16150

Western North American Boreal Lowland Large River Floodplain Forest and Shrubland

Model Date: 03/11/08 Report Date: 9/11/15

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Vegetation Type

Forest and Woodland

Map Zones

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

Geographic Range

This type is found in the AK boreal region and in MZ76 associated with high volume interior rivers such as the Yukon, Kuskokwim, Koyukuk and Tanana.

Biophysical Site Description

This system includes large floodplains associated with high volume interior rivers. The flooding regime is characterized by large spring floods at 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 is usually absent, but can be present in small lenses. 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. sinuata, Alnus incana ssp. tenuifolia, Salix barclayi, 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. The next seral stage includes communities dominated by Populus balsamifera and/or (less commonly) Picea glauca with an understory of Alnus viridis ssp. Sinuata, Salix spp., and bryophytes or uniform stands of Salix alaxensis. On dry sites the shrub layer may be dominated by Dryas octopetala, D. integrifolia, and fruticose lichens (Steroucaulon spp.). 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). Populus balsamifera does not regenerate in the understory and consequently, Picea glauca gains dominance in the overstory within 150yrs. Rosa acicularis and Viburnum edule are common understory shrubs in semi-open older stands.

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)

However, Hollingsworth an 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 | Willow |
| ALNUS | Alnus | Alder |
| ROAC | Rosa acicularis | Prickly rose |
| VIED | Viburnum edule | Squashberry |
| LUPIN | Lupinus | Lupine |
| EQUIS | Equisetum | Horsetail |

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. 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 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 FRI) 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** | **Min FI** | **Max FI** | **Percent of All Fires** |
| Replacement | 9999 |  |  | 3 |
| Moderate (Mixed) | 303 |  |  | 97 |
| Low (Surface) |  |  |  |  |
| **All Fires** | **294** |  |  | **100** |

Scale Description

Linear

Non-Fire Disturbances

Insects/Disease

Other 1: Flooding

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

Review question:

-The modeled fire frequency for this BpS is on the long end of the few available studies. Should it be revised?

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, 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.

**Model Parameters**

*Using Track Changes in Word you may suggest changes to any of the parameters indicated in the following tables. If you wish to see how those changes impact model results, go to the “Simulation Model Review Instructions” section on* <http://www.landfirereview.org/models.html>*. If you do not wish to edit and run the actual model, the TNC LANDFIRE will do so and if requested provide the reviewer with the results.*

**Deterministic Transitions**

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

**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** |
| Optional1 | Early1:ALL | Early1:ALL | 0.0500 | 20 | No | 0 |
| Optional1 | Late1:CLS | Early1:ALL | 0.0020 | 500 | Yes | 0 |
| ReplacementFire | Late1:CLS | Early1:ALL | 0.0015 | 667 | Yes | 0 |
| Insect/Disease | Late1:CLS | Late1:OPN | 0.0200 | 50 | Yes | 0 |
| MixedFire | Late1:CLS | Late1:OPN | 0.0050 | 200 | Yes | 0 |
| Optional1 | Late1:OPN | Early1:ALL | 0.0050 | 200 | Yes | 0 |
| AltSuccession | Late1:OPN | Late1:CLS | 0.0050 | 200 | Yes | 0 |
| MixedFire | Late1:OPN | Mid2:ALL | 0.0064 | 156 | Yes | 0 |
| Optional1 | Mid1:CLS | Early1:ALL | 0.0300 | 33 | Yes | 0 |
| AltSuccession | Mid1:CLS | Late1:CLS | 0.0100 | 100 | Yes | 0 |
| Optional1 | Mid2:ALL | Early1:ALL | 0.0100 | 100 | Yes | 0 |
| MixedFire | Mid2:ALL | Mid2:ALL | 0.0025 | 400 | No | 0 |

Succession Classes

Class A 5 Early Development 1 - All Structures

Structural Information

Tree Size Class: Seedling/Sapling <5"

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| EQUIS | Equisetum | Horsetail | Upper |
| SALIX | Salix | Willow | Upper |
| POBAB2 | Populus balsamifera ssp. balsamifera | Balsam poplar | Upper |
| LUPIN | Lupinus | 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 and Hedysarum are common herbaceous species in this stage.

Class B 10 Mid Development 1 - Closed

Structural Information

Tree Size Class: Seedling/Sapling <5"

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Upper |
| ALNUS | Alnus | 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), or saplings may 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.

Class C 50 Mid Development 2 - All Structures

Structural Information

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

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.

Class D 25 Late Development 1 - Open

Structural Information

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

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 | 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.

Class E 10 Late Development 1 - Closed

Structural Information

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

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 | 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.

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