USDA Natural Resources Conservation Service

Ecological site F004BX123CA
Douglas-fir-tanoak/tanoak, upper mountain slopes, clay loam

Accessed: 05/11/2025

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

F004BX114CA	**Oregon white oak/perrenial and annual grasses, mountain slopes, sandstone and mudstone, clay loam** F004BX114CA, upper slope oak woodlands, is found in conjuction with this ecological site.
F005XB101CA	**Douglas-fir/tanoak, mountain slopes, sandstone and mudstone, clay loam** F005XB101CA is associated with this ecological site but it is found on drier, more exposed ridges and slopes.
F005XB102CA	**Douglas-fir-tanoak/tanoak, mountain slopes, sandstone and mudstone, very gravelly clay loam** F005XB102CA is associated with this ecological site but it is found on drier, more exposed ridges and slopes.

Similar sites

F004BX109CA	**Douglas-fir/redwood/tanoak/California huckleberry, mountain slopes, sandstone and schist, clay loam** F004BX109CA is similar to this ecological site, but redwood occupies a significant percentage of the overstory.

F005XB101CA	**Douglas-fir/tanoak, mountain slopes, sandstone and mudstone, clay loam** F005XB101CA may be confused with this ecological site because of similar Douglas-fir/tanoak predominance; however, F005XB101CA has a different soil temperature and moisture regime, mesic and xeric, respectively. Additionally, F005XB101CA is less productive and may have chinquapin in the subcanopy.
F005XB102CA	**Douglas-fir-tanoak/tanoak, mountain slopes, sandstone and mudstone, very gravelly clay loam** F005XB102CA may be confused with this ecological site because of similar Douglas-fir/tanoak predominance; however, F005XB102CA has a different soil temperature and moisture regime, mesic and xeric, respectively. Additionally, F005XB101CA is less productive and may have chinquapin in the subcanopy.
F004BX102CA	**Douglas-fir-redwood/tanoak, mountain slopes, sandstone, clay loam** F004BX102CA is similar to this ecological site; however, redwood occupies a significant percentage of the overstory and productivity is higher.

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii* (2) *Lithocarpus densiflorus*
Shrub	(1) *Lithocarpus densiflorus*
Herbaceous	Not specified

Physiographic features

This ecological site is found on mountain slopes in Redwood Valley, the Lacks Creek drainage, and east of the Bald Hills Road in the lower Klamath drainage. It occurs on uniform and convex positions of steep middle and upper slopes. This ecological site is further inland or at higher elevation than the physiographic range of redwood.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	495–3,185 ft
Slope	30–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this ecological site is dominated by mild, rainy winters and relatively warm, dry summers. The total annual precipitation for this ecological site ranges from 80 to 100 inches, the majority of which falls October to May. Summer temperatures range from 75 to 90 degrees F.

Table 3. Representative climatic features

Frost-free period (average)	290 days
Freeze-free period (average)	290 days
Precipitation total (average)	100 in

Influencing water features

No influencing water features occupy this site.

Soil features

This ecological site overlies well-drained, very deep and moderately deep soils that have developed from colluvium and residuum weathered from sandstone and mudstone. The soil temperature and moisture regimes are isomesic ustic, respectively.

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

Map unit Soil
543 Wiregrass
543 Rockysaddle
543 Scaath
537 Wiregrass
537 Scaath

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Very gravelly silt loam (3) Extremely gravelly
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to very slow
Soil depth	20 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3.7–7.3 in
Subsurface fragment volume <=3" (Depth not specified)	35–85%
Subsurface fragment volume >3" (Depth not specified)	0–50%

Ecological dynamics

This ecological site is found on mountain slopes of Humboldt County, CA in Redwood Valley, Lacks Creek drainage, and east of the Bald Hills Road in the lower Klamath drainage. The reference plant community consists of Douglas-fir (*Pseudotsuga menziesii*) as the dominant overstory species and tanoak (Lithocarpus densiflorus) occupying the subcanopy. The amount of each species present is dependent on past disturbances. Pacific madrone (*Arbutus menziesii*) and an occasional redwood (*Sequoia sempervirens*) can also be found on the site. The dominant shrub species in the understory is tanoak with a lesser component of California huckleberry (*Vaccinium ovatum*). Western modesty (*Whipplea modesta*) is the most common herbaceous species found on the site.

Coastal fog does not have a significant influence on this inland ecological site, and redwood is scarce on the landscape. 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 California Coast Range evolved within a low to moderate natural disturbance regime, with severe fire intervals ranging from 50 years at the eastern extent of redwood (Veirs 1979) and 10 to 30 years in Douglas-fir-tanoak forests of the Klamath Mountains (Wills 1994). Fires could have historically occurred by lightning ignition or deliberate setting by Native Americans to create desirable hunting habitat (Veirs 1996).

Fire effects and the patterns of stand development in the mixed evergreen forest-type are complex and highly variable (Eyre, 1990). Depending on intensity, fires in this region can create a mosaic of tree age classes or even-aged regeneration. Frequent light fires may kill thin-barked Douglas-fir seedlings (Mahony and Stuart 2000), but mature Douglas-fir are fairly fire resistant. Tanoak and madrone are sensitive to fire but are able to re-sprout and so are able to maintain their presence following fire (Mc Murray, 1989). Tanoak can sustain a shrub-like form until the canopy is opened, and then may rapidly attain tree status (McDonald and Tappenier, 1987). As California huckleberry is typically a fire-dependent species, sprouting can be widespread following natural fire or site preparation treatments (Tirmenstein 1990).

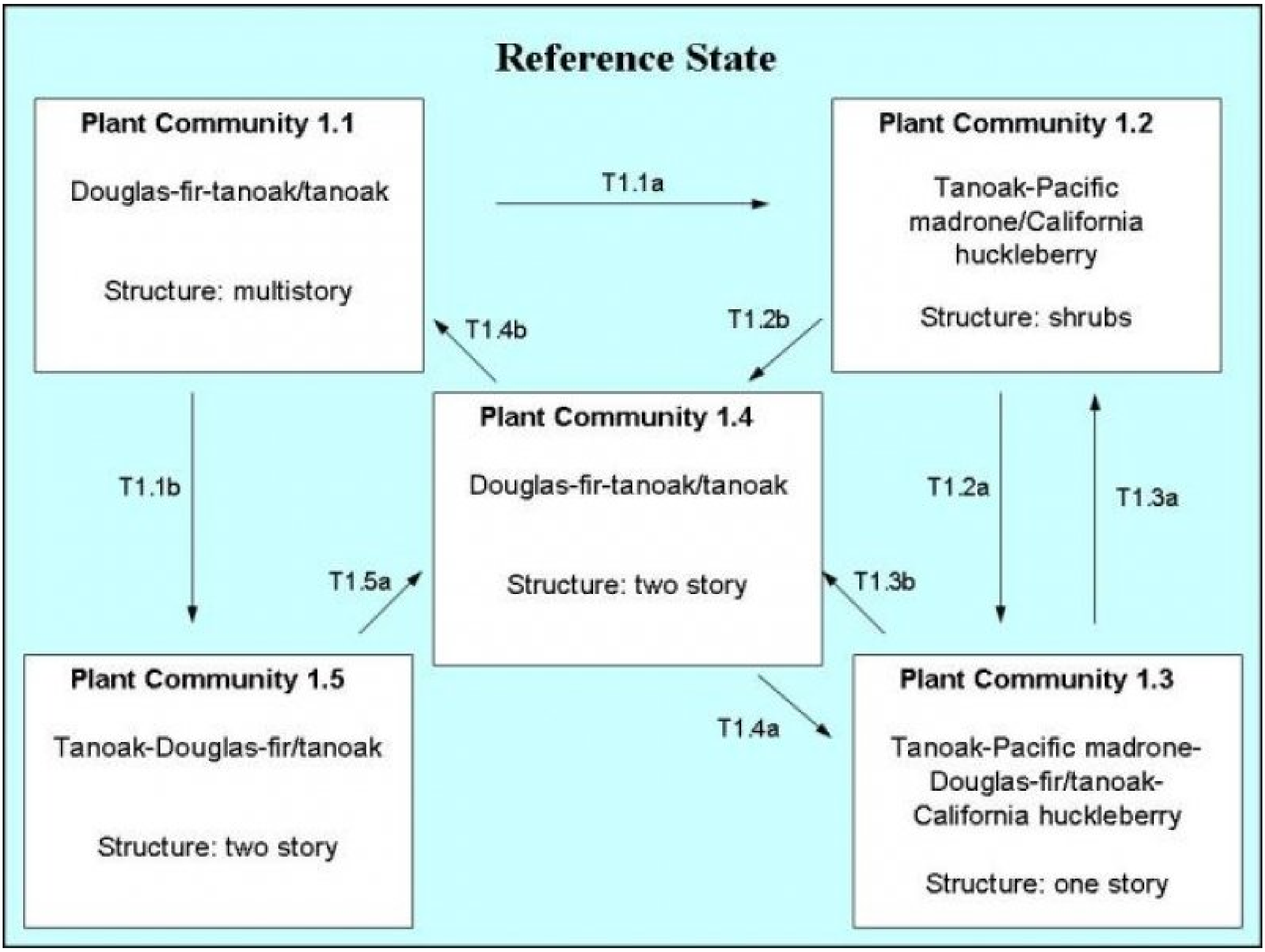
Douglas-fir sapling establishment and growth may be hindered by competition from re-sprouting hardwoods (Harrington et al 1991), limiting the proportion of Douglas-fir saplings able to become dominant members of the stand. Gradually, Douglas-fir will infill from adjacent areas, and eventually overtop tanoak. This process could take many years depending on the size of the burned area.

Management decisions can also influence stand dynamics as disturbance from timber harvesting is likely to mimic fire. Intensive harvest and the use of fire for slash treatment could favor hardwoods and limit Douglas-fir regeneration. Aerial seeding in past decades in the Redwood Creek basin have led to Douglas-fir dominated stands in some areas of the redwood region, skewing the natural overstory species composition (Noss 2000). However, large redwood stumps are absent throughout this ecological site, suggesting Douglas-fir is naturally the dominant conifer on this site.

Wind damage from winter storms can cause canopy top breakage which may kill individual trees or create windthrow gaps in the forest (Noss 2000), providing a break in the canopy for saplings and subcanopy trees to exploit.

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) and likely Douglas-fir dominated stands adjacent the current redwood zone. 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 plant community for this site is the presumed historic plant community prior to European settlement. This reference community is characterized by an overstory dominated by Douglas-fir (*Pseudotsuga menziesii*), with a moderate cover of tanoak (Lithocarpus densiflorus) in the sub-canopy. T1.1a) Block harvest or fire would open up light and nutrients for pioneer species and shrubs to dominate the site. T1.1b) Partial cutting of Douglas-fir could result in tanoak temporarily dominating the site.

Forest overstory. The overstory is primarily Douglas-fir with lesser amounts of and madrone (Arbutus menziesii).

Beneath the primary overstory tanoak often forms a sub-canopy with minor amounts of California bay (Umbellularia californica), canyon live oak (Quercus chrysolepis) and black oak (Quercus kelloggii).

Average Percent Canopy Cover:

Main canopy

Douglas-fir 50-70%
Madrone 5-10%

Sub-canopy

Tanoak 20-30%
Other hardwoods <5%

Forest understory. The understory is dominated by shrubs, with tanoak and California huckleberry (Vaccinium ovatum) predominating.

Average Percent Canopy Cover:

Tanoak 10-20%
California huckleberry 5-10%
Pink honeysuckle 2-5%
Common whipplea 2-5%
Douglas-fir 2-5%
Woodland strawberry 2-5%
Salal 2-5%
Madrone 2-5%
Poison oak 2-5%
Coyotebrush 1-5%
Swordfern 1-5%
Bracken fern 1-5%
Common snowberry 1-5%
California bay 1-2%
Oregon grape 1-2%
California blackberry 1-2%

Table 5. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	–	0-5%
>0.5 <= 1	–	0-1%	–	0-1%
>1 <= 2	–	–	–	0-7%
>2 <= 4.5	–	5-45%	–	–
>4.5 <= 13	–	7-40%	–	–
>13 <= 40	–	–	–	–
>40 <= 80	20-30%	–	–	–
>80 <= 120	50-75%	–	–	–
>120	–	–	–	–

State 2
Plant Community 1.2

Community 2.1
Plant Community 1.2

This plant community is dominated by the hardwoods tanoak and madrone, woody shrubs, and a variety of pioneering species. T1.2a) If the site is left to develop, tanoak and madrone will form a tree layer and Douglas-fir will begin to infill from surrounding seed sources. Tanoak and madrone are fast growing and will dominate the site and compete with regenerating Douglas-fir for decades. T1.2b) Mechanical or chemical hardwood management techniques could accelerate the establishment of Douglas-fir by decreasing competition from sprouting tanoak and madrone. Direct seeding or planting of conifers could also improve establishment.

State 3
Plant Community 1.3

Community 3.1
Plant Community 1.3

After initial establishment of hardwoods, Douglas-fir may regenerate under the hardwood canopy. In several decades, Douglas-fir may exceed the height of the hardwoods and become firmly established in the overstory. T1.3a) A block harvest or severe fire would initiate the shrub community phase of this site. T1.3b) Douglas-fir dominance could be regained by natural processes over several decades or could be accelerated by tree planting and hardwood management.

State 4
Plant Community 1.4

Community 4.1
Plant Community 1.4

Following hardwood management or several decades of ecological succession, Douglas-fir will dominate the overstory of this plant community phase and tanoak will occupy the subcanopy and understory. T1.4a) Selective harvesting of Douglas-fir or a moderate fire could return this site to tanoak and hardwood dominance. T1.4b) Time and an intermediate disturbance regime could create the opportunity for the site to transition towards the reference plant community.

State 5
Plant Community 1.5

Community 5.1
Plant Community 1.5

Selective harvesting of Douglas-fir could result in tanoak dominating the overstory with few Douglas-fir scattered throughout the site. T1.5a) Douglas-fir dominance could be regained by natural processes over several decades or could be accelerated by tree planting and hardwood management.

Additional community tables

Animal community

A wide variety of bird and animal species use the Douglas-fir/tanoak forest. The diversity of wildlife utilizing the site is influenced by the presence of the mast-producing tanoak as well as berry producing species such as California huckleberry, Pacific madrone and Oregon-grape (Mahonia nervosa).

Bird species that may utilize these upland sites include woodpecker, warbler, nuthatch, finche, and Stellar's jay. Other bird species include numerous hawks. Tanoaks are also used by cavity nesting birds, such as the downy woodpecker, northern flicker, red and white breasted nuthatch, brown creeper and house wren. Tanoak habitats are also food and nesting sites for the northern flying squirrel, Allen's chipmunk, and dusky-footed woodrat.

Mammals such as the black-tailed deer, black bear, Townsend chipmunk, California ground squirrel, and redwood chickaree utilize tanoak for food and cover.

Hydrological functions

The runoff class for these soils is high.

The hydrological group for the soils of this ecological site are as follows:

Wiregrass-543--C
Wiregrass-537--C
Scaath-543--C
Scaath-537--C
Rockysaddle-543--C

Refer to the Soil Survey Manuscript for further information.

Recreational uses

This site can support a variety of recreational uses including hiking, camping, OHVs, mountain biking, and bird watching. This ecological site is found on public land open for recreation including NPS Redwood National Park and BLM Lacks Creek Management Area.

Slopes exceeding 25% may limit trail development.

Wood products

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.

The manufacturing of tanoak wood products is limited. Upper-grades produce good quality veneers and plywood. Tanoak flooring, paneling and decking have also been produced. Lower-grades are used to make pallets, crossties, mine timbers, baseball bats and tool handles. The wood had also been chipped for pulp and for use in the cogeneration of electricity. It is also widely utilized as firewood.

Other products

Tannin from tanoak bark is used commercially to cure leather.

Berries from California huckleberry are edible and are made into jams and pies. The foliage of Oregon grape and salal are utilized for decorative floral arrangements.

Wild mushrooms are often sought on this ecological site, especially chanterelles and morels, the later of which often emerge following fire.

Historically, tanoak acorns provided a dietary staple for native americans throughout the California Coast Ranges.

Other information

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

Species Curve Base age

Douglas-fir 790 100 years

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
Douglas-fir	*PSME*	110	150	98	158	–	–	–	

Inventory data references

Forestry data was collected in association with the following soils pits in the CA605 soil survey area:

Soil and map unit

pit #

Wiregrass 543
81-005
03-0325
03-05007
03-05339

Rockysaddle 543
83-021
88-010
06-056A

Scaath 543
04-016

Forestry plot#
05F111
05F114
09F064
09F045
09F057
05F112
05F113
09F082
09F089
09F090
09F044
09F081

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	T8N R3E S28
UTM zone	N
UTM northing	4527977
UTM easting	429707
General legal description	Hupa Mountain Quadrangle

Other references

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Veirs, S.D. 1996. Ecology of the coast redwood. Conference on coast redwood ecology and management. Pg 9-12.

Veirs, S.D. 1979. The role of fire in northern coast redwood forest dynamics. Conference on Scientific Research in the National Parks.

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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):

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

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

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:**

17. **Perennial plant reproductive capability:**