

# LANDFIRE Biophysical Setting Model

**Biophysical Setting 7216011**

**Western North American Boreal Treeline  
White Spruce Woodland - Boreal**

- ☒ This BPS is lumped with: WNA Boreal Spruce-Lichen Woodland (in part)
- ☒ This BPS is split into multiple models: Western North American Boreal Treeline White Spruce Woodland 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** 4/8/2008

**Modeler 1** Tricia Wurtz twurtz@fs.fed.us **Reviewer**  
**Modeler 2** **Reviewer**  
**Modeler 3** **Reviewer**

### Vegetation Type

Forest and Woodland

### Map Zone

72

### 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\*

PIGL LEDUM  
PIMA ALVI5  
BENA SAPU15  
VAUL BEPA

### General Model Sources

- ☒ Literature  
☐ Local Data  
☒ Expert Estimate

## Geographic Range

This type is found in boreal AK from the south slopes of the Brooks Range to the north slopes of the Alaska Range and west to the limit of tree growth. Boreal Spruce-Lichen Woodland, which is included as a variant of a later seral stage within this type, occurs primarily in the northern and western portions of the boreal zone.

## Biophysical Site Description

Boreal White Spruce Woodland occurs primarily near the elevational and latitudinal limit of tree growth. It occurs above Boreal White Spruce to 900 m (Boggs et al. 2001) and below the subalpine shrub and tundra systems and can be seen as the forested transition zone between boreal white spruce forest and non-forested subalpine vegetation. Depending on the topography, this system can occupy a narrow band just below non-forested subalpine or a broad expanse across gentle slopes and benches. Soils are cold, but peat-forming mosses are not common in the ground layer.

## Vegetation Description

This type is dominated by *Picea glauca* although *Picea mariana* may be codominant (NatureServe 2008). Canopy cover is generally between 10% and 25%. Hardwoods, if present, can include *Betula papyrifera* and *Populus tremuloides*. The shrub layer typically features *Betula nana*, but other shrubs such as *Vaccinium uliginosum*, *Ledum groenlandicum* and *Salix pulchra* may be common or dominant

\*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

(NatureServe 2008). In some locations *Alnus viridis* is the dominant understory shrub (NatureServe 2008). Feathermoss may be common in the in the ground layer (NatureServe 2008). On drier or more exposed sites, *Cladina* spp. replace feathermosses as the dominant ground cover (Viereck 1979).

### **Disturbance Description**

This information was taken from the draft Boreal Ecological Systems description (NatureServe 2008), which notes that fire information is lacking:

Fire return interval is in the vicinity of 100yrs, shorter than for Western North American Boreal Treeline White Spruce Woodland - Alaska Sub-boreal.

A possible scenario for post-fire succession in this type is the resprouting of low shrubs from underground propagules followed by *Picea glauca* invading by seed from adjacent stands or surviving trees. *Betula papyrifera* may invade the site if a seed source is available and site conditions are favorable. The typical succession sequence for this type does not include a hardwood sere. The rate of succession depends on severity of fire and seed source, and some sites may be shrub-dominated for long periods without spruce invasion.

The successional relationships of the Boreal Spruce-Lichen Woodland included here are poorly understood. This system has been included in this model as a variant of the late successional stage (Class C).

### **Adjacency or Identification Concerns**

This system is similar to Western North American Boreal Treeline White Spruce Woodland - Alaska Sub-boreal but does not include an insects and disease probability and has a more frequent MFRI.

### **Native Uncharacteristic Conditions**

### **Scale Description**

Large patch

### **Issues/Problems**

Experts at the LANDFIRE Fairbanks modeling meeting (Nov. 07) indicated the need for a late seral woodland white spruce-lichen class that could develop after approximately 200yrs in the absence of disturbance. This class was not included as a separate class because it was felt that LANDFIRE would not be able to distinguish it for mapping. The woodland white spruce-lichen concept is included in class C in the current model.

### **Comments**

This model was created for the AK boreal region and did not receive review for the arctic region.

This model was based on input from the experts who attended the LANDFIRE Fairbanks modeling meeting (Nov. 07) and refined by Tricia Wurtz.

## ***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  
 VAUL Upper  
 LEGR Upper  
 SAPU15 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 -24yrs

This class is characterized by herbaceous and shrub vegetation. Shrubs resprout from underground propagules and then *Picea glauca* invades by seed from adjacent stands or surviving trees. The shrub layer typically features *Betula nana*, but other shrubs such as *Vaccinium uliginosum*, *Ledum groenlandicum* and *Salix pulchra* may be common or dominant. In some locations *Alnus viridis* is the dominant understory shrub. Feathermoss may be common in the in the ground layer. On drier or more exposed sites, *Cladina* spp. replace feathermosses as the dominant ground cover (Viereck 1979). The rate of succession depends on severity of fire and seed source, and some sites may be shrub-dominated for long periods without spruce invasion.

The main successional trajectory is to class C (white spruce woodland) but an alternate succession pathway to class B (probability = 0.04) represents sites where hardwoods may invade the site if a seed source is available and site conditions are favorable. Replacement MFRI = 150yrs.

**Class B 15 %**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous  
☐ Shrub  
☒ Tree

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

BEPA Upper  
 POTR5 Upper  
 PIGL Upper  
 PIMA Upper

**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 | Pole 5–9" (swd)/5–11" (hwd)  |                             |

☐ Upper layer lifeform differs from dominant lifeform.

Presence of hardwoods distinguishes class B from class C.

**Description**

25-69yrs

This class is characterized by hardwood or white spruce-hardwood mixed forest. *Betula papyrifera* and/or *Populus tremuloides* invade with or without spruce and gain canopy dominance over the shrubs. Forest canopy cover is generally 10-25%. Eventually hardwoods senesce and white spruce gains canopy dominance (class C).

Succession to class C. Replacement MFRI = 150yrs. Mixed fire (FRI = 300yrs) maintains this class.

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**Class C 75 %**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous  
☐ Shrub  
☒ Tree

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

PIGL Upper  
 PIMA Upper  
 BENA Low-Mid  
 CLADI3 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 | Med. 9–20" (swd)/11–20" (hwd) |                             |

☐ Upper layer lifeform differs from dominant lifeform.

Absence of hardwoods distinguishes class C from class B.

**Description**

25yrs+

This class is characterized by open white spruce woodland. Forest canopy cover is generally 10-25%. Hardwoods, if previously present in the stand, lose dominance in overstory during this phase. The understory may include various combinations of low shrubs, herbs and mosses. Lichens grow as the stand ages. This class includes the Spruce-Lichen Woodland system on some sites. The dominant lichen genus is typically Cladonia; species include *C. arbuscula*, *C. mitis*, *C. rangiferina*, and *C. stellaris*. Other lichens may include *Cetraria cucullata*, *C. islandica*, *C. nivalis*, *Bryoria* spp., *Alectoria nigricans* and *Alectoria ochroleuca*.

Beetles affect this class but because the rate of outbreaks is uncertain and generally not severe enough to cause a state transition, they were not included in the VDDT model. The frequency and severity of beetle outbreaks will likely increase under a warmer climate.

This class persists in the absence of disturbance. Replacement MFRI = 150yrs. Mixed fire (FRI = 300yrs) 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.

**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**

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## 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

**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 | 150.2  |        |        | 0.00666     | 69                   |
| Mixed       | 333.0  |        |        | 0.00300     | 31                   |
| Surface     |        |        |        |             |                      |
| All Fires   | 104    |        |        | 0.00967     |                      |

**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

Boggs, K., A. Garibaldi, J. Stevens, J. Grunblatt, and T. Helt. 2001. Denali National Park and Preserve Landcover mapping project. Volume 2: Landcover classes and plant associations. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, 707 A Street, Anchorage, AK. 164pp.

Foote, J. M. 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 Research Station. 108pp.

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

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

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