

10290

Mediterranean California Mixed Oak Woodland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
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Reviewers: Pat Hochhalter, Kerry Metlen, Jena Volpe

Vegetation Type

Forest and Woodland

Map Zones

2, 3, 4, 5, 6, 7, 12

Geographic Range

This Biophysical Setting (BpS) is found throughout the Sierra Nevada and California Coast Range foothills at lower montane elevations. It also occurs in the Klamath Mountains, but it begins to transition into other oak and oak conifer types at the north end of the Klamath ecoregion and is not present in the Willamette Valley.

Biophysical Site Description

This ecological system occurs in diverse climates, ranging from cool, humid conditions near the coast to the hot, dry environment of inland valleys and foothill woodlands. Slopes may be steep but are typically gentle (<30%). Soils are characteristically poor, drought prone, and moderately to excessively well drained. The range includes islands supported by paralithic contacts, Vertisols, and mudstones (Umpqua and Lookingglass formations). Climate is Mediterranean, with hot, dry summers and cool, wet winters. Elevations range from nearly sea level to 7,500ft.

Vegetation Description

This BpS is characterized by open savanna to dense woodlands of large oak, with a native perennial bunch grass understory. Species composition varies with fire frequency. Dominant oak where fire is more frequent include *Quercus kelloggii* and *Quercus garryana*, with *Quercus garryana* var. *garryana* co-dominant in the central and northern Coast Ranges and *Quercus garryana* var. *breweri* often co-dominant in the northwestern Coast Ranges as well as portions of the Sierra Nevada. *Q. garryana* is the dominant oak in southwest Oregon. With less-frequent fire, *Quercus chrysolepis* becomes dominant, except in Oregon, where this species is associated with other BpSs, either Mediterranean California Mixed-Evergreen Forest or Mediterranean California Dry-Mesic Mixed-Conifer Forest and Woodland. Other conspicuous species include ponderosa pine and Pacific madrone in the south and Douglas-fir in the north.

Understory is typically perennial bunchgrass and perennial forbs. Grass component includes *Festuca roemerii* (Roemer's fescue), *F. californica* (California fescue), *Achnatherum lemmonii* (Lemmon's needlegrass), *Danthonia californica* (California oatgrass), *Pseudoroegneria spicata*

(bluebunch wheatgrass), and brome. Associated shrub species include *Toxicodendron diversilobum* (poison oak), ceanothus, manzanita, and garrya.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
QUGA4	<i>Quercus garryana</i>	Oregon white oak
QUKE	<i>Quercus kelloggii</i>	California black oak
PIPO	<i>Pinus ponderosa</i>	Ponderosa pine
PSME	<i>Pseudotsuga menziesii</i>	Douglas-fir
TODI	<i>Toxicodendron diversilobum</i>	Pacific poison oak
FECA	<i>Festuca Californica</i>	California fescue
FEIDR2	<i>Festuca roemerii</i>	Roemer's fescue

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

Fire regime I, primarily short-interval (e.g., <10yrs) surface fires. Surface fires every 3-10yrs maintained an open savanna-like structure. Fires can be mixed severity, especially when closed canopy conditions or additional species such as conifers and shrubs are present. Native American burning was a significant factor in fire frequency and maintenance of this type, but return intervals may increase significantly with a little distance from native settlements and valley bottoms.

- In their summary of pre-settlement fire regimes for California, Van de Water and Safford (2011) reported mean and median fire return intervals (FRIs) of 12yrs, a mean minimum FRI of 5yrs, and a mean maximum FRI of 45yrs for oak woodland.
- Metlen et al. (2016) reported a 6-yr median FRI (1- to 22-yr interval for the 5th-95th percentile) from cross-dated fire scar samples from an Oregon white oak site in the western Rogue Basin (Emigrant site).
- In a species review for *Quercus garryana* (Gucker 2007), an FRI of <35yrs was reported for California oak woodlands where *Quercus* spp. are dominant, and 3-30yrs for Oregon white oak communities dominated by *Quercus garryana*.
- Sugihara and Reed (1987) reported that the oak woodlands in Redwood National Park likely experienced surface fire annually or every few years prior to settlement, with much of it set by Native Americans. Currently in the Bald Hills area, the National Park Service tries to maintain a 3- to 5-yr FRI in oak woodlands to prevent Douglas-fir invasion (Eamon Engber, pers. comm.).
- The California Native Plant Society (CNPS 2017) reported a 3- to 30-yr fire frequency for the Oregon White Oak Woodland alliance.

Other disturbances in this BpS include native ungulate grazing, insects, disease (e.g., Armillaria root rot), drought stress, and wind damage (especially snow followed by wind, which can cause stem throw).

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	284	3		
Moderate (Mixed)	33	25		

Low (Surface)	11	72		
All Fires	8	100	4	45

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

The distribution of this type is naturally patchy on the landscape controlled by soil and aspect along with variable incidence of fire. The result is a typically smaller patch size, on the order of hundreds of acres (10-500ac).

Adjacency or Identification Concerns

Mixed-evergreen forest, mixed-conifer forest, tanoak PNV and PSME or ABCO PNV may be adjacent. This BpS is similar to North Pacific Oak Woodland, but is distinguished by the relative lack of conifer species and the presence of oaks other than *Q. garryana*.

Infill with grazing and fire exclusion includes small oaks, manzanita, mountain mahogany, and, on more productive sites, conifers. Reed and Sugihara (1987) documented the encroachment of Douglas-fir and redwoods into “bald hills” oak woodlands in Redwood National Park in the absence of frequent fire. They reported that prescribed fires typically killed only Douglas-fir trees that were <3m tall -- a height usually achieved by about 10yrs of age. Although conifers, especially Douglas-fir, can be present in this BpS, the California Native Plant Society allows <25% relative cover of conifers within its Oregon White Oak Woodland alliance (CNPS 2017).

Herbaceous composition shifts have been observed with a notable invasion of annual grasses. In some areas there is a significant non-native perianal grass component due to agricultural introductions.

In the Sierra Nevada, it is thought that not much of this type occurs today because much of it has been cut (Provencher, pers. comm.).

Currently, sudden oak death (SOD; *Phytophthora ramorum*) has become established in this BpS. SOD is often lethal to tanoak, but may affect black oak and some shrub species. There is currently drought-related oak and conifer mortality in this BpS in the southern Sierra. Goldspotted oak borer, an introduced beetle, is causing oak mortality in southern California.

Issues or Problems

One model reviewer observed that the model appears to misrepresent the community in the Southwest in regard to oak-dominated communities with historically high canopy cover, especially in southwest Oregon (Brewer’s oak and transition into chaparral). A description of chaparral as a vegetation type adjacent to southwest Oregon oak woodlands is necessary to prevent assumptions that chaparral with an oak component were historically more open. Similarly, naturally high-canopy cover Brewer’s oak communities that likely experienced stand-replacement fire as a norm should also be better described. Poor assumptions about historical condition may lead to fuel reduction/restoration projects that detract from historical conditions, at least in a subset of woodland and adjacent communities in southwest Oregon.

In response to these reviewer comments, another model reviewer stated that Brewer's oak communities in southwest Oregon make up only a small part of the landscape, and therefore that reviewer did not think there was much of a problem because the comment applied to such a small subset of the landscape.

Native Uncharacteristic Conditions

Comments

For LANDFIRE National, this BpS was created by Edward Reilly, Diane White, and Darren Borgias, and was reviewed by Tom Atzet. In 2016, it was reviewed by Kerry Metlen, Pat Hochhalter, and Jena Volpe. Conversations with Eamon Engber, Clint Isbel, Zach Principe, and Jimmy Kagen informed this model. The 2016 review resulted in changes to the disturbance probabilities (especially more frequent surface fire), the class age ranges, and the description.

Several assumptions were made when creating this model:

- The early-seral age limit in this model is consistent with the “young-dense” characteristic oak stand type reported in Sugihara and Reed (1987; Table 1).
- The closed and open development pathways with and without fire in this model are consistent with the development flow chart for oak stand structure developed by Sugihara and Reed (1987; Figure 2).
- A mean FRI of about 10yrs was targeted for consistency with the 12-yr mean FRI reported by Van de Water and Safford (2011) for California oak woodlands and the 10-yr interval required to control Douglas-fir invasion at Bald Hills (Reed and Sugihara 1987).
- The alternative succession pathway used to transition open to closed stands in the absence of fire was set at 20yrs, or roughly twice the mean FRI. Sugihara and Reed (1987) suggest that Douglas-fir encroachment can be controlled successfully with low-intensity fire within about the first 10yrs of age, but it was assumed that -- in drier parts of the range -- infill and conifer encroachment would occur less quickly.
- The closed versus open class canopy cover break was set at 40% because Long et al. (2016), citing Bigelow et al. (2011), suggested that oak and pine will be favored over conifers at <40% canopy cover. Bigelow et al. demonstrated that thinning forest to 40% canopy cover resulted in 10-20% of the area available for pine regeneration.

This model covers the entire range of the Mediterranean California Mixed-Oak Woodland, but it is unclear how suitable it is in the California Central Coast and Sierra Nevada ecoregions. Reviewers familiar with the northern end of the range speculated there could be several differences across the vast north/south and west/east gradients covered by this model. For example,

- Douglas-fir encroachment happens rapidly in wetter areas such as the Bald Hills. A reviewer speculated that fir encroachment would likely be slower and infill more shrub dominated in the Sierra.
- The Sierra Nevada might have a more prominent shrub component than areas farther north and west, which could affect fire severity
- This type in northwest California may have a more dominant grass component in the understory from frequent Native American burning

- Species composition could change throughout the range of this BpS; there is likely more canyon live oak and ponderosa pine at the eastern extent of the range
- Drought stress likely increases inland and south within the range of this BpS
- Canopy cover could be higher in wetter areas in northwest California than south or inland

LANDFIRE National Review Comments:

- Thomas Atzet (jatzet@budget.net) reviewed this model for map zone (MZ) 2.
- A reviewer for MZ02 added comments to class descriptions, scale, site description, and disturbance description. This reviewer felt that replacement fire intervals could have been better modeled at half or two thirds the interval indicated. As evidence, even in the area around Diamond Lake, fire-scarred trees were showing very frequent fire scars right at the soil level. Another reviewer commented that the classes were well defined for this type.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41 - 50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	A	A	A	A	A	A	A	A
Shrub	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Shrub	1.0-3.0	A	A	A	A	A	A	A	A	A	A
Shrub	>3.0	A	A	A	A	A	A	A	A	A	A
Tree	0-5	A	A	A	A	UN	UN	UN	UN	UN	UN
Tree	0-5	A	A	A	A	A	A	A	A	A	A
Tree	5-10	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	C	C	C	C	B	B	B	B	B	B
Tree	10-25	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	D	D	D	D	E	E	E	E	E	E
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	D	D	D	D	E	E	E	E	E	E
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	D	D	D	D	E	E	E	E	E	E

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A	11	Early Development 1 - All Structures
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUERC	Quercus	Oak	All
CECU	Ceanothus cuneatus	Buckbrush	Lower
TODI	Toxicodendron diversilobum	Pacific poison oak	Lower
FEIDR2	Festuca roemerii	Roemer's fescue	Lower

Description

Bunchgrass/forb groundcover with resprouting oak and oak saplings following stand-replacement fire. These areas were favored by Native Americans; therefore, maintenance fires were common and early seral had a combination of grasses recycled continuously. Larger oak were occasionally burned and killed. Poison oak can be an aggressive pioneer.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class B	4	Mid Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUERC	Quercus	Oak	All
CECU	Ceanothus cuneatus	Buckbrush	Lower
TODI	Toxicodendron diversilobum	Pacific poison oak	Lower
FEIDR2	Festuca roemerii	Roemer's fescue	Lower

Description

Sapling, pole, and medium-size-diameter *Quercus* species (5-15in DBH measured in southwest Oregon). Understory and shrub layer of PSME, PIPO, CADE27, RHDI6, CECU, FEIDR2, FECA, and CYEC.

Maximum Tree Size Class

Medium 9-21" DBH

Class C	21	Mid Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUERC	Quercus	Oak	All
FEIDR2	Festuca roemerii	Roemer's fescue	Lower
PIPO	Pinus ponderosa	Ponderosa pine	All
PSME	Pseudotsuga menziesii	Douglas-fir	All

Description

Maximum Tree Size Class

Class D **54** **Late Development 1 - Open**

Indicator Species

Description

Maximum Tree Size Class

Class E	10	Late Development 1 - Closed
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Indicator Species

Description

Maximum Tree Size Class

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
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Early1:ALL	0	Mid1:OPN	39
Mid1:OPN	40	Late1:OPN	99
Mid1:CLS	40	Late1:CLS	99
Late1:OPN	100	Late1:OPN	999
Late1:CLS	100	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Alternative Succession	Early1:ALL	Mid1:CLS	1	1	Yes	20
Replacement Fire	Early1:ALL	Early1:ALL	0.005	200	Yes	0
Surface Fire	Early1:ALL	Early1:ALL	0.05	20	No	0
Mixed Fire	Early1:ALL	Early1:ALL	0.0666	15	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	1	1	Yes	20
Replacement Fire	Mid1:OPN	Early1:ALL	0.0033	303	Yes	0
Native Grazing	Mid1:OPN	Mid1:OPN	0.02	50	No	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.02	50	No	0
Surface Fire	Mid1:OPN	Mid1:OPN	0.1	10	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.0033	303	Yes	0
Insects or Disease	Mid1:CLS	Mid1:OPN	0.01	100	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.05	20	No	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.0666	15	Yes	0
Alternative Succession	Late1:OPN	Late1:CLS	1	1	Yes	20
Replacement Fire	Late1:OPN	Early1:ALL	0.0033	303	Yes	0
Native Grazing	Late1:OPN	Late1:OPN	0.01	100	No	0
Mixed Fire	Late1:OPN	Late1:OPN	0.02	50	No	0
Surface Fire	Late1:OPN	Late1:OPN	0.1	10	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.0033	303	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.01	100	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.01	100	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.05	20	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.05	20	Yes	0

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