

LANDFIRE Biophysical Setting Model

Biophysical Setting 7516460

Alaskan Pacific Maritime Western Hemlock Forest

☒ This BPS is lumped with: see below

☐ This BPS is split into multiple models: Alaskan Pacific Maritime Sitka Spruce Forest and North Pacific Hypermaritime Western Redcedar-Western Hemlock Forest are lumped into the Alaskan Pacific Maritime Western Hemlock Forest for BpS modeling.

Sitka Spruce Forest that is not associated with riparian areas or periglacial environments is lumped with Western Hemlock Forest for BpS modeling for most of the maritime region because sites where it dominates occupy relatively little area and is unclear how a successional model for Sitka spruce dominated forest would differ quantitatively from the Western Hemlock Forest model. A separate Sitka Spruce Forest model was created for areas in the maritime region where hemlock is not present.

Western Redcedar-Western Hemlock Forest and Western Hemlock Forest should be mapped as a separate existing vegetation types but they are lumped for modeling because it is unclear how models would differ quantitatively for the two types. Western Redcedar tends to occur on slightly wetter sites below 800ft elevation (Demeo et al. 1992) and Western Redcedar-Western Hemlock associations will overlap with Western Hemlock series, particularly in lower elevation, more poorly drained sites.

General Information

Contributors (also see the Comments field)

Date 8/20/2008

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Vegetation Type

Forest and Woodland

Map Zone

75

Model Zone

- | | |
|--|--|
| ☒ Alaska | ☐ N-Cent.Rockies |
| ☐ California | ☐ Pacific Northwest |
| ☐ Great Basin | ☐ South Central |
| ☐ Great Lakes | ☐ Southeast |
| ☐ Northeast | ☐ S. Appalachians |
| ☐ Northern Plains | ☐ Southwest |

Dominant Species*

TSHE MEFE
PISI RUSP
THPL OPHO
VAOV COCA13

General Model Sources

- ☒ Literature
☒ Local Data
☒ Expert Estimate

Geographic Range

Western hemlock is found from Prince William Sound (the northwestern limit of western hemlock) through southeast AK where it is the dominant forest type on mountain and hillslopes.

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Biophysical Site Description

This system is commonly found on moderately productive, upland sideslopes and low angle terrain from saltwater to about 2000ft elevation (DeMeo et al. 1992). Soils are typically well drained but somewhat poorly drained inclusions occur on some sites. Sites dominated by western hemlock tend to be more stable or less disturbance prone than sites dominated by Sitka spruce.

Vegetation Description

The overstory is typically dominated by *Tsuga heterophylla* or a mix of *Picea sitchensis* and *Tsuga heterophylla* or *Thuja plicata* and *Tsuga heterophylla*, especially below 800ft. Overstory canopy cover is usually at least 60%. Sites dominated by *Picea sitchensis* tend to be tied to disturbance such as slope instability, water movement, exposure to salt spray or windthrow (Martin et al. 1995, DeMeo et al. 1992, Deal et al. 1991). It is also associated with karst topography and limestone substrates which are discussed below. Common shrubs include *Vaccinium ovalifolium*, *Menziesia ferruginea*, *Rubus spectabilis* and *Oplopanax horridus* (NatureServe 2008). *Lysichiton americanus* occurs in poorly drained depressions. Other common forbs include *Rubus pedatus*, *Streptopus amplexifolius*, *Cornus canadensis*, *Tiarella trifoliata*, *Streptopus roseus* and *Maianthemum dilatatum* (NatureServe 2008, Schoen and Dovichin 2007). Common ferns include *Gymnocarpium dryopteris*, *Blechnum spicant* and *Dryopteris expansa*. (DeVelice et al. 1999, Demeo et al. 1992, Martin et al. 1995).

In the northern portion of the region (Yakutat through Prince William Sound) *Tsuga mertensiana* may also be present in the canopy. *Chamaecyparis nootkatensis* (= *Cupressus nootkatensis*) may be present in the canopy in southeast AK (e.g. Glacier Bay), and represents somewhat less productive sites, but is rare in this system in Prince William Sound (the northwest limit of *Chamaecyparis nootkatensis*) (Hennon and Trummer 2001). Sites tied to disturbance, such as v-notches, are dominated by *Oplopanax horridus* and *Rubus spectabilis* in the understory.

Western hemlock, Sitka spruce and redcedar forest found on karst topography represent a special subtype within the western hemlock BpS. Although most of this subtype has been eliminated due to logging it is important from a conservation perspective and provides extremely valuable wildlife habitat (Schoen and Dovichin 2007). Karst environments support some of the largest trees in the region because the soils have better drainage and roots anchored in the carbonate bedrock tend to be windfirm (Schoen and Dovichin 2007). Alaback (1982) found that the forest understory in karst environments had very low productivity due to the dense overstory canopy and very productive tree growth.

Disturbance Description

Wind disturbances at both small and large scales play a fundamental role in shaping forest dynamics in southeast AK (Harris and Farr 1974, Nowacki and Kramer 1998). Wind disturbance characteristics change over a continuum dependent on landscape features (e.g., exposure, position on the landscape, topography). Distinct wind disturbance regimes grade from exposed landscapes where recurrent, large-scale wind events prevail to wind-protected landscapes where small-scale canopy gaps predominate. Blowdowns in southeast Alaska range in size from 1-1000ac and disproportionately occur as smaller patches (typically <50ac) (Nowacki and Kramer 1998). An area's susceptibility to windthrow can affect stand structure and forest development. Stands on wind protected sites tend to have an uneven age structure and are more likely to reach late stages of development than stands on wind prone sites (Kramer et al. 2001).

Some research suggests that frequent, small-scale wind events have a larger impact on these forests than the relatively less frequent, large-scale blowdowns (Harcombe 1986). Stem-snap and resultant canopy gaps are more likely to occur in old growth forests and mean gap size tends to be larger in old growth forests

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than in mature forests (Nowacki and Kramer 1998). The direction of gap-maker tree falls is significantly aligned with the direction of prevailing winds.

Catastrophic winds commonly cause large-scale blowdown throughout southeast Alaska (Deal et al 1991). Depending on intensity, wind can create single-generation stands with uniform canopies or multi-generation stands with diverse canopy and size structures. Intervals between complete blowdowns tend to be long with forests cycling through stand initiation, stem exclusion, and understory reinitiation stages, eventually reaching the old growth stage (at about 350yrs).

Tree regeneration may be inhibited following windthrow due to the large amount of downed woody debris (Alaback 1984, Harris and Farr 1974). This can lead to the development of a patchy, open canopy structure (Alaback 1984). However, both spruce and hemlock readily germinate on decaying, downed logs, referred to as “nurse logs.” As trees develop on nurse logs their roots spread around the log to reach the soil. When the nurse log decays completely, a line of trees with buttressed roots is left behind.

Fire occurrence is rare and not well documented in the forests of southeast AK and therefore not included in this model. Fire plays some role in inland areas near Haines, Skagway and generally north of Lynn Canal where the climate is more continental and dryer (personal communication, Roy Josephson). Yakutat, Icy Bay and over to Cordova is not influenced by fire (personal communication, Roy Josephson). Most fires are anthropogenic and recently observed lightning caused fires were quite small (personal communication, Roy Josephson).

Other important disturbances affecting this type can include avalanches, landslides and tectonic movement. Insect and disease attacks are rare although black-headed budworm and hemlock sawfly outbreaks occasionally cause widespread defoliation (Harris and Farr 1974). Dwarf mistletoe and heart rot fungi perpetuate the hemlock-dominated old-growth condition (Hennon and McClellan 2003).

Adjacency or Identification Concerns

This type occurs below the mountain hemlock zone and above the Sitka spruce riparian zone.

Native Uncharacteristic Conditions

Timber harvest, predominantly clearcut harvest, throughout southeast AK has created large areas of early successional (particularly the stem exclusion stage) forest.

With global warming the intensity and duration of wind events may increase as a result of stronger land-water thermal gradients (Alaback and McClellan 1993). A warming climate also appears to be enabling redcedar to grow further north and may be responsible for the decline of yellow-cedar (Schoen and Dovichin 2007).

Scale Description

Matrix. Frequent small scale windthrow drives patch size.

Issues/Problems

Comments

This system was created for the maritime region and did not receive review for other regions in the state.

This model was developed by Sheila Spores but much of the disturbance description was taken from the Coastal Forest PNVG description (Murphy and Witten 2006) and Roy Josephson provided input on fire for

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the Lynn Canal area. Reviewer Paul Alaback noted that the successional model is a good representation of the Western Hemlock type on the most productive sites. These sites, sometimes referred to as “large tree old-growth (see Caouette and DeGayner 2008),” can support trees with >40in DBH and occupy a relatively small percentage of the western hemlock zone. While small tree old-growth (see Caouette and DeGayner 2008) can be considered part of the Poorly Drained Conifer BpS a separate model for medium tree old-growth may be needed (but has not been created yet). Although small and medium tree old-growth (see Caouette and DeGayner 2008) Western Hemlock are more common than the large tree old-growth much less is known about it. Review comments resulted in minor descriptive changes as well as the addition of the discussion on karst environments and several references. Other review comments resulted in minor edits to the description and slight adjustments to the s-class age ranges.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

TSHE Upper
PISI Upper
VAOV Mid-Up
MEFE Mid-Up

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-29yrs

Post disturbance stand initiation

Herbs, shrubs and tree seedlings grow from seeds, sprouts and advance regeneration. Within five years following disturbance, a vigorous shrub layer develops, and will often persist past age 20yrs. 30yrs is used as the estimate of the end of this stage (Alaback 1984, DeMeo et al. 1992). By age 50yrs, shrub cover is reduced past the pre-disturbance level (DeMeo et al. 1992). Post disturbance conifer regeneration will depend on the pre disturbance stand composition and the type of disturbance. Hemlock is more likely to regenerate following windthrow whereas spruce is more likely to regenerate if mineral soil is exposed (e.g. after a landslide).

A reviewer noted that the length of this seral stage will vary somewhat with site quality. The main notable difference is karst vs. non-karst. On karst the trees are patchier initially and it takes longer for a closed canopy to develop. Hemlock sites with devil’s club—an indicator of aerated soils with frequent forest gap creation—will also show this lag. The lag is about 10yrs; i.e., canopies on these sites can be expected to be closed by age 40 (DeMeo et al. 1992).

Succession to class B. Wind events (modeled as wind/weather/stress; probability = 0.001) reset the age of this class.

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Class B 15%

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

TSHE Upper
PISI Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9-20" (swd)/11-20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

30-119yrs

Stem exclusion

Tree canopy closes and shade in-tolerant species in the understory are lost. Forest structure becomes stratified, with slower-growing, shade tolerant conifer species forming lower canopy strata. Some trees are thinned from the stand due to lack of resources (e.g., light, growing space, nutrients, etc.). Spruce and hemlock dominate. Understory can be completely void of vegetation, therefore no understory species are listed as indicators for this class.

Succession to class C. Wind events (modeled as wind/weather/stress; probability = 0.001) cause a transition to class A.

Class C 20%

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

TSHE Upper
PISI Upper
VAOV Lower
MEFE Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Large 20" – 40"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

120-249yrs

Understory re-initiation

As the overstory ages, new species of shade-tolerant forbs and shrubs appear on the forest floor. Eventually larger tree-fall gaps, which are not subject to closure by lateral extension, begin to appear in the overstory, thus allowing for conifer regeneration and the beginning of gap-phase replacement. A two-aged, two-layered stand forms. Pure hemlock or hemlock-spruce dominate.

Succession to class D. Wind events (modeled as wind/weather/stress; probability = 0.001) cause a transition to class A.

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Class D 60 %

Late Development 2 Closed

Structure Data (for upper layer lifeform)**Upper Layer Lifeform**

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

TSHE Upper
 PISI Upper
 VAOV Lower
 MEFE Lower

	Min	Max
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Very Large 40.0"+	

☐ Upper layer lifeform differs from dominant lifeform.

Description

250yrs+

Old growth

Multi-aged, multi-layered stand with continuing gap-phase replacement. Tree mortality is generally balanced with growth from newly established seedlings. Large, decadent trees, standing snags, coarse woody debris, overhead gaps and regeneration patches are all present. Heart rot, mistletoe and fluting tend to make these stands valuable for wildlife habitat (Schoen and Dovichin 2007). Pure hemlock or hemlock-spruce dominate.

This class persists in the absence of disturbance. Large scale wind events (modeled as wind/weather/stress; probability = 0.002) cause a transition to class A, but small scale wind events (modeled as wind/weather/stress; probability = 0.01) will maintain this class.

Class E 0 %

[Not Used] [Not Used]

Structure Data (for upper layer lifeform)**Upper Layer Lifeform**

- ☐ Herbaceous
☐ Shrub
☐ Tree

Indicator Species* and Canopy Position

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description**Disturbances****Fire Regime Group**:** NA**Historical Fire Size (acres)**

Avg 0

Min 0

Max 0

Sources of Fire Regime Data

- ☐ Literature
☐ Local Data
☒ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement					
Mixed					
Surface					
All Fires					

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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Additional Disturbances Modeled

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

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