LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7516780** **Alaska Sub-boreal Mountain Hemlock-White Spruce Forest**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field **Date** 3/26/2008

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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*
PILU MEFE
TSME VACCI
BEPAK RUPE
POBA2

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
This system occurs primarily in the Kenai and Chugach Mountains.

Biophysical Site Description
Mountain Hemlock-White Spruce occurs on sideslopes and rolling terrain in the Kenai and Chugach Mountains and represents a transition from maritime forests to southcentral boreal forests. Soils are mesic and derived from colluvium, glacial deposits or residual bedrock. (NatureServe 2008).

Vegetation Description
Picea glauca (more common on the northern part of the Kenai Peninsula) or P. X lutzii (the hybrid produced where the ranges of P. sitchensis and P. glauca overlap; more common on the central and western portions of the Kenai Peninsula) and Tsuga mertensiana are the dominant conifers. T. mertensiana has at least 15% cover. Other tree species that may be present include Betula papyrifera and Populus balsamifera.

Common shrubs include Menziesia ferruginea, Alnus viridis ssp. Sinuata, Vaccinium ovalifolium, Oplopanax horridus, Vaccinium vitis-idaea, Rubus pedatus and Linnaea borealis (NatureServe 2008). Common herbaceous species include Equisetum arvense, Dryopteris expansa and Gymnocarpium dryopteris (NatureServe 2008). Common mosses include Hylocomium splendens and Pleurozium schreberi. Plant communities in this system are described by DeVelice et al. (1999).

Disturbance Description
The major disturbance processes in this system are fire, human disturbance, blowdown, avalanches and insect infestations (NatureServe 2008). Although lightning and natural fires have historically been infrequent, wildfire plays an important role in the disturbance regime of this system. Under the natural fire

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regime, fires were infrequent, but large. Estimates of the mean fire return interval range from 600-800yrs (Berg and Anderson 2006, Potkin 1997 unpubl.). This model includes an overall fire return interval of 800yrs.

Spruce beetle (Dendroctonus rufipennis) infestations are a major natural disturbance of spruce forest in southcentral AK. Forests of the Kenai Peninsula have experienced periodic beetle infestations which occasionally rise to epidemic proportions (NatureServe 2008). The most recent infestation, which began in 1987, impacted 429,000ha on the Kenai Peninsula (USDA Forest Service 2004; Rude, Kenai Peninsula Spruce Bark Beetle Mitigation Program, unpublished data) out of 772,000ha of total forested area (van Hees and Larson 1991). This model includes an overall annual probability of bark beetle infestation of 0.02.

Adjacency or Identification Concerns

This system is similar to Alaska Sub-boreal White Spruce Forest, but has at least 15% cover Tsuga Mertensiana (NatureServe 2008). Within the Kenai Mountains, the Mountain Hemlock-White Spruce Forest occurs above the Kenai White Spruce Forest and below the Mountain Hemlock Forest (NatureServe 2008).

Native Uncharacteristic Conditions

The following information was taken from the Coastal Boreal Transition Forest FRCC Guidebook model description (Murphy and Witten 2006):
The present landscape of the western Kenai Peninsula reflects human-caused fires that occurred over the last 100yrs, creating areas of early successional plant communities, which include large stands of broadleaved forests (Potkin 1997). Over 99% of the fires occurring on the Kenai Peninsula portion of the Chugach National Forest between 1914 and 1997 were ignited by human actions (Potkin 1997). These human-caused fires have generally increased the richness and patchiness of the vegetation at the landscape scale (USDA Forest Service 2002). The large number of acres burned on the Kenai Peninsula during settlement caused conversion of some mature spruce stands to grass, brush and broadleaf tree vegetation types. Prior to the settlement period of the late 1800s, the majority of the age structures of the coniferous forest surveyed by Potkin (1997) were likely in the late successional stages (Langille 1904 in Potkin 1997) and conifers were likely dominant.

Following spruce bark beetle outbreaks on the Kenai Peninsula grass and other fine vegetation increased (Holsten et al. 1995). Fire spreads rapidly through this type of vegetation; indeed the majority of fires (most of which were human caused) on the Kenai Peninsula portion of the Chugach National Forest between 1914 and 1997 occurred in grassland vegetation (Potkin 1997). Standing and downed beetle killed trees increase the amount of both fine, flashy fuels and heavy fuels. Spruce bark beetle outbreaks are increasing in frequency and severity in southcentral AK due to the warming climate (Berg 2004), making this pattern uncharacteristic for the BpS.

Scale Description

Matrix

Issues/Problems

Comments

Tina Boucher and Kori Blankenship based this model on the FRCC Guidebook PNVG model for Coastal Boreal Transition Forest (CBTF; Murphy and Witten 2006). The MFRI was increased from the CBFT model based on input from the experts who attended the LANDFIRE Anchorage modeling meeting (Dec.

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07), class ages were adjusted slightly to make them line up along the main successional pathway and the relative age function was not used in any class except A to comply with LANDFIRE modeling rules. Beth Schulz reviewed an initial draft of this model. Tina Boucher reviewed a later draft and suggested that this system would be mostly in the closed canopy classes under reference conditions. Alternate succession pathways were added to classes C and D to allow for recovery and closure of the canopy following insect attacks.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BEPA	Upper
MEFE	Upper
ALVIS	Upper
CHAN2	Upper

Structure Data (for upper layer lifeform)

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

☐ Upper layer lifeform differs from dominant lifeform.

Description

0 -29yrs

Herbaceous vegetation, shrubs and saplings dominate this class. Following a moderate severity burn, shrubs (e.g., Menziesia ferruginea, Alnus viridis ssp. sinuata, Vaccinium ovalifolium and Oplopanax horridus) reproduce vegetatively from shoots and suckers. Light-seeded herbs establish where mineral soil is exposed (e.g., Chamerion angustifolium and Equisetum arvense). Birch seeds in on mineral soil if there is a seed source. White and Lutz spruce seedlings are rare, but may be present if mineral soil was exposed, seed trees remained after fire and they produced a good seed crop (Foote 1983). Later in this class dense tall shrubs (Alnus spp. and Salix spp.) and/or saplings are in the overstory, and herbs, tree seedlings and litter below. Mosses and lichens exist but are not an important component.

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

Class B 20%

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PILU	Upper
TSME	Upper
BEPA	Upper
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	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

If structure or tree size class can't be used to distinguish the mid from the late seral stages, class B can be distinguished from E by the presence of hardwoods.

Description

30-129yrs

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Hardwood, spruce-hemlock or spruce-hemlock-hardwood forest dominates. Tree saplings gain canopy dominance over shrubs. Menziesia ferruginea, Alnus viridis ssp. sinuata, Vaccinium ovalifolium, Oplopanax horridus, Vacciniun vitis-idaea and Linnaea borealis are commonly in the understory. Mosses and lichens become established.

Succession to class E. Replacement MFRI = 1250yrs. Wind/weather/stress (probability = 0.0001) causes a transition to class C.

Class C 5 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PILU	Upper
TSME	Upper
BEPA	Upper
MEFE	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	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

If structure or tree size class can't be used to distinguish the mid from the late seral stages, class C can be distinguished from D by the presence of hardwoods.

Description

30-129yrs

Hardwood, spruce-hemlock or spruce-hemlock-hardwood forest dominates. Young trees become dominant in the overstory. Menziesia ferruginea, Alnus viridis ssp. sinuata, Vaccinium ovalifolium, Oplopanax horridus, Vaccinium vitis-idaea and Linnaea borealis are commonly in the understory. Lichens and mosses become established.

If this class originates from an insect attack that has thinned the spruce to open up the canopy, the canopy will often close up as the remaining overstory trees expand their canopies and understory trees grow into the canopy. This pathway is represented by alternate succession to class B.

Succession to class D. Alternate succession (probability = 0.02) to class B. Replacement MFRI = 1250yrs.

Class D 25 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PILU	Upper
TSME	Upper
MEFE	Lower
VAOV	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

130yrs+

Open spruce-hemlock forest with < 60% canopy closure. Hardwoods, if present and mixed with spruce, lose dominance in the overstory during this phase. Occasional hardwoods may remain. The understory may include

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various combinations of tall shrubs, low shrubs, herbs, mosses and lichens.

If this class originates from an insect attack that has thinned the spruce to open up the canopy, the canopy will often close up as the remaining overstory trees expand their canopies and understory hemlocks grow into the canopy. This pathway is represented by alternate succession to class E.

This class may persist in the absence of disturbance or may follow an alternate succession pathway (probability = 0.02) to class E. Replacement MFRI = 900yrs. Mixed fire (MFRI = 3000yrs) causes a transition to class C. Insects and disease can cause a transition to class C (probability = 0.0015) or class D (probability = 0.028).

Class E 45 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PILU	Upper
TSME	Upper
MEFE	Lower
VAOV	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

130yrs+

Closed spruce-hemlock forest with > 60% canopy closure. Hardwoods, if present and mixed with spruce, lose dominance in overstory during this phase. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens.

This class persists in the absence of disturbance. Replacement MFRI = 900yrs. Mixed fire (MFRI = 2500yrs) causes a transition to class D. Insects and disease can cause a transition to class C (probability = 0.0018), class D (probability = 0.013), or maintain class E (probability = 0.012). Wind/weather/stress (probability = 0.0001) causes a transition to class D.

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	1000			0.001	83
Mixed	5000			0.0002	17
Surface					
All Fires	833			0.00121	

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)

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