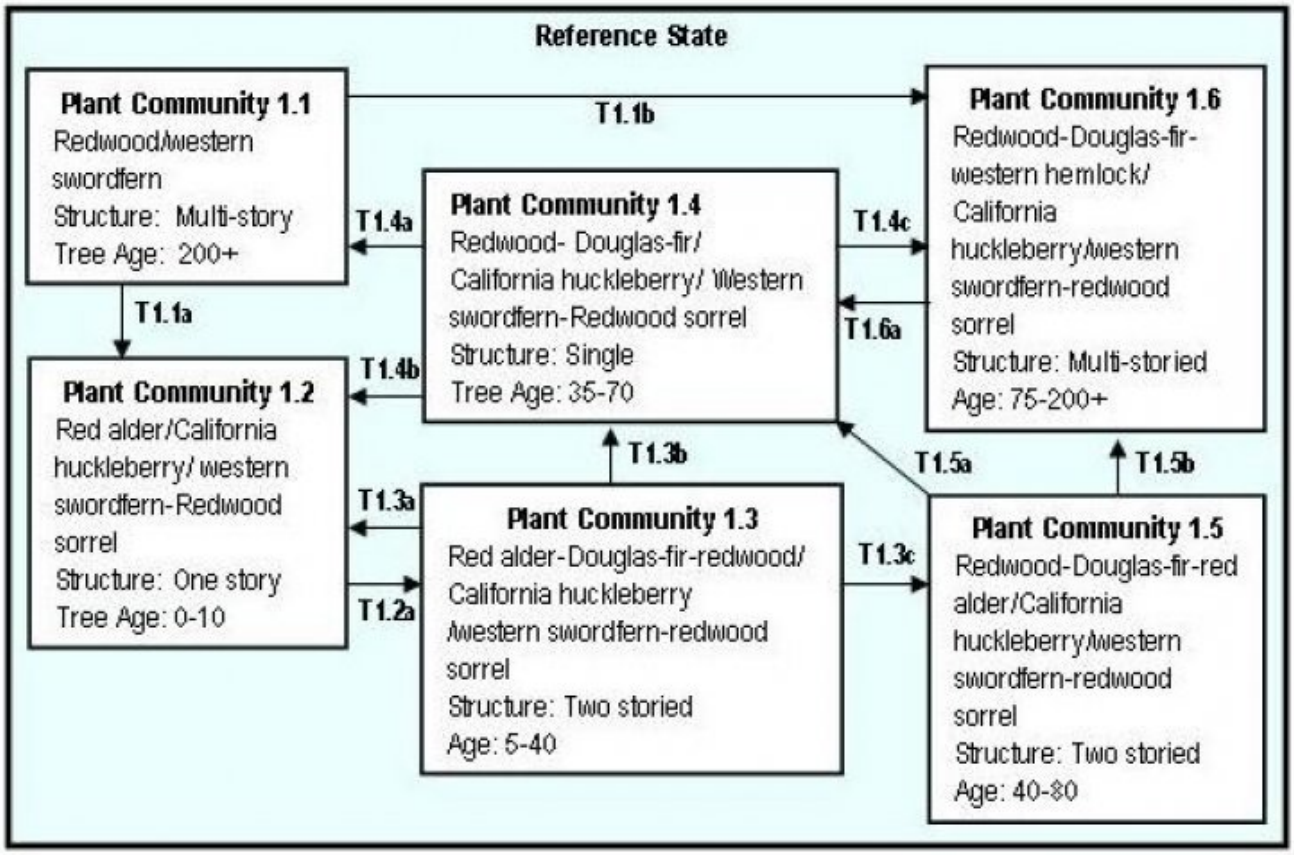

Figure 4. Redwood/Western swordfern model

State 1
Reference State - Plant Community 1.1

Community 1.1
Reference State - Plant Community 1.1

The characteristic plant community for this site is the reference plant community. This site has an overstory nearly completely dominated by redwood (*Sequoia sempervirens*). Disturbance has modified species composition on some sites leading to a minor component of Douglas-fir (*Pseudotsuga menziesii*) inland and sitka spruce (*Picea sitchensis*) towards the coast. Western hemlock (Tsuga heterophyllia) is also present on most sites, though in very minor amounts. The shrub layer present on most sites is very patchy, but consists of California huckleberry (*Vaccinium ovatum*) and in some instances, salal (*Gaultheria shallon*). Western swordfern (*Polystichum munitum*) and redwood-sorrel (Oxalis oregano) dominate the understory layer. T1.1a – Following block harvesting and post-harvest burning, infill of red alder (*Alnus rubra*) will occur. Red alder, a prolific seeder, rapidly seeds into disturbed areas with exposed mineral-rich soil (Uchytil, 1989). Shrubs, such as California huckleberry and salal, will sprout and may increase in cover. Western swordfern spores are wind disseminated and are often dominant following disturbance (Zinke, 1977). Redwood-sorrel reproduces via rhizomes and seed. 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 and Douglas-fir.

Overstory composition %

Redwood (Sequoia sempervirens)
80-90
Douglas-fir (Pseudotsuga menziesii) 10-15

Western hemlock (Tsuga heterophyllia) <5
Red alder (Alnus rubra) <5
Grand fir (Abies grandis) <5

Forest understory. The understory is dominated by forbs, primarily western swordfern and redwood-sorrel.

Understory composition %

California huckleberry (Vaccinium ovatum) 5-35
Salal (Gaultheria shallon) 0-15
Western swordfern (Polystichum munitum) 20-50
Redwood-sorrel (Oxalis oregano)
5-25

Table 5. Ground cover

Tree foliar cover	70-85%
Shrub/vine/liana foliar cover	10-30%
Grass/grasslike foliar cover	0%
Forb foliar cover	20-40%
Non-vascular plants	0%
Biological crusts	0%
Litter	80-90%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

Block harvesting, followed by post-harvest burning, will leave mineral-rich soil exposed. Red alder is a prolific seeder and is capable of rapid growth. It may rapidly invade an area if there is a seed source present. T1.2a – Redwood sprouts and Douglas-fir infill will grow underneath the red alder canopy. See PC#1.3.

State 3
Plant Community 1.4

Community 3.1
Plant Community 1.4

After the removal of red alder, the plant community is dominated by redwood and Douglas-fir. California huckleberry, western swordfern and redwood-sorrel continue to be present in the understory. T1.4a – With continued growth over time, a mature multi-story redwood/Douglas-fir overstory could develop. See PC#1.1. T1.4b – If the plant community were block harvested, the vegetation would likely return to red alder. See PC#1.2. T1.4c – With continued growth and infill, coupled with the lack of fire, western hemlock may become more of a component of the understory. This would develop the area into a redwood/Douglas-fir/western hemlock plant community. See PC#1.6.

State 4
Plant Community 1.5

Community 4.1
Plant Community 1.5

Over time, conifers height will surpass that of the red alder. Redwood and Douglas-fir dominate the site. T1.5a – Partial cutting or chemical control of red alder could accelerate conifer growth and development. See PC#1.4. T1.5b – After 40 to 60 years, red alder declines and slowly dies out. Infill of western hemlock may occur, if there is a lack of disturbance. See PC#1.6.

State 5
Plant Community 1.3

Community 5.1
Plant Community 1.3

Red alder may rapidly invade an area if there is a seed source present. Douglas-fir seedlings and redwood sprouts may become established at the time of disturbance and will grow under the red alder canopy for many years. T1.3a – If the red alder was block harvested, it would likely re-seed to red alder. See PC#1.2. T1.3b – With hardwood management, such as partial cutting, the time period of red alder dominance could be reduced and conifer growth accelerated. See PC#1.4. T1.3c – With no management, conifers will equal hardwood heights after 20 to 25 years. In 30 to 40 years redwood and Douglas-fir will become the dominant overstory conifers. See PC#1.5.

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 61 species of mammals and approximately 100 native bird species. Historical predators included the grizzly (extirpated) and black bear, fisher and marten, mountain lion, fox, and bobcat. Ungulates include deer and elk.

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

Hydrologic Group:

291-Ossagon--C
292-Ossagon--C
293-Ossagon--C

294-Ossagon--B
291-Squashan--B
292-Squashan--B
293-Squashan--C
294-Squashan--B

Refer to the Soil Survey Manuscript for further information.

Recreational uses

Limitations to recreational uses and development may occur due to slope considerations, soil texture and rock fragments.

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.

California huckleberries are made into wine, as well as processed into pie fillings for home and commercial use. Foliage of the California huckleberry is used by florists in floral arrangements and to make Christmas decorations.

Other information

Pacific rhododendron is sometimes used for erosion protection on steep slopes.

California Huckleberry leaves may be eaten by deer, and its berries are utilized by many bird and mammal species including bear, fox, squirrel, and skunk.

Table 6. 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*	172	178	276	294	–	–	–	
Douglas-fir	*PSME*	135	160	138	170	–	–	–	

Inventory data references

Vegetation data was collected in association with soil pits or notes and on vegetation transects.

MU Component Soil Pit #

293 Ossagon 03-059 04-036
03-069 04-025
03-062

294 Ossagon 03-011 04-038
03-050 04-028
291 Squashan 03-001
03-008
292 Squashan 03-002
293 Squashan 04-026 04-037
294 Squashan 04-030

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	T8 R2 S22
General legal description	Panther Creek Quad, 2.5 miles from CR 2960.

Other references

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

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Tappeiner, John C., II; Harrington, Timothy B.; Walstad, John D. 1984. Predicting recovery of tanoak (Lithocarpus densiflorus) and Pacific madrone (Arbutus menziesii) after cutting or burning. Weed Science. 32: 413-417.

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Contributors

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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):**

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

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

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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:**
