## Douglas Fir - Tanoak (DFTO)

### General Information

### Cover Type Overview

* Crosswalks
  + EVeg: Regional Dominance Type 1
    - Pacific Douglas Fir
    - Tanoak
  + EVeg: Regional Dominance Type 2
    - Tanoak (regardless of RD Type 1 value, and therefore inclusive of all potential Type 1 vegetation types)
  + LandFire BpS Model: 0610430 Mediterranean California Mixed Evergreen Forest (shared with Montane Hardwood)
  + Presettlement Fire Regime Type: Mixed Evergreen
* Ultramafic
  + This type is created by intersecting an ultramafic soils/geology layer with the existing vegetation layer. Where cells intersect with DFTO they are assigned to the ultramafic modifier.

Reviewed by:

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### Vegetation Description

This landcover type forms a complex mosaic of forest due to the geologic, topographic, and successional variation typical within its range. Deep mesic soils support aggregations that include a lower or midstory layer of dense, sclerophyllous, broad-leaved evergreen trees like *Notholithocarpus densiflorus[[1]](#footnote-1)* and *Arbutus menziesii*, with an irregular, often open, higher layer of tall needle-leaved evergreen trees, typically *Psuedotsuga menziesii*. A small number of pole and sapling trees occur throughout stands. On wetter sites, shrub layers are well developed, often with 100% cover. Cover of the herbaceous layer under the shrubs can be up to 10 percent. At higher elevations, the shrubs disappear and the herb layer is often 100%. Diversity of tree size typically increases with stand age, along with tree spacing. Young stands have closely spaced and uniformly distributed trees, whereas older stands have a more patchy stem distribution. Snags and downed logs, an important structural component of this habitat, increase in density or volume with stand age (Raphael 1988).

Additional hardwood tree associates may include *Quercus chrysolepis*, *Quercus kelloggii*, and *Umbellularia californica*. Potential additional conifer associates include *Abies concolor*, *Pinus lambertiana*, *Calocedrus decurrens,* and *Pinus ponderosa* (Tappeiner 1990). A large variety of shrubs, forbs, grasses, sedges, and ferns are also associated with the DFTO landcover type. Generally these plants are not abundant once the canopy has closed, but, along with *N. densiflorus* sprouts, can become aggressive on burned or cutover areas. This is especially true in areas where high severity fires have locally eliminated conifer seed sources. Among the most common shrubs are *Ceanothus*, *Corylus*, *Gaultheria*, *Morella*, *Rhododendron*, *Ribes*, *Rubus*, *Toxicodendron diversilobum*, and *Vaccinium*. Common forbs include *Chimaphila*, *Mahonia,* *Cirsium vulgare*, *Erechtites*, and *Whipplea*. Grass species include *Bromus*, *Festuca*, and *Hierochloe*. *Polystichum munitum* and *Pteridium aquilinum* var. *pubescens* sometimes grow abundantly. *Carex* spp. are present in some places (Tappeiner 1990).

* **Ultramafic Modifier** *Notholithocarpus densiflorus* var. *echinoides*, or dwarf tanoak, growns on ultramafic and other less productive sites (Estes 2013). It is unclear if the 2 varieties differ genetically or if the small stature of dwarf tanoak is due to unproductive site conditions. Ecology literature does not usually distinguish between the 2 infrataxa (Fryer 2008). However, its identification is pertinent to management decisions. While *N. lithocarpus* is generally protected as an oak species, the dwarf variety may be classified as a shrub and therefore subject to treatment or removal.

On these sites, *P. menziesii* attains less dominance and is replaced by open stands of various conifers, such as *Pinus ponderosa, Pinus sabiniana,* or *Pinus jeffreyi*. The shrub layer is likely to include *Quercus vaccinifolia*, *N. densiflorus*, *U. californica*, *Quercus breweri*, and *Rhamnus*. Common grasses include *Stipa, Festuca,* and *Danthonia* (LandFire 2007b, McDonald 1988, O’Geen et al. 2007, Raphael 1988).

### Distribution

Douglas Fir–Tanoak is typically found on soils that are deep, well-drained, and loamy, sandy, or gravelly. It grows in valleys, coves, ravines, along streams, and on north as well as east slopes. It is typically found in areas that are cool and moist sites in areas where precipitation is highest most likely in the form of rain and snow. The elevation range of this type is between 580 and 1220 m (1,900 and 4,000 ft) (Tappeiner 1990).

* **Ultramafic Modifier**  Ultramafics have been mapped at various spatial densities throughout the elevational range of the DFTO landcover type. Low to moderate elevations in ultramafic and serpentinized areas often produce soils low in essential minerals like calcium potassium, and nitrogen, and have excessive accumulations of heavy metals such as nickel and chromium. These sites vary widely in the degree of serpentinization and effects on their overlying plant communities (“CalVeg Zone 1” 2011). Note, the terms “ultramafic rock” and “serpentine” are broad terms used to describe a number of different but related rock types, including serpentinite, peridotite, dunite, pyroxenite, talc and soapstone, among others (O’Geen et al. 2007).

**Disturbances**

### Wildfire

*N. densiflorus* is adapted to ignite easily. In the lower montane zone of the Sierra Nevada where *N. densiflorus* occurs, the historic fire regime was characterized by dormant season fires of mostly low to moderate severity. Patchy, stand-replacement fires were most common on north-facing slopes and during extended droughts (Tappeiner 1990). Historically, lighting ignited most fires in this cover type. However, there is evidence that Native American burning prior to 1850 may have been extensive (LandFire 2007a).

*N. densiflorus* seedlings and saplings are typically top-killed by even low severity surface fire. Large trees usually survive moderate-severity fire, bearing fire scars afterward. Even *N. densiflorus* with thick bark (3-10 cm) typically sustain bole damage from fire. Relative to associated conifers, mature *P. menziesii* is fairly resistant to surface fires. Crown fires cause extensive mortality (Tappeiner 1990).

Data on fire return intervals (FRIs) are available from a few review papers. Skinner and Chang (1996) aggregated FRIs from the Sierra Nevada and separated pre-1850 data from overall data. Van de Water and Safford’s 2011 review paper aggregates hundreds of articles, conference proceedings, and LandFire data on fire return intervals, with an emphasis on Californian sources. We also include here data from the pertinent LandFire BpS model (2007a, 2007b).

For mixed evergreen-tanoak in the Klamath mountains, Skinner and Chang (1996) report a median FRI of 13 years, minimum of 3 years, and a maximum of 41 years. Van de Water and Safford (2011) estimated a mean FRI of 29 years, with a median of 13 years, mean minimum of 15 years and mean maximum of 80 years. The LandFire model for this type (2007a) predicts a mean FRI of 8 years. Replacement FRI has a mean of 333 years with a range of 65 to 500 years, while surface FRI has a mean of 10 years with a range of 7 to 15 years. We recalculated these numbers using condition-specific information and using only high and low mortality fire categories, which resulted in an interval of 75 years for high mortality fire, 8 years for low mortality fire, and 8 years for any fire.

* **Ultramafic Modifier** Skinner and Chang’s (1996) analysis, described above, is the most relevant to the ultramafic type as well. Van de Water and Safford (2011) categorized the LandFire model for Klamath-Siskiyou Xeromorphic Serpentine Savanna and Chaparral into the Chaparral and serotinous conifers PFR, which has a mean FRI of 55 years, a median of 59 years, a mean min of 30 years and a mean max of 90 years. The LandFire model itself (2007b) predicted a mean replacement FRI of 200 years with a range of 100-300 years, no mixed severity fire, a mean surface FRI of 15 years with a range of 10-20 years, and an overall mean FRI of 14 years. We recalculated these numbers using condition-specific information and using only high and low mortality fire categories, which resulted in an interval of 90 years for high mortality fire, 19 years for low mortality fire, and 16 years for any fire.

Table 1. Fire return intervals (years) and percentage of high versus low mortality fires. Values for DFTO were derived from BpS model 0610430 (LandFire 2007a), Van de Water and Safford (2011), and input from Safford and Estes (pers. comm. 2013). Values for DFTO on ultramafic soils were derived from BpS model 0711700 (LandFire 2007b) and input from Safford and Estes (pers. comm. 2013).

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| --- | --- | --- | --- | --- | --- | --- |
| **Variant** | **Modifier** | **Fire Mortality** | **Mean** | **Min** | **Max** | **% of Fires** |
| DFTO | None | High | 65 | – | – | 18 |
| Low | 8 | – | – | 82 |
| All Fires | 30 | 5 | 41 | 100 |
| Ultramafic | High | 90 | – | – | 17 |
| Low | 19 | – | – | 83 |
| All Fires | 40 | 15 | 80 | 100 |

### Other Disturbance

Other disturbances are not currently modeled, but may, depending on the condition affected and mortality levels, reset patches to early development, maintain existing stages, or shift/accelerate succession to a more open stage. All of the tree species associated with this vegetation type are susceptible to a wide variety of pathogens and insects (such as sudden oak death for *N. densiflorus*, which is caused by the pathogen *Phytophthora ramorum*).

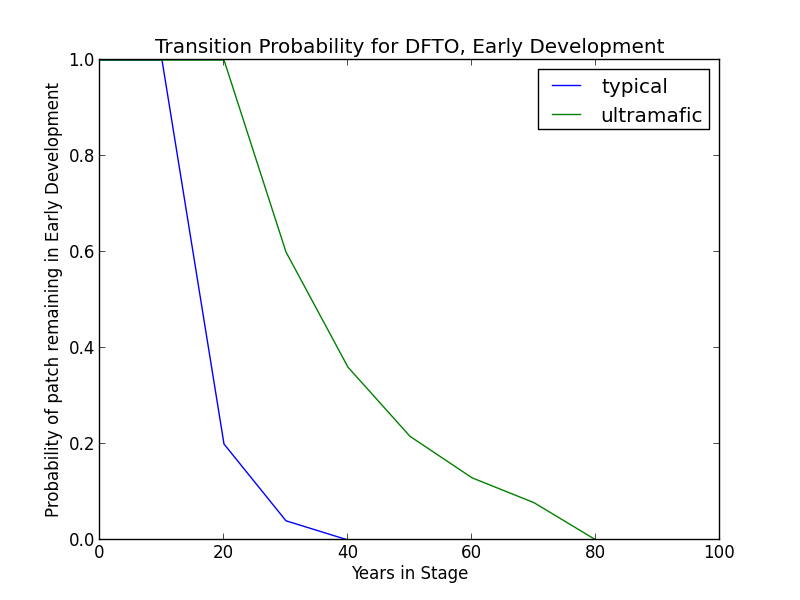
### Vegetation Condition Classes

We recognize three separate condition classes for DFTO: Early Development (ED), Mid Development (MD), and Late Development (LD). We use condition classes not in the sense of fire regime condition classes, but as an alternative to “successional” classes that imply a linear progression of states and tend not to incorporate disturbance. The condition classes identified here are derived from a combination of successional processes and anthropogenic and natural disturbance, and are intended to represent a composition and structural condition that can be arrived at from multiple other conditions described for that landcover type. Thus our condition classes incorporate age, size, canopy cover, and vegetation composition as well as relative seral stages. In general, the delineation of stages has originated from the LandFire biophysical setting model descriptive of a given landcover type; however, condition classes are not necessarily identical to the classes identified in those models.

### Early Development (ED)

**Description** Abundant grasses, forbs, low shrubs, and sparse to moderate cover of trees (primarily *P. menziesii* and *N. densiflorus*) seedlings/saplings with an open canopy. This condition is characterized by the diversity of species establishing and reestablishing into an open area created by a stand-replacing disturbance.

Seedling establishment of *P. menziesii* following fire is dependent on the spacing and number of surviving seed trees. Seedling establishment following large stand-replacing fires may be slow if seed trees are killed over extensive areas. Or, if there are numerous, well-spaced surviving seed trees within the burned area, a new cohort of seedlings can quickly establish (Uchytil 1991).

Nearly all *N. densiflorus* burls sprout after fire, and survivorship is high. *Q. chrysolepis*, if present, also sprouts readily, and shrubs such as *Mahonia*, *Gaultheria*, and *Rhododendron* may be significant. Shrub growth from seed banks, e.g. *Ceanothus integerrimus*, can also be high (LandFire 2007a). Thus, *N. densiflorus* and other shrubs usually dominante the initial condition if *P. menziesii* isn’t able to seed in quickly (Raphael 1988).

On ultramafic sites, *P. menziesii* may be stunted and slow-growing, and *N. densiflorus* var. *echinoides* may be present. Grasses like *Festuca, Danthonia*, and *Acnatherum,* or else chaparral shrubs establish. Scattered *Pinus ponderosa, Pinus sabiniana,* or *Pinus jeffreyi* may also be present (LandFire 2007b).

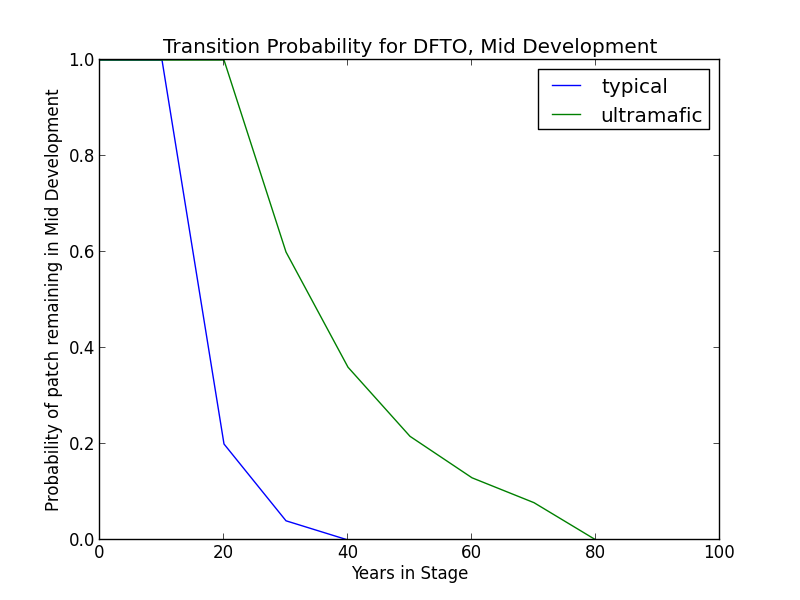
**Succession Transition** In the absence of disturbance, patches in this condition class will begin transitioning to mid development at 20 years. The rate of succession per time step is 0.8. At 40 years, all patches will succeed.

* **Ultramafic Modifier** Succession may be delayed. Thus, in the absence of disturbance, patches in this condition class will begin transitioning to MD after 30 years and may be delayed in the ED condition for as long as 80 years. A patch in this condition succeeds at a rate of 0.4 per time step.

**Wildfire Transition** High mortality wildfire (100% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire is not modeled for this condition class.

**Mid Development (MD)**

**Description** Sparse ground cover of grasses, forbs, and shrubs; moderate but most likely dense cover of trees (primarily *P. menziesii* and *N. densiflorus*). Other *Quercus* and *Arctostaphylos* species may also be present. In this stage, hardwoods are dominant (40-100% canopy cover), but *P. menziesii* and possibly other conifers are established or establishing under the predominantly *N. densiflorus* canopy (LandFire 2007a, McDonald 1988). Ultramafic sites are characterized by open *P. menziesii, Pinus ponderosa, Pinus sabiniana,* or *Pinus jeffreyi* stands with an understory comprised of *N. densiflorus* var. *echinoides* as well as grasses, forbs, and shrubs (LandFire 2007b).

**Succession Transition** After 20 years without high mortality fire, this class will begin transitioning to late development. The rate of succession per time step is 0.8. At 40 years, all stands will succeed.

* **Ultramafic Modifier** Succession may be delayed. Thus, in the absence of high mortality disturbance, patches in this condition class will begin transitioning to LD after 30 years and may be delayed in the MD condition for as long as 80 years. A patch in this condition succeeds at a rate of 0.4 per time step.

**Wildfire Transition** High mortality wildfire (15% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire (85%) does not effect a change in the MD condition.

* **Ultramafic Modifier** High mortality wildfire (7.0% of fires) recycles the patch through the ED condition. Low mortality wildfire (93.0%) does not effect a change in the MD condition.

**Late Development (LD)**

**Description** Overstory of large and very large trees, primarily *P. menziesii*. Canopy cover exceeds 60%. *P. lambertiana* also occurs. *N. densiflorus* is tolerant of both full sun and shade, and usually dominates the subcanopy at this stage. Co-dominance of the upper canopy with *P. menziesii* is uncommon but possible after extended periods without disturbance (Uchytil 1991, LandFire 2007a). There is also some evidence that the senescence of late development *N. densiflorus* may cause openings in the canopy and allow for continued *P. menziesii* dominance (Estes pers. comm. 2013). *Quercus* and *Arctostaphylos* species may also be present in the sub-canopy (LandFire 2007a).

On ultramafic sites, large *Pinus ponderosa, Pinus sabiniana,* or *Pinus jeffreyi* may be present along with *P. menziesii* and *N. densiflorus* var. *echinoides*. Grass savannah persists on sites experiencing low intensity fire (with *Festuca, Achnatherum,* and *Danthonia*). Where fire is less frequent, chaparral shrubland develops (with *Arctostaphylos* and *Quercus breweri*) (LandFire 2007b).

**Succession Transition** In the absence of disturbance, patches in this condition class will maintain, regardless of soil characteristics.

**Wildfire Transition** High mortality wildfire (10% of fires) recycles the patch through the ED condition. Low mortality wildfire (90%) does not effect a change in the LD condition.

* **Ultramafic Modifier** High mortality wildfire (6.7% of fires) recycles the patch through the ED condition. Low mortality wildfire (93.3%) does not effect a change in the LD condition.

**Condition Classification**

Table 2. Classification of cover condition for DFTO. Diameter at Breast Height (DBH) and Cover From Above (CFA) values taken from EVeg polygons. DBH categories are: null, 0-0.9”, 1-4.9”, 5-9.9”, 10-19.9”, 20-29.9”, 30”+. CFA categories are not used for this condition because there is no “closed” vs. “open” differentiation. Each row in the table below should be read with a boolean AND across each column of a row.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Cover Condition | Overstory Tree  Diameter 1 (DBH) | Overstory Tree  Diameter 2 (DBH) | Total Tree  CFA (%) | Conifer  CFA (%) | Hardwood  CFA (%) |
| Early All | 0-9.9” | any | any | any | any |
| Mid All | 10-19.9” | any | any | any | any |
| Late All | 20-40”+ | any | any | any | any |

**Draft Model**

(See PDF) Disturbance-Succession model for DFTO.

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1. Tan oak was known as *Lithocarpus densiflorus* for over 90 years before botanists renamed it *Notholithocarpus densiflorus* in 2008 (Manos et al. 2008). Some sources and database continue to use the old name and plant symbol. [↑](#footnote-ref-1)