16141

Western North American Boreal Montane Floodplain Forest and Shrubland - Boreal

BpS Model/Description Version: Nov. 2024

|  |  |  |  |
| --- | --- | --- | --- |
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Reviewer: Janet Fryer and Blaine T. Spellman

Vegetation Type

Forest and Woodland

Map Zones

68, 69, 70, 71, 72, 73, 74, 76, 78

Model Splits or Lumps

This Biophysical Setting (BpS) is split into multiple models: Western North American Boreal Montane Floodplain Forest and Shrubland was split into a Boreal and Sub-boreal variant for BpS modeling so that regional differences could be represented. For mapping BpS 16141 should apply in level 2 ecoregions (Nowaki et al. 2001): Intermontane Boreal, Aleutian Meadows, Arctic Tundra, Bering Taiga, Bering Tundra.

Geographic Range

This type occurs on floodplains throughout the boreal region of AK.

Biophysical Site Description

The substrate is typically well-drained sand or cobble, although finer silts and clays can be found on higher terraces, in ponds, on distal floodplains, and in lower energy systems. Permafrost is usually absent. Soils tend to be sandy and gravelly, at least somewhere within the top one meter, and as a result, these soils do not develop permafrost.

Vegetation Description

Primary succession on floodplains begins when new alluvial surfaces are colonized by tree, shrub, and herbaceous vegetation. Common early seral woody species include *Populus balsamifera* (seedlings), *Picea glauca* (seedlings), *Alnus viridis* ssp. *sinuata*, Alnus incana ssp. *tenuifolia*, *Salix barclayi* (most commonly found in and south of the Alaska Range), and *Salix alaxensis* (Boggs 2000; Scott 1974; Shephard 1995; Thilenius 1990; Viereck 1966). Common early seral herbaceous species may include *Lupinus* spp., *Hedysarum* spp., and *Equisetum* spp. (NatureServe 2008). The next seral stage is dominated by *Populus balsamifera* and/or *Picea glauca* with an understory of *Alnus viridis* ssp. *sinuata*, *Salix* spp., and various bryophytes. On dry sites the shrub layer may be dominated by *Shepherdia canadensis, Dryas octopetala, Dryas integrifolia*, and fruticose lichens (*Stereoucaulon* spp.) (NatureServe 2008). The tall shrub component (*Salix/Populus*) of the early successional stages diminishes rapidly because of decreased light from the dense tree overstory (Chapin et al. 2006). *Populus balsamifera* does not regenerate in the understory and consequently, *Picea glauca* gains dominance in the overstory within 150yrs (NatureServe 2008). *Rosa acicularis, Alnus viridis* spp. *fruticose, Viburnum edule, Calamagrostis canadensis, Hylocomium splendens,* and *Pluerozium schredberi* are common on older surfaces.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| POBAB2 | *Populus balsamifera ssp. balsamifera* | Balsam poplar |
| PIGL | *Picea glauca* | White spruce |
| ALNUS | *Alnus spp.* | Alder |
| SALIX | *Salix spp.* | Willow |
| SHCA | *Shepherdia canadensis* | Russet buffaloberry |
| ROAC | *Rosa acicularis* | Prickly rose |
| VIED | *Viburnum edule* | Squashberry |
| EQUIS | *Equisetum spp.* | Horsetail |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Flooding is the primary disturbance in this system. Flooding can be caused by snowmelt, precipitation, ice jams, and glacial runoff. Different rivers or portions of rivers may be more prone to certain types of flooding. Frequent flooding and channel migration creates a pattern of gravel bars and early successional stages across the valley bottom. Sediment deposition raises the surface of the floodplain over time. As the terrace becomes farther removed from the channel, flooding becomes less frequent. Water availability on terraces plays a major role in community structure and composition. Water inputs come from overbank flow (flooding), ground water, and precipitation. Deposits with high permeability become progressively drier as they are vertically and horizontally removed from the active channels.

Vegetation succession on gravel bars can be represented by the following seral stages: barren or herbaceous, willow or willow-alder, alder, poplar or spruce-poplar, and spruce. Oxbows and other wet depressions commonly form on the floodplains and develop into wetlands (which are represented by different BpS descriptions and models). However, succession and species composition is variable due to diverse environmental conditions such as water depth, substrate, and nutrient input.

Estimates of mean fire return intervals include:

-200yrs+ (200-300yr range) (Viereck 1973, Barney 1971)

-300yrs (Rowe et al. 1974) (for alluvial white spruce, MacKenzie River Valley)

-300yrs (Heinselman 1981)

-300yrs (Duchesne and Hawkes 2000)

-300yrs (personal communication experts’ workshop March 2004)

Small, relatively infrequent, mixed severity fires characterize this BpS due to the sites’ proximity to rivers, which act as firebreaks (Viereck 1973, Barney 1971, Foote 1983). High moisture content of the vegetation, high percentage of deciduous species, and high relative humidity also contribute to making fires less frequent in the riparian spruce hardwood communities than in typically adjacent BpS. In interior Alaska the oldest white spruce stands (350+ yrs) are commonly found on islands within floodplains where they are protected from fire (Viereck 1973).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 5952 | 5 |  |  |
| Moderate (Mixed) | 315 | 95 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 299 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Linear

Adjacency or Identification Concerns

This model applies to forest and shrub systems in the active and inactive portions of the floodplain, but not abandoned floodplains. Oxbows and other wet depressions commonly form on the floodplains. Floodplain Wetlands are a separate ecological system and a separate BpS.

Issues or Problems

Wetlands that occur on the floodplain are not considered in this model.

Native Uncharacteristic Conditions

Comments

4/2022 – During the Boreal Forest BpS Review Work Session in February 2022 participants ranked the boreal forest BpS by relative fire frequency. Based on that ranking it was estimated that this BpS would have the least frequent fire of all boreal forest BpS. Since the existing mean fire return interval (MFRI) was already the least frequent of any of the BpS, the model was kept as is.

2022 – Based on NRCS plots in closed white spruce stands on floodplains, a reviewer estimated that a MFRI of 200-300 years would be reasonable for this BpS.

2014 – A reviewer noted that: “This model is in the ballpark of existing (and very sparse) literature but may be high. From Fryer 2014: “as of 2014 there were few fire history studies documenting fire-return intervals of Alaskan balsam poplar communities. The Riley Creek study (see Table 2A\*) found a fire-return interval of 40 to 60 years (Mann & Plug 1999). Stand ages of 1 and 2 centuries (Edwards & Dunwiddie 1985; Krause et al. 1959) suggest stand-replacement fires are uncommon in balsam poplar stands (Cronan et al. [n.d.]). On the North Slope, for example, balsam poplars were 100 to 250 years old (Edwards & Dunwiddie 1985). Paleological studies found fire was relatively infrequent when *Populus* spp. dominated the landscape (Hu et al. 2006; Lynch & Hu 2003) (see Table 2B\*\*).”

During LANDFIRE National, this model was created for the boreal region of AK and did not receive review for other parts of the state. This model was based on the FRCC Guidebook PNVG model for Riparian Spruce Hardwood (RSH) (Murphy and Witten 2006) and input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting. It was refined by Michelle Schuman. The relative age function used in the RSH model was not used in any class except Class A to comply with LANDFIRE modeling rules and the 10,000 years replacement fire was removed from Class D. These changes did not change the model results. Because changes to the VDDT model were relatively minor, Karen Murphy and Evie Witten were retained as modelers and Michelle Schuman's name was added.

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | A | A | A | A | A | A | B | B | B | B |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | B | B | B | B |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | B | B | B | B |
| Shrub | >3.0 | A | A | A | A | A | A | B | B | B | B |
| Tree | 0-5 | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 5-10 | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 10-25 | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 25-50 | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | >50 | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | D brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 0-5 | D mix | D mix | D mix | D mix | D mix | D mix | C mix | C mix | C mix | C mix |
| Tree | 5-10 | D mix | D mix | D mix | D mix | D mix | D mix | C mix | C mix | C mix | C mix |
| Tree | 10-25 | D mix | D mix | D mix | D mix | D mix | D mix | C mix | C mix | C mix | C mix |
| Tree | 25-50 | D mix | D mix | D mix | D mix | D mix | D mix | C mix | C mix | C mix | C mix |
| Tree | >50 | D mix | D mix | D mix | D mix | D mix | D mix | C mix | C mix | C mix | C mix |
| Tree | 0-5 | D con | D con | D con | D con | D con | D con | E con | E con | E con | E con |
| Tree | 5-10 | D con | D con | D con | D con | D con | D con | E con | E con | E con | E con |
| Tree | 10-25 | D con | D con | D con | D con | D con | D con | E con | E con | E con | E con |
| Tree | 25-50 | D con | D con | D con | D con | D con | D con | E con | E con | E con | E con |
| Tree | >50 | D con | D con | D con | D con | D con | D con | E con | E con | E con | E con |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 4 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| LUPIN | *Lupinus* spp. | Lupine | Upper |
| HEDYS | *Hedysarum* spp. | Sweetvetch | Upper |
| EQUIS | *Equisetum* spp. | Horsetail | Upper |
| SALIX | *Salix* spp. | Willow | Upper |

Description

This class is characterized by post disturbance regeneration (herbs, shrub regeneration, seedlings). Silt is deposited on the inside of river meanders following flood events. Flooding deposits seeds, which germinate and take root. *Lupinus* spp., *Hedysarum* spp., *Equisetum* spp., and *Salix* spp. colonize in the first year. Within five years *Salix* spp. and balsam poplar seedlings are abundant. Plant cover is 1-2% during the first year. Shrub cover increases up to 40% by the fifth year, with a diverse herbaceous layer underneath. Occasionally white spruce will germinate in large numbers on mineral soil after flooding, resulting in a dense, even-aged stand and eventual succession to Class E (via Class B).

*Maximum Tree Size Class*  
Seedling/Sapling <5"

Class B 18 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | *Salix* spp. | Willow | Upper |
| ALNUS | *Alnus* spp. | Alder | Upper |
| POBAB2 | *Populus balsamifera* ssp. *balsamifera* | Balsam poplar | Upper |
| ROAC | *Rosa acicularis* | Prickly rose | Lower |

Description

Tall shrubs (*Salix* spp. and *Alnus* spp.) and saplings with a closed canopy (>60%). Saplings may consist of balsam poplar with white spruce in the understory (succession to Class C), or saplings may consist of pure, even-aged spruce (succession to Class E). Saplings overtop shrubs at 20-40yrs, when shade-intolerant pioneer shrub species decline and shade-tolerant shrubs such as *Rosa acicularis* (prickly rose) and *Viburnum edule* (squashberry) become more common and have a canopy cover of 10%. The alternate succession pathway represents the possibility that white spruce will germinate in large numbers on mineral soil after flooding, resulting in a dense, even-aged stand.

*Maximum Tree Size Class*  
Seedling/Sapling <5"

Class C 40 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POBAB2 | *Populus balsamifera* ssp*. balsamifera* | Balsam poplar | Upper |
| PIGL | *Picea glauca* | White spruce | Middle |
| ROAC | *Rosa acicularis* | Prickly rose | Lower |
| VIED | *Viburnum edule* | Squashberry | Lower |

Description

Closed balsam poplar forest. Balsam poplar is the dominant overstory species, but white spruce is commonly in the understory. Shade-tolerant shrub species persist in the understory. If spruce is present, at approximately 100-150yrs the transition from balsam poplar to white spruce dominance begins (succession to Class D). If white spruce is not present, poplar persists, the stand ages, and individual trees are lost to wind, disease, or rot. Shrub cover commonly increases as the overstory canopy declines.

*Maximum Tree Size Class*  
Pole 5–9" (softwood)/5–11" (hardwood)

Class D 27 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIGL | *Picea glauca* | White spruce | Upper |
| ROAC | *Rosa acicularis* | Prickly rose | Lower |
| VIED | *Viburnum edule* | Squashberry | Lower |

Description

Open white spruce forest. Spruce gains dominance over poplar and a mixed age, open stand develops. If enough young spruce establishes as poplar declines, the canopy closes again (modeled as alternate succession to Class E). Alternatively, the stand may remain open with shrubs in the understory.

*Maximum Tree Size Class*  
Pole 5–9" (softwood)/5–11" (hardwood)

Class E 11 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIGL | *Picea glauca* | White spruce | Lower |
| ROAC | *Rosa acicularis* | Prickly rose | Lower |
| VIED | *Viburnum edule* | Squashberry | Lower |

Description

Closed white spruce forest. These stands may be even-aged, resulting from spruce establishment on mineral soil after a flood event (succession from Class B), or mixed age (succession from Class D). If succession is from Class D, occasional mature balsam poplar may persist in the overstory. As the spruce canopy closes, feathermoss becomes dominant on the forest floor, reaching 80% cover. *Rosa acicularis*, *Viburnum edule,* and *Alnus* spp. may be scattered in the stand. A low shrub and herb layer may also occupy the forest floor.

*Maximum Tree Size Class*  
Med. 9–20" (softwood)/11–20" (hardwood)

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 4 |
| Mid1:CLS | 5 | Mid1:OPN | 29 |
| Mid1:OPN | 30 | Late1:OPN | 149 |
| Late1:CLS | 30 | Late1:CLS | 399 |
| Late1:OPN | 150 | Late1:OPN | 399 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Optional 1 | Early1:ALL | Early1:ALL | 0.05 | 20 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.0025 | 400 | No | 0 |
| Optional 1 | Mid1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Alternative Succession | Mid1:CLS | Late1:CLS | 0.01 | 100 | Yes | 0 |
| Optional 1 | Mid1:CLS | Early1:ALL | 0.03 | 33 | Yes | 0 |
| Mixed Fire | Late1:OPN | Mid1:OPN | 0.0064 | 156 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.005 | 200 | Yes | 0 |
| Optional 1 | Late1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.005 | 200 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.02 | 50 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

Optional Disturbances

Optional 1: Flooding

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