USDA Natural Resources Conservation Service

Ecological site F004BX122CA
Redwood/western swordfern, mountain slopes and earthflows, schist, gravelly loam

Accessed: 04/24/2024

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

F004BX101CA	**Redwood/Douglas-fir/Pacific rhododendron, mountain slopes, schist, clay loam** The redwood-Douglas-fir/rhododendron site F004BX101CA can be found upslope from F004BX122CA or adjacent to F004BX122CA on spur ridges or more stable slopes.
F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** This redwood/swordfern-oxalis site can be found on alluvial terraces and along larger stream courses.

Similar sites

F004BX111CA	**Redwood/western swordfern-redwood sorrel, floodplains and terraces, loam** F004BX111CA may have similar vegetation as F004BX122CA, but it is found on alluvial terraces and landslides are not a significant disturbace mechanism.
F004BX108CA	**Redwood, western swordfern, mountain slopes, sandstone and schist, clay loam** F004BX108CA has similar vegetation to F004BX122CA but is found closer to the coast on more stable hillslopes. Landslides are also not a frequent disturbance on F004BX108CA.

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 west side of lower Redwood Creek on stabilized debris slides on steep mountains. This site occurs near creeks on slightly convex positions. This site generally has a northern facing aspect and has steep, unstable slopes.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Landslide (3) Debris flow
Flooding frequency	None
Ponding frequency	None
Elevation	50–2,100 ft
Slope	40–65%
Water table depth	30–99 in
Aspect	N, NE, SW

Climatic features

The climate is humid with cool, foggy summers and cool, moist winters. Coastal influence limits the diurnal range in temperatures. The total annual precipitation ranges from 70 to 90 inches and usually falls from October to May. Mean annual temperature ranges from 50 to 55 degrees F.

Table 3. Representative climatic features

Frost-free period (average)	300 days
Freeze-free period (average)	300 days
Precipitation total (average)	90 in

Influencing water features

There are no influencing water features on this site.

Soil features

These very deep soils developed from debris flow colluvium weathered from schist. They are often found on stabilized debris slides on mountains. These soils can have a seasonal water table and redoximorphic features found as high as 24 to 60 inches below the surface. Panthercreek soils are classified as loamy-skeletal, mixed, semiactive, isomesic Typic Eutrudepts.

Soils that have been tentatively correlated to this ecosite include:

Soil Survey Area map unit component
CA605 545 Panthercreek
CA605 555 Panthercreek

Table 4. Representative soil features

Surface texture	(1) Gravelly loam

Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	60 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.8–8.2 in
Subsurface fragment volume <=3" (Depth not specified)	6–60%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

This ecological site is found on western slopes of lower Redwood Creek in Humboldt County, CA and is largely contained with the coastal fog belt. The reference plant community for this ecological site is inferred as no late successional stands of this site remain on the landscape. Redwood (*Sequoia sempervirens*) dominates this site, which also has a productive understory of western swordfern (*Polystichum munitum*) and other shrubs and forbs of the redwood region.

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 and 150-200 years on intermediate sites further inland (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 (Psuedotsuga menziesii) 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 regeneration of Douglas-fir and lead to a larger proportion of Douglas-fir in the stand for several centuries (Agee 1993). Aerial seeding in past decades in Redwood Creek basin has led to dense Douglas-fir dominated stands in some areas of the redwood region, skewing the natural overstory species composition (Noss 2000).

This site overlies soils and structural geology highly susceptible to debris slides. As the underlying soils have developed from debris flow colluvium derived from unstable schist bedrock, the ecological dynamics of this site are influenced by frequent ground disturbance. Redwood is able to reestablish on old landslides through infilling but also resprouting, as dormant trunk buds can produce sprouts following burial in sediment (Veirs 1996). Redwood Creek has experienced heavy sediment loading for decades, a result of the natural instability of the Franciscan Formation bedrock, a clustering of storm events, and timber harvesting (Pitlick 1981). Harvesting and upslope road

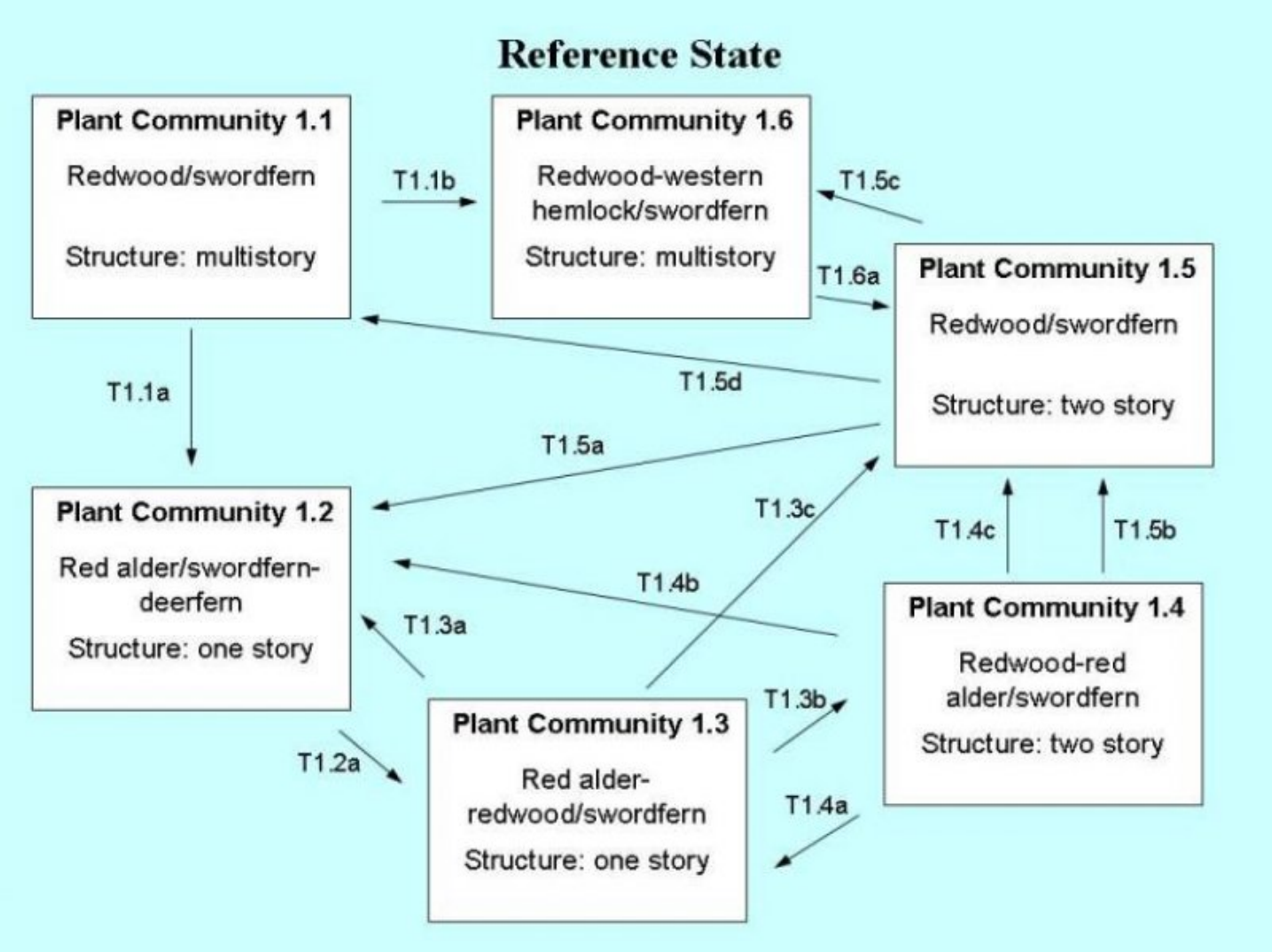
building can increase the likelihood for debris slides by triggering ground disturbance, increasing overland flow of water on roads, reducing water uptake by cutting stands. Debris slide disturbances could increase in frequency if mitigating measures are taken during forest management. Current vegetation on this site includes a high percentage of red alder, which is able to rapidly colonize disturbed areas such as recent harvest blocks or debris slides.

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.

Western swordfern occupies a large percentage of the understory on this site. Western swordfern can grow in a range of light conditions and can be often indicative of moist, productive forest habitat (Crane 1989). Redwood sorrel (Oxalis oregano) is also found on the site, indicating a moist type IV redwood forest type (Popenoe 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 community consists of redwood (*Sequoia sempervirens*) in the overstory and swordfern (*Polystichum munitum*) dominating the understory. This is the presumed reference plant community as no old-growth communities exist for this ecological site. The high disturbance frequency associated with this debris side prone ecological site may limit full development of the reference plant community. T1.1a) This site is highly susceptible to debris slides, which would create ideal conditions for red alder to colonize the site. Increased moisture availability would also favor swordfern and deerfern gaining a strong hold on the site. Block harvesting could also provide a similar transition pathway and increase the likelihood for further debris slides. T1.1b) In the absence of fire and of triggered debris slides, shade tolerant western hemlock could become established in the subcanopy and eventually be a codominant in the overstory.

Forest overstory. The overstory is primarily redwood with occasional pockets of red alder.

Average Percent Canopy Cover:

redwood 25-75%
red alder 5-40%

Forest understory. The moist soils of this ecological site support a lush swordfern understory.

Average Percent Canopy Cover:

swordfern 30-70%
redwood sorrel 0-10%
tanoak <5%
evergreen violet <5%
spreading woodfern <5%

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

This plant community may arise following a debris slide or block harvest. The intensive ground disturbance will provide the opportunity for red alder to colonize and dominate the site. The increased moisture availability provides for a dense cover of swordfern and deerfern. T1.2a) Regaining stability of the slope through red alder colonization could provide for redwood resprouting and establishment.

State 3
Plant Community 1.3

Community 3.1
Plant Community 1.3

Following slope stabilization by colonizing red alder, redwood sprouts are able to establish and grow in the subcanopy. T1.3a) The initiation of another debris slide spurred by tectonic activity, heavy rains, or management activities upslope transition the site to the red alder dominated community phase. T1.3b) Redwood will continue to grow and over several decades will overtop red alder and dominate the site. T1.3c) Mechanical or chemical hardwood management would accelerate the growth of redwood and provide for quicker conifer dominance of the overstory.

State 4
Plant Community 1.4

Community 4.1
Plant Community 1.4

After several decades of red alder dominance of the canopy, redwood will grow to exceed the height of red alder. Red alder continues to persist in this plant community phase, but it no longer occupies large swaths of the site. This plant community phase most accurately reflects the status of this ecological site on the contemporary landscape. T1.4a) Selectively cutting redwood would again create a mixed overstory of red alder and redwood. T1.4b) Block harvesting or the initiation of another debris slide spurred by tectonic activity, heavy rains, or management activities upslope transition the site to the red alder dominated community phase. T1.4c) Redwood dominance could be regained by natural processes over several decades or could be accelerated by hardwood management.

State 5
Plant Community 1.5

Community 5.1
Plant Community 1.5

Redwood fully occupies the site in this community phase and has overtopped and shaded red alder out of the stand. 1.5a) Block harvesting or the initiation of another debris slide spurred by tectonic activity, heavy rains, or management activities upslope transition the site to the red alder dominated community phase. 1.5b) Windthrow in

a small area of the site would provide for the establishment of red alder in the disturbance area and create a mixed overstory canopy. 1.5c) Without natural fire, shade tolerant western hemlock could become established in the subcanopy and eventually be a codominant in the overstory. 1.5d) Time and an intermediate disturbance regime could create the opportunity for the site to transition towards the reference plant community.

State 6
Plant Community 1.6

Community 6.1
Plant Community 1.6

A suppression of the natural fire regime would create the opportunity for shade-tolerant western hemlock to be codominant in the overstory. 1.6a) Fire or selective cutting of western hemlock could return the plant community to the redwood/swordfern community phase.

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.

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 have a moderately high saturated hydraulic conductivity. They are dominately very deep and are within the fine-loamy and loamy-skeletal texture classes.

Hydrologic Group:

545--Panthercreek--B
545--Panthercreek--B

Recreational uses

Recreational development and use may be limited by steep and unstable slopes.

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.

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

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*	145	192	202	346	–	–	–	

Inventory data references

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

Panthercreek-555

08F051 - Plot# 51 in 2008
08F056
02F006
09F010

Type locality

Location 1: Humboldt County, CA	
UTM zone	N
UTM northing	4556061
UTM easting	416316
General legal description	USGS Bald Hills Quadrangle, SW corner of quadrangle.

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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):**

    _____

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):**

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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:**
