LANDFIRE Biophysical Setting Model

Biophysical Setting 7716481 Alaskan Pacific Maritime Mountain Hemlock Forest - Northern

☑ *This BPS is lumped with: see below*

☐ *This BPS is split into multiple models: Alaskan Pacific Maritime Subalpine Mountain Hemlock Woodland (1649).*

General Information

Contributors (also see the Comments field **Date** 11/5/2008

Modeler 1	John Morton	John_M_Morton@fws.gov	**Reviewer**	Tom DeMeo	tdemeo@fs.fed.us
Modeler 2	Edward Berg	Edward_Berg@fws.gov	**Reviewer**	Barbara Schrader	bschrader@fs.fed.us
Modeler 3	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**		

Vegetation Type

Forest and Woodland

Map Zone

77

Model Zone

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

Dominant Species*

TSME	ALVIS
PISI	MEFE
PILU	ELPY
VAOV	NECR2

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system occurs in the Kenai, Chugach, and St. Elias mountains in the subpolar rainforest region (Alaback 1991, 1995). It occurs primarily in the maritime region, but also occurs in the sub-boreal transition between coastal and boreal forests. It extends along the Gulf Coast of AK from Kenai Fjords to Yakutat and possibly Glacier Bay and upper Lynn Canal (North Pacific Mountain Hemlock Forest is defined as occurring from Glacier Bay south).

Biophysical Site Description

Within the Kenai, Chugach, and St. Elias Mountains this system occurs on mountain side slopes, shoulders, and bedrock outcrops from 0-1900 ft (NatureServe 2008a). On the Chugach National Forest Mt. Hemlock-Sitka Spruce associations are found at elevations up to 1200 feet and Mt. Hemlock associations are found several hundred feet higher (DeVelice 1999). Soils are typically shallow, well-drained and are derived from glacial and colluvial deposits as well as residual bedrock. Alaska Sub-boreal Mountain Hemlock Forest is common on north-facing slopes, and also occurs on east and west aspects. This system is uncommon on south-facing slopes (NatureServe 2008a).

Vegetation Description

Tsuga mertensiana may dominate or share dominance with Picea sitchensis or Tsuga heterophylla on sites along the central Gulf Coast (Prince William Sound). Cupressus nootkatensis may be present in the overstory in isolated locations in Prince William Sound. Picea glauca or Picea X Lutzii, may be present on the inland (non-maritime) portion of the Kenai and Chugach Mountains, but have less than 15% canopy cover. Betula papyrifera may be common in early seral stages in inland sites..

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve

Common shrubs include Menziesia ferruginea, Alnus viridis ssp. sinuata, Vaccinium ovalifolium, V. vitis-idaea, Oplopanax horridus, Cassiope stellariana, Rubus spectabilis, Elliotia pyroliflora and Empetrum nigrum (NatureServe 2008a, NatureServe 2008b). Common herbaceous species include Cornus canadensis, Rubus pedatus, Dryopteris expansa, Gymnocarpium dryopteris, Listera cordata, Tiarella trifoliata and Streptopus amplexifolius (NatureServe 2008a, NatureServe 2008b). Common mosses include Hylocomium splendens and Pleurozium schreberi (NatureServe 2008). Sphagnum spp. may be abundant on some sites. Plant communities in this system are described by DeVelice et al. (1999).

Picea sitchensis, Elliottia pyroliflorus and Nephrophyllidium crista-galli do not occur in the sub-boreal portion of the region.

Disturbance Description

The major disturbance processes affecting this system include soil creep, wind, snow avalanche and fungal pathogens such as red ring rot (Phellinus pini). Windthrow gap disturbances are important in both spruce and hemlock recruitment in these forests (Potkin 1997). A moderate level of disturbance probably maintains Picea sitchensis in the system.

Although lightning strikes and natural fires are rare in the maritime region, wild fires can play an important role in disturbance regime of the Mountain Hemlock PNV (Potkin 1997) and other similar temperate rainforest types (Agee 1993, Franklin and Hemstrom 1981) in areas where lightning strikes do occur, such as the inland side of the Kenai and Chugach mountains and upper Lynn Canal. Radiocarbon dates of five charcoal samples from soils at various locations in the Kenai Mountains ranged from 3010-570yrs before present with an average of 600yrs between dates (Potkin 1997). Charcoal has been reported as present in most soil pits within the forest zone in the Kenai Mountains; this anecdotal evidence suggests the occurrence of widespread, infrequent fires in this BpS (USDA Forest Service 2002). Mountain hemlock, the climax species, is a fire “avoider”; the infrequent fires tend to be large and stand-replacing (Agee 1993). In the Kenai Mountains fires travel from the valley bottom Lutz spruce stands, but often stop at the lower boundary of mountain hemlock dominated forests (Potkin 1997).

Estimates of fire return intervals include:
570-3010 yrs (600 yr average) (Potkin 1997) (for Kenai Mountains);
1000 yrs (personal communication, FRCC expert’s workshop, March 2004);
1500+ yrs (Lertzman and Krebs 1991) (Cascades and Olympic Mountains).

The infrequent fires in the subalpine hemlock forests tend to be large and stand-replacing (Agee 1993). The extent of subalpine fires is partly a function of fire weather, but mainly depends on the distribution of the subalpine forests, which is often patchy and grades into shrub, tundra, rock and ice (Agee 1992). In the mountain hemlock zone in Washington State, fires have tended to be confined to individual slopes (Agee and Smith 1984). In Oregon, historic fires >3200 ha have been located; however, the majority of stands found were patches of <500 ha each (Dickman and Cook 1989). On the Kenai Peninsula, drought weather conditions resulting from the 1912 Katmai eruption have been suggested to contribute to large scale fires from 1913-1915, burning approximately 20,000 acres on the Chugach National Forest (note that this figure includes fire in all vegetation types present on the landscape). There is almost no lightning and little human activity in the Prince William Sound area suggesting that fire is not an important factor in this system (personal communication, Sue Kesti) for the entire area to which it applies.

Adjacency or Identification Concerns

The Martime and Sub-boreal Mountain Hemlock system typically occurs from sea level to treeline in coastal environments; adjacent types include Maritime Sitka Spruce and Martime Western Hemlock. In

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve

the sub-boreal region, it typically occurs in the elevation zone above the Sub-boreal White Spruce-Mountain Hemlock system.

Native Uncharacteristic Conditions

As a result of climate warming white spruce are now recruiting above mountain hemlock in the sub-boreal region of the Kenai Peninsula.

Scale Description

Matrix

Issues/Problems

Vegetation communities in the Mountain Hemlock BpS are stable over long periods and rarely disturbed; therefore, secondary succession patterns are poorly understood (Viereck et al 1992). Fire is included in the model but may not occur (or is extremely rare) in some areas to which this model applies

Comments

This model was based on the FRCC Guidebook PNVG model for Kenai Mountain Hemlock (KMHM; Murphy and Witten 2006) but the mid and late seral stages had to be collapsed so that LANDFIRE could distinguish them for mapping. Ed Berg and John Morton helped to refine the model for the Kenai Peninsula and Tina Boucher modified the description to include the rest of the range. Much of the Disturbance Description was taken from the Kenai Mountain Hemlock (KMHM; Murphy and Witten 2006) description with some modifications.

Reviewers suggested that this northern Mt. Hemlock type could probably be combined with the southern Mt. Hemlock type (North Pacific Mountain Hemlock Forest). This advice was followed for the Ecological Systems classification but not for modeling purposes because the northern variant of the model includes fire disturbance but the southern variant does not.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

VAOV	Upper
MEFE	Upper
RUSP	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open Shrub (25-74% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Dwarf Shrub (< 20 cm)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-49yrs

This post-disturbance class is characterized by mesic herbaceous vegetation and tall shrubs. Herbaceous species may start from seed immediately post-disturbance. Shrubs and tree seedlings become established; after approximately 50yrs tree saplings attain the height of tall shrubs. Common shrubs include Menziesia ferruginea, Alnus viridis ssp. sinuata, Vaccinium ovalifolium and Oplopanax horridus (NatureServe 2008a, NatureServe 2008b).

Succession to class B. Alternate succession (probability = 0.005) causes a transition to class C.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve

Class B 60 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

TSME	Upper
PILU	Upper
MEFE	Lower
ALVIS	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	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

50yrs+

This class is characterized by closed spruce-hemlock or hemlock forest. Conifers share dominance with tall shrubs in the early stages of this class. Between 170-200yrs conifers gain canopy dominance. Tsuga mertensiana is the dominant tree with at least 15% cover.

This class persists in the absence of disturbance. Replacement MFRI = 1250yrs. Mixed fire (MFRI = 5000yrs) causes a transition to class C. Wind/weather/stress (probability = 0.0002) maintains this class.

Class C 35 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

TSME	Upper
PILU	Upper
MEFE	Lower
ALVIS	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open (25-59% tree cover)	Open (25-59% 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

50yrs+

This class is characterized by open spruce-hemlock or hemlock forest. Conifers share dominance with tall shrubs in the early stages of this class. Between 170-200yrs conifers gain canopy dominance. Tsuga mertensiana is the dominant tree with at least 15% cover.

This class persists in the absence of disturbance. Replacement MFRI = 1250yrs. Mixed fire (MFRI = 5000yrs) maintains this class. Wind/weather/stress (probability = 0.0002) maintains this class.

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve

Description

Class E **0%**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** V

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	1430			0.0007	77
Mixed	5000			0.0002	22
Surface					
All Fires	1111			0.00091	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fir combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inver 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.

Additional Disturbances Modeled

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

References

Agee, J. K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press publishing. 493 p.

Agee, J. K. and Smith, L. 1984. Subalpine tree establishment after fire in the Olympic Mountains, Washington. Ecology 65:810-19.

Alaback, P.B. 1991. Comparative ecology of temperate rainforests of the Americas along analogous climatic gradients. Rev. Chil. Hist. Nat. 64: 399–412.

Alaback, P.B. 1995. Biodiversity patterns in relation to climate and a genetic base for the rainforests of the west coast of North America. In R. Lawford, P.B. Alaback, and E.R. Fuentes, eds. 1995. High Latitude Rain Forests of the West Coast of the Americas: Climate, Hydrology, Ecology and Conservation. Berlin: Springer-Verlag.

DeVelice, R.L., Hubbard, C.J., Boggs, K. et al. 1999. Plant community types of the Chugach National Forest. Tech. Publ. R10-TP-76. Juneau, AK: U.S. Forest Service, Alaska Region. 375pp.

Dickman, A. and Cook, S. 1989. Fire and fungus in mountain hemlock forest. Can. J. Bot. 67:2005-16.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve

Franklin, J.F.; Hemstrom, M.A. 1981. Aspects of succession in the coniferous forests of the Pacific Northwest. In: West, D.C.; Shugart, H.H.; Botkin, D.B.. Forest succession; concepts and application. Springer-Verlag, NewYork.

Lertzman, K.P. and Krebs, C.J. 1991. Gap-phase structure of old-growth forest. Can. J. For. Res. 21:1730-41.

Murphy, K.A. and E. Witten. 2006. Kenai Mountain Hemlock. In Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions. Available at www.frcc.gov.

NatureServe. 2008a. International Ecological Classification Standard: Terrestrial Ecological Classifications. Draft Ecological Systems Description for Alaska Boreal and Sub-boreal Regions.

NatureServe. 2008b. International Ecological Classification Standard: Terrestrial Ecological Classifications. Draft Ecological Systems Description for the Alaska Maritime Region.

Potkin, M. 1997. Fire history disturbance study of the Kenai Peninsula mountainous portion of the Chugach National Forest. Draft. USDA Forest Service, Chugach National Forest. December 5, 1997. Anchorage, Alaska.

USDA Forest Service. 2002. Revised land and resource management plan, final environmental impact statement. Alaska Region Chugach National Forest. R10-MB-480d, May 2002.

Viereck, L.A. 1979. Characteristics of treeline plant communities in Alaska. Holarctic Ecology. 2:228-238.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 seve