LANDFIRE Biophysical Setting Model

Biophysical Setting **7016150** **Western North American Boreal Lowland Large River Floodplain Forest and Shrubland**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field **Date** 3/11/2008

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Vegetation Type
Forest and Woodland

Map Zone
70

Model Zone
☑ Alaska
☐ California
☐ Great Basin
☐ Great Lakes
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Dominant Species*

PIGL ROAC
POBAB2 VIED
SALIX LUPIN
ALNUS EQUIS

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This type is found in the AK boreal region 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 tree, shrub and herbaceous 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

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component of the early successional stages diminishes rapidly because of decreased light from the dense tree overstory. In addition, 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.

Disturbance Description

Flooding can be caused by snow melt, 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. 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.

Adjacency or Identification Concerns

This system is found adjacent to a range of upland systems, including hardwoods (birch-dominated), upland white spruce and white spruce-hardwood, as well as all boreal black spruce types.

Native Uncharacteristic Conditions

Scale Description

Linear

Issues/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 AK.

Comments

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.

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

Vegetation Classes

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

EQUIS	Upper
SALIX	Upper
POBAB2	Upper
LUPIN	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)	Low Shrub (20 cm to 1.5 m)
Tree Size Class	Seedling/Sapling <5"	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

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.

Succession to class B. Flooding (probability = 0.05), represented by Option 1 in the model, resets the age of this class.

Class B 10 %

Mid Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

SALIX	Upper
ALNUS	Upper
POBAB2	Upper
ROAC	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Closed Shrub (> 75% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Low Shrub (20 cm to 1.5 m)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

5-19yrs

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.

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Succession to class C or E. The deterministic succession pathway is to class C. The alternate succession pathway to E (probability = 0.01) represents the possibility that white spruce will germinate in large numbers on mineral soil after flooding, resulting in a dense, even-aged stand. Flooding (probability = 0.03), represented by Option 1 in the model, causes a transition to class A.

Class C **50 %**

Mid Development 2 All Structures

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Indicator Species* and Canopy Position

POBAB2	Upper
PIGL	Middle
ROAC	Lower
VIED	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Presence of hardwoods distinguishes class C from classes D and E.

Description

20-149yrs

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.

Succession to class D. Flooding (probability = 0.01), represented by Option 1 in the model, causes a transition to class A. Mixed fire (MFRI = 400yrs) maintains this class.

Class D **25 %**

Late Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
ROAC	Lower
VIED	Lower
ALNUS	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open (25-59% tree cover)	Open (25-59% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

150-400yrs

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.

This class can persist in the absence of disturbance or follow an alternate succession pathway to E (probability = 0.005). Flooding (probability = 0.005), represented by Option 1 in the model, causes a transition to class A. Mixed fire (MFRI = 150yrs) causes a transition to class C.

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Class E **10 %**

Late Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
ROAC	Lower
VIED	Lower
ALNUS	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

20-400yrs

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.

This class will persist in the absence of disturbance. Flooding (probability =0.002), represented by Option 1 in the model, causes a transition to class A. Mixed fire (MFRI = 200yrs) causes a transition to class D. Replacement fire (MFRI = 667yrs) causes a transition to class A. Insects/disease (probability = 0.02) can cause a transition to class D.

Disturbances

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	9999			0.00010	3
Mixed	303			0.00330	97
Surface					
All Fires	294			0.00341	

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fir combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inver 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.

Additional Disturbances Modeled

☑ Insects/Disease ☐ Native Grazing ☑ Other (optional 1) Flooding
☐ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

References

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: US Dept. Ag. Forest Service, Pacific Northwest Research Station. 244 pp.

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Butler, L.G., K. Kielland, T.S. Rupp and T.A. Hanley. 2007. Interactive controls of herbivory and fluvial dynamics over vegetation patterns along the Tanana River, interior Alaska. J. Biogeography 34: 1622-1631.

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

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

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: 4: 319-329.

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.

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