LANDFIRE Biophysical Setting Model

Biophysical Setting 7616042 Western North American Boreal Mesic Black Spruce Forest - Alaska Sub-boreal

☑ *This BPS is lumped with: WNA Boreal Spruce-Lichen Woodland (in part)*

☐ *This BPS is split into multiple models: Western North American Boreal Mesic Black Spruce Forest was split into a Boreal and Sub-boreal variant for BpS modeling so that regional differences could be represented.*

Boreal Spruce Lichen Woodland may occur as a seral stage or variant of Boreal Treeline White Spruce Woodland, Boreal Mesic Black Spruce Forest, or, less commonly, in these same systems in the sub-Boreal region.

General Information

Contributors (also see the Comments field **Date** 4/7/2008

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Modeler 2			**Reviewer**
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Vegetation Type

Forest and Woodland

Map Zone

76

Model Zone

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

Dominant Species*

PIMA	VAUL
PIGL	VAVI
BENA	EMNI
LEDUM	HYSP70

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system occurs in the boreal transition region of AK, south of the Alaska Range, including the Susitna and Matanuska Valleys and the Kenai Peninsula (NatureServe 2008).

Biophysical Site Description

This information was taken from the draft Boreal Ecological Systems description (NatureServe 2008): Sub-boreal Mesic Black Spruce Forest occurs on well-drained to moderately well-drained sites including old alluvial fans, abandoned floodplains and inactive terraces. Soils are gravelly and feature shallow to moderately deep organic horizons. Permafrost is absent.

Vegetation Description

This information was taken from the draft Boreal Ecological Systems description (NatureServe 2008): Picea mariana and P. glauca are the dominant overstory species in an open forest canopy. Common understory shrubs include Betula nana, Ledum spp., V. uliginosum, Vaccinium vitis-idaea and Empetrum nigrum. Common mosses include Hylocomium splendens and Pleurozium schreberi. Total tree cover typically ranges from 40-70%.

*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

Disturbance Description

This information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
The disturbance regime is characterized by crown fires or ground fires of enough intensity to kill overstory trees. Mean fire return interval estimates for this type have not been defined, but estimates for similar sites from interior AK range from 25-100yrs (Rowe et al. 1974, DeVolder 1999 [Kenai Lowland including human-caused], Yarie 1983, Heinselman 1978, Heinselman 1981, Viereck 1983, Viereck 1986). It is likely that the natural fire return interval is longer than those estimated for boreal sites due to less frequent lightning strikes. A "best guess" for this system without human disturbance has been estimated at 170yrs (FRCC expert's consultation, 2004).

Succession after fire can return to black spruce or can pass through a hardwood sere before returning to black spruce. Seasonality affects burn severity. An early season burn can kill the overstory without affecting the ground layer, but a late-season burn can reduce the duff layer and kill the understory plants. Calamagrostis is not a major factor in Sub-boreal black spruce succession.

Adjacency or Identification Concerns

In some locations, this BpS can be confused with the White Spruce BpS because black and white spruces often mix, especially on sites with transitional moisture and thermal conditions (Murphy and Witten 2006).

Native Uncharacteristic Conditions

The following information was taken from the Black Spruce Southcentral PNVG model description (Murphy and Witten 2006):
In recent decades black spruce began encroaching into drying sphagnum bogs, creating "islands" of spruce where spruce were not previously present (Ed Berg, personal communication, March 4, 2004). This drying and resultant encroachment is attributed to the warming climate.

Scale Description

This BpS is typically found in large patches (NatureServe 2008).

The following information was taken from the Black Spruce Southcentral PNVG (Murphy and Witten 2006) model description:
Fires tend to be large – 50,000 hectares or larger. During most fire years a small number of large fires account for most of the total area burned (Gabriel and Tande 1983). Ecologically significant fires usually occur during the exceptional fire years and cover 200,000+ ha (Viereck 1983).

Issues/Problems

Comments

This model did not receive review specifically for z76.

This model was based on the FRCC Guidebook PNVG model for Black Spruce Southcentral (BSSC; Murphy and Witten 2006) and input from the experts who attended the LANDFIRE Fairbanks(Nov. 07) and Anchorage (Dec. 07) modeling meetings. It was refined by Michelle Schuman. The class definitions and age ranges were taken from experts at the Anchorage and Fairbanks meetings with input from Michelle Schuman and the disturbance probabilities are similar to those in the BSSC model.

Vegetation Classes

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Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
LEDUM	Middle
VAUL	Low-Mi
VAVI	Lower

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

0-14yrs

Moss, herbs, seedlings of trees and shrubs establish 3 months to three years post fire (Foote 1983). Shrubs and saplings 1.4 to 7 m tall typically begin capturing sites 4-5yrs post fire. The tall shrub and sapling layer is characterized by 60-100% canopy closure. Tree saplings may include spruce, hardwoods or both. Common understory shrubs include Betula nana, Ledum spp., Vaccinium uliginosum, V. vitis-idaea and Empetrum nigrum. Common mosses include Hylocomium splendens and Pleurozium schreberi.

Succession to class B. Alternate succession (probability = 0.011) causes a transition to class C and represents the probability that some stands will go through a hardwood (with spruce understory) or spruce-hardwood stage rather than following the main successional pathway to a black spruce dominated stage (class B). Replacement MFRI = 167yrs.

Class B 10 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PIGL	Upper
BENA	Lower
LEDUM	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

B should be distinguished from D and E based on tree size class but if that is not mapped, B can be considered a dwarf tree class for mapping.

Description

15-74yrs

Black or white spruce overtops shrubs and gains dominance. Tree density may be < or > 60% depending on site conditions.

The alternate succession pathway to E represents an alternative to the main successional trajectory to class D.

Succession to class D. Alternate succession (probability = 0.015) causes a transition to class E and represents the probability that some stands go directly to a closed spruce stage rather than following the main successional pathway to an open spruce stage (class D). Mixed (MFRI = 830yrs) maintains the class. Replacement MFRI = 450yrs.

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Class C 5 %

Mid Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
PIMA	Mid-Upper
PIGL	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open (25-59% 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.

Presence of hardwoods distinguishes C from B, D and E.

Description

15-74yrs

Hardwoods (with spruce in the understory) or hardwoods and spruce overtop shrubs and gain dominance. Early in this age class trees are at least 2.5 cm DBH and 4-8 m tall (Foote 1983). Populus tremuloides replaces Betula papyrifera on drier sites (Foote 1983, Chapin et al. 2006). Spruce may occur as an understory, subdominant, and/or co-dominant component. Tree density may be < or > 60% depending on site conditions. Beneath trees shrubs, herbs and mosses exist. As the stage advances spruce and moss become more important.

Succession to class D. Replacement MFRI = 250yrs.

Class D 50 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PIGL	Upper
BENA	Lower
LEDUM	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Woodland (10-24% tree cover)	Open (25-59% tree cover)
Height	Tree (> 3 m)	Tree (> 3m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

75yrs+

This class is characterized by open spruce lichen forest or woodland. Spruce gains dominance over hardwoods (if previously present). Tree canopy cover is < 60% and maybe < 25% (woodland) depending on site conditions. Occasional hardwoods may remain. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens. For spruce lichen woodland, the dominant lichen genus is Cladina; species include C. arbuscula, C. mitis, C. rangiferina, and C. stellaris. Other lichens include Cetraria cucullata, C. islandica, C. nivalis, Bryoria spp., Alectoria nigricans and Alectoria ochroleuca.

If fire is absent for long periods paludification may occur.

This class persists in the absence of disturbance. Mixed (MFRI = 1400yrs) maintains the class. Replacement MFRI = 200yrs.

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Class E **25 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PIGL	Upper
BENA	Lower
LEDUM	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 (> 3m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

75yrs+

This class is characterized by closed spruce forest. Site is dominated by mature black or white spruce with > 60% canopy closure although cover generally does not exceed 70%. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens.

This class persists in the absence of disturbance. Mixed (MFRI = 1400yrs) causes a transition to class D. Replacement MFRI = 200yrs. Insects and disease (probability = 0.001) and wind/weather/stress (probability = 0.001) cause a transition to class D.

Disturbances

Fire Regime Group:** **IV**

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	216.9			0.00461	87
Mixed	1430			0.0007	13
Surface					
All Fires	188			0.00532	

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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