USDA Natural Resources
Conservation Service

Ecological site F004BX119CA
Redwood-Douglas-fir/California huckleberry/western swordfern, marine terraces, silty eolian deposits over marine deposits, 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

F004BX120CA	**Redwood-Sitka spruce/California huckleberry-salmonberry/western swordfern-deer fern, marine terraces, loam** F004BX120CA is found on a younger marine terrace with moderately well drained soils and a greater components of salmonberry and deerfern in the understory.
F004BX121CA	**Redwood-Sitka spruce/salal-California huckleberry/western swordfern, marine terraces, marine deposits, sandy loam and loam** F004BX121CA can be found adjacent to this ecological site on a younger marine terrace with steeper slopes. F004BX121CA has a greater component of Sitka spruce in the overstory and can have sandy loam soils.

Similar sites

F004BX124CA	**Redwood-Douglas-fir/California huckleberry-salal, marine terrace, silty eolian deposits over marine deposits, loam** F004BX124CA is also a redwood-Douglas-fir ecological site on marine terraces; however, it is less productive and overlies a soil with an E horizon.

Table 1. Dominant plant species

Tree	(1) *Sequoia sempervirens* (2) *Pseudotsuga menziesii*
Shrub	(1) *Vaccinium ovatum*
Herbaceous	(1) *Polystichum munitum*

Physiographic features

This ecological site is of limited extent and is only found on an upper, dissected marine terrace southeast of Trinidad, CA, which was uplifted over 200,000 years ago. The site occurs on a uniform nearly level to gently sloping surface.

Table 2. Representative physiographic features

Landforms	(1) Marine terrace
Flooding frequency	None
Ponding frequency	None
Elevation	550–700 ft
Slope	0–5%
Aspect	E, SE, S

Climatic features

The climate of this ecological site is humid with cool, foggy summers and cool, rainy winters. Close proximity to the coast limits the diurnal and seasonal range in temperatures. Mean annual precipitation ranges from 56 to 71 inches and usually falls from October to May. Mean annual temperature is 50 to 55 degrees F.

Table 3. Representative climatic features

Frost-free period (average)	325 days
Freeze-free period (average)	325 days
Precipitation total (average)	71 in

Influencing water features

There are no influencing water features on this site.

Soil features

These very deep, well drained soils with an udic moisture regime were formed in silty eolian deposits over sandy marine deposits. These soils are classified as fine, isotic, isomesic Andic Palehumults.

Soils that have been tentatively correlated to this ecological site include the following:
Soil Survey Area CA605 - Northern Humboldt and Del Norte

Mapunit Symbol Soil Component

256 Bulewinkle

Table 4. Representative soil features

Surface texture	(1) Loam
Family particle size	(1) Loamy

Drainage class	Well drained
Permeability class	Slow
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	11.7 in
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This ecological site occupies a marine terrace outside Trinidad, CA and is largely contained with the coastal fog belt. This site is of limited extent, and as no late successional stands of this site remain on the landscape the reference plant community is inferred. Redwood (*Sequoia sempervirens*) and to a lesser extent Douglas-fir (*Pseudotsuga menziesii*) dominate this site which also has a productive understory of California huckleberry (*Vaccinium ovatum*), western swordfern (*Polystichum munitum*), and other shrubs and forbs of the redwood region. This site is extremely productive for both redwood and Douglas-fir growth.

The range of redwood is largely influenced by coastal fog, which ameliorates the effects of solar radiation on conifer transpiration rates (Daniel 1942). Fog is a critical source of water in the drier summer months for redwood, which has high transpiration rates. Fog drip and direct fog uptake by foliage may contribute significant moisture to understory species and the forest floor (Dawson 1998).

The northern range of redwoods evolved within a low to moderate natural disturbance regime, with severe fire intervals ranging from 500 to 600 years on the coast (Veirs 1979). Fires could have historically occurred by lightning ignition or deliberate setting by Native Americans to create desirable hunting habitat (Veirs 1996).

Surface fires may modify tree species composition by favoring thicker-barked redwood and killing grand fir (*Abies grandis*) and mature western hemlock (*Tsuga heterophylla*) (Veirs 1979). Redwood has the ability to resprout following fire from the root crown or from dormant buds under the bark of the bole and branches (Noss 2000), but shallow roots and thin bark make western hemlock susceptible to fire damage (Arno 2002). However, frequent surface fire may promote establishment of western hemlock in the understory by exposing mineral-rich soil and reducing competition (Veirs 1979). In contrast, Douglas-fir seedling success may be decreased with a light fire regime (Mahony and Stuart 2000).

Moderate fire, wind disturbance, and management decisions could create a mosaic in regeneration patterns. Previous harvest and the use of fire as a slash treatment can alter species composition on many sites (Noss 2000) as repeated burning can favor resprouting of redwood and hardwoods and limit the regeneration of Douglas-fir and other conifers. Wind damage from winter storms can cause canopy top breakage which may kill individual trees or create windthrow gaps in the forest (Noss 2000). Canopy gap creation or selective redwood cutting could favor Douglas-fir regeneration and growth and lead to a larger proportion of Douglas-fir in the stand for several centuries (Agee 1993). Aerial seeding in past decades have lead to dense Douglas-fir dominated stands in some areas of the redwood region, skewing the natural overstory species composition (Noss 2000).

Red alder (*Alnus rubra*) is effective at rapidly colonizing disturbed landscapes following ground disturbance, harvest, or fire. Several thousand red alder per acre initially outgrow and dominate any conifers that become established in the disturbed area. Red alder is able to fix nitrogen with a symbiotic relationship with an actinomycete located on its root nodules (Bormann and Gordon 1984). These significant inputs of nitrogen to the ecosystem by red alder can increase overall stand productivity (Hart et al 1997). Shade intolerant red alder will eventually decrease in the stand as conifer regrowth reaches greater canopy heights.

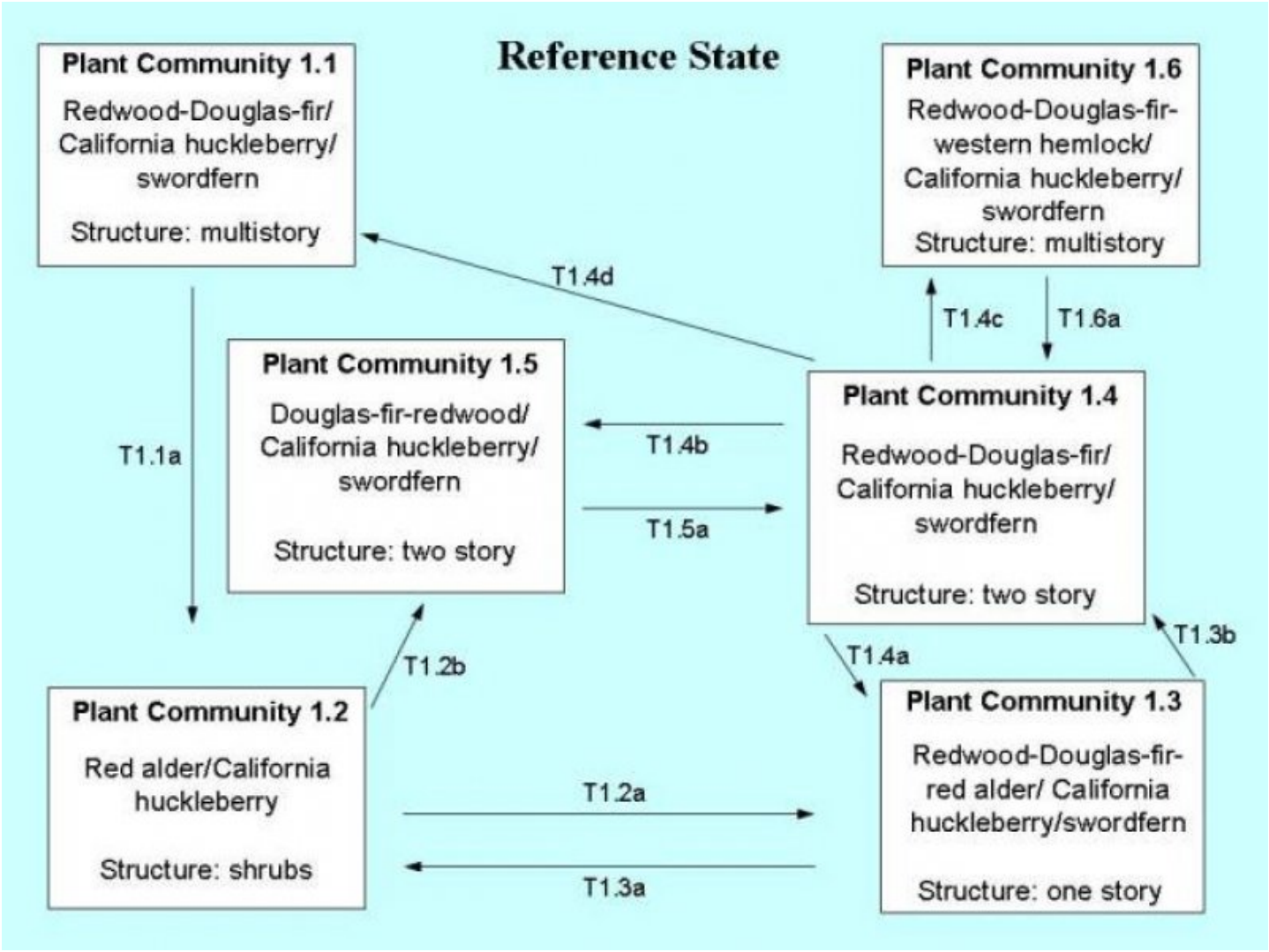
California huckleberry and western swordfern occupy a large percentage of the understory on this site. California

huckleberry is a dominant shrub species across redwood ecological sites as it can thrive in both moist and dry environments. As California huckleberry is typically a fire-dependent species, sprouting can be widespread following natural fire or site preparation treatments (Tirmenstein 1990b). Western swordfern can grow in a range of light conditions and can be often indicative of moist, productive forest habitat (Crane 1989).

This ecological site occupies a young marine terrace near Trinidad. The marine terrace sequence around Trinidad demonstrates the fluctuations of sea level and tectonic uplift over the past 400,000 years. Six distinct marine terraces are identified in this area, the sediments of which we deposited during times of higher sea level (Woodward-Clyde Consultants). The youngest emergent terrace is found closest to the coast, and subsequently older terraces are found further east and at higher elevation. The oldest and highest terrace (Maple Stump) is found furthest east and exhibits the most soil development (Stephens 1982). Local eolian and colluvial deposits overlie the marine sediments on older terraces (Stephens 1982). The Sky Horse terrace, upon which this ecological site is found, is the third oldest of these six terraces and likely formed about 200,000 years.

The effects of climate change on species distribution and viability need to be considered in this age of rapidly changed climate regimes. The western United States is already experiencing an increase in tree mortality across all tree cohort age classes, likely due to regional warming and water deficits (van Mantgem et al 2009). These forest structure changes may cause species to migrate to higher elevations, as much as 500-1000m, as temperatures increase in lower elevations (Urban et al 1993). Climate models project many different climate regimes for the north coast of California. One model predicts a warmer, wetter climate regime in which redwood may be able to expand into canyon live-oak-madrone and chaparral systems (Lenihan et al 2003). Climate change and its effects on vegetation patterns should be considered along with historical perspectives in ecological site development.

State and transition model



State 1
Reference State - Plant Community 1.1

Community 1.1
Reference State - Plant Community 1.1

The reference community for this site is a highly productive predominately redwood (*Sequoia sempervirens*) forest with a lesser proportion of Douglas-fir (*Pseudotsuga menziesii*) and Sitka spruce (*Picea sitchensis*) in the overstory. Red alder (*Alnus rubra*) is often found in forest openings and western hemlock (*Tsuga heterophylla*) can be found in the subcanopy. The understory is shrub-dominated but also is occupied by a high percentage of swordfern (*Polystichum munitum*). Important shrub species include: California huckleberry (*Vaccinium ovatum*), cascara (Rhamnus purshiana), and salal (*Gaultheria shallon*). Blackberry (*Rubus ursinus*), salmonberry (*Rubus spectabilis*), and thimbleberry (*Rubus parviflorus*) can often be found in light gaps. Bracken fern (*Pteridium aquilinum*), stickywilly (Gallium aparine), and evergreen violet (*Viola sempervirens*) are present throughout this community in trace amounts. T1.1a) Block harvest or fire would open up light and nutrients for pioneer species and shrubs to dominate the site.

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

Red alder dominates this plant community phase following block harvest or another large scale disturbance. Shrubs and other pioneer species will also cover a large percentage of this site. T1.2a) Several years after a large disturbance, redwood will resprout and Douglas-fir will infill into the site. Red alder and shrubs will continue to be major species components of the site. T1.2b) Planting of Douglas-fir or a prolific nearby seed source could create a Douglas-fir dominated site until redwood sprouts grow into the overstory.

State 3
Plant Community 1.3

Community 3.1
Plant Community 1.3

This plant community phase consists of redwood sprouts and Douglas-fir recruits filling out the overstory with red alder still present. T1.3a) Block harvesting would remove canopy trees and send the site into the shrub community phase. T1.3b) Redwood and Douglas-fir continue to grow and over several decades will shade out red alder and dominate the site.

State 4
Plant Community 1.4

Community 4.1
Plant Community 1.4

Over time or after hardwood management, redwood and Douglas-fir dominate the canopy of this plant community phase. Several decades of growth will also allow recruits to create a more ecologically diverse two story canopy structure. T1.4a) Windthrow or other small scale disturbances could create a gap in the overstory for red alder and shrubs to colonize, providing for hardwood species along with conifers in the overstory. T1.4b) A selective redwood cut would leave Douglas-fir dominating the site as redwood sprouts grow in the subcanopy. T1.4c) Long term fire exclusion could result in infilling by western hemlock, which could become a codominant in the overstory. 1.4d) Time and an intermediate disturbance regime could create the opportunity for the site to transition towards the reference plant community with a multi-layered canopy and more open understory.

State 5

Plant Community 1.5

Community 5.1
Plant Community 1.5

A Douglas-fir dominated canopy would result from a selective redwood harvest. Shrub cover may be higher in gaps created by disturbance or selective harvest. 1.5a) Several decades of redwood sprout regrowth would provide for a mixed overstory of dominate redwood and codominant Douglas-fir.

State 6
Plant Community 1.6

Community 6.1
Plant Community 1.6

This plant community phase could arise after long periods of fire exclusion. Western hemlock, which can persist for long periods in the shady subcanopy, could become a dominant tree species on this site. T1.6a) Without natural fire, shade tolerant western hemlock could become established in the subcanopy and eventually be a codominant in the overstory.

Additional community tables

Animal community

California huckleberry leaves may be eaten by deer, and its berries are utilized by many bird and mammal species including bear, fox, squirrels and skunks.

Hydrological functions

These soils are dominantly very deep, well-drained, and have a fine texture. The soils have a moderately slow rate of water transmission.

As this ecological site is predominately shallow sloped, erosion may not be a major concern; however road building, timber harvest, and site preparation for planting may increase surface erosion and potential for mass wasting.

Hydrologic Group:

256--Bulewinkle--D

Refer to the Soil Survey Manuscript for further information.

Recreational uses

As this ecological site has a limited extent (less than 2.5 square miles in one area east of Trinidad, California), it will likely not be targeted for widescale recreational use. However, the forested landscape would provide excellent hiking and pack trails. Development on other marine terraces west of this ecological site exhibit the desirability of the shallow slopes of the ecological site for building and industrial use.

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.

Sitka spruce is used as saw timber, wood pulp and plywood. It has a high stength to weight 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

California huckleberries are made into wine, and used by home and commercial processors for pie fillings. Berries from Rubus species can also be eaten raw or processed. Foliage of the California huckleberry and salal are used by florists in floral arrangements. Edible mushrooms can be found on this ecological site by experienced fungi identifiers.

Other information

Site productivity interpretations are based on the following site index curves:

Species Curve Base age

Redwood 930 100 years
Douglas-fir 790 100 years
Sitka spruce 490 100 years

Table 5. 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*	176	206	288	402	–	–	–	
Sitka spruce	*PISI*	200	200	300	300	–	–	–	
Douglas-fir	*PSME*	156	193	165	202	–	–	–	

Inventory data references

Data was collected with forest plots at or near the location of soil pits. Plot numbers correspond to forest plots.

Bulewinkle-256

08F012 - Plot #12 2008 CA Humboldt County
08F014 - Plot #14 2008 CA Humboldt County
08F015 - Plot #15 2008 CA Humboldt County
08F016 - Plot #16 2008 CA Humboldt County
08FT001 - Traverse #1 2008 CA Humboldt County

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	T8N R1E S32
UTM zone	N
UTM northing	4543238
UTM easting	408977
General legal description	USGS Crannell Quadrangle. Approximately 1000 meters east of Westhaven, CA

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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):**

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):**

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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:**
