

# LANDFIRE Biophysical Setting Model

**Biophysical Setting 7616220**

**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

|                               |                       |                                  |                              |
|-------------------------------|-----------------------|----------------------------------|------------------------------|
| <b>Modeler 1</b> Joan Foote   | joanf@mosquitonet.com | <b>Reviewer</b> Michelle Schuman | michelle.schuman@ak.usda.gov |
| <b>Modeler 2</b> Colleen Ryan | colleen_ryan@tnc.org  | <b>Reviewer</b> Will Putnam      | wputman@tananachief.fs.org   |
| <b>Modeler 3</b>              |                       | <b>Reviewer</b> Lisa Saperstein  | Lisa_Saperstein@fws.gov      |

### Vegetation Type

Wetlands/Riparian

### Map Zone

76

### Model Zone

- |                                            |                                            |
|--------------------------------------------|--------------------------------------------|
| <input checked="" type="checkbox"/> Alaska | <input type="checkbox"/> N-Cent.Rockies    |
| <input type="checkbox"/> California        | <input type="checkbox"/> Pacific Northwest |
| <input type="checkbox"/> Great Basin       | <input type="checkbox"/> South Central     |
| <input type="checkbox"/> Great Lakes       | <input type="checkbox"/> Southeast         |
| <input type="checkbox"/> Northeast         | <input type="checkbox"/> S. Appalachians   |
| <input type="checkbox"/> Northern Plains   | <input type="checkbox"/> 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 and in MZ76.

## 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 8% grade (T. Jorgenson, pers. Comm.) Above the 8% 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

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

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.

\*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

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

\*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

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). 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 40-60. 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

#### **Structure Data (for upper layer lifeform)**

#### **Upper Layer Lifeform**

- ☐ Herbaceous  
☐ Shrub  
☒ Tree

#### **Indicator Species\* and Canopy Position**

PIMA Upper  
PLSC70 Lower  
CLADI3 Lower  
SPGI70 Lower

|                 | 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**

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]

#### **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**

\*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

## Disturbances

**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

Foote, 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.