

**10412**

## North Pacific Mountain Hemlock Forest - Xeric

BpS Model/Description Version: Aug. 2020

| Modelers     |                             | Reviewers      |                     |
|--------------|-----------------------------|----------------|---------------------|
| Jane Kertis  | jkertis@fs.fed.us           | Miles Hemstrom | mhemstrom@fs.fed.us |
| Karen Kopper | karen_kopper@nps.gov        | Ellen Goheen   | egoheen@fs.fed.us   |
| Gwen Kittel  | gwen_kittel@natureserve.org | None           | None                |

**Reviewer:** James Dickinson, Andrew Merschel, Mike Simpson

### Vegetation Type

Forest and Woodland

### Map Zones

1, 7

### Model Splits or Lumps

This Biophysical Setting (BpS) is split into multiple models; the Mountain Hemlock BpS is split into a wet and a cold-dry, well-drained (“xeric”) variant.

### Geographic Range

This type occupies some of the highest-elevation forested zones in the Cascade and Olympic mountains. Above the elevation of closed forest, the type can exist as tree clumps in a matrix of parkland.

### Biophysical Site Description

The lower elevation limit of the type ranges from about 5,000ft in southern Oregon to about 4,000ft in northern Washington. Sites are cold and characterized by deep and persistent snowpacks and short growing seasons.

### Vegetation Description

The late seral stands are dominated by mountain hemlock, though a wide variety of other tree species are present throughout the geographic range of the type. In some areas, lodgepole pine dominates post-disturbance stands. Mature stands may be nearly all mountain hemlock or may have varying amounts of Pacific silver fir, Alaska yellow cedar, subalpine fir, and Douglas-fir across its range and additionally *Abies magnifica* and white fir at the southern end of its range. Common understory species include Alaska huckleberry, big huckleberry, grouse whortleberry, and beargrass.

### BpS Dominant and Indicator Species

| Symbol | Scientific Name                   | Common Name        |
|--------|-----------------------------------|--------------------|
| VACCI  | <i>Vaccinium</i>                  | Blueberry          |
| PICO   | <i>Pinus contorta</i>             | Lodgepole pine     |
| ABAM   | <i>Abies amabilis</i>             | Pacific silver fir |
| CHNO   | <i>Chamaecyparis nootkatensis</i> | Alaska cedar       |
| TSME   | <i>Tsuga mertensiana</i>          | Mountain hemlock   |

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

## Fire Frequency

| Severity         | Avg FI | Percent of All Fires | Min FI | Max FI |
|------------------|--------|----------------------|--------|--------|
| Replacement      | 300    | 56                   | 125    | 500    |
| Moderate (Mixed) | 627    | 27                   | 250    | 750    |
| Low (Surface)    | 1021   | 17                   | 500    | 1500   |
| All Fires        | 169    | 100                  | 71     | 250    |

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.

## Disturbance Description

Wildfire is the major disturbance event in this type, although the frequency of fire tends to be low. Fire is generally stand-replacing, since the major tree species are highly susceptible to fire mortality. Simon (1991) estimated a fire return interval (FRI) of 168yrs for the TSME zone as a whole on the eastern side of the Jefferson Wilderness in Oregon. The ratios of mixed- to stand-replacement-severity were 55% mixed and 45% replacement from 1914-1987. The root rot *Phellinus weirii*, bark beetles, and other insects can be locally important disturbance agents. The lodgepole pine component is particularly susceptible to bark beetle infestation in late maturity.

## Scale Description

In areas of continuous forest, fire sizes can range from 10s of acres to at least 10,000ac. At upper-elevation parkland areas, discontinuous fuels can limit fire spread and extent. Root-rot patches can be up to about 100ac.

## Adjacency or Identification Concerns

The type is immediately upslope from the wet Pacific silver fir types in the north and the Red Fir type in the south Oregon Cascades. Upslope from this type are subalpine and alpine park lands and in some cases whitebark pine forest or parkland. Along moisture gradients (i.e., west to east across either the Olympic or Cascade mountains), this type can grade into the subalpine fir type.

## Issues or Problems

According to Thies and Sturrock (1995), *Phellinus weirii* is distributed from northern California to southern British Columbia and east to western Montana. So it seems likely that it could affect mountain hemlock anywhere it grows in Oregon or Washington. This part of our model would not be applicable to other parts of the range of mountain hemlock.

## Native Uncharacteristic Conditions

## Comments

James Dickinson, Andrew Merschel, and Mike Simpson refined this model during the 2016 review period. Changes include: revised sclass mapping rules, adjusted FRIs, and minor additions to the description.

The insects/disease transition in Mid 1 Closed could be more accurately modeled with the Age Reset function set to “yes” so that when the transition occurred the age would change to the class start age. This was not done because LANDFIRE rules prohibit the use of Age Reset, and the use of Age Reset did not significantly change the model results.

We used data from the COLA (Central Oregon Landscape Assessment) models from Hemstrom for age information.

## 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     | B     | B     | B     | B     | B     | B      |
| Tree                 | 25-50      | D                | D     | D     | D     | E     | E     | E     | E     | E     | E      |
| 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      15      Early Development 1 - All Structures**

#### Indicator Species

| Symbol | Scientific Name   | Common Name      | Canopy Position |
|--------|-------------------|------------------|-----------------|
| VACCI  | Vaccinium         | Blueberry        | Lower           |
| XETE   | Xerophyllum tenax | Common beargrass | Lower           |
| PICO   | Pinus contorta    | Lodgepole pine   | Upper           |
| TSME   | Tsuga mertensiana | Mountain hemlock | 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 various huckleberries, beargrass, lodgepole pine, and mountain hemlock. Depending on seed source or lack of regeneration success, about one-third of the stands develop directly into Class C (modeled as Alt. Succession).

This class represents mid-seral, open stands that are predominantly comprised of mountain hemlock. Shrubs are prevalent in the understory, including big huckleberry and grouse whortleberry. Herbs include beargrass and sedges. This class can persist for decades. Based on personal communication from Ellen Goheen and Beth Willhite, the effect of *Phellinus weirii* is to maintain some portion of the landscape in a semi-permanent, semi-open condition with scattered lodgepole pine, western white pine, subalpine fir, and other species. We modeled this as a loop, maintaining portions of the landscape in this class.

## Tree Size Class Medium 9-21" DBH

### Indicator Species

Description

Typical structure for this class could include: trees 25-55m tall. Inventory data from CVS and FIA for the region showed a maximum height for mountain hemlock of about 58m for a TSME/VAOV site, which is probably wetter than what is represented by this BpS. Based on that, we estimated a maximum of about 55m for the “xeric” mountain hemlock BpS. Maximum DBH was 88.1” from a TSME/RHMA plant association, which is representative of this BpS.

Very Large >33" DBH

### Indicator Species

Description

This class represents late-successional stands with large individuals (>20in DBH) of mountain hemlock dominating the stand (and other species), advanced regeneration of mountain hemlock and other shade tolerant species, and typical understory species. Mixed-severity fires are typically small, single-tree lightning fires that create gaps. The insect/disease transition in this class represents *Phellinus weirii*.

Typical structure for this class could include: trees 25-55m tall, 40-90% cover. Inventory data from CVS and FIA for the region showed a maximum height for mountain hemlock of about 58m for a TSME/VAOV site, which is probably wetter than what is represented by this BpS. Based on that, we estimated a maximum of about 55m for the “xeric” mountain hemlock BpS. Maximum DBH was 88.1” from a TSME/RHMA plant association, which is representative of this BpS.

### Maximum Tree Size Class

Very Large >33” DBH

## **Model Parameters**

### **Deterministic Transitions**

| <b>From Class</b> | <b>Begins at (yr)</b> | <b>Succeeds to</b> | <b>After (years)</b> |
|-------------------|-----------------------|--------------------|----------------------|
| Early1:ALL        | 0                     | Mid1:CLS           | 49                   |
| Mid1:OPN          | 50                    | Late1:OPN          | 199                  |
| Mid1:CLS          | 50                    | Late1:CLS          | 199                  |
| Late1:OPN         | 200                   | Late1:CLS          | 300                  |
| Late1:CLS         | 200                   | Late1:CLS          | 999                  |

### **Probabilistic Transitions**

| <b>Disturbance Type</b> | <b>Disturbance occurs In</b> | <b>Moves vegetation to</b> | <b>Disturbance Probability</b> | <b>Return Interval (yrs)</b> | <b>Reset Age to New Class Start Age After Disturbance?</b> | <b>Years Since Last Disturbance</b> |
|-------------------------|------------------------------|----------------------------|--------------------------------|------------------------------|------------------------------------------------------------|-------------------------------------|
| Surface Fire            | Early1:ALL                   | Early1:ALL                 | 0.001                          | 1000                         | No                                                         | 0                                   |
| Mixed Fire              | Early1:ALL                   | Early1:ALL                 | 0.002                          | 500                          | No                                                         | 0                                   |
| Replacement Fire        | Early1:ALL                   | Early1:ALL                 | 0.004                          | 250                          | Yes                                                        | 0                                   |
| Alternative Succession  | Early1:ALL                   | Mid1:OPN                   | 0.005                          | 200                          | Yes                                                        | 0                                   |
| Surface Fire            | Mid1:OPN                     | Mid1:OPN                   | 0.001                          | 1000                         | No                                                         | 0                                   |
| Mixed Fire              | Mid1:OPN                     | Mid1:OPN                   | 0.002                          | 500                          | No                                                         | 0                                   |
| Replacement Fire        | Mid1:OPN                     | Early1:ALL                 | 0.002                          | 500                          | Yes                                                        | 0                                   |
| Insects or Disease      | Mid1:OPN                     | Mid1:OPN                   | 0.004                          | 250                          | No                                                         | 0                                   |
| Surface Fire            | Mid1:CLS                     | Mid1:CLS                   | 0.001                          | 1000                         | No                                                         | 0                                   |
| Mixed Fire              | Mid1:CLS                     | Mid1:CLS                   | 0.0013                         | 769                          | No                                                         | 0                                   |
| Insects or Disease      | Mid1:CLS                     | Early1:ALL                 | 0.0033                         | 303                          | Yes                                                        | 0                                   |
| Insects or Disease      | Mid1:CLS                     | Mid1:OPN                   | 0.004                          | 250                          | Yes                                                        | 0                                   |
| Replacement Fire        | Mid1:CLS                     | Early1:ALL                 | 0.004                          | 250                          | Yes                                                        | 0                                   |
| Insects or Disease      | Mid1:CLS                     | Mid1:CLS                   | 0.006                          | 167                          | No                                                         | 0                                   |
| Insects or Disease      | Late1:OPN                    | Mid1:OPN                   | 0.0001                         | 10000                        | Yes                                                        | 0                                   |
| Surface Fire            | Late1:OPN                    | Late1:OPN                  | 0.001                          | 1000                         | No                                                         | 0                                   |
| Mixed Fire              | Late1:OPN                    | Late1:OPN                  | 0.002                          | 500                          | No                                                         | 0                                   |
| Replacement Fire        | Late1:OPN                    | Early1:ALL                 | 0.002                          | 500                          | Yes                                                        | 0                                   |

|                    |           |            |        |       |     |   |
|--------------------|-----------|------------|--------|-------|-----|---|
| Insects or Disease | Late1:CLS | Mid1:OPN   | 0.0001 | 10000 | Yes | 0 |
| Surface Fire       | Late1:CLS | Late1:CLS  | 0.001  | 1000  | No  | 0 |
| Mixed Fire         | Late1:CLS | Late1:CLS  | 0.0013 | 769   | No  | 0 |
| Replacement Fire   | Late1:CLS | Early1:ALL | 0.004  | 250   | Yes | 0 |

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