16142

Western North American Boreal Montane Floodplain Forest and Shrubland – Boreal Transition

BpS Model/Description Version: Nov. 2024

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

Forest and Woodland

Map Zones

73, 74, 75, 76, 77, 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 16142 should apply in level 2 ecoregions (Nowaki et al. 2001): Alaska Range Transition, Pacific Mountains Transition, Coast Mountains Transition, Coastal Rainforests.

Geographic Range

This BpS is found throughout the AK sub-boreal region adjacent to rivers.

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, do not develop permafrost.

Vegetation Description

Primary succession on floodplains begins when new alluvial surfaces are colonized by herbaceous, shrub, and tree species. Common early seral woody species include *Populus balsamifera* ssp*. trichocarpa* (seedlings), *Picea glauca* (seedlings), *Alnus viridis* ssp. *sinuata, Alnus incana* ssp. *Tenuifolia, Salix barclayi,* and *Salix alaxensis* (Boggs 2000, Scott 1974, Shephard 1995, Thilenius 1990, Viereck 1966). Herbaceous species may include *Equisetum* spp*., Chamerion latifolium, Lupinus* spp*.,* and *Hedysarum* spp. The next seral stage includes communities dominated by *Populus balsamifera* and/or *Picea glauca* with an understory of *Alnus viridis* ssp*. sinuata, Salix* spp. and bryophytes. On dry sites the shrub layer may be dominated by *Shepherdia canadensis, Dryas octopetala, D. integrifolia* and fruticose lichens (*Stereocaulon* spp.). As succession continues, the tall shrub component of the early successional stages diminishes rapidly, probably because of decreased light from the dense tree overstory. *Populus balsamifera* ssp*. trichocarpa* 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 on older surfaces.

BpS Dominant and Indicator Species

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

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 BpS. 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, as frequent flooding and channel migration create a pattern of gravel bars and early successional stages across the valley bottom, and 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 can come from overbank flow (flooding), ground water, and precipitation. Deposits with high permeability become progressively drier as sediment is added and they become increasingly vertically and horizontally removed from the active channels.

As discussed in the Riparian Spruce Hardwood Kenai Potential Natural Vegetation Group (PNVG) model description (Murphy and Witten 2006), small, relatively infrequent, mixed severity fires characterize this system due to the sites’ proximity to rivers, which act as fire breaks (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 this system than in typically adjacent upland vegetation types.

This BpS includes two successional pathways: one with a hardwood stage that succeeds to an open spruce stand and the other in which spruce establishes on mineral soil following a flood. Either of these pathways could result in an open or closed mature spruce stand. The successional classes in this model were defined by canopy cover classes in order to make them mappable. As a result, the system may move back and forth between the open and closed successional classes regardless of age.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 6702 | 10 |  |  |
| Moderate (Mixed) | 754 | 90 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 678 | 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

This model was based on the FRCC Guidebook PNVG model for Riparian Spruce Hardwood Kenai (RSHK; Murphy and Witten 2006) and input from the experts who attended the LANDFIRE Anchorage (Dec. 07) modeling meeting. The relative age function used in the RSHK model was not used in any class except Class A to comply with LANDFIRE modeling rules. Because changes to the VDDT model were relatively minor, Karen Murphy and Evie Witten were retained as modelers and Kori Blankenship's name was added.

In the first draft of the model, Classes D and E were indistinguishable for mapping (because both could be open or closed canopy forest). Tina Boucher reviewed an early draft of this model and confirmed that both successional pathways could lead to either open or closed stands. To correct this, Colleen Ryan defined Class D as open and Class E as closed and added an alternative succession pathway from Class E to Class D. This is meant to represent the possibility that some closed stands could open up over time (after age 150). This change did not substantially change the class landscape percentages.

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 6 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| EQUIS | *Equisetum* spp. | Horsetail | Upper |
| SALIX | *Salix* spp. | Willow | Upper |
| ALNUS | *Alnus* spp. | Alder | Upper |

Description

Silt is deposited on the inside of river meanders following flood events. Flooding deposits seeds which germinate and take root. *Equisetum* spp. and *Salix* spp. colonize in the first year. Within five years *Salix* spp and black cottonwood seedlings are abundant. Plant cover is 1-2% first year. Shrub cover increases up to 40% by the fifth year, with a diverse herbaceous layer underneath. Occasionally white (or Lutz) spruce will germinate in large numbers on mineral soil after flooding, resulting in a dense, even-aged stand. Common woody species include *Alnus viridis* ssp*. sinuata, Alnus incana* ssp*. tenuifolia, Salix barclayi* and *Salix alaxensis* (Boggs 2000, Scott 1974, Shephard 1995, Thilenius 1990, Viereck 1966). Herbaceous species may include *Equisetum* spp*., Chamerion latifolium, Lupinus* spp. and *Hedysarum* spp. On dry sites the shrub layer may be dominated by *Shepherdia canadensis, Dryas octopetala, D. integrifolia* and fruticose lichens (*Stereocaulon* spp.).

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

Class B 16 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | *Salix* spp. | Willow | Upper |
| ALNUS | *Alnus* spp. | Alder | Upper |
| ROAC | *Rosa acicularis* | Prickly rose | Upper |
| VIED | *Viburnum edule* | Squashberry | Upper |

Description

This class is typically dominated by tall shrubs (*Salix* spp*., Alnus* spp.) and saplings with a closed canopy (>60%). Common woody species include *Alnus viridis* ssp*. Sinuata, Alnus incana* ssp*. Tenuifolia, Salix barclayi,* and *Salix alaxensis*. On dry sites the shrub layer may be dominated by *Shepherdia canadensis, Dryas octopetala, D. integrifolia*, and fruticose lichens (*Steroucaulon* spp.). Saplings may consist of black cottonwood with white (or Lutz) 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 (*Rosa aciculIaris* (prickly rose) or *Viburnum edule* (high bush cranberry)) become more common and have a canopy cover of 10%.

The alternate succession pathway to Class E 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 28 Mid Development 1 - Open

Indicator Species

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

Description

Black cottonwood is the dominant overstory species. White spruce (or Lutz) is commonly in the understory. Shade-tolerant shrub species persist in the understory. If spruce is present, at approximately 100-150yrs the transition from black cottonwood 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" (swd)/5–11" (hwd)

Class D 38 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

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.

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

Class E 12 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 |
| ALNUS | *Alnus* spp. | Alder | Lower |

Description

This class contains closed stands of white (or Lutz) spruce. These stands may be even-aged, resulting from spruce establishment on mineral soil after a flood event (succession from Class A), or mixed age (succession from Class D). If succession is from Class D, occasional mature black cottonwood 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. This class may persist in the absence of disturbance, or the canopy may open up as the stand matures on some sites, causing a transition back to Class D.

*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 | Mid1:OPN | 29 |
| Mid1:OPN | 30 | Late1:OPN | 149 |
| Late1:CLS | 30 | 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 | 0.1 | 10 | 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 | 0.0012 | 833 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0003 | 3333 | Yes | 0 |
| Optional 1 | Late1:OPN | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.0012 | 833 | Yes | 0 |
| Insects or Disease | Late1:CLS | Late1:OPN | 0.02 | 50 | Yes | 0 |
| Alternative Succession | Late1:CLS | Late1:OPN | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.0003 | 3333 | Yes | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.002 | 500 | Yes | 0 |

Optional Disturbances

Optional 1: Flooding

References

Barney, R.J. 1971. Wildfires in Alaska – some historical and projected effects and aspects. In: Fire in the Northern Environment – a symposium [Fairbanks, Alaska]. P. 51-59.

Boggs, K. 2000. Classification of community types, successional sequences, and landscapes of the Copper River Delta, Alaska. Gen Tech. Rep. PNW-GTR-469. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 244 pp.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

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. 108 pp.

Murphy, K.A. and E. Witten. 2006. Riparian Spruce Hardwood Kenai. In Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions. Available at www.frcc.gov.

Scott, R.W. 1974. Successional patterns on moraines and outwash of the Frederika Glacier, Alaska. In: Bushnell, V.C.; Marcus, M.G., eds. Icefield ranges research project scientific results. New York: American Geographical Society: 319-329. Vol. 4.

Shephard, M.E. 1995. Plant community ecology and classification of the Yakutat Foreland, Alaska. R10-TP-56.

Thilenius, J.F. 1990. Woody plant succession on earthquake-uplifted coastal wetlands of the Copper River Delta, Alaska. Forest Ecology and Management 33/34: 439-462.

Viereck, L.A. 1966. Plant succession and soil development on gravel outwash on the Muldrow Glacier, Alaska. Ecological Monographs. 36(3): 181-199.

Viereck, L.A. 1973. Ecological effects of river flooding and forest fires on permafrost in the taiga of Alaska. In: Permafrost - - The North American Contribution to the Second International Conference. National Academy of Sciences, Washington, DC. 60-67 pp.