

LANDFIRE Biophysical Setting Model

Biophysical Setting 7516220

**Western North American Boreal Black
Spruce Wet-Mesic Slope Woodland**

☐ This BPS is lumped with:

☐ This BPS is split into multiple models:

General Information

Contributors (also see the Comments field)

Date 4/18/2008

Modeler 1 Joan Foote

joanf@mosquitonet.com

Reviewer Michelle Schuman

michelle.schuman@ak.usda.gov

Modeler 2 Colleen Ryan

colleen_ryan@tnc.org

Reviewer Will Putnam

wputman@tananachief.fs.org

Modeler 3

Reviewer Lisa Saperstein

Lisa_Saperstein@fws.gov

Vegetation Type

Wetlands/Riparian

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*

PIMA VAUL
LEPAD BENA
VAVI SPGI70
EMNI

General Model Sources

- ☒ Literature
☐ Local Data
☒ Expert Estimate

Geographic Range

This system is found throughout interior boreal AK.

Biophysical Site Description

This BpS is found on north-facing slopes underlain by permafrost. Soils are poorly drained and acidic with a well-developed peat layer (NatureServe 2008).

Vegetation Description

The dominant overstory vegetation is *Picea mariana*. Mature trees on these sites are usually smaller than those on mesic sites. Common shrubs include *Ledum groenlandicum*, *Ledum palustre*, *Betula nana* (this species here includes *B. glandulosa*), *Empetrum nigrum*, *Vaccinium vitis-idaea* and *V. uliginosum* (NatureServe 2008). Herbs include *Equisetum sylvaticum*, *Rubus chamaemorus* and *Carex* spp. (Foote 1983). Older stands will include lichens, especially *Cladonia arbuscula* and *C. rangiferina*. Mosses include *Sphagnum* spp., *Pleurozium schreberi* and *Polytrichum* spp. Feathermosses are typical of cooling soils, which can lead to permafrost development. Sites where permafrost is closer to the surface will have more sphagnum.

Disturbance Description

Fire is the dominant disturbance mechanism for this forest type. Fire is facilitated by an abundance of fine fuels and ladder fuels in this type. The overall MFRI for this model is similar to that for Western North American Boreal Mesic Black Spruce Forest - Boreal. Despite saturated soils, wet black spruce forest on

*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 severity

slopes lacks the standing water that limits fire in wet black spruce flats (Boreal Lowland Wet Black Spruce Complex). Fires in this forest type are usually fast-moving and patchy. High severity fire may lead to an increased deciduous tree component (Johnstone and Kasischke 2005).

Adjacency or Identification Concerns

This type is intermingled with the Western North American Boreal Mesic Black Spruce Forest - Boreal BpS and the Boreal Lowland Wet Black Spruce Complex BpS. Boreal Lowland Wet Black Spruce Complex is found on low flats and concave and toeslope sites. Boreal Black Spruce Wet-Mesic Slope Woodland is found on north-facing slopes, while Mesic Black Spruce Forest - Boreal is found on upper, convex slopes of other aspects. In hilly areas, Lowland Wet Black Spruce Complex typically occurs on the flats and toe slopes up to an eight percent grade (T. Jorgenson, pers. Comm.) Above the eight percent cutoff will be Boreal Black Spruce Wet-Mesic Slope Woodland on north-facing slopes or Boreal Mesic Black Spruce Forest - Boreal on other slopes.

This model applies to sites with well-developed peat soils on permafrost. In contrast, mesic black spruce typically occurs on sites lacking permafrost and peat soils in the southern parts of the Boreal region. North of Fairbanks, both Boreal Mesic Black Spruce Forest - Boreal and Boreal Lowland Wet Black Spruce Complex may occur with permafrost.

Native Uncharacteristic Conditions

Scale Description

Large patch (small patch)

Issues/Problems

Comments

Joan Foote and Colleen Ryan drafted this model. Michelle Schuman, Lisa Saperstein and Will Putnam reviewed an early draft of this model.

Vegetation Classes

Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Indicator Species* and Canopy Position

EQSY Upper
 BENA Middle
 RUCH Low-Mi
 SPGI70 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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Herbs or shrubs can dominate.

Description

0-19yrs

Herbaceous and/or shrub, open or closed. After a fire, herbs and shrubs quickly re-establish on the site. Soon, the shrubs begin to overtop the herbs. By the end of this class, a closed shrub canopy is present. Spruce seedlings are present in the understory.

Common shrubs include *Ledum groenlandicum*, *Ledum palustre*, *Betula nana* (syn. *B. glandulosa*), *Empetrum*

*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 severity

nigrum, Vaccinium vitis-idaea and V. uliginosum. Herbs include Equisetum sylvaticum, Rubus chamaemorus and Carex spp. Mosses include Sphagnum spp., Pleurozium schreberi and Polytrichum spp. On some sites, alder and willow may be present.

Fire is unlikely in this class due to lack of fuel and saturated soils. Any fire will be stand-replacing.

Succession to class B. Replacement MFRI = 1000yrs.

Class B 20 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

PIMA Mid-Upper
RUCH Low-Mid
EMNI Low-Mid
SPGI70 Lower

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.

For mapping, if this class can not be distinguished from class C and D by existing vegetation type (Black Spruce Scrub and Shrub Swamp), class B can be considered a dwarf tree class.

Description

20-40yrs

Black spruce, open or closed, seedling/sapling. This class is dominated by black spruce saplings and shrubs. Early in this stage, the tree seedlings begin to overtop the low shrubs. By the end of this class, the trees will overtop the tall shrubs (willow and/or alder), if present. The end of this class will be a closed stand of spruce saplings. In some cases, this class may include older black spruce trees that have survived a mixed fire.

Succession to class C is the primary pathway, which is followed by closed stands. If this class is open, it will succeed to class D, represented in the model by alternate succession (probability = 0.03). Replacement MFRI = 170yrs. Mixed fire (MFRI = 170yrs) maintains the system in class B.

Class C 35 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

PIMA Upper
RUCH Low-Mid
EMNI Low-Mid
SPGI70 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

40yrs+

Black spruce, closed. This class is dominated by relatively dense sapling to pole-sized Picea mariana, typically in even-aged stands. Trees will typically range from 2.5-10cm DBH and 2-7m tall (Foote 1983).

*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 severity

However, uneven aged stands may occur where some individuals have survived an earlier mixed fire. The canopy is nearly 100% spruce.

This is typically the most flammable class because of the pulses of fuels created by the die-off of overtopped shrubs around age 40-60yrs. Abundant snags, dead lower branches and fine fuels also increase the likelihood of fire in this class. Mixed fire in this class will transition the system to class B, creating patches of mature trees in a matrix of shrubs, with spruce regeneration in the understory.

This class will persist in the absence of disturbance. Replacement MFRI = 125yrs. Mixed fire (MFRI = 110yrs) causes a transition to class B.

Class D 35 %

Late Development 2 Open

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☒ Tree

Indicator Species* and Canopy Position

PIMA Upper
 PLSC70 Lower
 CLADI3 Lower
 SPGI70 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 (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

40yrs+

Black spruce/lichen, open. Open canopy mature *Picea mariana*, with feathermoss and lichen. Mosses and lichens expand with age, as the leaf litter from the shrubs disappears. In this class, the canopy has begun to open up and lichen development has begun. Lichen species include *Cladonia arbuscula*, *C. rangiferina* and *Nephroma arcticum*. Mosses include *Pleurozium schreberi*, *Polytrichum* spp., *Hylocomium splendens* and *Dicranum* spp, as well as *Sphagnum* spp. Low shrubs, including *Vaccinium vitis-idaea*, *V. uliginosum* and *Ledum groenlandicum*, are often present in the understory.

Any fire in this class will kill the lichens. Mixed fire will transition the system to class B, creating patches of mature trees in a matrix of shrubs, with spruce regeneration in the understory.

This class will persist in the absence of disturbance. Replacement MFRI = 170yrs. Mixed fire (MFRI = 110yrs) causes a transition to class B.

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

*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 severity.

Fire Regime Group:** III

Historical Fire Size (acres)

Avg 0

Min 0

Max 0

Sources of Fire Regime Data

- ☐ Literature
☐ Local Data
☒ Expert Estimate

Additional Disturbances Modeled

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

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	163.9			0.0061	46
Mixed	140.8			0.0071	54
Surface					
All Fires	76			0.01321	

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.

References

Foot, M. Joan. 1983. Classification, description, and dynamics of plant communities after fire in the Taiga of Interior Alaska. Res. Pap. PNW-307. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 108 pp.

Johnstone, J.F. and E.S. Kasischke. 2005. Stand-level effects of soil burn severity on post-fire regeneration in a recently-burned black spruce forest. Canadian Journal of Forest Research 35: 2151-2163.

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

*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 severity.