10440

Northern California Mesic Subalpine Woodland

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Kent van Wagtendonk | kent\_van\_wagtendonk@nps.gov | Anthony Caprio | tony\_caprio@nps.gov |
| Jen Hooke | jen\_hooke@nps.gov | Hugh Safford | hughsafford@fs.fed.us |
| Neil Sugihara | nsugihara@fs.fed.us | None | None |

Vegetation Type

Forest and Woodland

Map Zones

3, 6, 7

Geographic Range

This type occupies the west-side subalpine forested zones of the Sierra Nevada and in localized patches in the Klamath Mountains.

Biophysical Site Description

This system typically occupies gentle upper to lower slope positions above 2,500m (range is 2,250- 2,800m, 7,380-9,160ft) with a northern aspect. Sites are cold and characterized by deep, persistent snowpacks and short growing seasons. Soils are relatively deep (>35in) and granitic, with low temperatures. Forests are interspersed with diverse subalpine meadows.

Vegetation Description

Stands are generally co-dominated by mountain hemlock, lodgepole pine, and red fir, with a significant western white pine component. In some areas, lodgepole pine dominates post-disturbance stands. Shrub component is comprised of *Ribes montigenum* and *Ribes roezlii*. Understory species include *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Aster brewerii*, *Erigeron peregrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi* (Potter 1994).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| TSME | *Tsuga mertensiana* | Mountain hemlock |
| PICO | *Pinus contorta* | Lodgepole pine |
| ABMA | *Abies magnifica* | California red fir |
| PIMO3 | *Pinus monticola* | Western white pine |
| RIRO | *Ribes roezlii* | Sierra gooseberry |
| RIMO2 | *Ribes montigenum* | Gooseberry currant |

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

Disturbance Description

Fire is the major disturbance event of this type, although the frequency of fire tends to be low. Fire is generally stand-replacing, because the major tree species are highly susceptible to fire mortality. Estimates of the return of wildfire range from 100-500+yrs. Lodgepole needle miner causes lodgepole pine mortality. Avalanches occasionally cause stand replacement or localized mortality.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 507 | 65 |  |  |
| Moderate (Mixed) | 935 | 35 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 329 | 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

In areas of continuous forest, fire size can range from 1-25ac, which corresponds to stand size. In upper elevation parkland areas, discontinuous fuels can limit fire spread and extent.

Adjacency or Identification Concerns

The type is immediately upslope from the red fir alliance. Upslope again from this type are lodgepole pine forests and parkland, and, in some cases, whitebark pine forest or parkland.

Issues or Problems

Reviewers commented that there is little literature for this type, and the distinction between this model and other subalpine woodland models is not clear. The listed references may provide a good starting point.

Native Uncharacteristic Conditions

Class A canopy closure should not exceed 50%.

Comments

Map zones 3, 6, and 7 were combined during 2015 BpS Review.

Tony Caprio suggested combining Classes A and B into a longer duration shrub, PICO and ABMA class, and allowing Class B to be the class when TSME becomes established (at well >100yrs after disturbance). Also, Caprio suggested that duration in Class D may take longer than currently modeled before succession to Class E.

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 | UN | UN | UN | UN | UN |
| Tree | 5-10 | C | C | C | C | C | B | B | B | B | B |
| Tree | 10-25 | D | D | D | D | D | E | E | E | E | E |
| 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 3 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| POBO | Poa bolanderi | Bolander’s bluegrass | Upper |
| CARO5 | Carex rossii | Ross' sedge | Upper |

Description

The first few years following stand-replacing wildfire are characterized by bare ground, herbs, shrubs, and varying densities of tree seedlings (presumably dependent on seed sources). Dominant species include coniferous tree seedlings, resprouting grasses and shrubs, and invading herbs. Shrubs include Sierra gooseberry and alpine prickly current. Herbs include *Aster breweri*, *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Erigeron perigrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi*.

An alternate succession to a delayed type is represented by a transition to Class C.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 8 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| TSME | Tsuga mertensiana | Mountain hemlock | Upper |
| ABMA | Abies magnifica | California red fir | Upper |
| PIMO3 | Pinus monticola | Western white pine | Upper |

Description

This class represents rapid regeneration by lodgepole pine, with additional conifers coming in, including hemlock, red fir, and western white pine. Shrubs include Sierra gooseberry and alpine prickly current. Herbs include *Aster breweri*, *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Erigeron perigrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi*.

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

Class C 13 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| TSME | Tsuga mertensiana | Mountain hemlock | Upper |
| ABMA | Abies magnifica | California red fir | Upper |
| PIMO3 | Pinus monticola | Western white pine | Upper |

Description

This class represents delayed tree regeneration and long-term domination by shrubs and herbs. Shrubs include Sierra gooseberry and alpine prickly current. Herbs include *Aster breweri*, *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Erigeron perigrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi*. Trees are represented by seedlings and saplings of mountain hemlock, lodgepole pine, and other species.

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

Class D 29 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| TSME | Tsuga mertensiana | Mountain hemlock | Upper |
| ABMA | Abies magnifica | California red fir | Upper |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| PIMO3 | Pinus monticola | Western white pine | Upper |

Description

This class represents late-successional stands with large individuals (>20in in DBH) of mountain hemlock and other species, with open-stand structure maintained by mixed-severity fire and insect-caused tree mortality. In absence of fire or insect mortality, natural succession to Class E occurs. Shrubs include Sierra gooseberry and alpine prickly current. Herbs include *Aster breweri*, *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Erigeron perigrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi.*

Insect/disease outbreaks focus on the older trees.

*Maximum Tree Size Class*  
Large 21-33" DBH

Class E 47 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| TSME | Tsuga mertensiana | Mountain hemlock | Upper |
| ABMA | Abies magnifica | California red fir | Upper |
| PICO | Pinus contorta | Lodgepole pine | Upper |
| PIMO3 | Pinus monticola | Western white pine | Upper |

Description

This class represents late-successional stands with large individuals (>20 in in DBH) of mountain hemlock and other species, advanced regeneration of mountain hemlock and other shade-tolerant species, and typical understory species.

Shrubs include Sierra gooseberry and alpine prickly current. Herbs include *Aster breweri*, *Pedicularis semibarbata*, *Hieracium albiflorum*, *Arabis platysperma*, *Erigeron perigrinus*, *Carex rossii*, *Luzula comosa*, and *Poa bolanderi*.

Insect/disease can kill older trees.

*Maximum Tree Size Class*  
Large 21-33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 19 |
| Mid1:OPN | 20 | Late1:OPN | 80 |
| Mid1:CLS | 20 | Late1:CLS | 80 |
| Late1:OPN | 81 | Late1:CLS | 160 |
| Late1:CLS | 81 | 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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Alternative Succession | Early1:ALL | Mid1:OPN | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.0013 | 769 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Mid1:OPN | Mid1:OPN | 0.005 | 200 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.0013 | 769 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:OPN | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.005 | 200 | Yes | 0 |

References

Arno, Stephen F. 2000. Fire in western forest ecosystems. In: Brown, James K. and Jane Kapler Smith, eds. Wildland fire in ecosystems: Effects of fire on flora. General Technical Report RMRS-GTR-42-Vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 97-120.

Booth, Douglas E. 1991. Estimating prelogging old-growth in the Pacific Northwest. Journal of Forestry 89(10): 25-29.

FEIS. Fire Regime Table. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/fire\_regime\_table/fire\_ecology.html.

Fischer, William C. and Anne F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Ogden, UT: USDA Forest Service, Intermountain Research Station. 95 pp

Griffin, James R. and William B. Critchfield. 1972. The distribution of forest trees in California. Res. Pap. PSW-82. Berkeley, CA: USDA Forest Service, Pacific Southwest Forest and Range Experiment Station. 118 pp

Means, Joseph E. 1990. Tsuga mertensiana (Bong.) Carr. Mountain hemlock. In: Burns, Russell M. and Barbara H. Honkala, technical coordinators. Silvics of North America. Volume 1. Conifers. Agric. Handbook 654. Washington, DC: USDA Forest Service. 623-634.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Potter, Don. 1994. Guide to Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada. R5-ECOL-TP-003. San Francisco, CA: USDA Forest Service, Pacific Southwest Region.

Skinner, C.N. and C. Chang. 1996. Fire regimes, past and present. In: Sierra Nevada Ecosystem Project: final report to Congress, Vol. II, Assessments and scientific basis for management options. Davis, CA: University of California Davis, Centers for Water and Wildland Resources. 1041-1070.

SNEP. 1996. Sierra Nevada Ecosystem Project: Final Report to Congress. Wildlands Resources Center Report No.37. Davis, CA: Centers for Water and Wildlands Resources, University of California. 1528 pp.

Tesky, Julie L. 1992. Tsuga mertensiana. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ Accessed April 8, 2006.

Van Wagtendonk, J. and J. Fites-Kaufmann. 2006. Chapter 12: Sierra Nevada Bioregion. In: Sugihara, N. et al. eds. Fire in California Ecosystems. Davis, CA: University of California Press. In press.