10280

Mediterranean California Mesic Mixed Conifer Forest and Woodland

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Joe Sherlock | jsherlock@fs.fed.us | None | None |
| Neil Sugihara | nsugihara@fs.fed.us | None | None |
| Hugh Safford | hughsafford@fs.fed.us | None | None |

Reviewer: U.S. Forest Service Region 5 ecologists

Vegetation Type

Forest and Woodland

Map Zones

4, 6, 7, 12

Geographic Range

This type occurs throughout California and into southern Oregon and westernmost Nevada. It occurs as far north as the North Umpqua River (Oregon), ending within the Steamboat 5th field drainage.

In southern California, this Biophysical Setting (BpS) includes small stands in the south coast ranges (e.g., Mt. San Benito, San Benito Co.; Big Pine Mtn., Santa Barbara Co.; Pine Mtn., Ventura Co.; Palomar Mountain, San Diego Co.; Cuyamaca Mountains, San Diego Co.) and larger stands in the San Gabriel and the San Bernardino mountains and the San Jacinto and San Pedro Mártir ranges (Baja California) of the Peninsular Ranges.

This particular model and description applies within the East Cascades-Modoc Plateau ecoregion and throughout California except within the Klamath Mountains and California North Coast ecoregions.

Biophysical Site Description

At its lowest elevation, this BpS occurs primarily on north and east aspects, moist sites such as toeslopes, and other protected settings. It can occur at all aspects at higher elevations, shifting to warmer slopes as it transitions into upper montane forest types. In California, it is generally found above 1,500m in the Sierra Nevada and from 1,500-2,500m in the Transverse and Peninsular ranges. In southwest Oregon, it generally occurs from ~300-1,000m and on E-NW aspects. Typically occurs with 100-150cm annual precipitation in southern California, 50% as snow. Upper elevations defined by ecotone with red fir and lodgepole. Lower elevations defined by ecotone with drier mixed conifer types.

Vegetation Description

Mesic mixed conifer forests are typically composed of three or more conifer species, with white fir, Douglas-fir, incense cedar, ponderosa pine, and sugar pine being the most common dominants. Giant sequoia is an important component of this forest type in the southern Sierra Nevada. Douglas-fir does not extend much further south than Yosemite National Park. Lodgepole pine occurs near waterbodies, mostly at upper elevations. Jeffrey pine occurs mostly on the east side of the Sierra Nevada or on ultramafic (“serpentine”) soils in northwestern California and southwestern Oregon.

Madrone, live oak, big-leaf maple, and tan oak are common hardwood species in this forest type. Shrub associates include *Ceanothus* spp., *Arctostaphylos* spp. (and other members of the montane chaparral community), *Cornus nuttallii*, *Ribes* spp., etc.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ABCO | *Abies concolor* | White fir |
| PSME | *Pseudotsuga menziesii* | Douglas-fir |
| PILA | *Pinus lambertiana* | Sugar pine |
| PIPO | *Pinus ponderosa* | Ponderosa pine |
| CADE27 | *Calocedrus decurrens* | Incense cedar |
| PIJE | *Pinus jeffreyi* | Jeffrey pine |
| SEGI2 | *Sequoiadendron giganteum* | Giant sequoia |

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

Disturbance Description

In their summary of pre-settlement fire regimes for California, Van de Water and Safford (2011) report a mean fire return interval (FRI) of 16yrs, a mean minimum FRI of 5yrs, and a mean maximum FRI of 80yrs for moist mixed conifer based on a review of 53 studies. Surface fire occurs at an average generally between 10-20yrs (Taylor and Skinner 2003; Taylor and Skinner 1998; Sensenig 2002). Most medium- and high-severity fires occur on mid- and upper-slope positions (Taylor and Skinner 1998; Taylor 2000; Beaty and Taylor 2001; Bekker and Taylor 2001).

Insect/drought-related mortality affects this BpS, especially when combined with periodic drought, causing individual and small patch effects. With historic fire regimes, insect outbreaks may have been much reduced compared to current conditions. Snow breakage can be relatively frequent in some mid-seral closed stands at higher elevations. This disturbance does not impact stand structure enough to warrant inclusion in the state-and-transition model. Insect activity increases in amount and frequency in the northern part of the range of this BpS, particularly in the mid-open and mid-closed stands following surface and mixed-severity fires.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 146 | 12 |  |  |
| Moderate (Mixed) | 46 | 37 |  |  |
| Low (Surface) | 33 | 51 | 10 | 40 |
| All Fires | 17 | 100 |  |  |

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

Literature suggests an historical average fire size of 50-200ha (Agee 1993; Taylor, various). This forest type occurred in a small to medium patch size (<1-100ac) mosaic, driven by variations in topography, surface fire intensity, and insect/pathogen-related mortality. Larger patches were rare, but modern fires often generate high severity patches >1000ac.

Adjacency or Identification Concerns

Found at similar elevations to the Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland (BpS 1027), although it extends to higher elevations than the latter. The difference between the Dry-Mesic and Mesic Mixed Conifer types is moisture balance. For mapping in the central Sierra Nevada, a first (very coarse) approximation of splitting the two types could be based on putting the Mesic above 1,000mm precipitation and the Dry-Mesic below.

In southwestern Oregon, upper elevations are defined by the ecotone with both red fir and silver fir. Lower elevations defined by cedar-hemlock-Douglas-fir or the mixed evergreen types. In the Sierra Nevada, this BpS extends between the low-elevation hardwood forests and dry mixed conifer forest up to the red fir forests of the upper montane zone. In the Transverse Ranges and Mt. San Jacinto, the upper elevations defined by ecotone with lodgepole and even subalpine stands of limber pine. The lower ecotone occurs with mixed evergreen forests (mixes with *P macrocarpa* and *Q chrysolepis*), and lower elevations encounter dry-mesic mixed conifer forests or, as at Big Pine Mountain in Santa Barbara Co., even chaparral on south slopes.

CALVEG types that are included in the model are DF, DW, DP, MB, MF (depending on RF content), MK, WF (depending on site productivity), and BT.

The extent of this forest type has probably expanded notably, due to fire-suppression-driven successional dynamics that result in infill of dry mixed conifer stands with fire-intolerant but shade-tolerant species such as white fir and incense cedar (Safford and Stevens, in press).

Issues or Problems

It is unknown if there is a need for a northern (latitude) versus a southern mixed conifer BpS. Literature inferences suggest that "north" slopes, perhaps especially in the northern Sierra Nevada through the Klamath region, have a longer fire regime and larger patch size than estimated by work in the southern and central Sierra Nevada. Likewise, the Klamath region literature also indicates that the topographic complexity also contributes to disparity between the two types; aspect plays a more significant role there in determining differences in fuel loading and fire severity, particularly in the southern portions to be replaced by elevation in the most northern extent of this type. Even though differences in fire frequency may exist between N and S aspects, Skinner and Taylor (1998) found that the numbers were not statistically significant in their study. Difference in severity between aspects may be more important. It is also unclear whether a distinct model is needed for this BpS in the East-Cascades Modoc Plateau ecoregion.

During the 2016 review, Forest Service region 5 ecologists decided that this one model could adequately represent the BpS throughout most of California (i.e., East Cascades-Modoc Plateau and Sierra Nevada ecoregions and areas further south). A separate model is used to represent the BpS in areas at the northwest end of the range (Klamath Mtns., California North Coast ecoregion, etc.).

Due to the vegetative effects of the mixed-severity fire regime, mapping is difficult. Also, the limitations of the LANDFIRE modeling process (fuel accumulation, five classes, and inability to model climate variability) prevent our representing some of the nuance of this system. As a result, replacement fire appears to be too short, but the overall fire regime and landscape proportions are representative.

California Montane Woodland and Chaparral (BpS 1098) can be regarded as a successional stage (Class A) within this BpS. See the Comments section for additional information on this topic.

Native Uncharacteristic Conditions

Extent of high-density forest is higher today, primarily due to effective fire suppression. Species composition has shifted to higher levels of shade-tolerant conifer in the absence of frequent surface fire.

Comments

During the 2016 review period, Forest Service Region 5 ecologists suggested that only two models were needed to represent the Mesic Mixed Conifer forests in California: one model to represent most of California (i.e., East Cascades-Modoc Plateau and Sierra Nevada ecoregions and areas further south) and one to represent the wetter, more productive areas at the northwestern end of the range (Klamath Mtns., California North Coast ecoregion, etc.). The BpS models and descriptions were adjusted accordingly.

The review revived debate about the successional status of chaparral within mixed conifer forest as noted in the Issues and Problems section. Forest Service reviewers felt that the Montane Chaparral BpS (1098) was almost always successional to conifers and did not need a separate model, except possibly on serpentine soils. NatureServe staff, responsible for the Ecological Systems classification, indicated that Montane Chaparral is a distinct concept because of its geophysical setting and resulting floristic composition. It occurs across rocky and very thin-soil conditions that take centuries (if ever) to develop a closed tree canopy. The Ecological Systems description indicates that major fire events can open up areas and enable this type to occur as larger patches than previously, but it’s generally distinguishable (on the ground, floristically) from the successional patches where soils are better developed and where they close in as forest within decades. Finally, NatureServe staff indicated that plot data would help mappers distinguish Montane Chaparral from other successional shrublands among existing vegetation. Kori Blankenship was unable to resolve this debate and did not make any changes to either the mixed conifer BpS (10270 and 10280) or the Montane Chaparral (1098). Future review should reconsider this issue.

LANDFIRE National information for this BpS in southern California was taken from the model (10280) that was originally created for map zone (MZ) 4 by Todd Keeler-Wolf (tkwolf@dfg.ca.gov) and Hugh Safford (hughsafford@fs.fed.us) and reviewed by Joe Sherlock (jsherlock@fs.fed.us) and Steve Norman (snorman@fs.fed.us). Information for this BpS in the southern Oregon, Klamath region was taken from the model (10280) that was originally created for MZs 2 and 7 by Alan Baumann (abaumann@fs.fed.us) and Charlie Martin (charlie\_martin@blm.gov).

The 50% canopy cover break between the open and closed states in this BpS was chosen intentionally because it is used in California forest management plans. Very little data on reference percent of PNVG by state.

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 | A | A | A | A | A | A |
| Tree | 5-10 | A | A | A | A | A | A | A | A | A | A |
| Tree | 10-25 | C | C | C | C | C | B | B | B | B | B |
| Tree | 25-50 | D | D | D | D | D | E | E | E | E | E |
| Tree | >50 | D | D | D | D | D | 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 18 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ABCO | Abies concolor | White fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PILA | Pinus lambertiana | Sugar pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |

Description

Early succession after stand-replacement disturbance. This stage can occur as small patches (<1-100ac) within mixed-severity fire or as large patches from more extensive fire (100-1,000ac). This class includes the California Montane Woodland and Chaparral (BpS 1098).

These early succession stands have vegetation comprised of grass, shrubs, and shade-intolerant tree species as seedlings, saplings, and poles. Snags are typically present. In some cases, tree seedlings may develop a nearly continuous canopy and succeed relatively quickly to mid-development conditions. In other cases, chaparral conditions may dominate Class A and persist for long periods of time. Shrub species may include *Arctostaphylos patula*, *Quercus vaccinifola*, *Ceanothus* spp,, *Holodiscus discolor*. Hardwood resprouting can be significant with madrone, chinquapin, tanoak, live oak, and big-leaf maple. In the northern portion of the range, Douglas-fir is the predominant upper-canopy conifer with white fir establishing in the mid-upper canopy. CADE27 is an indicator species for the southern range of this BpS.

*Maximum Tree Size Class*  
Pole 5-9” DBH

Class B 14 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ABCO | Abies concolor | White fir | Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |
| PILA | Pinus lambertiana | Sugar pine | Upper |

Description

Pole- to medium-sized conifers. These stands develop in settings and climatic periods that support longer intervals between fires. White fir continues to recruit below pines or Douglas-fir depending on local site conditions. CADE27 is an indicator species for the southern range of this BpS. Hardwoods are shaded out at later stages. Depauperate understory. Insect and disease are prevalent in these stands.

Surface fuel moderate and complex. Ladder fuels and sub-canopy height low enough for crown fire initiation. Many of the fuels in this class are in the crown versus on the ground due to dead limbs calving off to create most of the fuel loading.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class C 21 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| ABCO | Abies concolor | White fir | Upper |
| PILA | Pinus lambertiana | Sugar pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |

Description

Pole- to medium-sized conifers. Open stands of predominantly pines (with hardwood trees very patchy) in younger stages, persisting on protected sites, on knolls and noses with many scars. Pine crown health is maintained by more open conditions found in more frequently disturbed areas. *Calocedrus decurrens* can be very sparse or quite common. White fir continues to reseed below pines or Douglas-fir depending on local site conditions but is periodically completely consumed by fire. Rich herbaceous and woody understory due to more open stand conditions. Native grasses and forbs and mostly resprouting shrubs favored with frequent fires. Surface fuel light and complex.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class D 28 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ABCO | Abies concolor | White fir | Mid-Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PILA | Pinus lambertiana | Sugar pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |

Description

Overstory of large and very large trees. Occurring in small to moderately sized patches on southerly aspects and ridge tops. These stands develop with frequent, low-severity fires. Open stands of predominantly pines (hardwood trees very patchy) in younger stages, persisting in protected sights, on knolls and noses with many scars. *Calocedrus decurrens* can be very sparse or quite common. White fir continues to reseed below pines or Douglas-fir depending on local site conditions but is periodically replaced by severe fire. Rich herbaceous and woody understory. Native grasses and forbs and mostly resprouting shrubs are favored with frequent fires. Surface fuel light and complex.

In Oregon, the open late-seral stands can be maintained for long periods of time (100s of yrs), alternating between ~30-55% crown closure. These stands occur as a matrix (not a patch) across many of the mid-slope areas and on E-NW aspects.

Lidar data for California national forests suggest that the minimum height in this class is 32-40m. The 33m height aligns with 25in DBH break in eastern Sierra and 33in or larger DBH elsewhere.

*Maximum Tree Size Class*  
Very Large >33" DBH

Class E 19 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ABCO | Abies concolor | White fir | Mid-Upper |
| PIPO | Pinus ponderosa | Ponderosa pine | Upper |
| PILA | Pinus lambertiana | Sugar pine | Upper |
| PSME | Pseudotsuga menziesii | Douglas-fir | Upper |

Description

Overstory of large and very large trees with a multi-layered, complex canopy structure. Occurring in small to moderately sized patches on north aspects and lower slope positions. These stands develop as an alternate succession pathway in settings and climatic periods that support longer intervals between mixed-severity fires -- a fire-free interval >65yrs. Crowded stands of conifers can overtop the hardwood layer. White fir and/or incense cedar is now a co-dominant with the larger pines and Douglas-fir and contributes to their mortality through competition for moisture and nutrients. Hardwoods are shaded out at later stages. Undergrowth is highly variable from depauperate to quite dense, depending on canopy density and local site conditions.

Ladder fuels and sub-canopy height may be low enough for crown fire initiation in some stands. Surface fuel is moderate to high and complex.

In Oregon, these stands are located in refugia areas of the landscape occurring in small- to moderately sized patches on mid-slope E-NW aspects.

Lidar data for California national forests suggest that the minimum height in this class is 32-40m. The 33m height aligns with 25in DBH break in eastern Sierra and 33in or larger DBH elsewhere.

*Maximum Tree Size Class*  
Very Large >33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 49 |
| Mid1:OPN | 25 | Late1:OPN | 129 |
| Mid1:CLS | 50 | Late1:CLS | 99 |
| Late1:CLS | 100 | Late1:CLS | 999 |
| Late1:OPN | 130 | Late1:OPN | 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:OPN | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.005 | 200 | No | 0 |
| Alternative Succession | Early1:ALL | Mid1:CLS | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.015 | 67 | Yes | 0 |
| Alternative Succession | Mid1:OPN | Mid1:CLS | 1 | 1 | Yes | 35 |
| Insects or Disease | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.0078 | 128 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.031 | 32 | No | 0 |
| Surface Fire | Mid1:OPN | Mid1:OPN | 0.039 | 26 | No | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.005 | 200 | No | 0 |
| Insects or Disease | Mid1:CLS | Mid1:CLS | 0.005 | 200 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.007 | 143 | No | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.015 | 67 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.018 | 56 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 1 | 1 | Yes | 35 |
| Insects or Disease | Late1:OPN | Late1:OPN | 0.001 | 1000 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0035 | 286 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.029 | 34 | No | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.065 | 15 | No | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:CLS | 0.002 | 500 | No | 0 |
| Mixed Fire | Late1:CLS | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0038 | 263 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.0045 | 222 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.0065 | 154 | No | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |

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