

LANDFIRE Biophysical Setting Model

Biophysical Setting: 0710412

North Pacific Mountain Hemlock Forest - Xeric

This BPS is lumped with:

This BPS is split into multiple models: Wet and dry. Washington has two types in Mtn Hemlock. BpS 0710411 represents the wet variant. For the dry variant in WA, use the OR Model (BpS 0710412).

General Information

Contributors (also see the Comments field)

Date 10/25/2005

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Vegetation Type

Forest and Woodland

Dominant Species

VACCI

PICO

ABAM

CHNO

Map Zone

7

Model Zone

Alaska

California

Great Basin

Great Lakes

Hawaii

Northeast

Northern Plains

N-Cent.Rockies

Pacific Northwest

South Central

Southeast

S. Appalachians

Southwest

General Model Sources

Literature

Local Data

Expert Estimate

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 5000ft in southern Oregon to about 4000ft 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.

Disturbance Description

Wildfire is the major disturbance event of 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. Estimates of the return of wildfire range from 400 to over 1500yrs. 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.

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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.

Native Uncharacteristic Conditions

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.

Issues/Problems

According to Thies and Sturrock, *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.

Comments

We assumed that class A can go to class B or class C, with roughly twice the probability of moving to class B. To start with, we assumed that stand-replacing fire affects all classes with a frequency of 500. We used data from the COLA (Central Oregon Landscape Assessment) models from Hemstrom for height and age information. The insect/disease disturbance of class B is mountain pine beetle, which can thin or destroy the stand. 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 class C. For classes D and E, we used mixed fire to represent small (e.g., single tree lightning fires) fires that create gaps. (This infrequent fire was modeled in VDDT as 0.0001 probability (~10,000yrs). The insect/disease for classes D and E represent *Phellinus weirii*.

Darren Johnson (darren_johnson@tnc.org) Changed the following:

Class B:

Changed min upper layer lifeform cover from 40% to 41%. Changed min and max upper layer lifeform height from <5 to 10-24 to 0-10

Class C:

Changed min and max upper layer lifeform height to 0-10

Class D:

Changed min and max upper layer lifeform height to 10.1 - 25

Class E:

Changed min upper layer lifeform cover from 60% to 61%. Changed min and max upper layer lifeform height to 10.1 - 25

Class E development stage changed from MidDev3 Closed to Late1 Closed.

Vegetation Classes

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Class A 15 %

Early Development 1 All Structure

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model
5

Description

Indicator Species and Canopy Position

VACCI
Lower
XETE
Lower
PICO
Upper
TSME
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	30 %
Height	Tree 0m	Tree 10m
Tree Size Class	Seedling <4.5ft	

Upper layer lifeform differs from dominant lifeform.

The shrub layer is dominant. The minimum height is 0.5 feet, and the maximum height is 3.5 feet. The canopy cover ranges from 0 to 90%.

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. [Succession to class B after 50yrs. Replacement fire (MFRI about 500yrs) sets it back. Depending on seed source or lack of regeneration success, about one third of the stands develop directly into class C (Alt. Succession, probability=0.007).]

Class B 25 %

Mid Development 1 Closed

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model

Description

Indicator Species and Canopy Position

PICO
Upper
VACCI
Lower
TSME
Upper
MEFE
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	80 %
Height	Tree 0m	Tree 10m
Tree Size Class	Sapling >4.5ft; <5"DBH	

Upper layer lifeform differs from dominant lifeform.

This class represents rapid regeneration by lodgepole pine, and/or mountain hemlock. Typical understory species for the type are usually present (i.e., huckleberry species, fool's huckleberry, and various herbs). Trees are in sapling and small pole size. (averaging four inches DBH, 10m tall). [Succession to class E (open canopy/late) after 200yrs. Replacement fire (MFRI about 500yrs) resets. We assume that there is a 0.01 probability (every 100yrs) of insect and disease occurring in the stand at this point. The total annual probability is evenly distributed between pathways A,B and C.]

Class C 15 %

Mid Development 1 Open

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model

Description

Indicator Species and Canopy Position

TSME
Upper
XETE
Low-Mid
VACCI
Low-Mid
CAREX
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	10 %	40 %
Height	Tree 0m	Tree 10m
Tree Size Class	Medium 9-21"DBH	

Upper layer lifeform differs from dominant lifeform.

Shrubs are the dominant lifeform. Canopy cover ranges from 20-90% (averaging 45%). The average height is three feet.

This class represents mid-seral, open stands that are predominantly comprised of mountain hemlock. Shrubs

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are prevalent in the understory, including big huckleberry and grouse whortleberry. Herbs include beargrass and sedges. This class can persist for decades, eventually transitioning to class D after 150yrs in this class. Replacement fire (MFRI=500yrs) resets. Insect and disease (MRI=100yrs) either resets the stand to Class A (60% of the time), or maintains the stand in Class C (40% of the time).

<p>Class D 5 %</p> <p>Late Development 1 Open</p> <p>Upper Layer Lifeform</p> <p><input type="checkbox"/> Herbaceous</p> <p><input type="checkbox"/> Shrub</p> <p><input checked="" type="checkbox"/> Tree</p> <p style="text-align: right;">Fuel Model</p>	<p>Indicator Species and Canopy Position</p> <p>PICO</p> <p>Upper</p> <p>TSME</p> <p>Upper</p> <p>ABAM</p> <p>Upper</p> <p>VACCI</p> <p>Lower</p>	<p>Structure Data (for upper layer lifeform)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;"><i>Min</i></th> <th style="text-align: center;"><i>Max</i></th> </tr> </thead> <tbody> <tr> <td><i>Cover</i></td> <td style="text-align: center;">21 %</td> <td style="text-align: center;">60 %</td> </tr> <tr> <td><i>Height</i></td> <td style="text-align: center;">Tree 10.1m</td> <td style="text-align: center;">Tree 50m</td> </tr> <tr> <td><i>Tree Size Class</i></td> <td colspan="2" style="text-align: center;">Medium 9-21"DBH</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p>		<i>Min</i>	<i>Max</i>	<i>Cover</i>	21 %	60 %	<i>Height</i>	Tree 10.1m	Tree 50m	<i>Tree Size Class</i>	Medium 9-21"DBH	
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<p>Description</p> <p>This class represents the late open stand, where lodgepole is senescing and mountain hemlock and Pacific silver fir (15in DBH, 30m tall) are more prominent. The stand is fairly open due to gaps created from fallen lodgepole. Typical understory species are present. [After 100yrs the stands fill-in to class E. Replacement fire MFRI=500yrs. Mixed severity fire (MFRI=1000yrs) kills small patches of trees, maintaining the stand in Class D. Insect/disease (0.0001 probability) move this stand back to class C.</p>														

<p>Class E 40 %</p> <p>Late Development 1 Closed</p> <p>Upper Layer Lifeform</p> <p><input type="checkbox"/> Herbaceous</p> <p><input type="checkbox"/> Shrub</p> <p><input checked="" type="checkbox"/> Tree</p> <p style="text-align: right;">Fuel Model</p>	<p>Indicator Species and Canopy Position</p> <p>TSME</p> <p>Upper</p> <p>ABAM</p> <p>Upper</p> <p>CHNO</p> <p>Lower</p> <p>VACCI</p> <p>Lower</p>	<p>Structure Data (for upper layer lifeform)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;"><i>Min</i></th> <th style="text-align: center;"><i>Max</i></th> </tr> </thead> <tbody> <tr> <td><i>Cover</i></td> <td style="text-align: center;">61 %</td> <td style="text-align: center;">90 %</td> </tr> <tr> <td><i>Height</i></td> <td style="text-align: center;">Tree 10.1m</td> <td style="text-align: center;">Tree 50m</td> </tr> <tr> <td><i>Tree Size Class</i></td> <td colspan="2" style="text-align: center;">Large 21-33"DBH</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p>		<i>Min</i>	<i>Max</i>	<i>Cover</i>	61 %	90 %	<i>Height</i>	Tree 10.1m	Tree 50m	<i>Tree Size Class</i>	Large 21-33"DBH	
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<p>Description</p> <p>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. [Maintains in class E. Replacement fire MFRI=500yrs. Mixed severity fire (0.001 probability) kills small patches of trees, maintaining the stand in Class E. Insect/disease (0.0001 probability) move this stand back to class C.]</p>														

Disturbances

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Fire Regime Group:** V

Historical Fire Size (acres)

Avg

Min

Max

Sources of Fire Regime Data

- Literature
- Local Data
- Expert Estimate

Additional Disturbances Modeled

- Insects/Disease
- Wind/Weather/Stress
- Native Grazing
- Competition
- Other (optional 1)
- Other (optional 2)

Fire Intervals	<i>Avg FI</i>	<i>Min FI</i>	<i>Max FI</i>	<i>Probability</i>	<i>Percent of All Fires</i>
<i>Replacement</i>	500	500	1500	0.002	80
<i>Mixed</i>	2000			0.0005	20
<i>Surface</i>					
<i>All Fires</i>	400			0.00251	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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