USDA Natural Resources Conservation Service

Ecological site F004BX120CA
Redwood-Sitka spruce/California huckleberry-salmonberry/western swordfern-deer fern, marine terraces, loam

Accessed: 05/19/2024

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

F004BX118CA	**Sitka spruce-redwood/salal/western brackenfern, marine terraces, marine deposits, fine sandy loam** F004B118CA can be found adjacent to this ecological site; however, it is dominated by Sitka spruce and is found on a younger marine terrace with coarse-loamy soils.

Similar sites

F004BX121CA	**Redwood-Sitka spruce/salal-California huckleberry/western swordfern, marine terraces, marine deposits, sandy loam and loam** F004BX121CA is similiar to this ecological site with redwood and Sitka spruce dominately the canopy; however, F004BX121CA has well drained soils, is more productive, and occupies a younger marine terrace.

Table 1. Dominant plant species

Tree	(1) *Sequoia sempervirens* (2) *Picea sitchensis*
Shrub	(1) *Vaccinium ovatum* (2) *Rubus spectabilis*

Herbaceous	(1) *Polystichum munitum* (2) *Blechnum spicant*

Physiographic features

This ecological site is found on marine terraces around Crescent City, CA and Trinidad, CA, which were uplifted over 100,000 years ago. The site occurs on a uniform, nearly level to gently sloping surface. The flat terrace landform and proximity to coastal harbors have made these soils prime for pasture and urban development.

Table 2. Representative physiographic features

Landforms	(1) Marine terrace
Flooding frequency	None
Ponding frequency	None
Elevation	3–116 m
Slope	0–7%
Aspect	SW, W, NW

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 60 to 80 inches and usually falls from October to May. Mean annual temperature is 52 to 57 degrees F.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	2,032 mm

Influencing water features

There are no influencing water features on this site.

Soil features

These very deep, moderately well drained soils with an udic moisture regime were formed in silty eolian deposits over marine deposits on upper dissected marine terraces. These soils are classified as fine-loamy, mixed, superactive, isomesic Typic 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
223 Timmons

Table 4. Representative soil features

Surface texture	(1) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained

Permeability class	Moderately slow
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This ecological site occupies marine terraces outside Trinidad, CA and Crescent City 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 Sitka spruce (*Picea sitchensis*) dominate this site which also has a productive understory of California huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*), salal (*Gaultheria shallon*), western swordfern (*Polystichum munitum*), and deer fern (*Blechnum spicant*). The moderately drained soils of this site influence the moist forest habitat vegetation and also limit stand productivity compared to adjacent ecological sites. The close proximity to the coast may promote the establishment of Sitka spruce in the overstory (Franklin and Dyrness 1973).

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 both western hemlock and Sitka spruce susceptible to fire damage (Arno 2002, Griffith 1992). 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 can 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 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 Sitka spruce growth and lead to a larger proportion of Sitka spruce in the stand.

Another mechanism through which Sitka spruce could become more firmly established in the stand is the propensity for Sitka spruce to rapidly invade coastal prairies after cessation of burning, grazing, or tilling (Franklin and Dyrness 1973). If land clearing and stump removal did occur, redwood regeneration may be slow to infill onto the site.

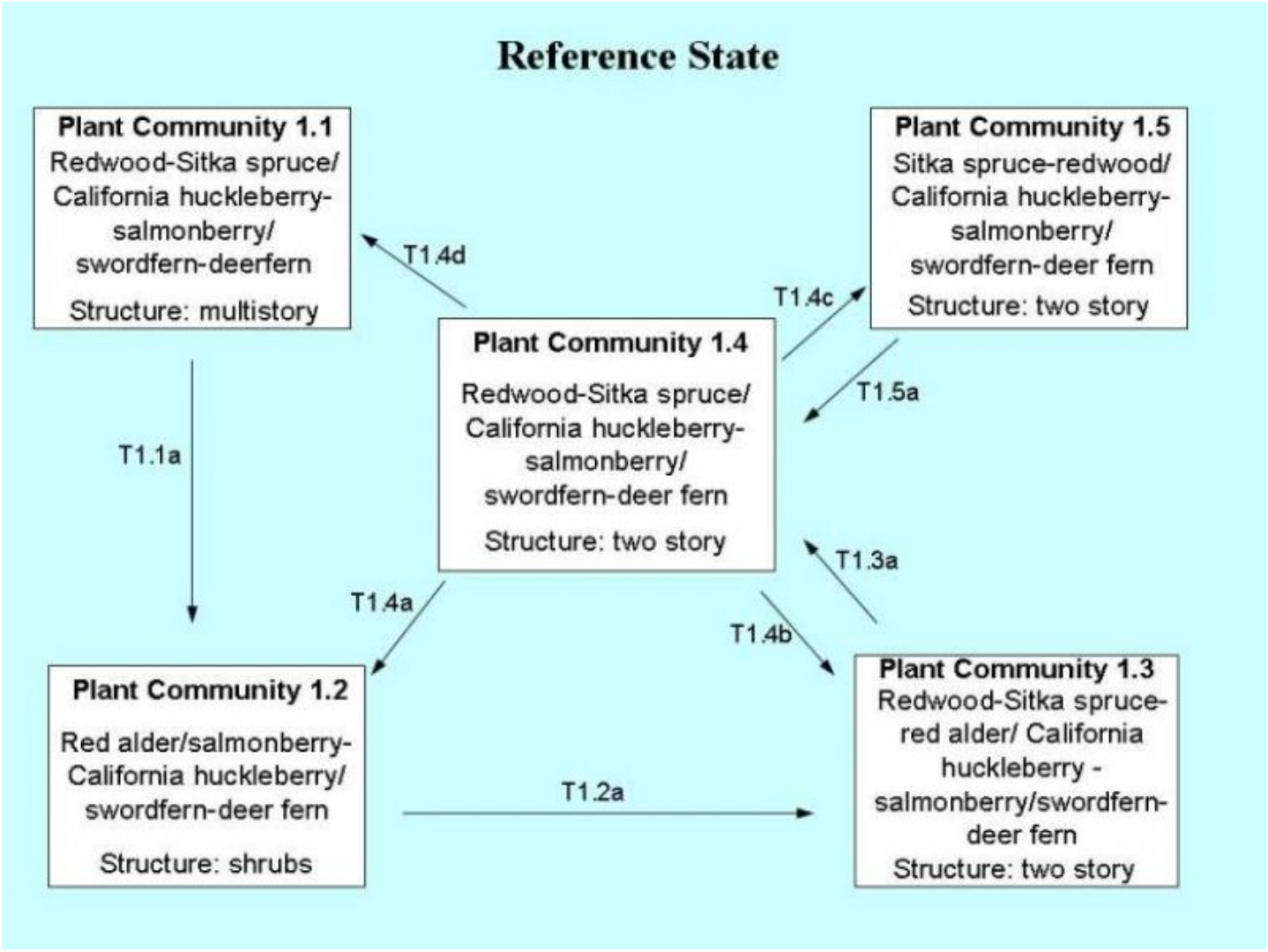
Red alder (*Alnus rubra*) is effective at rapidly colonizing disturbed landscapes following ground disturbance, harvest, or fire. Several thousand red alder per acre initially outgrow and dominate any conifers that become established in the disturbed area. Red alder is able to fix nitrogen with a symbiotic 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, salmonberry, and salal 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). Salal increases significantly after harvest and can even reduce regeneration and stocking of Douglas-fir (Tirmenstein 1990a). Dense stands of salmonberry can arise following removal of the overstory by harvest or large-scale natural disturbance (Tirmenstein 1989). Western swordfern can grow in a range of light conditions and can be often indicative of moist, productive forest habitat (Crane 1989). Deer fern is also present in appreciable amounts on this site, indicating a shady, wet forest environment (Matthews 1993).

This ecological site occupies a young marine terrace near Trinidad and Crescent City. 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 Westhaven terrace, upon which this ecological site is found near Trinidad, is the third youngest of these six terraces and likely formed about 124,000 years. Marine terraces in the vicinity of Crescent City suggest similar deposition during sea level high stands, with the formation of the terrace, upon which this ecological site, estimated to be 125,000-200,000 years ago (Lorenz and Kelsey 1999).

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

This reference plant community consists of redwood and Sitka spruce in the overstory with mix of shrubs and forbs in the understory, including California huckleberry, salmonberry, salal, swordfern, and deerfern. The reference plant community for this ecological site is interpreted from second and third growth stands across the landscape, as no old-growth persists. T1.1a) Block harvest or fire would open up light and nutrients for pioneer species and shrubs to dominate the site.

Forest overstory. Both redwood and Sitka spruce are present in the canopy.

Average Percent Canopy Cover:

redwood 25-50%
Sitka spruce 20-40%
red alder <5%

Forest understory. The understory consists of a mixture of species often found in the redwood forest. As this site has moderately well drained soils, species that grow well in moist environments are present.

Average Percent Canopy Cover:

California huckleberry 10-20%
salmonberry 5-20%
salal 5-20%
swordfern 5-20%
deerfern 5%
cascara 5-10%
spreading woodfern <5%

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

This early seral stage plant community may arise following block harvest or another intense disturbance. Red alder is the dominant tree species and shrubs and ferns will be present in understory. The moderately well drained soils of this site will provide additional moisture to promote salmonberry and deer fern in the understory. Dense stands of salmonberry can arise following removal of the overstory by harvest or natural disturbance. T1.2a) Several years after a large disturbance, redwood will resprout and Sitka spruce will infill into the site. Red alder and shrubs will continue to be major species components of the site.

State 3
Plant Community 1.3

Community 3.1
Plant Community 1.3

Redwood sprouts and Sitka spruce recruits have reached the height of the red alder canopy. This transition seral stage continues to have a high percentage of red alder, shrubs, and swordfern and deer fern. T1.3a) Mechanical or chemical hardwood management techniques may hasten the growth of conifers by decreasing competition for light from red alder and shrub species. Several decades of growth would also allow conifers to overtop red alder and dominate the canopy.

State 4
Plant Community 1.4

Community 4.1
Plant Community 1.4

In this plant community, redwood and Sitka spruce are firmly established in the overstory. Red alder is not as prevalent and understory density may decrease with reduced light penetrating the upper canopy. T1.4a) Block harvest or fire would remove the overstory and open up light and nutrients for pioneer species and shrubs to dominate the site. T1.4b) 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. T1.4c) A selective redwood cut would leave Sitka spruce dominating the site as redwood sprouts grow in the subcanopy. 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

This plant community phase may occur on the site following a selective redwood harvest. Sitka spruce dominates

the overstory for several decades until redwood sprouts grow into the upper canopy. 1.5a) Several decades of redwood sprout regrowth would provide for a mixed overstory of redwood and Sitka spruce.

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 and moderately well drained. The soils have a moderately high 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:

223--Timmons--C/D

Refer to the Soil Survey Manuscript for further information.

Recreational uses

The forested landscape of this site 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
Sitka spruce	*PISI*	165	189	248	285	–	–	–	
redwood	*SESE3*	159	165	237	254	–	–	–	
grand fir	*ABGR*	93	105	224	249	–	–	–	

Inventory data references

Data was collected with forest plots at or near the location of soil pits in the CA605 soil survey area. Plots numbers correspond to forest plots.

Timmons--223

08F046 - plot #46 in 2008 at soil pedon #082064
08F047 - plot #47 in 2008 at soil pedon #082061
09F037 - plot #37 in 2009 at soil pedon #082235
08FT007 - traverse #7 in 2008
08FT006 - traverse #7 in 2008

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	T8N R1W S2
UTM zone	N
UTM northing	4552225
UTM easting	403144
General legal description	USGS Trinidad Quadrangle Type location is south of Patrick's Point.

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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:**

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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:**
