16150

Western North American Boreal Lowland Large River Floodplain Forest and Shrubland

BpS Model/Description Version: Nov. 2024

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| --- | --- | --- | --- |
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Vegetation Type

Forest and Woodland

Map Zones

68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 80

Geographic Range

This Biophysical Setting (BpS) is found in the AK boreal region and in MZ76 associated with high volume interior rivers such as the Yukon, Kuskokwim, Koyukuk, and Tanana Rivers.

Biophysical Site Description

This BpS includes large floodplains associated with high volume interior rivers. The flooding regime is characterized by large spring floods at ice break-up caused by ice jams or summer floods caused by extreme rain events, the latter sometimes in combination with glacial melt. The active flooding zone often can be several kilometers wide (NatureServe 2008). Permafrost can be present in small lenses. It is very common on the Yukon River floodplain in the Yukon Flats (Kingslough & Chetlechak soils) and within the Yukon Charley River National Preserve. Ice scouring and ice dams are important dynamics that result in regeneration of willow carrs on the active floodplain and less frequently on higher terraces (NatureServe 2008). Wetland development in abandoned channels is intermixed with succession on more mesic sites (NatureServe 2008).

Vegetation Description

Primary succession on floodplains begins when new alluvial surfaces are colonized by herbaceous, shrub, and tree species. Common woody species include *Populus balsamifera, Picea glauca, Alnus viridis* ssp. Sinuate*, A. alnobetula* ssp. *sinuata* (more common south of the Alaska Range), *A. viridis* ssp. *fruticosa* (more common north of the Alaska Range), *A. incana* ssp. *tenuifolia, Salix barclayi*, *S. interior*, and *S. alaxensis* (Boggs 2000; Scott 1974; Shephard 1995; Thilenius 1990; Viereck 1966). Common early seral herbaceous species may include *Lupinus* spp., *Hedysarum* spp., *Equisetum* spp., *Artemisia tilesii, Eurybia sibirica, Chamerion latifolia,* and *Elymus* spp. A subsequent seral stage could include communities dominated by *Populus balsamifera* ssp. *balsamifera* and/or (less commonly) *Picea glauca* with an understory of *Alnus viridis* ssp. *sinuata*, *Salix* spp., or uniform stands of *Salix alaxensis*. The tall shrub component of the early successional stages diminishes rapidly because of decreased light from the dense tree overstory, and high levels of herbivory by moose or snowshoe hares may accelerate succession (Butler et al. 2007; Chapin et al. 2006). *Populus balsamifera* does not regenerate in the understory and consequently, *Picea glauca* gains dominance in the overstory within 150yrs. *Rosa acicularis, Cornus sericea,* and *Viburnum edule* are common understory shrubs in semi-open older stands. Bryophytes like *Hylocomim splendens* can dominate.

Eight general successional stages were described for the Tanana River floodplain (Van Cleve and Viereck):

1. bare surface (0-1 years)
2. bare surface, salt crust (1-2 years)
3. open shrub (2-5 years)
4. closed shrub (5-10 years)
5. young balsam poplar (20-40 years)
6. mature balsam poplar, young white spruce, alder (80-100 years)
7. old balsam poplar, young white spruce (125-175 years)
8. mature white spruce (200-300 years)

See also: [Boreal Scrub Loamy Flood Plain Low](https://edit.jornada.nmsu.edu/catalogs/esd/232X/XA232X01Y200), Ecological Site XA232X01Y200 for 1-4; [Boreal Forest Loamy Flood Plain Middle](https://edit.jornada.nmsu.edu/catalogs/esd/232X/XA232X01Y202), Ecological Site XA232X01Y202 for 5-6; [Boreal Forest Loamy Flood Plain High](https://edit.jornada.nmsu.edu/catalogs/esd/232X/XA232X01Y204), Ecological Site XA232X01Y204 for 7-8.

However, Hollingsworth and others (2010) note that many different successional trajectories are possible.

BpS Dominant and Indicator Species

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

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

Disturbance Description

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 create a pattern of gravel bars and early successional stages across the valley bottom. Sediment deposition raises the surface of the floodplain over time. The floodplain transitions to a terrace as the soil surface becomes farther removed from the channel, and subsequently flooding becomes less frequent. Water availability on terraces plays a major role in community structure and composition. Water inputs are 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.

Oxbows and other wet depressions commonly form on the floodplains and develop into wetlands. Succession and species composition is variable due to diverse environmental conditions such as water depth, substrate, and nutrient input. Aquatic bed, marsh, and fen communities are common.

Fire frequency in floodplain systems is considerably less than that of the surrounding terrain because channels can act as fuel breaks. According to Heinselman (1981), of the boreal forests in Alaska and Canada: "the longest fire cycles were probably in white spruce forests on the floodplains of major rivers where cycles may have been as long as 200 to 300 years. Perhaps some floodplain forests never burned." Of the few fire history studies on white spruce floodplain sites reviewed by Abrahamson (2014) studies on the Mackenzie River found sites that had not burned in 300 years (Heinselman1981, Rowe et al. 1984), and a study along the Tanana River found a 70-100 year interval between fires (Mann et al. 1995). The Fire Regime Synthesis of quaking aspen and balsam poplar (Fryer 2014) reported a fire cycle (not fire return interval) of 146 years for quaking aspen-paper birch on the Yukon River (Kasischke & Williams 2002) and a fire cycle of 26 years for a mixed quaking aspen, paper birch, and balsam poplar stand on the Porcupine River (Yarie 1981). Early seral vegetation is less flammable than mature boreal forest, which may develop an organic soil layer that can spread fire into the floodplain in dry years. Fires burn in an irregular pattern due to the variability of vegetation and soil moisture, resulting in a high degree of edge. For additional information about fire regimes in Alaskan floodplain communities, see Fire Regimes of Alaskan white spruce communities (Abrahamson 2014).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 4055 | 6 |  |  |
| Moderate (Mixed) | 280 | 94 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 262 | 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 system is found adjacent to a range of upland systems, including hardwoods (birch-dominated), upland white spruce, white spruce-hardwood, as well as all boreal black spruce types.

Issues or Problems

Frequency of major flood events on the larger rivers seems to be lower compared with the middle 20th century, as evident from the age of *Salix alaxensis* cohorts on higher terraces. With the advent of climate change and changing weather patterns, historical ice scouring/jamming and flooding events are no longer common. The decline in floods that deposit a silt cap for willow and poplar regeneration and in ice scouring that rejuvenates willows could have a major impact on reducing the amount of available winter forage for moose, an important game species in Interior Alaska.

Native Uncharacteristic Conditions

Comments

8/2022 – A reviewer stated that while uncertain about the pre-colonial fire regime in the Yukon Flats along the Yukon/Porcupine Rivers current data from NRCS suggests that “it burns pretty commonly here. We sampled 263 plots in this system and 58 were in some stage of fire succession with 18 having burned within 10 years or so of sampling.” Kori Blankenship adjusted the modeled MFRI from 294 to 263 years based on the reviewer’s comments as well as the relative fire frequency rankings developed for boreal forest BpS during the Boreal Forest BpS Review Work Session in February 2022. The change in fire frequency had almost no effect on the succession class proportions.

During LANDFIRE National, this BpS was created for the AK Boreal region and did not receive review for other regions in the state. This model was based on the FRCC Guidebook Potential Natural Vegetation Group (PNVG) model for Riparian Spruce Hardwood (RISH; Murphy and Witten 2006), input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and was refined by Kori Blankenship and Robert Lambrecht. The resulting model is similar to RISH but with minor adjustments to some of the class ages, including the removal of replacement fire in Class D, and the removal of the relative age setting for mixed fire in Class B, which violated LANDFIRE modeling rules.

The vegetation description is closely based on the Ecological System description (NatureServe 2008), with minor edits by Robert Lambrecht.

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 | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 5-10 | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 10-25 | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 25-50 | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | >50 | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf | C brdlf |
| Tree | 0-5 | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix |
| Tree | 5-10 | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix |
| Tree | 10-25 | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix |
| Tree | 25-50 | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix | C mix |
| Tree | >50 | C mix | C mix | C mix | C mix | C mix | C 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** |
| EQUIS | *Equisetum* spp. | Horsetail | Upper |
| SALIX | *Salix* spp. | Willow | Upper |
| POBAB2 | *Populus balsamifera* ssp*. balsamifera* | Balsam poplar | Upper |
| LUPIN | *Lupinus* spp. | Lupine | Upper |

Description

Post disturbance regeneration. This class can include gravel bar, herbs, shrub regeneration, and seedlings. Silt is deposited on the inside of river meanders following flood events, although it can occur on higher terraces. Flooding deposits seeds which germinate and take root. *Equisetum* spp. and *Salix* spp. colonize in the first year. Within five years *Salix* spp. and balsam poplar seedlings are abundant. Plant cover is 1-20% in the first year. Shrub cover increases up to 40% by the fifth year, with a diverse herbaceous layer underneath. *Lupinus* spp. and *Hedysarum* spp. are common herbaceous species in this stage.

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

Class B 12 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 | Upper |

Description

Tall shrubs (*Salix* spp., *Alnus* spp., *Populus balsamifera*) and saplings with a closed canopy (>60%). Saplings may consist of *Salix alaxensis* (dominant) or balsam poplar, with white spruce in the understory (succession to Class C). Saplings may also consist of pure, even-aged spruce (succession to Class E). Saplings overtop shrubs at 15-40yrs when shade-intolerant pioneer shrub species decline, and shade-tolerant shrubs (*Rosa acicularis, Viburnum edule*) become more common and have a canopy cover of 10%. Uncommonly, white spruce may germinate in large numbers on mineral soil after flooding, resulting in a dense, even-aged stand.

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 52 Mid Development 2 - All Structures

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

Balsam poplar is the dominant overstory species, though white spruce may co-dominate. 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. Stands tend to be closed but can be open depending on site conditions.

*Maximum Tree Size Class*  
Med. 9–20" (swd)/11–20" (hwd)

Class D 24 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 |
| ALNUS | *Alnus* spp. | Alder | Lower |

Description

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

*Maximum Tree Size Class*  
Med. 9–20" (swd)/11–20" (hwd)

Class E 8 Late Development 1 - Closed

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 |
| ALNUS | *Alnus* spp. | Alder | Lower |

Description

Closed white spruce. These stands can 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.

In the absence of disturbance, this class is self-replacing, with single tree or larger openings filled in by white spruce seedlings established in the understory. If the class begins as an even-aged stand, it will become uneven-aged over time.

*Maximum Tree Size Class*  
Med. 9–20" (swd)/11–20" (hwd)

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 4 |
| Mid1:CLS | 5 | Mid2:ALL | 19 |
| Mid2:ALL | 20 | Late1:OPN | 149 |
| Late1:CLS | 20 | Late1:CLS | 999 |
| Late1:OPN | 150 | Late1:OPN | 999 |

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 |
| Alternative Succession | Mid1:CLS | Late1:CLS | 0.01 | 100 | Yes | 0 |
| Optional 1 | Mid1:CLS | Early1:ALL | 0.03 | 33 | Yes | 0 |
| Mixed Fire | Mid2:ALL | Mid2:ALL | 0.0033 | 303 | No | 0 |
| Optional 1 | Mid2:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Late1:OPN | Mid2:ALL | 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 | 0.0033 | 303 | Yes | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

Optional Disturbances

Optional 1: Flooding

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