USDA Natural Resources Conservation Service

Ecological site F005XB101CA
Douglas-fir/tanoak, mountain slopes, sandstone and mudstone, clay loam

Accessed: 05/21/2025

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

F005XB102CA	**Douglas-fir-tanoak/tanoak, mountain slopes, sandstone and mudstone, very gravelly clay loam** F005BX102CA is found in conjunction with this ecological site but it overlies loamy-skeletal soils and is less productive.

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 near the Beaver and Pine ridge areas. It occurs on uniform to slightly convex summits of broad ridges and upper mountain slopes, which are strongly sloping and moderately steep to very steep.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	164–4,921 ft
Slope	9–30%
Ponding depth	0 in
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by dry, warm summers, and cold, moist winters. Summertime temperatures range from 70 to 90 degrees F. The total annual precipitation ranges from 49 to 80 inches and usually falls as rain or snow from October to May.

The climate station data was taken from the nearest station and may vary from conditions found on the ecological site.

Table 3. Representative climatic features

Frost-free period (average)	250 days

Freeze-free period (average)	250 days
Precipitation total (average)	80 in

Influencing water features

No influencing water features occur on this ecological site.

Soil features

These well-drained, very deep soils developed from colluvium and residuum derived from sandstone and mudstone. They are strongly to very strongly acidic at 40 inches with a dominantly loamy subsurface rock content ranging from non-gravelly to gravelly. Some soils may have a clayey subsurface texture group ranging from non-gravelly to very gravelly.

Soils that have been tentatively correlated to this ecological site include the following.
Soil Survey Area: CA605 - Redwood National and State Parks

Mapunit Symbols Soil Components

462 Mooncreek
462 Tossup

Table 4. Representative soil features

Surface texture	(1) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	80 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–2%
Available water capacity (0-40in)	5–8 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0

Soil reaction (1:1 water) (0-40in)	4.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site has evolved with natural disturbances from lightning-ignited fire and historic ignitions from Native American burning (Agee, 1993).

Generally this site has a low to moderate fire regime with occasional severe fires (Arno, 2002). Fire return intervals fluctuate from 10 to 30 years (Wills, 1994, Agree, 1991). Fire effects and the patterns of stand development in the mixed evergreen forest-type are complex and highly variable (Eyre, 1990). Often, multiple ages and sizes of trees are found on the same site.

Young Douglas-fir (*Pseudotsuga menziesii*) is has thin bark and will likely be killed by fire, while the thick-barked mature Douglas-fir is more resistant. Tanoak (Lithocarpus densiflorus) and other hardwoods are sensitive to fire but are able to re-sprout and so are able to maintain their presence following fire (Mc Murray, 1989).

Light surface fire will kill young tanoak, while older stands may survive. Moderate fire may kill some Douglas-fir but leave others. Tanoak and other hardwoods will re-sprout and grow rapidly. Severe fire may kill mature Douglas-fir and while enabling the re-sprouting of tanoak, which will then dominate a site for decades (Agee, 1991). 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.

There are a few potential pathways for stand development following fire (adapted from Agee 1993, Thornburg, 1982):

1) Immediately after a fire, Douglas-fir infills and tanoak will re-sprout. This causes a mixed stand with a mosaic of Douglas-fir in the overstory, and tanoak existing as a co-dominant tree in the sub-canopy. Some areas are dominated by tanoak, while other areas are primarily Douglas-fir (Jimerson, 1990).

2) Douglas-fir does not infill or there are large areas of fire-killed Douglas-fir; tanoak and other sprouting hardwoods may dominate the site for decades. Eventually, Douglas-fir overtops tanoak and dominates the site. Tanoak continues to exist in the sub-canopy.

Disturbance from timber harvesting is likely to mimic fire. Forest management may result in the dominance of hardwoods. The combined effects of fire and harvesting have

increased the stocking and density of tanoak and Pacific madrone (*Arbutus menziesii*), as well as other shrubs.

Tanoak can establish under full shade and maintains itself through periodic diebacks. It sustains a shrub-like form until the canopy is opened, and then may rapidly attain tree status (McDonald and Tappenier, 1987). It may regenerate via seed or vegetatively.

Douglas-fir requires a mineral seedbed or light litter to regenerate. Light shade aids the first year's survival. Thereafter, Douglas-fir requires full sunlight and will not survive under dense shade (Burns and Honkala, 1990).

State and transition model

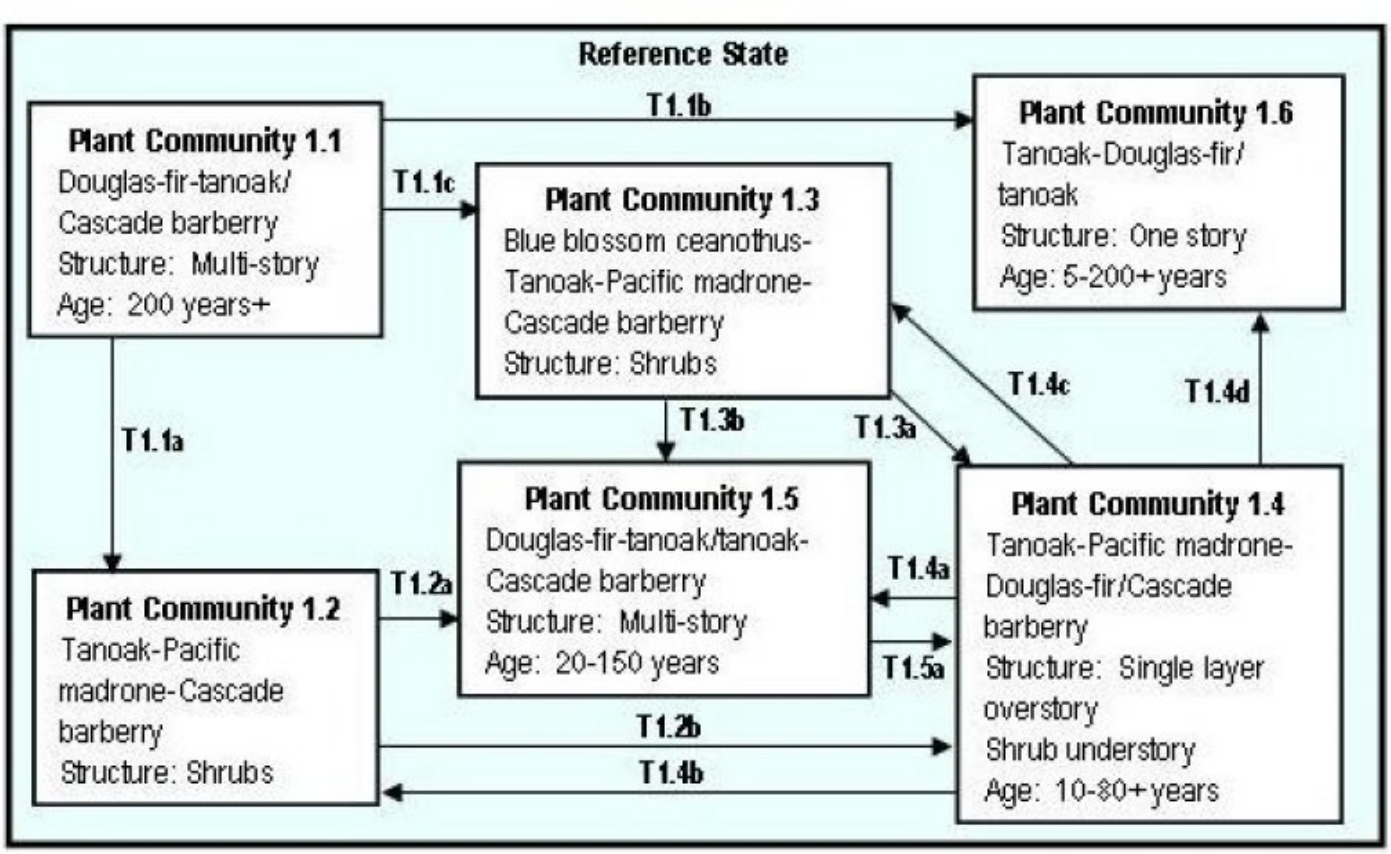

Figure 4. Douglas-fir-tanoak model

State 1
Douglas-fir/tanoak

Community 1.1
Douglas-fir/tanoak

Plant Community 1. The interpretive plant community for this site is also the presumed historic climax plant community (HCPC). A dominant overstory canopy consists of Douglas-fir (*Pseudotsuga menziesii*), with a sub-canopy of tanoak (Lithocarpus densiflorus). The amount of each species present is dependent on past disturbances.

Pacific madrone (*Arbutus menziesii*) and giant chinquapin (*Chrysolepis chrysophylla*) exists as minor components of the sub-canopy. The dominant shrub species in the understory is tanoak with a lesser component of Cascade barberry (*Mahonia nervosa*) and salal (*Gaultheria shallon*). The dominant herbaceous species found on the site include western modesty (*Whipplea modesta*) and brackenfern (Pteridium Gleditsch). 1a) Disturbance from block harvesting and post-harvest burning is likely to mimic that of a severe fire, and may result in the dominance of hardwoods for a period of time. The combined effects of fire and harvesting may increase the stocking and density of tanoak and Pacific madrone, as well as other shrubs. Tanoak and Pacific madrone are top-killed but will sprout and infill into the area. If a seed source is present, Douglas-fir may establish in the area. See PC#2. 1b) Disturbance from block harvesting and post-harvest burning may result in a dominance of blueblossom, if a seed source is present in the soil. Blueblossom may grow rapidly to tree size and dominate a site for a long period until conifers are able to overtop and out-compete it. Other sprouting shrubs such as tanoak and Pacific madrone may also be a component of the shrub community. See PC#3. 1c) Partial cutting and periodic moderately intense fire could change the dominant species structure and composition. Opening up the stand with partial cutting would release tanoak in the shrub layer, allowing it to rapidly grow and occupy the site. In some areas, Douglas-fir may form a dense canopy to the exclusion of hardwoods. Tanoak would slowly invade after several decades. See PC#6.

Forest overstory. The overstory is usually dominated by Douglas-fir, with a sub-canopy of tanoak. *The relative species composition may vary greatly depending on past fire or harvesting disturbances.

Overstory Average Canopy Cover

Douglas-fir (Pseudotsuga menziesii) 50-75%
Tanoak (Lithocarpus densiflorus) 20-50%
Pacific madrone (Arbutus menziesii) 5-10%
Giant chinquapin (Chrysolepis chrysophylla) 0-5%

Forest understory. The understory is primarily composed of the shrub form of tanoak, Cascade barberry, and salal. Western modesty and brackenfern may be found in the herbaceous layer.

Understory average cover

Tanoak (Lithocarpus densiflorus) 5-15%
Cascade barberry (Mahonia nervosa) 0-5%
Salal (Gaultheria shallon) 0-5%
western modesty (Whipplea modesta) 0-15%
Brackenfern (Pteridium aquilinum) 0-5%

State 2

Blueblossom/tanoak/Pacific madrone

Community 2.1
Blueblossom/tanoak/Pacific madrone

Plant Community 3. The plant community is dominated by blueblossom (*Ceanothus thyrsiflorus*). Other sprouting hardwoods and shrubs that occur may include tanoak, Pacific madrone and Cascade barberry. Some Douglas-fir may survive a moderate fire and would eventually infill into the understory. Douglas-fir may also infill from adjacent seed sources. 3a) Without intervention or disturbance, tanoak will grow vigorously to become the canopy over the shrub layer. Douglas-fir infill from adjacent stands, or existing seedlings established following the initial disturbance, will become part of the community. Overtime, Douglas-fir will overtop the tanoak and dominate the overstory. See PC#4. 3b) With a severe fire, the shrub-state plant community would be perpetuated. 3c) The plant community could trend towards a Douglas-fir-dominated site if chemical control, tree planting and follow-up timber stand management was implemented. See PC#5.

State 3
Tanoak/Pacific madrone/California huckleberry

Community 3.1
Tanoak/Pacific madrone/California huckleberry

Plant Community 2. Following a disturbance, the shrub community is dominated by tanoak, with lesser amounts of Pacific madrone and Cascade barberry as possible associates. Both hardwood trees and evergreen shrubs will sprout, and are capable of rapid growth (McMurray, 1989). If a seed source is present, Pacific madrone, which is an abundant seeder, may also infill into the open areas. 2a) Establishment of Douglas-fir could be accelerated with mechanical or chemical methods of treating brush, sprouting tanoak, and other hardwoods, followed immediately by planting. See PC#5. 2b) If left to develop without intervention, tanoak and madrone would eventually form a tree layer over shrubs. Some scattered infill of Douglas-fir may occur from adjacent seed sources. Tanoak and Pacific madrone are vigorous growers and provide significant competition to conifer growth and survival. See PC#4.

State 4
Tanoak/Pacific madrone/Douglas-fir

Community 4.1
Tanoak/Pacific madrone/Douglas-fir

Plant Community 4. Tanoak grows rapidly and forms the overstory canopy. If a seed source was present at the time of disturbance, Pacific madrone may also be part of the overstory. Douglas-fir that became established either at the time of the initial disturbance or as the result of later infill, may be initially overtopped by hardwoods. 4a) Tree planting

of Douglas-fir in conjunction with the partial cutting or chemical control of hardwoods would accelerate the establishment and dominance of Douglas-fir. See PC#5. 4b) Block harvesting, followed by chemical control, would temporarily set the plant community back to a shrub state. See PC#2. 4c) A tanoak-dominated plant community may result from continued fire exclusion and the removal of conifer seed sources. See PC#6.

State 5
Douglas-fir/tanoak

Community 5.1
Douglas-fir/tanoak

Plant Community 5. The plant community is a mosaic of Douglas-fir and tanoak in the overstory. Tanoak is also established in the understory in shrub form. 5a) A moderate fire or partial cutting of Douglas-fir could return this community to a tanoak-dominated stand. See PC#4.

State 6
Tanoak/Douglas-fir

Community 6.1
Tanoak/Douglas-fir

Plant Community 6. Fire exclusion or the partial cutting of Douglas-fir could result in a tanoak/Douglas fir overstory, with a tanoak shrub layer. Tanoak regeneration is favored by the removal of Douglas-fir seed sources, which creates continuous openings in the canopy. With continued fire exclusion, tanoak could become the dominant climax species over Douglas-fir on some sites (Atzet, 1979. Franklin and Dyrness, 1987).

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 and giant chinquapin, as well as berry producing species such as Pacific madrone and Oregon-grape (Mahonia aquifolium).

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

Runoff class is medium to high.

The hydrologic groups, hydrologic conditions and runoff curves for each soil series are:

Mooncreek

462--C
463--B
464--C

Tossup

462--D
464--D

Refer to the Soil Survey Manuscript for further information.

Recreational uses

This site can support a variety of recreational uses.

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 Cascade barberry are edible and are made into jams and pies. The foliage is utilized for decorative purposes.

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 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
Douglas-fir	*PSME*	120	160	115	170	–	–	–	

Inventory data references

Forestry data was collected in association with the following soils pits:

Soil pit #

Mooncreek
03-068
03-082
03-083

Tossup
03-066

Type locality

Location 1: Humboldt County, CA	
Township/Range/Section	T7N R3E S11
UTM zone	N
UTM northing	4540622
UTM easting	431790

General legal description	.25 miles north of Faulkner prairie on Barnum Timber land.

Other references

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Eyre, F.H., Editor. 1980. Forest Cover Types of the United States and Canada. Society of American Foresters.

Franklin, Jerry F. and Dyrness, C.T. 1973. Natural Vegetation of Oregon and Washington. Gen. Tech. Rep. PNW-8. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Southwest Range and Experiment Station. 417 p.

Jimerson, T.M., 1996. A Field Guide to the Tanoak and the Douglas-fir Plant Associations in Northwest Caifornia.

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Tappenier, John C., II; Harrington, Timothy B; Walstad, John D. 1984. Predicting recovery of Tanoak (Lithocarpus densiflorus) and Pacific madrone (*Arbutus menziesii*) seedlings in the forests of southwestern Oregon. New Forests. 1:43-55. [3234]

Tappeiner, John C., II; McDonald, Philip M. 1984 Development of tanoak understories in conifer stands. Canadian Journal of Forest Research. 14: 271-277. [6445]

Thornburg, D.A. 1982. Succession in the mixed evergreen forests of northwest California. In Means,J.E. (ed.) Forest Succession and stand development research in the Northwest. pp.87-91. Corvallis: Oregon State University For. Res. Lab.

Wills, R. D., and Stuart, J.D. 1994. Fire history and stand development of a Douglas-fir/hardwood forest in northern California. Northwest Science 68:205-212.

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:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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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:**
