LANDFIRE Biophysical Setting Model

Biophysical Setting 7016011 Western North American Boreal Treeline White Spruce Woodland - Boreal

☑ *This BPS is lumped with: WNA Boreal Spruce-Lichen Woodland (in part)*

☑ *This BPS is split into multiple models: Western North American Boreal Treeline White Spruce Woodland was split into a boreal and sub-boreal variant for BpS modeling so that regional differences could be represented.*

Boreal Spruce Lichen Woodland may occur as a seral stage or variant of Boreal Treeline White Spruce Woodland, Boreal Mesic Black Spruce Forest, or, less commonly, in these same systems in the sub-boreal region.

General Information

Contributors (also see the Comments field **Date** 4/8/2008

Modeler 1 Tricia Wurtz twurtz@fs.fed.us **Reviewer**

Modeler 2 **Reviewer**

Modeler 3 **Reviewer**

Vegetation Type

Forest and Woodland

Map Zone

70

Model Zone

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

Dominant Species*

PIGL	LEDUM
PIMA	ALVI5
BENA	SAPU15
VAUL	BEPA

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This type is found in boreal AK from the south slopes of the Brooks Range to the north slopes of the Alaska Range and west to the limit of tree growth. Boreal Spruce-Lichen Woodland, which is included as a variant of a later seral stage within this type, occurs primarily in the northern and western portions of the boreal zone.

Biophysical Site Description

Boreal White Spruce Woodland occurs primarily near the elevational and latitudinal limit of tree growth. It occurs above Boreal White Spruce to 900m (Boggs et al. 2001) and below the subalpine shrub and tundra systems and can be seen as the forested transition zone between boreal white spruce forest and non-forested subalpine vegetation. Depending on the topography, this system can occupy a narrow band just below non-forested subalpine or a broad expanse across gentle slopes and benches. Soils are cold, but peat-forming mosses are not common in the ground layer.

Vegetation Description

This type is dominated by Picea glauca although Picea mariana may be codominant (NatureServe 2008). Canopy cover is generally between 10-25%. Hardwoods, if present, can include Betula papyrifera and Populs tremuloides. The shrub layer typically features Betula nana, but other shrubs such as Vaccinium uliginosum, Ledum groenlandicum and Salix pulchra may be common or dominant (NatureServe 2008).

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In some locations Alnus viridis is the dominant understory shrub (NatureServe 2008). Feathermoss may be common in the in the ground layer (NatureServe 2008). On drier or more exposed sites, Cladina spp. replace feathermosses as the dominant ground cover (Viereck 1979).

Disturbance Description

This information was taken from the draft Boreal Ecological Systems description (NatureServe 2008), which notes that fire information is lacking:

Fire return interval is in the vicinity of 100yrs, shorter than for Western North American Boreal Treeline White Spruce Woodland - Alaska Sub-boreal.

A possible scenario for post-fire succession in this type is the resprouting of low shrubs from underground propagules followed by Picea glauca invading by seed from adjacent stands or surviving trees. Betula papyrifera may invade the site if a seed source is available and site conditions are favorable. The typical succession sequence for this type does not include a hardwood sere. The rate of succession depends on severity of fire and seed source and some sites may be shrub-dominated for long periods without spruce invasion.

The successional relationships of the Boreal Spruce-Lichen Woodland included here are poorly understood. This system has been included in this model as a variant of the late successional stage (class C).

Adjacency or Identification Concerns

This system is similar to Western North American Boreal Treeline White Spruce Woodland - Alaska Sub-boreal but does not include an insects and disease probability and has a more frequent MFRI.

Native Uncharacteristic Conditions

Scale Description

Large patch

Issues/Problems

Experts at the LANDFIRE Fairbanks modeling meeting (Nov. 07) indicated the need for a late seral woodland white spruce-lichen class that could develop after approximately 200yrs in the absence of disturbance. This class was not included as a separate class because it was felt that LANDFIRE would not be able to distinguish it for mapping. The woodland white spruce-lichen concept is included in class C in the current model.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks modeling meeting (Nov. 07) and refined by Tricia Wurtz.

Vegetation Classes

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Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
VAUL	Upper
LEGR	Upper
SAPU15	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)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-24yrs

This class is characterized by herbaceous and shrub vegetation. Shrubs resprout from underground propagules and then Picea glauca invades by seed from adjacent stands or surviving trees. The shrub layer typically features Betula nana, but other shrubs such as Vaccinium uliginosum, Ledum groenlandicum and Salix pulchra may be common or dominant. In some locations Alnus viridis is the dominant understory shrub. Feathermoss may be common in the in the ground layer. On drier or more exposed sites, Cladina spp. replace feathermosses as the dominant ground cover (Viereck 1979). The rate of succession depends on severity of fire and seed source, and some sites may be shrub-dominated for long periods without spruce invasion.

The main successional trajectory is to class C (white spruce woodland) but an alternate succession pathway to class B (probability = 0.04) represents sites where hardwoods may invade the site if a seed source is available and site conditions are favorable. Replacement MFRI = 150yrs.

Class B 15 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
PIGL	Upper
PIMA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Presence of hardwoods distinguishes class B from class C.

Description

25-69yrs

This class is characterized by hardwood or white spruce-hardwood mixed forest. Betula papyrifera and/or Populs tremuloides invade with or without spruce and gain canopy dominance over the shrubs. Forest canopy cover is generally 10-25%. Eventually hardwoods senesce and white spruce gains canopy dominance (class C).

Succession to class C. Replacement MFRI = 150yrs. Mixed fire (MFRI = 300yrs) maintains this class.

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Class C 75 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
PIMA	Upper
BENA	Low-Mid
CLADI3	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Absence of hardwoods distinguishes class C from class B.

Description

25yrs+

This class is characterized by open white spruce woodland. Forest canopy cover is generally 10-25%. Hardwoods, if previously present in the stand, lose dominance in overstory during this phase. The understory may include various combinations of low shrubs, herbs and mosses. Lichens grow as the stand ages. This class includes the Spruce-Lichen Woodland system on some sites. The dominant lichen genus is typically Cladina; species include C. arbuscula, C. mitis, C. rangiferina and C. stellaris. Other lichens may include Cetraria cucullata, C. islandica, C. nivalis, Bryoria spp., Alectoria nigricans and Alectoria ochroleuca.

Beetles affect this class but because the rate of outbreaks is uncertain and generally not severe enough to cause a state transition, they were not included in the VDDT model. The frequency and severity of beetle outbreaks will likely increase under a warmer climate.

This class persists in the absence of disturbance. Replacement MFRI = 150yrs. Mixed fire (MFRI = 300yrs) maintains this class.

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	150.2			0.00666	69
Mixed	333.0			0.00300	31
Surface					
All Fires	104			0.00967	

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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Boggs, K., A. Garibaldi, J. Stevens, J. Grunblatt and T. Helt. 2001. Denali National Park and Preserve Landcover mapping project. Volume 2: Landcover classes and plant associations. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, 707 A Street, Anchorage, AK. 164 pp.

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.

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

Viereck, L.A. 1979. Characteristics of treeline plant communities in Alaska. Holarctic Ecology. 2: 228-238.

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LANDFIRE Biophysical Setting Model

Biophysical Setting 7016030 Western North American Boreal White Spruce-Hardwood Forest

☑ *This BPS is lumped with: Western North American Boreal White Spruce Forest*

☐ *This BPS is split into multiple models: Boreal White Spruce Forest was lumped with this type because it was felt that although it is a separate existing vegetation type, a separate biophysical environment could not be described for it.*

General Information

Contributors (also see the Comments field **Date** 3/12/2008

Modeler 1	Kori Blankenship	kblankenship@tnc.org	**Reviewer**	Tina Boucher	antvb@uaa.alaska.edu
Modeler 2	Robert Lambrecht	Robert_Lambrecht@fws.gov	**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type

Forest and Woodland

Map Zone

70

Model Zone

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

Dominant Species*

PIGL	ARUV
PIMA	VAVI
BEPA	BENA
POTR5	CHANA

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Boreal White Spruce-Hardwood Forest occurs from the southern slopes of the Brooks Range to southcentral AK and west to the limit of tree growth.

Biophysical Site Description

These systems occur on rolling hills, inactive terraces and mountain side slopes up to 750m. Soils are typically derived from glacial or other depositional processes and include moraines, drumlins, eskers, kettle-kame, colluvium and loess deposits (NatureServe 2008). These systems commonly occur on well-drained upland terrain on west, east and south aspects, but are possible on all aspects (NatureServe 2008). Permafrost is commonly absent.

Boreal Spruce-Lichen Woodland occurs most commonly on cool, well-drained sites with thin soils (NatureServe 2008).

Vegetation Description

Canopy cover in mature stands is dominated by Picea glauca and typically ranges from 25-70%, except in the case of Boreal Spruce-Lichen Woodland, which has a more open canopy (10-25% cover). Other trees such as Picea mariana, Betula papyrifera and Populus tremuloides may be subdominant in the overstory, but Picea glauca contributes at least 75% of the total forest canopy in the forested type (NatureServe 2008). Mature stands are often open-canopied with a well-developed shrub layer (NatureServe 2008). The woodland type may be dominated by Picea mariana (NatureServe 2008).

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Common understory shrubs include Arctostaphylos uva-ursi, Vaccinium vitis-idaea, V. uliginosum, Betula nana, Empetrum nigrum, Ledum palustre ssp. decumbens, L. groenlandicum, Rosa acicularis and Viburnum edule. Arctostaphylos rubra and Shepherdia canadensis are typically found on dryer sites (Viereck et al. 1992). Common herbaceous species include Chamerion angustifolium ssp. angustifolium and Calamagrostis canadensis. Other herbaceous species can include Equisetum sylvaticum, E. arvense, Geocaulon lividum, Mertensia paniculata, Pyrola ssp., Linnaea borealis and Goodyera repens (Viereck et al. 1992). Feather mosses such as Hylocomium splendens and Pleurozium schreberi are common in the ground layer of the forested type (Boggs and Sturdy 2005). In the mature woodland type, feather mosses are less important, while lichens, primarily Cladina spp, form a very important component of the understory (NatureServe 2008).

Disturbance Description

The disturbance regime is characterized by large crown fires with estimates of mean fire return intervals ranging from 50-238yrs (Rowe 1972; Heinsleman 1981; Yarie 1981, 1983; Foote 1983; Duchesne and Hawkes 2000). Except in the case of severe fires, post-fire succession tends to return to the pre-disturbance forest type (Foote 1983). Pre-burn species colonize the site via rhizomes, root sprouts and trunk sprouts (NatureServe 2008). A variety of herbaceous communities dominate: primarily Chamerion angustifolium ssp. angustifolium and Calamagrostis canadensis (NatureServe 2008). Betula papyrifera, Populus tremuloides or Picea glauca may individually invade and dominate sites, but eventually Picea glauca gains dominance over hardwoods (NatureServe 2008). In severe fires, the organic layer is consumed killing the underground propagules and revegetation of the site is by seed.

A typical successional sequence progresses from herbaceous to shrub to hardwood/hardwood-spruce to spruce (NatureServe 2008). In upland spruce stands post-burn succession occasionally skips the hardwood/hardwood-spruce stage (class C in this model) and proceeds directly to a spruce dominated stage (Viereck et al. 1992). The former successional scenario is typical of the Fairbanks area while the later is more common around Yukon Charley, Noatak, northeast boreal and at higher elevations (NatureServe 2008). Boreal Spruce-Lichen Woodland may occur as a very late successional stage of this system.

Post-fire regeneration of white spruce appears to be more successful when fires occur in mast years (Peters et al. 2005). This interaction between fire, masting and subsequent tree regeneration could have implications for historical stand structure and successional dynamics over time (Peters et al. 2005).

Adjacency or Identification Concerns

This system may be found alongside any boreal black spruce or hardwood systems.

Native Uncharacteristic Conditions

Recent warmer and drier conditions, along with human activities including fire suppression and some logging practices have likely increased the current frequency and severity of spruce bark beetle outbreaks compared with presettlement conditions.

Scale Description

This BpS occurs in a matrix with other vegetation types. Crown fires were typically large patch occurrences.

Issues/Problems

It should be noted that there is a considerable variation across the range of this community type. This

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description and the associated model attempt to capture the most common attributes of the system across its range.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks modeling meeting (Nov. 07) and refined by Robert Lambrecht. Experts from this workshop indicated the potential need for a self-replacement spruce model and another for the short-term mix of spruce and hardwood. This model represents both concepts using a deterministic pathway to represent the more common spruce-hardwood pathway and an alternate succession pathway to represent the less common spruce-spruce pathway.

This model may need to be split into two regional variants: this model to cover most of the boreal region and a variant with a lower fire return interval and no birch, to apply to the Copper River Basin and the Wrangell Mountains.

Though Robert Lambrect originally lumped Western North American Boreal Spruce-Lichen Woodland into this model as a late seral stage, a reviewer suggested that the Spruce Lichen Woodland would be a better fit as a seral stage of the Boreal and Sub-boreal Treeline White Spruce Woodland and the Mesic Black Spruce Forest models. Colleen Ryan removed the reference to the lump in this model but did not alter the description or VDDT model. The model still includes a seral stage with lichens.

Tina Boucher reviewed a draft of this model.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CHANA2	Upper
CACA4	Upper
EQSY	Upper
EQAR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

Post disturbance regeneration. A variety of herbaceous communities dominate; primarily Chamerion angustifolium ssp. angustifolium and Calamagrostis canadensis. Other herbaceous species can include Equisetum sylvaticum, E. arvense, Geocaulon lividum, Mertensia paniculata and Pyrola spp. (Viereck et al. 1992). Shrubs and trees resprout from root stocks, but woody cover is low.

Succession to class B. Replacement MFRI = 150yrs.

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Class B 15 %

Early Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ARUV	Upper
VAVI	Upper
BENA	Upper
LEPAD	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)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

5-29yrs

This stage is dominated by shrubs and saplings. Common shrub species include Rosa acicularis, Viburnum edule, Betula nana, Ledum palustre ssp. Decumbens, L. groenlandicum, Vaccinium vitis-idaea, V. uliginosum and Empetrum nigrum. Arctostaphylos uva-ursi, Arctostaphylos rubra and Shepherdia canadensis are typically found on dryer sites (Viereck et al. 1992). Betula papyrifera and Populus tremuloides saplings are common on some sites.

Succession to class C. The alternate succession pathway to D (probability = 0.01) represents self-replacing white spruce stands in areas where there is no adjacent hardwood seed source (e.g., Noatak, northeast boreal and higher elevation). Replacement MFRI = 150yrs.

Class C 30 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
PIGL	Upper
ROAC	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Presence of hardwoods distinguishes class C from D.

Description

30-129yrs

This is predominantly a hardwood forest although conifers may be present and mixed with the hardwoods. Trees begin to shade out the shrub understory. The overstory dominants include Betula papyrifera and Populus tremuloides. Picea glauca and P. mariana may be present. Common understory species include Rosa acicularis, Viburnum edule, Arctostaphylos spp., Linnaea borealis, Chamerion angustifolium and Geocaulon lividum

Succession to class E. Replacement MFRI = 150yrs. Mixed fire (MFRI = 300yrs) maintains this class.

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Class D 10 %

Mid Development 2 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
BENA	Lower
ARRU	Lower
VAVI	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Absence of hardwoods distinguishes class D from C. There are not mapping criteria to distinguish class D from E but trees are likely shorter and the stand likely more dense in D than in E.

Description

30-129yrs

This class represents mid-seral, self-replacing white spruce stands in areas where there is no adjacent hardwood seed source or geographic areas that tend to lack the hardwood component such as the Noatak, northeast boreal region and higher elevations. Picea glauca dominates the overstory but P. mariana may be present.

Succession to class E. Replacement MFRI = 150yrs. Mixed fire (MFRI = 300yrs) maintains this class.

Class E 40 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
ROAC	Lower
VIED	Lower
BENA	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% 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.

Absence of hardwoods distinguishes class E from C. There are not mapping criteria to distinguish class D from E but trees are likely shorter and the stand likely more dense in D than in E.

Description

130yrs+

Mature spruce forest. Hardwoods senesce. Accumulation of evergreen litter begins to change soil characteristics.
Picea glauca dominates the overstory but P. mariana may be present. Common understory species include Rosa acicularis, Viburnum edule, Shepherdia canadensis, Vaccinium vitis-idaea, Arctostaphylos spp., Linnaea borealis, Chamerion angustifolium and Geocaulon lividum

This stage incorporates the concept of Boreal Spruce-Lichen Woodland where lichens, primarily Cladina spp., are a very important component of the understory. Feather mosses are not as important as in other white spruce systems.

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This class persists in the absence of disturbance. Replacement MFRI = 150yrs. Mixed fire (MFRI = 300yrs) maintains this class.

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	149.7			0.00668	71
Mixed	364.2			0.00275	29
Surface					
All Fires	106			0.00943	

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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016041 Western North American Boreal Mesic Black Spruce Forest - Boreal

☑ *This BPS is lumped with: WNA Boreal Spruce-Lichen Woodland (in part)*

☑ *This BPS is split into multiple models: Western North American Boreal Mesic Black Spruce Forest was split into a boreal and sub-boreal variant for BpS modeling so that regional differences could be represented.*

Boreal Spruce Lichen Woodland may occur as a seral stage or variant of Boreal Treeline White Spruce Woodland, Boreal Mesic Black Spruce Forest, or, less commonly, in these same systems in the sub-boreal region.

General Information

Contributors (also see the Comments field **Date** 3/12/2008

Modeler 1	Jill Johnstone	jill.johnstone@usask.ca	**Reviewer**	Will Putnam	wputman@tananachiefs.org
Modeler 2			**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type

Forest and Woodland

Map Zone

70

Model Zone

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

Dominant Species*

PIMA	BENA
BEPA	LEDUM
POTR5	SALIX
PIGL	CACA4

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This type occurs throughout the boreal region of AK.

Biophysical Site Description

This type is typically found on upland slopes and inactive alluvial deposits (NatureServe 2008). Soils are well-drained, and permafrost is generally absent (NatureServe 2008). There is little to no peat development; but there may be an organic layer derived from non-sphagnum mosses (NatureServe 2008).

Vegetation Description

Picea mariana is the dominant overstory species, but Picea glauca may be codominant on some sites (NatureServe 2008). Early successional stands may be dominated by Betula papyrifera or Populus tremuloides (NatureServe 2008). Populus tremuloides replaces Betula papyrifera on drier sites (Foote 1983, Chapin et al. 2006). Common understory shrubs include Rosa acicularis, Betula nana, Ledum spp., V. uliginosum, Vaccinium vitis-idaea and Empetrum nigrum (NatureServe 2008). Herbaceous species include Calamagrostis canadensis, Chamerion angustifolium (Epilobium angustifolium) and Equisetum spp. Common mosses include Hylocomium splendens and Pleurozium schreberi (NatureServe 2008). Lichens, such as Cladina spp., may be abundant, especially in later seral stages (NatureServe 2008). Total tree cover in mature stands typically ranges from 40-70% (NatureServe 2008).

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

Crown fires or ground fires of enough intensity to kill overstory trees are the dominant disturbance influencing Boreal Mesic Black Spruce. Mean fire return interval estimates for boreal black spruce in interior AK range from 25yrs to 130yrs (Yarie 1983, Heinselman1981, Viereck 1983, Viereck 1986).

The post-fire successional trajectory may be self-replacement, with black spruce following the early seral herb and shrub stages; alternatively, black spruce-hardwood may follow the early seral stages before returning to black spruce (Chapin et al. 2006). The pre-burn stand composition will influence the likely successional trajectory with pre-burn spruce stands more likely to succeed to spruce and pre-burn hardwood stands more likely to succeed to hardwood after the fire. If white spruce is present in the conifer initiation, then white and black spruce can be codominant in the conifer canopy throughout the successional stages.

Wind and insect damage affect this type but very little research exists to help describe or model that effect. These disturbances are also much smaller in their impacts than the dominant, stand-replacement disturbances caused by fire.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Matrix

Issues/Problems

The probability of fire in the mixed spruce-hardwood stage (class C) relative to the spruce dominated stages (class D and E) is unclear. It was assumed that the herb and shrub dominated stages (class A and B) are less fire prone, and therefore have a lower fire probability, than the later seral stages. The probability and effects of insects, disease and wind/weather events in this system are unclear and are included in the old-growth stage (class E) of the model as a place holder.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) and Anchorage (Dec. 07) modeling meetings and refined by Jill Johnstone.

Will Putnam expressed concern that the distinction between this BpS and Western North American Boreal White Spruce-Hardwood Forest is ambiguous. They can occur on similar sites, and in many cases the relative dominance of P. mariana vs. P. glauca is mostly a function of succession and/or disturbance history.

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

CACA4	Upper
CHAN9	Upper
EQUIS	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

Post-disturbance, herbaceous vegetation. Common herbaceous species include Calamagrostis canadensis, Chamerion angustifolium (Epilobium angustifolium) and Equisetum spp (NatureServe 2008).

Succession to class B. Replacement MFRI = 250yrs.

Class B 15 %

Early Development 2 Open

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

SALIX	Upper
BENA	Upper
LEDUM	Upper
ROAC	

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open Shrub (25-74% shrub cover)	Open Shrub (25-74% 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

5-29yrs

This class is shrub dominated. Common species include willow, Betula nana, Ledum spp, Rosa acicularis, Vaccinium uliginosum, V. vitis-idaea and Empetrum nigrum. Both hardwoods and spruce regeneration may be present.

The successional trajectory of the shrub stage will depend on the pre-burn stand composition. If hardwoods dominated the site before the burn, they are likely to vigorously resprout and gain dominance after the fire. If spruce dominated the site before a burn, they are likely to regain dominance in the post-fire stand.

Succession to class C or D. One possible successional trajectory (represented by deterministic succession in the model) would include a hardwood phase (class C). But this class can also take an alternative successional pathway (probability = .02) directly to a spruce dominated phase (class D). Replacement MFRI = 250yrs.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class C 30 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
PIMA	Upper
PIGL	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Presence of hardwoods distinguishes C from D and E.

Description

30-119yrs

Mixed hardwood-spruce forest. Hardwoods and spruce overtop shrubs and gain dominance. Early in this age class trees are at least 2.5cm DBH and 4-8m tall (Foote 1983). Populus tremuloides replaces Betula papyrifera on drier sites (Foote 1983, Chapin et al. 2006). Spruce may occur as an understory, subdominant and/or co-dominant component. Tree density may be < or >60% depending on site conditions. Beneath trees, shrubs, herbs and mosses exist. As the stage advances, spruce and moss become more important.

Succession to class E. Replacement MFRI = 150yrs. Mixed fire (MFRI = 250yrs) maintains this class.

Class D 30 %

Mid Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PIGL	Upper
BENA	Lower
LEDUM	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping purposes, if tree size class can't distinguish class D and E, class D can be considered closed and E woodland and open.

Description

30-119yrs

Mid-seral black spruce/feathermoss. Picea mariana dominates but Picea glauca may be codominant on some sites. Spruce overtops the shrubs. Spruce canopy cover is commonly 50-70%.

Succession to class E. Replacement MFRI = 80yrs. Mixed fire (MFRI = 133yrs) maintains this class.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E 20 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PIGL	Upper
BENA	Lower
LEDUM	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Open (25-59% 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.

For mapping purposes, if tree size class can't distinguish class D and E, class D can be considered closed and E woodland and open.

Description

120yrs+

Open, old-growth black spruce. Picea mariana dominates but Picea glauca may be codominant on some sites. Spruce gains dominance over hardwoods (if previously present). Tree canopy cover is generally <60% and may be <25% (woodland) depending on site conditions. Occasional hardwoods may remain. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens. If fire is absent for long periods paludification may occur, resulting in an opening of the tree canopy to woodland conditions.

Black Spruce-Lichen Woodland may occur in this class.

This class persists in the absence of disturbance. Replacement MFRI = 80yrs. Mixed fire (MFRI = 133yrs) maintains this class. Insects/disease (probability = 0.001) and wind/weather/stress (probability = 0.01) can cause a transition to class D.

Disturbances

Fire Regime Group:** III

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	111.9			0.00893	65
Mixed	206.3			0.00485	35
Surface					
All Fires	73			0.01379	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Chapter 23.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016050 Western North American Boreal Mesic Birch-Aspen Forest

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

General Information

Contributors (also see the Comments field **Date** 4/16/2008

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Modeler 3	Kori Blankenship	kblankenship@tnc.org	**Reviewer**		

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*

BEPA	VIED
POTR5	SHCA
POBA2	ALNUS
ROAC	LEDUM

General Model Sources

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range

Found throughout boreal AK.

Biophysical Site Description

This system occurs on rolling hills and mountain sideslopes on west, east, and south aspects up to 750m (NatureServe 2008). Soils are well-drained and develop on residual material or retransported deposits including glacial till, loess, and colluvium (NatureServe 2008). Hardwood-dominated sites often persist on slopes that are warmer and drier than white spruce or mixed white spruce hardwood sites, with aspen dominating the driest, warmest sites (Viereck et al. 1992, Chapin et al. 2006).

Vegetation Description

Canopy cover is dominated by Betula papyrifera or Populus tremuloides and typically ranges from 25-90%. P. balsamifera may be a common associate. Stands are often closed-canopied with an open shrub or herbaceous understory. Common understory species include Alnus spp., Ledum spp., Vaccinium vitis-idaea, Betula nana, Rosa acicularis, Viburnum edule and Equisetum spp. (NatureServe 2008). Shepherdia canadensis is common on drier sites, especially well-drained riparian gravel bars. Feathermosses such as Hylocomium splendens and Pleurozium schreberi are common in the ground layer (Jorgenson et al. 1999; Boggs and Sturdy, 2005).

Disturbance Description

Little research exists on the fire ecology of this type. The system often acts as a fire break. It is estimated that the MFRI is longer than that of white and black spruce sites and maybe comparable to Boreal White

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Spruce-Hardwood Forest system.

Adjacency or Identification Concerns

This system can be easily confused with seral stages of two other ecological systems in boreal AK: Western North American Boreal White Spruce-Hardwood Forest and Western North American Boreal White Spruce Forest. Adjacent systems include Boreal White Spruce-Hardwood, Boreal White Spruce Forest or Boreal Mesic Black Spruce Forest.

Native Uncharacteristic Conditions

Recent ongoing leaf miner activity has been observed in birch and aspen, but no long-term information on its impact is available.

Scale Description

Large patch

Issues/Problems

There is uncertainty about whether Boreal Mesic Birch-Aspen Forest is a separate BpS from Boreal White Spruce-Hardwood Forest and Boreal White Spruce Forest. This system may occur only where spruce seed sources are lacking.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks modeling meeting (Nov. 07) and refined by Michelle Schuman, Mitch Michaud and Kori Blankenship with input from Tina Boucher. Boreal Mesic Birch-Aspen Forest is treated as a separate BpS within the Boreal region because experts felt it could be distinguished as occupying different biophysical settings from the Boreal White Spruce Forest and Boreal White Spruce - Hardwood Forest systems. In contrast, the Boreal Mesic Birch-Aspen Forest system was lumped with the Sub-boreal White Spruce-Hardwood Forest system within the Sub-boreal region because experts there felt that they could not distinguish the biophysical settings that these types occur on.

Vegetation Classes

Class A **5%**

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CHAN9 Upper
CACA4
EQUIS
MEPA

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

Herbaceous species dominate, including Chamerion angustifolium ssp angustifolium, Calamagrostis canadensis, Equisetum sylvaticum, E. arvense, Mertensia paniculata and Geocaulon lividum. Shrubs are present but not dominant. Following fire, aspen resprouts and birch appears to invade by seed (Viereck and Schandelmeier 1980)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Succession to class B. Replacement MFRI = 200yrs.

Class B 5 %

Early Development 2 All Structures

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)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ROAC	Upper
VIED	Upper
LEDUM	Upper
ALNUS	Upper

☐ Upper layer lifeform differs from dominant lifeform.

Description

4-14yrs

Shrubs gain dominance over the herbs. Hardwood seedlings are present. Common shrubs include Alnus spp., Ledum spp., Vaccinium vitis-idaea, Betula nana, Rosa acicularis, Shepherdia canadensis and Viburnum edule.

Succession to class C. Replacement MFRI = 200yrs.

Class C 15 %

Mid Development 1 Closed

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
ROAC	Lower
VIED	Lower

☐ Upper layer lifeform differs from dominant lifeform.

For mapping purposes if classes C and D can't be distinguished based on structural characteristics, split them based on height (C = trees <3m; D = trees >3m).

Description

15-49yrs

Hardwoods gain dominance over shrubs. This class is characterized by dense stands of sapling and pole sized trees. Betula papyrifera or Populus tremuloides typically dominate but P. balsamifera may be a common associate. Common understory species include Alnus spp., Ledum spp., Vaccinium vitis-idaea, Betula nana, Rosa acicularis, Shepherdia canadensis and Viburnum edule. This stage tends to be more flammable than the others (personal communication, Joan Foote).

Succession to class D. Replacement MFRI = 150yrs.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class D 15 %

Mid Development 2 Closed

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Closed (60-100% 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.

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
ROAC	Lower
VIED	Lower

Description

50-99yrs

This stand is characterized by mature hardwood trees with more dead and downed fuel. Betula papyrifera or Populus tremuloides typically dominate but P. balsamifera may be a common associate. Common understory species include Ledum spp., Vaccinium vitis-idaea, Betula nana, Rosa acicularis, Shepherdia canadensis and Viburnum edule. Feathermosses such as Hylocomium splendens and Pleurozium schreberi are common in the ground layer (Boggs and Sturdy, 2005).

Succession to class E. Replacement MFRI = 200yrs.

Class E 60 %

Late Development 1 Open

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Open (25-59% 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.

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
POTR5	Upper
ALNUS	Lower
LEDUM	Lower

Description

100yrs+

Late seral stands are characterized by large hardwood trees. This class captures the old, open birch calamagrostis stands. A mixed-age stand can develop as aspen clones resprout when individual trees die. Betula papyrifera or Populus tremuloides typically dominate but P. balsamifera may be a common associate. Spruce may be present in the canopy, and in the absence of fire, could potentially occupy the site. Common understory species include Alnus spp., Ledum spp., Vaccinium vitis-idaea, Betula nana, Rosa acicularis, Shepherdia canadensis and Viburnum edule. Feathermosses such as Hylocomium splendens and Pleurozium schreberi are common in the ground layer (Boggs and Sturdy 2005).

This class persists in the absence of disturbance. Replacement MFRI = 200yrs. Mixed fire (MFRI = 300yrs) maintains this class.

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	190.7			0.00524	72
Mixed	503.5			0.00199	27
Surface					
All Fires	138			0.00724	

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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Boggs, K. and Sturdy, M. 2005. Plant associations and post-fire vegetation succession in Yukon-Charley Rivers National Preserve. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage. Prepared For: National Park Service, Landcover Mapping Program, National Park Service-Alaska Support Office, Anchorage, AK 99501.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016061 Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *Western North American Boreal Dry Aspen-Steppe Bluff was split into a lower elevation and a higher elevation model. The lower elevation model occur below treeline and trees are present. The higher elevation model generally occurs above treeline although sparse aspen (<10% cover) may be present.*

General Information

Contributors (also see the Comments field **Date** 3/8/2008

Modeler 1	Mitch Michaud	mitch.michaud@ak.usda.gov	**Reviewer**
Modeler 2	Michelle Schuman	michelle.schuman@ak.usda.gov	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type

Forest and Woodland

Map Zone

70

Model Zone

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

Dominant Species*

POTR5	ARAL5
PIGL	CAPU
ROAC	PSSP6
JUCO6	ARFR4

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This type is found in AK from the southern slopes of the Brooks Range to southcentral AK and west to the limit of tree growth (NatureServe 2008).

Biophysical Site Description

This system occurs commonly on moderately steep to very steep, dry, south-facing slopes and on wind-swept bluffs above major rivers (NatureServe 2008). Soils are typically well-drained to excessively well-drained and develop on glacial, loess, or fluvial deposits or residual material (NatureServe 2008). Soils are often unstable and rocky outcrops are common (NatureServe 2008).

Vegetation Description

Disturbance Description

Fire and insects are the dominant disturbance factors influencing this vegetation type.
White Spruce (Picea glauca), which can be present in later seral stages, tends to take longer to regenerate after fire than aspen which quickly resprouts. As a result, fire tends to favor aspen but spruce will eventually come back in (Viereck et al. 1992).

In the VDDT model the replacement fire probability is the same in all classes for lack of evidence to suggest otherwise.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Large aspen tortrix (Choristoneura conflictana) is an aspen defoliator which can have a severe effect on mature and overmature aspen stands. Although aspen tortrix would have been present under the reference condition, its presence and affect have increased in fire suppressed areas today. Other disturbance agents include aspen leaf miners (Phyllocinistis populiella) and ground rot.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Large patch

Issues/Problems

Need more information on the fire return intervals for this type.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) and Anchorage modeling meetings (Dec. 08) and refined by Mitch Michaud and Michelle Schuman.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CAPU	Upper
PSSP6	Upper
ARFR4	Upper
JUCO6	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.

Herbs or shrubs can dominate this class.

Description

0-2yrs

This stage is characterized by dry herbaceous and low shrub vegetation coming in after a major disturbance. Common shrub species include Vaccinium vitis-idaea, Rosa acicularis, Shepherdia canadensis and Chamerion angustifolium (Boggs and Sturdy, 2005). Very dry sites on bluffs typically have steppe vegetation including Juniperus communis, Arctostaphylos uva-ursi, Artemisia frigida, A. alaskana, Calamagrostis purpurascens, Pseudoroegneria spicata (= Agropyron spicatum), Festuca altaica and Poa spp (Viereck et al. 1992, Chapin et al. 2006 p.89).

This stage was modeled with a duration of two years. This represents a typical post-fire scenario where aspen quickly resprout and overtop the shrubs in 1-2yrs. It is possible that this stage may last much longer. For example, some sites severely affected by the tortrix moth (Choristoneura conflictana) can become heavily dominated by Calamagrostis canadensis which can impede aspen regeneration possibly for up to 10yrs and increase the ability of the site to carry fire.

Succession to class B. Replacement MFRI = 100yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 15 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POTR5	Upper
ROAC	Mid-Upper
JUCO6	Mid-Upper
ARAL5	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Dwarf Tree (< 3 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

3-9yrs

This stage is characterized by suckering Populus tremuloides and low shrubs. Populus tremuloides tends to overtop the shrub and herbaceous vegetation. The shrubs and herbaceous species listed in class A are still present.

For mapping purposes this class was defined as a state where trees are less than three meters tall. The age range at which Populus tremuloids exceeds three meters in height varies based on site conditions and can often happen in less than 10yrs. Heavy ungulate browsing will delay growth.

Succession to class C. Replacement MFRI = 100yrs.

Class C 70 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POTR5	Upper
ROAC	Lower
JUCO6	Lower
ARAL5	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, class C can be distinguished from class D by the absence of spruce in the upper-layer.

Description

10yrs+

This stage is characterized by mature and eventually over-mature Populus tremuloides. Populus tremuloides dominates the site but Picea glauca may be present in the mid or understory. The shrubs and herbaceous species listed in class A may still be present.

Experts who provided input at the LANDFIRE Fairbanks (Nov. 07) and Anchorage modeling meetings (Dec. 08) described a mature and an over-mature aspen sere. Both concepts are incorporated into this stage because it was felt that LANDFIRE mapping teams would not be able to distinguish them as separate units.

This class can persist in the absence of disturbance or follow an alternate succession pathway to class D (probability = 0.004) which represents sites where Picea glauca is present in the overstory. Replacement MFRI = 100yrs. Mixed fire (MFRI = 200yrs) maintains this class. Insects/disease (probability = 0.0125)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

cause a transition to class A.

Class D 10 %

Late Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POTR5	Upper
PIGL	Upper
ROAC	Lower
JUCO6	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% 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.

For mapping, Class D can be distinguished from Class C by the presence of spruce in the upper-layer.

Description

60yrs+

This stage is characterized by mature Populus tremuloides mixed with Picea glauca. Populus tremuloides typically decline between 60 and 100yrs of age allowing spruce to become more dominant on some sites (Viereck et al. 1992). Aspen are generally even aged initiating from a disturbance event while spruce tend to be uneven aged and come into the stand gradually over time (Viereck et al.1992). Canopy cover can range from woodland to closed but stands tend to open up overtime. The shrubs and herbaceous species listed in class A may still be present.

This class can persist in the absence of disturbance. Replacement MFRI = 100yrs. Mixed fire (MFRI = 200yrs) maintains this class. Insects/disease (probability = 0.0125) cause a transition to class A.

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** III

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	100.2			0.00998	71
Mixed	241.1			0.00415	29
Surface					
All Fires	71			0.01414	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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

- [x] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Boggs, K. and Sturdy, M. 2005. Plant associations and post-fire vegetation succession in Yukon-Charley Rivers National Preserve. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage. Prepared For: National Park Service, Landcover Mapping Program, National Park Service-Alaska Support Office, Anchorage, AK 99501.

Chapin, F.S., Oswood, M.W., Van Cleve, K., Viereck, L.A., Verblya, D. L. (eds.) 2006. Alaska's Changing Boreal Forest. Oxford University Press, NY. 354 pp.

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

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016062 Western North American Boreal Dry Aspen-Steppe Bluff - Higher Elevations

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *Western North American Boreal Dry Aspen-Steppe Bluff was split into a lower elevation and a higher elevation model. The lower elevation model occur below treeline and trees are present. The higher elevation model generally occurs above treeline although sparse aspen (<10% cover) may be present.*

General Information

Contributors (also see the Comments field **Date** 4/24/2008

Modeler 1	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 2	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type

Upland Shrubland

Map Zone

70

Model Zone

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

Dominant Species*

ARFR4 ARUV
ARAL5 BRINA
PSSP6 CAPU
JUCO6

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system occurs at high elevations throughout the boreal and sub-boreal regions of AK.

Biophysical Site Description

This low open shrub system occurs in the alpine or subalpine on steep south-facing, wind-swept bluffs and ridges. It may be associated with river systems above treeline. The substrate is steep, unstable, dry mineral soil. Rocky outcrops are common.

Vegetation Description

The vegetation cover in this system is typically open and discontinuous with much exposed mineral soil. Artemisia species are the primary characteristic dominants, but this system supports a unique assemblage of species including Artemisia frigida, Artemisia alaskana, Juniperus communis, Arctostaphylos uva-ursi, Pseudoroegneria spicata (= Agropyron spicatum), Bromus pumpellianus, Calamagrostis purpurascens, Festuca altaica and Poa spp. (Chapin et al. 2006). Populus tremuloides may be present, but canopy cover is <10% (NatureServe 2008).

Disturbance Description

The fire regime for this system is expected to be similar to that of the adjacent Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations. However, this system has less fuel, which would tend to produce fewer and patchier fires. For this model, the MFRI for replacement fires was estimated at 140yrs (vs. 100yrs for Boreal Dry Aspen and Steppe Bluff).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Because this system is often found on unstable slopes with dry mineral soils, shifting slopes are an ongoing disturbance. Grazing is probably an important factor in shaping this system, as this is important Dall sheep habitat. Neither grazing nor erosion was included as disturbances in the model because these are long-term, ongoing phenomena.

Adjacency or Identification Concerns

This system is similar to Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations, but lacks aspen and rose as dominant species. This system occurs above treeline and may be adjacent to Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations, which includes a mosaic of aspen and steppe vegetation.

Native Uncharacteristic Conditions

Scale Description

Linear; small patch

Issues/Problems

Comments

Fire frequencies in this model were adapted from the Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations model created by Mitch Michaud and Michelle Schuman.

Suggested reviewers for this system include: Carl Roland and Dalia Vargis-Kretzinger for information on grazing.

Vegetation Classes

Class A 5%

Early Development 1 Open

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

PSSP6	Upper
BRINA	Upper
CAPU	Upper
feal	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Typically herb-dominated, but herb cover may be sparse, and sprouting shrubs may be present.

Description

0-4yrs

Post-disturbance dry herbaceous or sparse shrubs. Grasses typically dominate the site. Shrubs may sprout from rootstock. Herbaceous cover tends to be open or sparse. In some cases, grasses may be absent and the ground will be bare until shrubs resprout. Pseudoroegneria spicata (= Agropyron spicatum), Bromus pumpellianus, Calamagrostis purpurascens and Festuca spp. are typical species. Artemisia frigida and Artemisia alaskana are typically regenerating in the understory.

Succession to class B. Replacement MFRI = 140yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 95 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ARFR4	Upper
ARAL5	Upper
PSSP6	Upper
BRINA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open Shrub (25-74% shrub cover)	Open Shrub (25-74% shrub cover)
Height	Low Shrub (20 cm to 1.5 m)	Low Shrub (20 cm to 1.5 m)
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Five years plus

Dry, low, open shrubs. Mature shrubs. Shrubs become dominant, but an herbaceous layer usually persists. Shrub cover is 25-75%. Artemisia frigida and Artemisia alaskana dominate. Common grasses include Pseudoroegneria spicata (= Agropyron spicatum), Bromus pumpellianus and Calamagrostis purpurascens. Populus tremuloides may be present, but canopy cover is <10%.

This class persists in the absence of disturbance. Replacement MFRI = 140yrs. Mixed (MFRI = 200yrs) maintains this class.

Class C 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group: III**

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	143.2			0.00698	59
Mixed	206.6			0.00484	41
Surface					
All Fires	85			0.01183	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

References

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Chapin, F.S., Oswood, M.W., Van Cleve, K., Viereck, L.A., Verblya, D.L. (eds.) 2006. Alaska's Changing Boreal Forest. Oxford University Press, NY. 354 pp.

Hanson, H.C. 1951. Characteristics of some grassland, marsh, and other plant communities in western Alaska. Ecol. Monogr. 21 (4):317-378.

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

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016070** **Western North American Boreal Subalpine Balsam Poplar-Aspen Woodland**

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

General Information

Contributors (also see the Comments field **Date** 3/27/2008

Modeler 1	Mitch Michaud	mitch.michaud@ak.usda.gov	**Reviewer**
Modeler 2	Michelle Schuman	michelle.schuman@ak.usda.gov	**Reviewer**
Modeler 3			**Reviewer**

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*
POBA2 ARCTO3
POTR5 SALIX
VIED CACA4
ROAC

General Model Sources
- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
This system occurs commonly throughout the mountain ranges of south-central AK and also near the northern and western limit of the boreal region (NatureServe 2008). It occurs beyond the coniferous treeline in Western and northern AK (NatureServe 2008).

Biophysical Site Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Western North American Boreal Subalpine Balsam Poplar-Aspen Woodland occurs on well-drained upland terrain on southerly aspects on upper slopes to treeline. In the upper elevation range of this system, it can occur in the subalpine zone above the coniferous treeline. Soils are generally well-drained, shallow, and develop on colluvial deposits, glacial till or bedrock.

Vegetation Description
Populus balsamifera ssp. balsamifera and/or P. tremuloides are the dominant overstory species. Trees are often stunted on exposed sties (Jorgenson et al. 2003). Plots from Denali National Park showed an average tree height of 2.4m for Dwarf Poplar Aspen Forest (Clark and Duffy 2006). Common understory shrubs include Viburnum edule, Rosa acicularis, Arctostaphylos spp. and Salix spp. A wide variety of herbaceous species may occur including Calamagrostis canadensis, Pyrola spp. and Aconitum delphinifolium (Viereck 1979, Jorgenson et al. 2003).

Disturbance Description
The disturbance dynamics of these high elevation forests are unclear but wind/exposure and fire could be

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

driving disturbance process. Balsam poplar and quaking aspen are fire adapted. Balsam poplar may be top killed by moderate intensity fires but can root sprout within several weeks following fire (Harris 1990). Aspen is also easily top killed by fire but fire stimulates vigorous root sprouting (Howard 1996).

The probability of fire in the VDDT model is a best guess based on the assumption that this type would have a fire return interval similar to that of tundra types.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Large patch or small patch

Issues/Problems

This model was defined at the Fairbanks workshop as having an additional early seral stage dominated by alpine tundra shrubs, herbaceous vegetation or bare ground. This class was described as a persistent state occurring on sites frequently disturbed by avalanches or other weather events (snow, ice, wind, etc). It was later determined that this stage could not be adequately modeled with the two tree dominated stages (class A and B in the current model) and that it was probably best to represent the non-forested sites as a different BpS.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) and Anchorage modeling meetings (Dec. 08) and refined by Mitch Michaud and Michelle Schuman.

Vegetation Classes

Class A 25 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POBA2	Upper
POTR5	Upper
VIED	Lower
ROAC	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-49yrs

This class is characterized by young stands of balsam poplar and/or aspen. Trees come in immediately via suckering in the post-disturbance stand along with the shrubs and herbaceous species. Wind desiccation can delay the development of trees.

Succession to class B. Replacement MFRI = 200yrs resets age to zero. Wind/weather/stress (probability = 0.0067) maintains this class.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 75 %

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POBA2	Upper
POTR5	Upper
VIED	Lower
ROAC	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 (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping purposes, if tree size class or image texture can't be used to distinguish class A and B, split them on height (A = trees <3m; B = trees >3m).

Description

50yrs+

This class is characterized by mature balsam poplar and/or aspen. Mature stands can be more open than early seral stands (class A) but not always. Hardwoods begin to senesce after about 150yrs and a mixed age stand develops.

This class persists in the absence of disturbance although it becomes even aged as hardwoods senesce. Mixed fire (MFRI = 150yrs) causes a transition to class A.

Class C 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group: III**

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	715			0.0014	22
Mixed	205			0.00488	78
Surface					
All Fires	159			0.00629	

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
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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Viereck, L.A. 1979. Characteristics of treeline plant communities in Alaska. Holarctic Ecology. 2: 228-238.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016080** **Alaska Sub-boreal Avalanche Slope Shrubland**

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

General Information

Contributors (also see the Comments field **Date** 4/15/2008

Modeler 1 Kori Blankenship kblankenship@tnc.org **Reviewer** Tina Boucher antvb@uaa.alaska.edu
Modeler 2 **Reviewer**
Modeler 3 **Reviewer**

Vegetation Type
Upland Shrubland

Map Zone
70

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

Dominant Species*
ALVIS CHAN9
SARA2 ATFI
SALIX DREX2
CACA4

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
This system is found on steep mountain slopes in the sub-boreal region and less frequently in the boreal region of AK.

Biophysical Site Description
Avalanche slopes occur where mountain slopes are steep enough to produce frequent snow slides preventing forest development. Upper avalanche slopes typically have a slope angle of at least 70% but the lower slopes and run-out zones may be much less steep. Soils are shallow and stony, underlain by colluvium, glacial till and residuum (NatureServe 2008).

Vegetation Description
The dominant shrub species is typically Alnus viridis ssp. sinuata; but other shrubs including Sambucus racemosa, Salix spp. and Spirea stevenii may be common (NatureServe 2008). Herbaceous patches are often dominated by Calamagrostis canadensis and Chamerion angustifolium; other common herbs include Athyrium filix-femina, Dryopteris expansa and Veratrum viride (Viereck et al. 1992). Tree seedlings and saplings may be common on some slopes but do not emerge as an overstory due to frequent snow avalanches (NatureServe 2008).

Disturbance Description
Avalanche slopes can extend from the alpine into the montane and lower toe slopes; this model, however, applies only to avalanche slopes occurring below treeline. Snow avalanche is the dominant disturbance, but rocks, soil and debris can also be transported in the slide. This system represents a topoedaphic climax (Viereck et al. 1992). Alnus viridis ssp. sinuata has a growth form that tolerates avalanche disturbance and can maintain dominance on the site (NatureServe 2008). Frequent snow slides prevent tree seedlings and saplings from reaching the upper canopy (NatureServe 2008). Fire is minimal and is expressed only

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

around the edges of this type as fires are introduced from neighboring types.

Adjacency or Identification Concerns

This system is similar in species composition to Alaska Sub-Boreal Mesic Subalpine Alder Shrubland, but it occurs below the subalpine zone and tree growth is limited by avalanche frequency rather than elevation as in the subalpine system (NatureServe 2008). Adjacent forest systems may include Alaska Sub-boreal Mountain Hemlock-White Spruce Forest, Alaska Sub-boreal Mountain Hemlock Forest or Alaska Sub-boreal White Spruce-Hardwood Forest.

Though avalanche slopes can occur from alpine to lower slopes, this model excludes the avalanche slopes above treeline—these would be included in other systems according to vegetation type: Alaska Sub-boreal Mesic Subalpine Alder Shrubland, Western North American Boreal Alpine Dwarf-Shrubland, Alaska Sub-boreal and Maritime Alpine Mesic Herbaceous Meadow, etc.

Native Uncharacteristic Conditions

Scale Description

Small to large patch.

Issues/Problems

No information is available on the MFRI for this type. The MFRI was estimated to be the same as the Alaska Sub-boreal Mesic Subalpine Alder Shrubland BpS.

Comments

This model was developed by Kori Blankenship using the class age ranges from the Persistent Shrub North PNVG model (Murphy and Witten 2006) and a similar MFRI to the Alaska Sub-boreal Mesic Subalpine Alder Shrubland BpS.

Vegetation Classes

Class A **70 %**

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CACA4	Upper
CHAN9	Upper
ATFI	Upper
DREX2	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

Forbs, shrubs, and deciduous trees resprout immediately following disturbance, but herbaceous vegetation dominates in early succession. Herbaceous patches are often dominated by Calamagrostis canadensis and Chamerion angustifolium; other common herbs include Athyrium filix-femina, Dryopteris expansa and Veratrum viride (Viereck et al. 1992).

Succession to class B. Avalanche (probability = 0.25) resets the age of this class. Replacement MFRI = 900 yrs. Mixed MFRI = 5000yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 30 %

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ALVIS	Upper
SALIX	Upper
SARA2	Upper
SPST3	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)	Tall Shrub (>1.5 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Five years plus

Shrubs can become established at the edges or the bottom of the chutes. The dominant shrub species is typically Alnus viridis ssp. sinuata; but other shrubs including Sambucus racemosa, Salix spp. and Spiraea stevenii may be common. Tree seedlings and saplings may be common on some slopes but typically do not emerge as an overstory due to frequent snow avalanche. On sites where avalanche activity is less frequent trees can occasionally emerge temporarily in the overstory.

This class persists in the absence of disturbance. Avalanche (probability = 0.25) resets the age of this class. Replacement MFRI = 900yrs. Mixed MFRI = 5000yrs.

Class C 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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	909.1			0.0011	84
Mixed	5000			0.0002	15
Surface					
All Fires	769			0.00131	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☑ Other (optional 1) Avalanche
- ☐ Other (optional 2)

References

Murphy, K.A. and E. Witten. 2006. Persistent Shrub North. 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.

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016090** **Alaska Sub-Boreal Mesic Subalpine Alder Shrubland**

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

General Information

Contributors (also see the Comments field **Date** 4/11/2008

Modeler 1 Kori Blankenship kblankenship@tnc.org **Reviewer** Tina Boucher antvb@uaa.alaska.edu
Modeler 2 **Reviewer**
Modeler 3 **Reviewer**

Vegetation Type
Upland Shrubland

Map Zone
70

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

Dominant Species*

ALVIS	CACA4
SALIX	CHAN9
SARA2	ATFI
SPST3	DREX2

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
Alaska Sub-boreal Mesic Subalpine Alder Shrubland is widespread on upper mountain slopes above treeline throughout the boreal transition region of AK (Viereck 1979). A riparian shrub variant of this system is found throughout the boreal and sub-boreal regions of AK in subalpine through alpine valleys.

Biophysical Site Description
These systems occur on well-drained mesic sites in the subalpine zone and in constrained riparian corridors on slopes in the alpine and subalpine. Seasonal overbank flooding may occur in the riparian areas, but generally it does not result in shifting channels or gravel bar formation (NatureServe 2008). Soils are shallow, stony and well-drained, underlain by colluvium, glacial till and residuum (NatureServe 2008).

Vegetation Description
This system often appears as a band of alder above treeline and below the alpine systems. Alnus viridis ssp. sinuata is the dominant shrub species, but other shrubs including Salix spp. (sometimes the dominant shrub), Sambucus racemosa and Spiraea stevenii may be common (NatureServe 2008). Herbaceous patches often occur within the shrub zone and may be dominated by Calamagrostis canadensis and Chamerion angustifolium; other common herbs include Athyrium filix-femina, Dryopteris expansa, Veratrum viride, Valeriana sitchensis, Lupinus nootkatensis and Sanguisorba sitchensis (Viereck et al. 1992).

Disturbance Description
This system represents a topoedaphic climax (Viereck et al. 1992). It occurs above treeline and is not controlled by avalanche activity, although avalanches may occur. Alder will resprout following fire but no studies exist on fire effects in this type. The fire return interval is likely long, possibly 500- 1000yrs. Early

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

season fire prior to green-up would be more likely to carry than late season fire. Alder is also affected by insects and diseases (NatureServe 2008).

Flooding and herbivory may be important disturbances, especially for the Alpine Riparian system (NatureServe 2008).

Adjacency or Identification Concerns

This system is similar in species composition to Alaska Sub-boreal Avalanche Slope Shrubland, but it occurs in the subalpine zone and tree growth is limited by elevation not avalanche frequency (NatureServe 2008). Pacific Maritime Tall Shrubland occupies a similar landscape position along the Gulf Coast of AK, but this system may be dominated by Rubus spectabilis, which does not occur in boreal regions. In the boreal transition region, the alder zone is intermixed with mesic herbaceous meadows (Calamagrosits canadensis and Chamerion angustifolium) (NatureServe 2008).

This system includes riparian shrub types in the alpine and subalpine zones.

Native Uncharacteristic Conditions

This system may have been expanding further into the alpine in recent decades (NatureServe 2008).

Scale Description

Large patch

Issues/Problems

In the absence of data on MFRI for this system, the MFRI was estimated to be slightly lower than that in the FRCC Guidebook Persistent Shrub North model.

Other major disturbances, including flooding, avalanches and herbivory, are not included in the model because it is believed that shrubs would resprout immediately following these disturbances.

Comments

This model was based on the FRCC Guidebook PNVG model for Persistent Shrub North (Murphy and Witten 2006). The MFRI was increased based on input from the experts who attended the LANDFIRE Anchorage (Dec. 07) modeling meeting. Tina Boucher reviewed an initial draft of this model and recommended eliminating mixed fire and decreasing the FRI for Replacement Fire slightly so that the AllFire FRI is slightly lower than that for Persistent Shrub North (these suggestions are reflected in the current draft of the model).

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

CACA4	Upper
CHAN9	Upper
ATFI	Upper
DREX2	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

Grasses, sedges and/or forbs dominate the site. Shrubs sprout from rootstock. Herbaceous patches often occur within the shrub zone and may be dominated by Calamagrostis canadensis and Chamerion angustifolium; other common herbs include Athyrium filix-femina, Dryopteris expansa, and Veratrum viride, Valeriana sitchensis, Lupinus nootkatensis and Sanguisorba sitchensis (Viereck et al. 1992).

Succession to class B. Replacement MFRI = 2000yrs.

Class B 95 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

ALVIS	Upper
SALIX	Upper
SARA2	Upper
SPST3	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)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Five years plus

Shrubs overtop herbaceous layer and become dominant. A low shrub and/or herbaceous layer usually persists. Shrub cover is 25-75%. Alnus viridis ssp. sinuata is the dominant shrub species, but other shrubs including Salix spp. (sometimes the dominant shrub), Sambucus racemosa and Spiraea stevenii may be common.

This class persists in the absence of disturbance. Replacement MFRI = 830yrs.

Class C 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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	833			0.00120	98
Mixed					
Surface					
All Fires	832			0.00122	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

References

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016101 Western North American Boreal Mesic Scrub Birch-Willow Shrubland - Boreal

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models: Boreal Mesic Scrub Birch-Willow Shrubland was split into Boreal Mesic Scrub Birch-Willow Shrubland - Boreal and Boreal Mesic Scrub Birch-Willow Shrubland - Sub-boreal for BpS modeling so that a longer fire return interval could be applied to the sub-boreal variant.*

General Information

Contributors (also see the Comments field **Date** 4/4/2008

Modeler 1	Jennifer Allen	Jennifer_Allen@nps.gov	**Reviewer**	Lisa Saperstein	Lisa_Saperstein@fws.gov
Modeler 2			**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type

Upland Shrubland

Map Zone

70

Model Zone

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

Dominant Species*

BENA	SABA3
VAUL	EMNIN
LEPAD	VAVI
SAPU15	HYSP70

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system is found in the boreal region from low elevations to the subalpine zone.

Biophysical Site Description

This system occurs on well-drained sites often in the subalpine. It is found on mesic sites on mid to upper slopes, above tree line and on terraces and sideslopes. Soils are mineral with a well-decomposed organic layer of 5-30cm thick (Viereck et al. 1992, NatureServe 2008).

Vegetation Description

Betula nana (this species now includes B. glandulosa) usually dominates the shrub layer, but Vaccinium uliginosum, Ledum decumbens (Ledum palustre L. ssp. Decumbens), Salix pulchra, S. barclayi, S. glauca or other Salix spp. may also be common or occasionally dominant (Viereck 1979, Viereck et al. 1992, NatureServe 2008). Dwarf shrubs such as Empetrum nigrum and Vaccinium vitis-idaea may be common under the low shrub layer. Herbaceous species are sparse, but may include Festuca altaica, Hierochloe alpina, Calamagrostis canadensis and Chamerion angustifolium. Feathermoss (Hylocomium splendens and Pleurozium schreberi) and lichens are common, but peat-forming mosses and sedges are not common (Viereck et al. 1992, NatureServe 2008).

Disturbance Description

This system represents a topoedaphic climax in some areas, in other cases it may be seral to shrub-tussock over long time periods (Viereck et al. 1992).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

There is little information available about the fire history of shrub communities in AK. Birch and ericaceous shrub tundra tends to produce more severe burns than sedge-shrub tussock tundra (Racine 1979). After fire, shrubs resprout readily from underground propagules if they have not been burned and a shrub community re-establishes on the site within five years. After severe fires that remove the organic layer and burn the propagules, herbaceous species that establish by seed may dominate the site for more than five years. Burned-over spruce woodlands near treeline may be converted to low shrub after fire (Pegau 1972) and may slowly regenerate a spruce overstory. The fire return interval is longer in the sub-boreal region than in boreal AK. Adjacent vegetation influences the fire frequency. If the adjacent vegetation is flammable, then the low shrub type will have a more frequent fire return. Fire return intervals are long, likely >100yrs. Trees may also invade these shrublands but over long time frames (NatureServe 2008).

Adjacency or Identification Concerns

At treeline, this system occurs above the Boreal Treeline White Spruce Woodland - Boreal (NatureServe 2008).

Sites dominated by non-riparian or wetland Salix spp. are included in this type (NatureServe 2008). Low shrub types on peat deposits are included in the wetland types (NatureServe 2008).

Native Uncharacteristic Conditions

Scale Description

Large patch

Issues/Problems

The probability for fire in the VDDT model is a best guess, not based on literature.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and refined by Jennifer Allen.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

FEAL	Upper
HIAL3	Upper
CACA4	Upper
CHAN9	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

After fire, herbaceous species such as Festuca altaica and Hierochloe alpina may dominate, especially at higher altitudes. Calamagrostis canadensis and Chamerion angustifolium are common. Low shrubs can resprout following fire, quickly regaining dominance of a site. This class may persist for more than five years

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

if fire severity is high enough to remove the organic layer.

Succession to class B. Replacement fire (MFRI = 200yrs) resets age to zero.

Class B **95 %**

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
VAUL	Upper
LEPAD	Upper
SALIX	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)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Five years plus

This class is dominated by shrubs, often Betula nana. Vaccinium uliginosum, Ledum decumbens, Salix pulchra, S. barclayi, S. glauca or other Salix spp. may also be common (Viereck 1979, Viereck et al. 1992). Dwarf shrubs such as Empetrum nigrum and Vaccinium vitis-idaea may be common under the low shrub layer. Some sites may include very low cover of trees, especially black spruce.

This class persists in the absence of disturbance. Replacement MFRI = 200yrs causes a transition to A.

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **IV**

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	200			0.005	100
Mixed					
Surface					
All Fires	200			0.00502	

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fire 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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016110** **Western North American Sub-boreal Mesic Bluejoint Meadow**

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

General Information

Contributors (also see the Comments field **Date** 4/25/2008

Modeler 1	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 2	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Upland Grassland/Herbaceous

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*
CACA4
CHANA
HEMA80
ATFI

General Model Sources
- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
This system occurs throughout the boreal and boreal transition regions of AK, though it appears to be less common north of the Alaska Range (NatureServe 2008).

Biophysical Site Description
Soils are typically fine-textured mineral and may be poorly drained (on flats) to well drained (on sideslopes). In the sub-boreal region, mesic Calamagrostis canadensis meadows often occur near treeline interspersed with subalpine tall shrub (NatureServe 2008). Its elevational limit is just above the limit of tall shrub (within 100m). This system may also occur as a small patch in drained lake beds within the boreal region.

Vegetation Description
Calamagrostis canadensis is the species that characterizes this system, though other grasses, forbs and ferns may codominate. Fern- and forb-dominated patches commonly occur in a matrix of bluejoint meadow. Mosses are uncommon, but patchy feathermosses may be present in more open stands. Lichens and woody plants are absent or scarce, though this system is often found in a mosaic with tall shrub (especially alder) communities (Viereck et al. 1992).

The vegetation is usually dense, with canopy height of 0.8-1.4m, occasionally reaching two meters (Viereck et al. 1992). Species composition ranges from nearly pure stands of Calamagrostis canadensis to mixtures of C. canadensis with forbs, ferns and other grasses, including Heracleum maximum, Angelica lucida, Chamerion angustifolium, Athyrium filix-femina, Dryopteris expansa, Equisetum arvense and Veratrum viride (Viereck et al 1992).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

Though Mesic Bluejoint Meadows often occur on disturbed sites, the Sub-boreal Mesic Bluejoint Meadow system, as described here, is stable over long periods. The fire regime is likely to be similar to that of the alder tall shrub vegetation typically found just downslope from this system. However, the Sub-boreal Mesic Bluejoint Meadow system is extremely flammable in early summer prior to green-up. Fires in this time period generally do not burn the duff layer, since the ground is usually still wet or frozen). For this model, overall MFRI was estimated at approximately 800yrs.

Avalanches are possible but are unlikely to affect the vegetation.

Adjacency or Identification Concerns

Mesic Bluejoint Meadow vegetation may also appear as a seral stage in a variety of other systems following fire or other disturbance. This system includes meadows that are long-term landscape features. This system is typically found just downslope from the Alaska Sub-boreal and Maritime Alpine Mesic Herbaceous Meadow or Alpine Dwarf-Shrubland system and upslope or interspersed with Alaska Sub-Boreal Mesic Subalpine Alder Shrubland. In some cases this system may be found directly adjacent to treeline.

Native Uncharacteristic Conditions

Scale Description

Large patch

Issues/Problems

In the absence of data, the fire regime for this system was assumed to be similar to that of the Alaska Sub-Boreal Mesic Subalpine Alder Shrubland system often found adjacent to this system.

Comments

The fire regime for this system was based on the Alaska Sub-Boreal Mesic Subalpine Alder Shrubland model by Kori Blankenship.

Vegetation Classes

Class A 100 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CACA4	Upper
CHANA2	Upper
HEMA80	Upper
ATFI	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

This class represents the stable Mesic Bluejoint Meadow system. Calamagrostis canadensis and other grasses, forbs and/or ferns dominate the site.

Replacement MFRI = 1000yrs. Mixed MFRI = 5000yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	909.1			0.0011	84
Mixed	5000			0.0002	15
Surface					
All Fires	769			0.00131	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

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

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016120** **Western North American Boreal Dry Grassland**

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

General Information

Contributors (also see the Comments field **Date** 4/25/2008

Modeler 1	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 2	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Upland Grassland/Herbaceous

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*

FEAL	BRINA
FERU2	ARFR4
CAPU	ARAL5
PSSP6	

General Model Sources
- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
Western North American Boreal Dry Grassland occurs across the boreal and sub-boreal regions of AK.

Biophysical Site Description
This system typically occurs on dry sideslopes or bluffs. Soils are well drained to excessively drained, and permafrost is absent. Some slopes may have steep, unstable soil (NatureServe 2008).

Vegetation Description
These sites are typically dominated by grasses, though forbs and shrubs may be common, but shrub cover is <25%. Common species include Festuca altaica, F. rubra, Calamagrostis purpurescens, Elymus inovatus, Artemisia frigida, Artemisia alaskana, Pseudoroegneria spicata, Bromus pumpellianus, Poa spp. and Achillea spp.(NatureServe 2008).

Disturbance Description
The fire regime for this system is expected to be similar to that of the adjacent Western North American Boreal Dry Aspen-Steppe Bluff - Higher Elevations.

Because this system is often found on loose, dry mineral soils on unstable slopes, shifting slopes are an ongoing disturbance. Grazing is probably an important factor in shaping this system, as this is important Dall sheep habitat. Grazing and erosion were not included as disturbances in the model because these are long-term, ongoing phenomena.

Adjacency or Identification Concerns
Adjacent systems may include Western North American Boreal Dry Aspen-Steppe Bluff - Higher Elevations or Western North American Boreal Dry Aspen-Steppe Bluff - Lower Elevations. This system

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

does not encompass the coastal Leymus-forb meadows that occur in Aleutians, southwest, southcentral and southeast AK (NatureServe 2008).

Native Uncharacteristic Conditions

Scale Description

Small to large patch

Issues/Problems

Comments

Fire intervals in this model were adapted from the Boreal Subalpine Steppe Bluff model, also by Boucher and Ryan.

Suggested reviewers for this system include Carl Roland and Dalia Vargis-Kretzinger for information on grazing.

Vegetation Classes

Class A 100 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

FEAL	Upper
FERU2	Upper
CAPU	Upper
BRINA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

This class represents the stable dry grassland community. Grasses, sedges and/or forbs dominate the site.

Replacement MFRI = 200yrs. Mixed MFRI = 1000yrs.

Class B 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class C 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **III**

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	143.0			0.00699	58
Mixed	200.6			0.00499	42
Surface					
All Fires	83			0.01199	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

References

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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016141 Western North American Boreal Montane Floodplain Forest and Shrubland - Boreal

☐ *This BPS is lumped with:*

☑ *This 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.*

General Information

Contributors (also see the Comments field **Date** 4/7/2008

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Vegetation Type

Forest and Woodland

Map Zone

70

Model Zone

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

Dominant Species*

POBAB2 SHCA
PIGL ROAC
ALNUS VIED
SALIX EQUIS

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

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

Biophysical Site Description

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):

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. Oxbows and other wet depressions commonly form on the floodplains, and these sites commonly develop into wetlands.

Vegetation Description

Primary succession on floodplains begins when new alluvial surfaces are colonized by tree, shrub and herbaceous species. Common early seral woody species include Populus balsamifera (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). Common early seral herbaceous species may include Lupinus spp., Hedysarum spp. and Equisetum spp. (NatureServe 2008). 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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

(Steroucaulon spp.) (NatureServe 2008). The tall shrub component of the early successional stages diminishes rapidly, probably because of decreased light from the dense tree overstory. Populus balsamifera does not regenerate in the understory and consequently, Picea glauca gains dominance in the overstory within 150yrs (NatureServe 2008). Rosa acicularis and Viburnum edule are common understory shrubs on older surfaces.

Disturbance Description

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
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 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.

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, spruce. Oxbows and other wet depressions commonly form on the floodplains and develop into wetlands. Succession and species composition is, however, variable due to diverse environmental conditions such as water depth, substrate and nutrient input.

The following information was taken from the Riparian Spruce Hardwood Potential Natural Vegetation Group (PNVG) model (Murphy and Witten 2006):
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 PNVG 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 the Riparian Spruce Hardwood PNVG than in typically adjacent PNVGs. In interior AK the oldest white spruce stands (350yrs+) are commonly found on islands of floodplains where they are protected from fire (Viereck 1973).

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.

Native Uncharacteristic Conditions

Scale Description

Linear

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Issues/Problems

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

Comments

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 A to comply with LANDFIRE modeling rules and the 10,000 year 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.

Vegetation Classes

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

LUPIN	Upper
HEDYS	Upper
EQUIS	Upper
SALIX	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open Shrub (25-74% shrub cover)	Open Shrub (25-74% shrub cover)
Height	Dwarf Shrub (< 20 cm)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-4yrs

This class is characterized by post disturbance regeneration (herbs, shrub regeneration and 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% 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).

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

Class B 20 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

SALIX	Upper
ALNUS	Upper
POBAB2	Upper
ROAC	Lower

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.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Description

5-29yrs

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 (Rosa acicularis (prickly rose) and Viburnum edule (high bushcranberry) become more common and have a canopy cover of 10%.

Succession to class C or E. The deterministic succession pathway is to class C. The alternate succession pathway to E (probability = 0.01) represents 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 40 %

Mid Development 1 Open

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	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, absence of spruce in the overstory distinguishes class C from class E.

Description

30 –149yrs

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.

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
	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	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

150yrs+

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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.

This class can persist in the absence of disturbance or follows 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 = 155yrs) causes a transition to class C.

Class E 10 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIGL	Lower
ROAC	Lower
VIED	Lower
	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.

For mapping, dominance of spruce in the overstory distinguishes class E from class C.

Description

30yrs+

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.

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	5000			0.0002	6
Mixed	312			0.00321	94
Surface					
All Fires	294			0.00342	

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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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

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Modeler 3			**Reviewer**		

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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
- ☑ 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
- ☑ 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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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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

References

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016160** **Western North American Boreal Riparian Stringer Forest and Shrubland**

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

General Information

Contributors (also see the Comments field **Date** 4/7/2008

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Modeler 3	Douglas Hanson	douglas.hanson@alaska.gov	**Reviewer**	Tom Paragi	tom.paragi@alaska.gov

Vegetation Type

Wetlands/Riparian

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 POTR5
BEPA SALIX
PIMA ALNUS
POBA2

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system occurs along streams throughout the boreal and sub-boreal regions of AK.

Biophysical Site Description

The riparian forest and shrub stringer is found as a narrow band of vegetation along streams in low gradient and low volume drainages (NatureServe 2008). Although, seasonal overbank flooding may occur, it generally does not result in shifting channels or gravel bar formation (NatureServe 2008). The well-drained soils have moderately thick to thin organic horizons at the surface (indicative of infrequent flooding), are strongly acidic, lack permafrost, and have deep water tables (Jorgenson et al. 1999).

Vegetation Description

The mature phase of this system is dominated by Picea glauca, Betula papyrifera and Picea mariana. Populus balsamifera and Populus tremuloides are common early seral species on some sites. Picea mariana is more common and more likely to be dominant in the northern parts of this system's range. Common understory species include Alnus tenuifolia, Rosa acicularis, Calamagrostis canadensis, Cornus canadensis, Equisetum arvense, Hylocomium splendens and Rhytidiadelphus triquetrus (Jorgenson et al. 1999).

Immediately adjacent to the stream bank and in recently burned areas, tall shrubs including Alnus tenuifolia, Salix. alaxensis, S. bebbiana and S. lasiandra tend to dominate, with Carex spp. and Calamagrostis canadensis in the understory (NatureServe 2008, Jorgenson et al. 1999).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

Fire is the primary disturbance influencing this system. However, riparian forest and shrub stringers typically burn less frequently than adjacent vegetation types and tend to act as fire breaks.

Because of the linear nature of this system, fire frequencies are strongly influenced by surrounding vegetation types. In the sub-boreal region, surrounding vegetation is more likely to be white spruce and hardwood forest. In the northern boreal region, adjacent forest is more likely to be a black spruce type that burns more frequently. However, this system may also occur in tundra areas where there is a gap in the permafrost layer along the riparian corridor. The riparian stringer in this environment will have a very low fire frequency. As a result, fire frequencies are likely to be more variable in the boreal region compared with the sub-boreal region.

For this model, the overall mean fire return interval was estimated at about 170yrs, somewhat longer than the MFRI for the white spruce-hardwood systems and substantially longer than the black spruce types. This reflects the observation that fires from the surrounding forest types frequently burn into the riparian stringer types, but often do not burn across the river or stream. Patchy, mixed severity fire is thought to be more common in this type than in most other spruce-hardwood types.

Seasonal overbank flooding may occur, but it generally does not result in shifting channels or gravel bar formation (NatureServe 2008). As a result, flooding typically only acts as a disturbance in a narrow zone along the bank. This zone will typically remain in a self-replacing shrub stage. This disturbance is modeled as Option 1 in the VDDT model. Beaver activity may play a role in the dynamics of this system, but it is not included in the model due to the limited scale of these impacts.

Adjacency or Identification Concerns

See the Disturbance Description for more information on adjacent types.

Native Uncharacteristic Conditions

Scale Description

Linear

Issues/Problems

The main factor controlling the disturbance regime in this system is its ecological setting. Ideally, we would create a separate model for this system on sites where the adjacent systems are non-forested. If these sites cannot be distinguished, then it is probably not worth creating separate models for the boreal and sub-boreal regions, as the MFRI is probably similar for the two regions.

A reviewer noted that the age of transition from the shrub/sapling class to the forest class may vary widely depending on the tree species present. Hardwoods will begin to overtop the shrubs around age 15, but this stage will be very difficult to distinguish from the shrub stage using satellite imagery. Spruce-dominated stands may not transition from class A to B for much longer, as it may take black spruce 30 years to reach 3m in height.

Classes B and C may overlap in canopy composition. For the purposes of this model, it has been assumed that class B will have >50% hardwoods in the canopy and class C will have >50% spruce, but there will be exceptions to this rule in reality.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Comments

The draft version of this model was created by Nacy Fresco and Colleen Ryan based in part on input from the experts who attended the LANDFIRE Anchorage (Dec. 07) modeling meeting. Extensive review by the Alaska Dept. of Natural Resources Div. of Forestry led to extensive changes to the model. As a result, lead reviewer Douglas Hanson was added as a modeler. The other Div. of Forestry reviewers, Marc Lee, Northern Region Forest Manager, and Tom Kurkowski, GIS specialist, were listed as reviewers. Will Putnam (wputman@tananachiefs.org) reviewed an early draft of this model.

Vegetation Classes

Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

SALIX	Upper
ALNUS	Upper
CAREX	Lower
CACA4	Low-Mi

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)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-15yrs

Shrub-sapling. This stage is dominated by shrubs but trees begin to sprout and saplings may be present. Around age 15yrs, the hardwood saplings will begin to overtop the shrubs, though the spruce saplings will still be in the understory.

Common shrub species include a variety of Salix spp. and Alnus tenuifolia. Herbs frequently include Calamagrostis canadensis, Equisetum arvense and Carex spp.

This class includes those areas immediately adjacent to the stream bank that are dominated by shrubs maintained by frequent flooding. These areas are unlikely to burn. The 0.1 annual probability of flooding in this class is meant to represent these areas.

Succession is to class B at age 15yrs. Replacement MFRI = 333yrs. Flooding (Option 1) probability = 0.1.

Class B 40 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

BEPA	Upper
PIGL	Upper
PIMA	Upper
ALNUS	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, the presence of hardwoods distinguishes class B from class C.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Description

16-119yrs

White spruce-hardwood mix. This is a mixed white spruce (black spruce) hardwood forest. Black spruce is more common and hardwoods are less common in the northern boreal region. Early in this age range, hardwoods will dominate the overstory. Spruce species typically will not overtop the shrub layer until age 30-50yrs. By the end of this age range, the canopy will typically be dominated by a mixture of birch and spruce.

Species composition is highly variable in this class, depending on landscape context, site characteristics, disturbance history and available seed sources. Picea glauca, Betula papyrifera, Populus balsamifera, Alnus spp. and Salix spp. typically dominate the overstory, though Picea mariana may be common, especially in the northern boreal region. The understory commonly includes Rosa acicularis, Carex spp. and Calamagrostis canadensis. Though species composition is highly variable, this class can be distinguished for mapping purposes by canopy composition (>50% hardwoods).

Succession is to class B at age 120yrs. Replacement MFRI = 500yrs. Mixed MFRI = 220yrs (system stays in class B).

Class C **50 %**

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIGL	Upper
BEPA	Upper
POBA2	Upper
PIMA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

This class may include some senescing hardwoods in the canopy, but the canopy should be at least 75% spruce.

Description

120yrs+

Mature spruce forest. This class is typically dominated by mature spruce (>50% spruce in the canopy). More northern sites will have more black spruce, while more southern sites will be mostly white spruce. However, when these stands extend to the far north of the boreal region, such as the south slopes of the Brooks Range, white spruce will dominate over black spruce. Birch frequently persists in the canopy but typically will constitute <50% of the canopy.

Understory plants include Alnus tenuifolia, Rosa acicularis, Cornus canadensis, Equisetum arvense, Hylocomium splendens and Rhytidiadelphus triquetrus (Jorgenson et al. 1999).

This class persists in the absence of disturbance. Replacement MFRI = 400yrs. Mixed MFRI = 220yrs (system transitions to class B).

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** III

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	434.8			0.0023	36
Mixed	243.9			0.0041	64
Surface					
All Fires	156			0.00641	

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

References

Foote, M. Joan. 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 Forest and Range Experiment Station. 108 pp.

Jorgenson, M.T., J.E. Roth, M.K. Raynolds, M.D. Smith, W. Lentz, A.L. Zusi-Cobb and C.H. Racine. 1999. An ecological land survey for Fort Wainwright, Alaska. U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH. CRREL TR-99-9. 92 pp.

NatureServe. 2008. International Ecological Classification Standard: Terrestrial Ecological Classifications.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Draft Ecological Systems Description for Alaska Boreal and Sub-boreal Regions.

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016170** **Western North American Boreal Shrub and Herbaceous Floodplain Wetland**

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

General Information

Contributors (also see the Comments field **Date** 5/7/2008

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Modeler 2	Kori Blankenship	kblankenship@tnc.org	**Reviewer**		
Modeler 3	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**		

Vegetation Type
Wetlands/Riparian

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*

METR3	ERAN6
CAAQ	MYGA
EQFL	BENA
COPA28	CHCA2

General Model Sources
- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
This system is found throughout the boreal and sub-boreal regions. It occurs within the floodplain boundaries of the Western North American Boreal Montane Floodplain Forest and Shrubland - Boreal,, Western North American Boreal Lowland Large River Floodplain Forest and Shrubland and Western North American Boreal Montane Floodplain Forest and Shrubland - Alaska Sub-boreal.

Biophysical Site Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Floodplain wetlands occur within the active and inactive portions of floodplain systems. Wetlands develop on poorly drained deposits, oxbows, and abandoned channels and are often mosaiced with well-drained floodplain vegetation.

Vegetation Description
Species composition is variable due to diverse environmental conditions such as water depth, substrate and nutrient input, as well as seral stage. Aquatic bed, marsh and fen communities are common. The earliest seral stages (aquatic bed) have aquatic vegetation such as Nuphar polysepala. Aquatic vegetation generally succeeds to marsh and fen communities with species such as Menyanthes trifoliata, Carex aquatilis and Equisetum fluviatile. Later seral stages of floodplain wetland development may include Sedge-Dwarf-Shrub Bogs and Low Shrub Peatland. Common species may include Sphagnum spp., Eriophorum angustifolium, Oxycoccus microcarpus, Andromeda polifolia, Myrica gale and Betula nana.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

Fire is likely quite rare on floodplain wetlands and was not included in the VDDT model.

The following paragraph was taken from the draft North Pacific Maritime Ecological Systems description (NatureServe 2008):
Frequent river channel migration and associated flooding and fluvial processes constitute the major disturbances. Floodplain wetland dynamics differ from wetlands in non-floodplain settings. Surface flooding and subsurface flow provide a more continuous flow of nutrients and create the potential for a more dynamic wetland environment. Wetland succession and species composition are variable due to diverse environmental conditions such as water depth, substrate and nutrient input. Common seral stages include aquatic bed, freshwater marsh, fen and wet low shrub. Wetland succession beginning in open water can proceed through aquatic bed and marsh communities to fens and wet meadows. Over time, fens can succeed to Sedge-Dwarf-Shrub Bogs or Low Shrub Peatlands. At any stage in succession, flooding can set back the vegetation to open water. Less dramatic changes in hydrology (such as an increase in water table from beaver activity) can reverse the direction of succession. Though an open water stage is part of the successional pathway, it is not included in the model due to LANDFIRE mapping constraints.

Floodplain wetlands can also develop through paludification on poorly drained, fine-textured deposits. In this pathway, poorly-drained shrubs would accumulate organic material in the ground layer and succeed to a fen/wet meadow or Sedge-Dwarf-Shrub bog.

Adjacency or Identification Concerns

Floodplain wetland vegetation includes the following classes: Freshwater Aquatic Bed, Freshwater Emergent Marsh, Wet Meadow or Herbaceous Fen, Low Shrub Peatland, and Sedge-Dwarf-Shrub Bog. These classes have also been described as unique Ecological Systems, but because floodplain wetland dynamics are different from wetland dynamics outside the floodplain, they are considered a distinct BpS and modeled accordingly.

Native Uncharacteristic Conditions

Scale Description

Floodplain wetland vegetation tends to occur in small, linear patches. Fire is rare (not modeled) but if it occurred would likely occur in very small patches moving into the floodplain from adjacent upland systems.

Issues/Problems

The lack of information about the successional dynamics of this system and the variability of environmental conditions across floodplain wetlands make it difficult to quantitatively model this BpS. The class percents also likely vary from site to site making it difficult to define a historic range of variability for FRCC calculation.

In a true model of ecological dynamics, class A would include areas of sparse and submerged vegetation and open water. Since these areas will be excluded from the LF mapping process, they were excluded from the model, and the landscape percentages for the successional classes reflect only the areas that are expected to map as vegetated (>10% cover).

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks modeling meeting (Nov. 07) and refined by Tina Boucher, Kori Blankenship and Colleen Ryan.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Vegetation Classes

Class A 20 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

NULUP	Upper
POTAM	Upper
SPARG	Upper
RATR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0 years

Freshwater Aquatic Bed

This is an early seral stage dominated by open water and aquatic vegetation occurring in oxbows, abandoned channels, or other shallow slow-moving water within the floodplain. Common species include Nuphar polysepalum, Potamogeton spp., Lemna minor, Sparganium spp., Ranunculus trichophyllus and Myriophyllum spp. Aquatic mosses such as Calliergon sarmentosum may also be present (Viereck et al. 1992).

This class can persist or follow an alternate succession pathway to class B (probability = 0.15). Flooding (probability = 0.07) can reset the age of this class to zero.

Class B 15 %

Early Development 2 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

METR3	Upper
EQFL	Upper
TYLA	Upper
COPA28	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

One year plus

Freshwater Emergent Marsh

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Marsh systems within the floodplain are typically semi-permanently flooded or have seasonal flooding. Water is at or above the surface for most of the growing season (typically at least 10cm above the surface). Soils are muck or mineral, and water is nutrient-rich. These systems are highly productive and have high rates of decomposition (National Wetlands Working Group 1997). Freshwater marsh vegetation is dominated by emergent vegetation such as Carex utriculata, Scirpus validus, Typha latifolia, Menyanthes trifoliata, Equisetum fluviatile and Comarum palustris (Gracz 2005, Viereck et al. 1992). Aquatic plants such as Potamogeton spp. and Myriophyllum spp. may also be common (Viereck et al. 1992).

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

This class can persist or follow an alternate succession pathway to class C (probability = .1). Flooding (probability = .07) can cause a transition to class A.

Class C 30 %

Mid Development 1 All Structures

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

METR3	Upper
CAAQ	Upper
EQFL	Upper
COPA28	Upper

☐ Upper layer lifeform differs from dominant lifeform.

Description

One year plus

Wet Meadow or Herbaceous Fen

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Fens are nutrient-rich and have a thick peat layer that may be floating or submerged. Standing water is usually present (Viereck et al. 1992). Dominant species may include Menyanthes trifoliata, Equisetum fluviatile, Comarum palustris, Calla palustris, Eriophorum angustifolium and Carex aquatilis. Other common but non-dominant species include Caltha palustris, Cicuta makenzieana, Galium trifidum, Rumex arcticus and Utricularia spp., (Racine and Walters 1994). Standing water is often present. Shrubs, including Myrica gale, Salix candida, Betula nana and Alnus incana spp. tenuifolia, are occasionally present, but do not exceed 25% cover. Aquatic plants such as Myriophyllum spicatum, Hippuris vulgaris, Potamogeton spp. and Sparganium spp. May be present, and aquatic mosses are often present (Viereck et al. 1992). This system may be seral to poor fens and bogs.

This class can persist or follow an alternate succession pathway to class D (probability = 0.02) or class E (probability = 0.005). Flooding (probability = 0.03) can cause a transition to class A.

Class D 20 %

Mid Development 2 All Structures

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	None	

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

MYGA	Upper
BENA	Upper
CHCA2	Upper
SAPU15	Upper

☐ Upper layer lifeform differs from dominant lifeform.

Description

One year plus

Low Shrub Peatland

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

This mid to late seral stage includes low shrub-dominated wetlands within the floodplain. Common species include Betula nana, Myrica gale, Ledum groenlandicum, Salix fuscescens, S. pulchra, Empetrum nigrum, Chamaedaphne calyculata and Sphagnum spp. Soils are saturated for at least a portion of the growing season. Sites may be bogs, fens, or wetlands with <40cm of peat. Myrica gale and Chamaedaphne calyculata are indicators of fen conditions.

This class will persist in the absence of disturbance or follow an alternate succession pathway to class E (probability = 0.01). Flooding (probability = 0.02) can cause a transition to class A.

Class E 15 %

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

SPHAG2	Lower
VAOX	Upper
ANPO	Upper
ERAN6	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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

One year plus

Sphagnum peatlands, Sedge-Dwarf-Shrub Bog or poor fen.

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
This class is a late seral stage of the riparian wetland system. It includes bogs and poor fens with thick (>40cm) peat deposits. Organic soils are acidic and nutrient poor. Common species include Oxycoccus microcarpus, Andromeda polifolia, Rubus chamaemorus, Vaccinium uliginosum, Ledum groenlandicum, Betula nana, Empetrum nigrum, Carex microglochin, C. rotundata, C. rariflora, C. lasiocarpa,C. limosa, C. chordorrhiza, Eriophorum brachyantherum, E. angustifolium and Drosera spp. Sphagnum spp. are usually abundant in the ground layer.

This class will persist in the absence of disturbance. Flooding (probability = 0.02) can cause a transition to class A.

Disturbances

Fire Regime Group:** NA

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					
Mixed					
Surface					
All Fires					

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fire 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.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Additional Disturbances Modeled

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

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Racine, C.H. and J.C. Walters. 1994. Groundwater-discharge fens in the Tanana Lowlands, Interior Alaska, USA. Arctic and Alpine Research 26(4): 418-426.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016211 Western North American Boreal Black Spruce Dwarf-tree Peatland - Boreal Complex

☑ *This BPS is lumped with: see below*

☐ *This BPS is split into multiple models:* *This system was created by merging several Ecological Systems: Western North American Boreal Black Spruce Dwarf-tree Peatland, Western North American Boreal Freshwater Emergent Marsh, Western North American Boreal Wet Meadow, Western North American Boreal Low Shrub Peatland and Western North American Boreal Black Spruce-Tamarack Fen*

Western North American Boreal Black Spruce-Tamarack Fen is lumped with Western North American Boreal Black Spruce Dwarf-tree Peatland because it occurs on similar sites and has a similar successional trajectory. The main difference is that the late seral stage would be dominated by Larix laricina but this is accounted for in the model by including both Picea mariana and Larix laricina in the later seral stage.

Western North American Boreal Freshwater Emergent Marsh, Western North American Boreal Wet Meadow and Western North American Boreal Low Shrub Peatland are lumped as successional stages of this model when they occur on sites with permafrost dynamics. These three systems are also lumped into the Sub-boreal Fen Complex model where they occur on non-permafrost sites in the boreal or sub-boreal regions.

General Information

Contributors (also see the Comments field **Date** 4/4/2008

Modeler 1	Jill Johnstone	jill.johnstone@usask.ca	**Reviewer**	Michelle Schuman	michelle.schuman@ak.usda.gov
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Modeler 3			**Reviewer**		

Vegetation Type

Wetlands/Riparian

Map Zone

70

Model Zone

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

Dominant Species*

PIMA	LEGR
LALA	MYGA
SALIX	CAAQ
BENA	SPHAG2

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system is found throughout boreal AK, in valley bottoms and broad, poorly drained floodplains (such as Yukon and Tanana Flats).

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Biophysical Site Description

This sytem is typically found on valley bottoms and toe slopes up to eight percent slope, except on gravel substrates. Soils are poorly drained and acidic, often with a well-developed peat layer (NatureServe 2008). Much of this vegetation type is likely to be underlain by near surface permafrost (active layers <1m deep). The presence of permafrost and poor drainage of flat areas work in conjunction to keep soils cool and wet, restricting decomposition and aiding the accumulation of peat. Warming climates and deep-burning fires that occur late in the summer have the potential to disrupt the soil thermal regime and lead to permafrost thawing and subsidence (thermokarst). Thermokarst will lead to prolonged stages of wetland-marsh type vegetation. Re-establishment of black spruce forests is likely to occur when peat-reaccumulates and the permafrost develops again, leading to a rising of the surface above the water table.

Vegetation Description

Boreal Lowland Wet Black Spruce forests are typically open and trees are generally stunted. Tree rooting zones are typically within the organic layer, with low nutrient availability and low rates of growth. Forests will tend to be open and stunted compared to adjacent, more well-drained areas.

Common species include Picea mariana, Ledum groenlandicum, L. palustre ssp. decumbens, Betula nana, B. glandulosa, Empetrum nigrum, Vaccinium vitis-idaea, V. uliginosum, Chamaedaphne calyculata, Myrica gale, Carex spp., Eriophorum angustifolium, Menyanthes trifoliata and Sphagnum spp (NatureServe 2008). Larix laricina may be locally abundant, particularly on less acidic sites.

Disturbance Description

Fire and thermokarst are the most important processes influencing Boreal Lowland Wet Black Spruce. Fire return intervals for this type generally range from 80-130yrs (this is a best guess).

For the VDDT model, it was assumed that fire would occur on the less frequent end of the range provided above because the presence of moist surface fuel and the open forest canopy associated with this BpS would limit fire spread and therefore decrease the probability of any particular patch burning.

Thermokarst processes play a key role in shaping the system, but the number of possible pathways and the time scale at which they operate are beyond the limit of what can be modeled with VDDT. As a result, this model has been simplified and limited in scope. This model includes Western North American Boreal Freshwater Emergent Marsh, Western North American Boreal Wet Meadow and Western North American Boreal Low Shrub Peatland as seral stages in the Boreal Lowland Wet Black Spruce system. These four classes are linked by thermokarst processes, as well as by fire dynamics. Boreal Freshwater Emergent Marsh may maintain itself on the landscape for decades, but on sites where permafrost development is likely and under appropriate hydrologic conditions, it may begin to dry out, develop an organic layer and succeed to Boreal Wet Meadow. In this class, permafrost development begins, as mosses and organic material accumulate. This stage will succeed to Boreal Wet Low Shrub in the absence of disturbance and permafrost and peat development will continue. In the absence of disturbance, trees will eventually begin to invade and around age 75yrs, Boreal Lowland Wet Black Spruce or Black Spruce-Tamarack Fen will appear.

In any of the three stages with permafrost, there is a low probability (modeled as 0.001) that permafrost melting will set the system back to the Freshwater Emergent Marsh class. Fire is also a possibility in the shrub and forest classes. A severe fire that impacts the peat layer may kill the shrub rootstock, setting the system back to the Wet Meadow class. If such a fire is followed by flooding (as from permafrost melting), the system may transition back to the Marsh class. If the fire is less intense, the shrubs may resprout and recover quickly.

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Although it is outside of the scope of this model, the system just described is part of a larger system connected by thermokarst dynamics. Under some conditions, the marsh class of this system may develop into a different type of Wet Meadow, with more bog characteristics and permafrost may not develop again. This trajectory leads into the Ericaceous Dwarf Shrub Bog model, which could eventually lead to a forested bog or Wet Black Spruce-Tussock Woodland. In this forested stage, a permafrost layer would develop again. Alternatively, the Black Spruce Dwarf-tree Peatland or Black Spruce-Tamarack Fen could undergo paludification and transition to Boreal Sedge-Dwarf-Shrub Bog system. This can happen when restricted drainage from permafrost development (on inactive alluvial terraces, for example) leads to the establishment of Sphagnum spp. or other peat forming mosses or sedges and over time, peatland plants dominate the site.

In either of these pathways, the forested bog or Tussock Black Spruce class has the potential to undergo permafrost melting and collapse and transition back to Marsh. However, these cycles are likely to take thousands of years and are thus outside the scope of this modeling effort. Other pathways that would take the system out of this model include melting and impoundment, leading to an open water stage, or drainage of the marsh stage, leading into a white spruce-Calamagrostis canadensis system.

Another pathway into this system is paludification over thousands of years, which could move a site from the Boreal and Sub-boreal Fen Complex model into this system.

Adjacency or Identification Concerns

This type can be found adjacent to Boreal Black Spruce Wet-Mesic Slope Woodland and Boreal Mesic Black Spruce Forest - Boreal. Boreal Lowland Wet Black Spruce is typically found on valley bottoms and toe slopes up to eight percent slope. As the slope increases past eight percent, the vegetation typically transitions to Mesic Black Spruce Forest or, on north-facing slopes, to Black Spruce Wet-Mesic Slope Woodland. Well-drained gravel sites may support Mesic Black Spruce Forest, even in low, flat areas.

Native Uncharacteristic Conditions

Scale Description

Large patch (Small patch)

Issues/Problems

Because the climate has been warming and drying over recent decades, thermokarst processes have been accelerating. At the same time, lakes and marshes have been shrinking and drying across the boreal region in recent decades. Many of the marshes in this region may be relicts of the earky Holocene post-glacial period, rather than parts of a stable cycle of disturbance and succession. As a result, the concept of equilibrium dynamics inherent in this modeling process is difficult to apply to this system. Because thermokarst processes are accelerating, it was difficult to assign a reference probability to these processes. Over the past 5000yrs, the probability of thermokarst influencing a given point on the landscape averaged about 0.000014, compared with approximately 0.0006 in the past 50yrs. Under current climate conditions, the probability is presumably higher.

Comments

This model was created by Torre Jorgenson and refined by Colleen Ryan based on a more narrowly focused model created by Jill Johnstone for the Boreal Lowland Wet Black Spruce system. Jill Johnstone reviewed the final model for the wetland complex. Information provided by Amy Larsen was used in developing this model.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

TYLA	Upper
CARO6	Upper
EQFL	Upper
	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0-20yrs

Freshwater Emergent Marsh.

This class is characterized by herbaceous marsh vegetation such as Typha latifolia, Carex rostrata, C. aquatilis, C. utriculata, Scirpus validus, Menyanthes trifoliata, Equisetum fluviatile and Eleocharis palustris. Arctophila fulva becomes more common in the northern boreal region. Floating aquatic vegetation (Nuphar polysepalum and Potamogeton spp.) may also be present. Water level may fluctuate seasonally or between years, but is at or above the surface for most of the growing season. Areas of open water are often present seasonally. Permafrost is absent in the class.

If water levels continue to be high, with frequent large fluctuations, class A may maintain itself for decades. If the hydrologic regime begins to stabilize and dry, this class may succeed to class B (Wet Meadow) in two years plus.

Fire is extremely unlikely in this class.

With regular seasonal flooding and high water levels, this class maintains itself. Alternate succession to class B (probability = 0.12) may occur if water levels stabilize and the site begins to dry.

Class B 5%

Mid Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

CACA4	Upper
CAAQ	Upper
ERAN6	Upper
	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Distinguish from class A for mapping by lack of aquatic plants and open water, presence of organic mat, mosses, permafrost, and/or dominance of sedges.

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Description

3-5yrs

Wet Meadow.

This class is characterized by dense sedges with a well-developed organic mat. Common and characteristic species include Calamagrostis canadensis, Carex aquatilis, C. bigelowii, Eriophorum angustifolium, E. russeolum, E. vaginatum, Equisetum arvense, Equisetum sylvaticum, Epilobium angustifolium and the moss Ceratodon purpureus (Gracz 2005, Jorgenson et al. 1999).

Water levels are more stable in this class than in the Freshwater Emergent Marsh. Soils are saturated at some point in the growing season but do not have standing water (NatureServe 2008). Permafrost development has begun in this class, making it subject to thermokarst processes. Fire is very unlikely in this class, due to the saturated soils.

Succession to class C under typical (drying) conditions. Option 1 (probability = 0.02) represents a stable hydrologic regime that maintains class B. Option 2 (probability = 0.0006) represents increased water levels which would cause a transition to class A.

Class C **45 %**

Mid Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
LEGR	Upper
SALIX	Lower
VACCI	Lower

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)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

6-74 yrs

Low Shrub Peatland

Dwarf ericaceous, low or tall shrubs dominate this class. Myrica gale and Chamaedaphne calyculata are among the first shrubs to invade. Presence of sphagnum mosses tends to increase soil acidity which in turn favors the ericaceous shrubs such as Ledum groenlandicum, L. palustre ssp. decumbens, Andromeda polifolia and Vaccinium uliginosum. Other common shrub species include Salix spp., Betula nana (B. glandulosa) and Empetrum nigrum.

Permafrost is well developed in this class, making it subject to thermokarst processes. Fire is possible in this class during dry periods.

Succession to class D under typical conditions. Severe replacement fire (MFRI = 175yrs) that burns into the peat layer will kill the shrubs, causing a transition to class B. Replacement fire followed by a hydrologic change that increased the water level could cause a transition to class A (probability = 0.0017). Option 2 (probability = 0.0006) represents increased water levels as a result of thermokarst processes which could kill the existing vegetation causing a transition to class A.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class D 45 %

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
LALA	Upper
BENA	Lower
MYGA	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

75yrs+

Mature wet black spruce forest. Picea mariana or Picea mariana-Larix laricina mix. Trees are generally stunted and generally pole sized although some achieve the medium (9-21in) size class. The presence of Larix laricina is associated with higher soil pH. Common understory species include the same shrubs as in class C, as well as Calamagrostis canadensis, Carex aquatilis, C. bigelowii and sphagnum.

Permafrost is well developed in this class, making it subject to thermokarst processes. The probability of fire is similar to that in the shrub class because the shrubs carry the fire.

This class persists in the absence of disturbance. Overall replacement MFRI = 130yrs. Severe replacement fire (MFRI = 175yrs) will kill the shrubs, causing a transition to class B. Replacement fire followed by a hydrologic change that increased the water level could cause a transition to class A (probability = 0.0017). A mixed fire (MFRI = 333yrs) that killed most of the trees and top-killed the shrubs would cause a transition to class C. Option 2 (probability = 0.0006) represents increased water levels as a result of thermokarst processes which could kill the existing vegetation causing a transition to class A.

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	133.7			0.00748	84
Mixed	727.7			0.00137	16
Surface					
All Fires	113			0.00886	

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
- [x] Other (optional 1) continued high water level
- [ ] Wind/Weather/Stress
- [ ] Competition
- [x] Other (optional 2) increased water level (thermokarst processes)

References

Foote, M. Joan. 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 Forest and Range Experiment Station. 108 pp.

Gracz, M., Noyes, K, North, P. and Tande, G. 2005 Wetland Mapping and Classification of the Kenai Lowland, Alaska. http://www.kenaiwetlands.net/.

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Post, R.A. 1996. Functional profile of black spruce wetlands in Alaska. US EPA, Alaska Operations Office, Seattle, WA. EPA/910/R-96/006. 170 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016220** **Western North American Boreal Black Spruce Wet-Mesic Slope Woodland**

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

General Information

Contributors (also see the Comments field **Date** 4/18/2008

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Modeler 3			**Reviewer**	Lisa Saperstein	Lisa_Saperstein@fws.gov

Vegetation Type
Wetlands/Riparian

Map Zone
70

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

Dominant Species*
PIMA VAUL
LEPAD BENA
VAVI SPGI70
EMNI

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
This system is found throughout interior boreal AK.

Biophysical Site Description
This BpS is found on north-facing slopes underlain by permafrost. Soils are poorly drained and acidic with a well-developed peat layer (NatureServe 2008).

Vegetation Description
The dominant overstory vegetation is Picea mariana. Mature trees on these sites are usually smaller than those on mesic sites. Common shrubs include Ledum groenlandicum, Ledum palustre, Betula nana (this species here includes B. glandulosa), Empetrum nigrum, Vaccinium vitis-idaea and V. uliginosum (NatureServe 2008). Herbs include Equisetum sylvaticum, Rubus chamaemorus and Carex spp.(Foote 1983). Older stands will include lichens, especially Cladina arbuscula and C. rangiferina. Mosses include Sphagnum spp., Pleurozium schreberi and Polytrichum spp. Feathermosses are typical of cooling soils, which can lead to permafrost development. Sites where permafrost is closer to the surface will have more sphagnum.

Disturbance Description
Fire is the dominant disturbance mechanism for this forest type. Fire is facilitated by an abundance of fine fuel and ladder fuel in this type. The overall MFRI for this model is similar to that for Western North American Boreal Mesic Black Spruce Forest - Boreal. Despite saturated soils, wet black spruce forest on

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

slopes lacks the standing water that limits fire in wet black spruce flats (Boreal Lowland Wet Black Spruce Complex). Fires in this forest type are usually fast-moving and patchy. High severity fire may lead to an increased deciduous tree component (Johnstone and Kasischke 2005).

Adjacency or Identification Concerns

This type is intermingled with the Western North American Boreal Mesic Black Spruce Forest - Boreal BpS and the Boreal Lowland Wet Black Spruce Complex BpS. Boreal Lowland Wet Black Spruce Complex is found on low flats and concave and toeslope sites. Boreal Black Spruce Wet-Mesic Slope Woodland is found on north-facing slopes, while Mesic Black Spruce Forest - Boreal is found on upper, convex slopes of other aspects. In hilly areas, Lowland Wet Black Spruce Complex typically occurs on the flats and toe slopes up to an eight percent grade (T. Jorgenson, pers. Comm.) Above the eight percent cutoff will be Boreal Black Spruce Wet-Mesic Slope Woodland on north-facing slopes or Boreal Mesic Black Spruce Forest - Boreal on other slopes.

This model applies to sites with well-developed peat soils on permafrost. In contrast, mesic black spruce typically occurs on sites lacking permafrost and peat soils in the southern parts of the Boreal region. North of Fairbanks, both Boreal Mesic Black Spruce Forest - Boreal and Boreal Lowland Wet Black Spruce Complex may occur with permafrost.

Native Uncharacteristic Conditions

Scale Description

Large patch (Small patch)

Issues/Problems

Comments

Joan Foote and Colleen Ryan drafted this model. Michelle Schuman, Lisa Saperstein and Will Putnam reviewed an early draft of this model.

Vegetation Classes

Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

EQSY	Upper
BENA	Middle
RUCH	Low-Mi
SPGI70	Lower

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)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Herbs or shrubs can dominate.

Description

0-19yrs

Herbaceous and/or shrub, open or closed. After a fire, herbs and shrubs quickly re-establish on the site. Soon, the shrubs begin to overtop the herbs. By the end of this class, a closed shrub canopy is present. Spruce seedlings are present in the understory.

Common shrubs include Ledum groenlandicum, Ledum palustre, Betula nana (syn. B. glandulosa), Empetrum

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

nigrum, Vaccinium vitis-idaea and V. uliginosum. Herbs include Equisetum sylvaticum, Rubus chamaemorus and Carex spp. Mosses include Sphagnum spp., Pleurozium schreberi and Polytrichum spp. On some sites, alder and willow may be present.

Fire is unlikely in this class due to lack of fuel and saturated soils. Any fire will be stand-replacing.

Succession to class B. Replacement MFRI = 1000yrs.

Class B 20 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Mid-Upper
RUCH	Low-Mid
EMNI	Low-Mid
SPGI70	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Closed (60-100% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, if this class can not be be distinguished from class C and D by existing vegetation type (Black Spruce Scrub and Shrub Swamp), class B can be considered a dwarf tree class.

Description

20-40yrs

Black spruce, open or closed, seedling/sapling. This class is dominated by black spruce saplings and shrubs. Early in this stage, the tree seedlings begin to overtop the low shrubs. By the end of this class, the trees will overtop the tall shrubs (willow and/or alder), if present. The end of this class will be a closed stand of spruce saplings. In some cases, this class may include older black spruce trees that have survived a mixed fire.

Succession to class C is the primary pathway, which is followed by closed stands. If this class is open, it will succeed to class D, represented in the model by alternate succession (probability=0.03). Replacement MFRI = 170yrs. Mixed fire (MFRI = 170yrs) maintains the system in class B.

Class C 35 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
RUCH	Low-Mid
EMNI	Low-Mid
SPGI70	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

40yrs+

Black spruce, closed. This class is dominated by relatively dense sapling to pole-sized Picea mariana, typically in even-aged stands. Trees will typically range from 2.5-10cm DBH and 2-7m tall (Foote 1983).

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

However, uneven aged stands may occur where some individuals have survived an earlier mixed fire. The canopy is nearly 100% spruce.

This is typically the most flammable class because of the pulses of fuel created by the die-off of overtopped shrubs around age 40-60yrs. Abundant snags, dead lower branches and fine fuel also increase the likelihood of fire in this class. Mixed fire in this class will transition the system to class B, creating patches of mature trees in a matrix of shrubs, with spruce regeneration in the understory.

This class will persist in the absence of disturbance. Replacement MFRI = 125yrs. Mixed fire (MFRI = 110yrs) causes a transition to class B.

Class D 35 %

Late Development 2 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
PLSC70	Lower
CLADI3	Lower
SPGI70	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% 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

40yrs+

Black spruce/lichen, open. Open canopy mature Picea mariana, with feathermoss and lichen. Mosses and lichens expand with age, as the leaf litter from the shrubs disappears. In this class, the canopy has begun to open up and lichen development has begun. Lichen species include Cladina arbuscula, C. rangiferina and Nephroma articum. Mosses include Pleurozium schreberi, Polytrichum spp., Hylocomium splendens and Dicranum spp, as well as Sphagnum spp. Low shrubs, including Vaccinium vitis-idaea, V. uliginosum and Ledum groenlandicum, are often present in the understory.

Any fire in this class will kill the lichens. Mixed fire will transition the system to class B, creating patches of mature trees in a matrix of shrubs, with spruce regeneration in the understory.

This class will persist in the absence of disturbance. Replacement MFRI = 170yrs. Mixed fire (MFRI = 110yrs) causes a transition to class B.

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** III

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	163.9			0.0061	46
Mixed	140.8			0.0071	54
Surface					
All Fires	76			0.01321	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Foote, M. Joan. 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 Forest and Range Experiment Station. 108 pp.

Johnstone, J.F. and E.S. Kasischke. 2005. Stand-level effects of soil burn severity on post-fire regeneration in a recently-burned black spruce forest. Canadian Journal of Forest Research 35: 2151-2163.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016240** **Western North American Boreal Deciduous Shrub Swamp**

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

General Information

Contributors (also see the Comments field **Date** 4/24/2008

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Modeler 2	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type
Wetlands/Riparian

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*
ALINT CACA4
ALVIS EQUIS
SAPU15
SARI4

General Model Sources
- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
This BpS occurs throughout the boreal and sub-boreal regions of AK.

Biophysical Site Description
Shrub swamps occur on poorly drained fine textured soil in lowland areas or depressions that retain standing water throughout all or most of the growing season (NatureServe 2008; Viereck et al. 1992). Soils range from muck to mineral (does not include peatlands; NatureServe 2008).

This system tends to occur in transition zones between peatlands and forest systems. Specific locations may shift over time.

Vegetation Description
Deciduous shrub swamps are usually dominated by alders, but willows or an alder/willow mix also occur (Viereck et al. 1992). Common species include Alnus incana ssp. tenuifolia, Alnus viridis ssp. sinuata, Salix pulchra, Salix richardsonii, Calamagrostis canadensis, Equisetum spp., Potentilla palustris (Comarum palustre) and hydrophytic mosses (Viereck et al. 1992).

Though this system is classified as closed by Viereck, et al. (1992), it may also occur in an open form.

Disturbance Description
Shrub swamps likely represent a topoedaphic climax community which will persist as long as the hydrologic conditions supporting them are maintained (Viereck et al. 1992). Some sites may move back and forth between this system and peatlands, forest, or even open water as hydrology changes, but these transitions are not directional and are generally outside of the time scale of this model.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

This system typically acts as a fire break, but it could burn under drought conditions and severe fire behavior. When fire occurs, it is likely to be replacement fire. Alder may resprout following fire, allowing recovery to this system. Alternatively, fire may cause changes in hydrology that could transition the site out of this system, possibly toward an open water condition. Replacement fire that regenerated this system is estimated at an MFRI of 500yrs.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Typically small patch, but some large patches occur, especially in the Tanana Flats area.

Issues/Problems

Comments

Addition of an early herb stage was considered, but it is believed that shrubs typically recover quickly from fire. Flooding was not included as a disturbance because the dominant species are flood-tolerant. Flooding severe or prolonged enough to kill the shrubs is likely to cause a transition out of this system.

Suggested reviewers for this system include: Al Batten, Torre Jorgenson and Katie Ireland.

Vegetation Classes

Class A 100 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ALINT	Upper
ALVIS	Upper
SAPU15	Upper
SARI4	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)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

Open to closed tall shrub swamp. The shrub canopy is commonly 3-5m tall (Viereck et al. 1992). Overstory is typically dominated by alder, willow or an alder/willow mix. Common overstory species include Alnus incana ssp. Tenuifolia, Alnus viridis ssp. sinuata, Salix pulchra and S. lanata. Understory can include Calamagrostis canadensis, Equisetum spp., Potentilla palustris (Comarum palustre) and hydrophytic mosses.

This class persists indefinitely under appropriate hydrological conditions. Replacement fire (MFRI = 500yrs) will reset the class to age zero, as shrubs resprout.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	496.1			0.00202	99
Mixed					
Surface					
All Fires	496			0.00204	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Batten, Alan R., S. Murphy and D.F. Murray. 1978. Definition of Alaskan coastal wetlands by floristic criteria. Corvallis, OR: Corvallis Environmental Research Laboratory; EPA 804965-01. 490 pp.

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Viereck, L.A., Dyrness, C.T., Batten, A.R., Wenzlick, K.J. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, U. S. Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016280** **Western North American Boreal Low Shrub-Tussock Tundra**

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

General Information

Contributors (also see the Comments field **Date** 4/4/2008

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Modeler 2			**Reviewer**	Stuart Chapin	fffsc@uaf.edu
Modeler 3			**Reviewer**		

Vegetation Type
Upland Shrubland

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*

ERVA4	LEPAD
CABI5	VACCI
BENA	CACA4
SAPU15	ARCTA

General Model Sources
- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Geographic Range
This BpS occurs in the boreal and the northern section of the sub-boreal region of AK. It is found on lowland to subalpine sites.

Biophysical Site Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Permafrost is usually present at depths of 30-50cm. Soils are generally acidic, poorly drained, gleyed, and often with a poorly decomposed organic horizon at the surface, which may constitute most of the active layer. Frost scars are common. Tussock communities occur on gentle slopes, terraces and old alluvial deposits. Sites are often underlain by silty mineral soils with a surface peat layer 10-40cm thick surrounding the tussocks (Viereck et al 1992).

Vegetation Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Boreal Low Shrub-Tussock Tundra is a common lowland system dominated by tussock sedges and low shrubs. Eriophorum vaginatum is the primary tussock-former in most stands, but Carex bigelowii may be the dominant tussock sedge on some sites. Other indicator species include Betula nana (includes B. glandulosa), Salix pulchra, Ledum decumbens (Ledum palustre L. ssp. Decumbens), Vaccinium vitis-idaea, V. uliginosum, Empetrum nigrum and Carex spp. Grasses, including Calamagrostis canadensis and Arctagrostis spp., may also be present. Lichens are scarce (with the possible exception of Peltigera canina).

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Disturbance Description

The fuel layer in sedge-shrub tussock tundra is dense and continuous and leads to large, fast spreading fires (Duchesne and Hawkes 2000, Racine et al 1987). Racine (1979) found much variation in burn intensity on a landscape scale on the Seward Peninsula, from completely unburned to intensely burned. These patterns are related to variations in topography and the composition, moisture content and soil organic accumulations of the plant communities. Fires in Eriophorum tussock tundra types tend to be light because of the wet soil profile (Wein 1971). Burns in this type usually consume all aerial woody and herbaceous plant material and litter; regeneration is vigorous via rhizomes and root sprouts. Racine (1979) found that burning was generally less severe in the tussock-shrub and sedge-shrub tundras than in the birch and ericaceous shrub tundra of the Seward Peninsula. He found that tundra burns were patchy, with unburned communities and unburned patches within burned communities.

More fires occur near the forest-tundra ecotone and spread further if trees are present (Heinselman 1981). Wein (1976) reports that July and August are the most common months for lightning fires in tundra ecosystems, while Racine et al (1983; 1985) found that distinct fire seasons occur in both June and July in the Noatak River watershed. Subsidence and thermal erosion following fire is usually minimal in tundra ecosystems (Walker 1996).

In most areas of tussock-shrub tundra on the Seward Peninsula, less than one half of accumulated organic soil layer was removed by fire (Racine 1979). Thaw depths increased to reach into the mineral soils, but were not greatly increased except where organics were removed. Frost features were made more conspicuous and soil nutrient concentrations (K and P) increased locally.

Mean fire return interval estimates for tussock tundra ecosystems include:
-50-300yrs (personal communication FRCC experts' workshop March 2004)
-260yr (s.d. 170) fire return interval for past 1500yrs for Noatak National Preserve (preliminary data from Higuera et al. 2008)
-180-1460yrs in forest shrubzone and 9320yrs in shrub subzone in northern Quebec; shorter cycle west of Hudson's Bay/in interior zone (Payette et al 1989)
-612yrs for Noatak River watershed (all vegetation types) (Racine et al 1983)
-611yr fire rotation for Noatak River watershed (all vegetation below 600m which is predominantly tundra) (Racine et al 1985)
-Fire interval yet to be determined (Racine et al 1987)
-Rapid recovery following fire makes fire frequency difficult to determine (Wein 1971)
-The fire regime of tundra systems are likely quite variable from one region to another making generalizations difficult (Viereck and Schandelmeier 1980)

On interior and southcentral Alaska Tussock Tundra sites the thaw pond cycle (disturbance leads to thawing of permafrost and ponding) and paludification (sphagnum layer buildup and saturation) are important disturbances. On the Seward Peninsula and western AK, frost action creates polygonal ground and other periglacial features and is a widespread, small-scale and continuous disturbance.

Change in the arctic and subarctic climate is another source of disturbance that is currently affecting tundra ecosystems.

Adjacency or Identification Concerns

The Boreal Low Shrub-Tussock Tundra is similar to the Arctic Tussock Low Shrub Tundra system (and the Tussock Tundra 2 PNV) that occurs in AK's arctic and has a longer mean fire return interval

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(NatureServe 2008). Geographic location is the best determinant between these two systems.

Native Uncharacteristic Conditions

Scale Description

Vegetation is found in large patches.

Wien (1976) reports many tundra fires in the 1-100ha size range and few large (thousands of ha) fires. Racine (1979) reports that in 1977, lightning-caused fires burned 35,480ha on the Seward Peninsula, with one fire burning 9440ha. Jandt and Meyers (2000) report that large fires (>200,000ha) occur about every 10yrs in the Buckland Valley and surrounding highlands of the Seward Peninsula. Racine et al (1983) found that 40 fires burned 100,000ha (1000km2) in the 30,000km2 watershed of the Noatak River between 1956 and 1981. Racine et al (1985) found a minimum fire size of 0.4ha, a maximum fire size of 45,800ha and a mean fire size of 1310ha from 1956-1983 in the Noatak River watershed, an area dominated by tundra vegetation. Of the 79 fires in analyzed by Racine et al (1985), nearly half were between one and 10ha in size. Forty-three percent of wildland fires occurring in interior AK occur in treeless areas, primarily tundra bogs and fens (Viereck 1975).

Issues/Problems

Comments

This model was based on the FRCC Guidebook PNVG model for Tussock Tundra 1 (TT1; Murphy and Witten 2006) and input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and was refined by Jennifer Allen. Much of the text in the Disturbance Description and Scale Description portion of this report were taken from the TT1 description (Murphy and Witten 2006).

Vegetation Classes

Class A 10%

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ERVA4	Upper
CABI5	Upper
CACA4	Upper
ARCTA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-14yrs

Mesic herbaceous-graminoid-tussock-sedge. First year following fire Eriophorum (cottongrass) and Carex spp. (sedges) regrow via rhizomes, most vascular species begin to recover, shrubs sprout from rootstock. Sedges often capture site 6-10yrs post fire. Grasses (Calamagrostis and Arctagrostis) are locally important following fire.

Succession to class B. Replacement MFRI = 175yrs.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 75 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
SALIX	Upper
ERVA4	Upper
CABI5	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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Classes B and C should be mapped based on EVT if possible. Class B is represented by Mixed Shrub-Sedge Tussock Tundra/Bog and class C by tussock-shrub-lichen. If these types are not mapped, B can be considered a low shrub class and C a dwarf shrub class for mapping.

Description

15yrs+

Low shrub-tussock. Tussocks dominated by Eriophorum (cottongrass) and Carex spp. (sedges). Common shrub species include Betula nana, Salix spp. and Vaccinium uliginosum. Lichens begin to re-establish but do not reach former abundance until 50-120yrs following fire. Fire is difficult to detect even in the early stages of this class; however, the proportions of species differ from the pre-burn community, with very few lichens, fewer shrubs and more sedges, grasses and cottongrass. Former abundances of all species are typically reached 50-120yrs post fire. Lichens, if present, have <25% cover.

This class can persist in the absence of disturbance or follow an alternate succession pathway to class C (probability = 0.001). Replacement MFRI = 175yrs causes transition to class A.

Class C 15 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
SALIX	Upper
ERVA4	Upper
PECA60	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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Classes B and C should be mapped based on EVT if possible. Class B is represented by Mixed Shrub-Sedge Tussock Tundra/Bog and class C by tussock-shrub-lichen. If these types are not mapped, B can be considered a low shrub class and C a dwarf shrub class for mapping.

Description

80yrs+

Dwarf shrub-lichen-tussock. Tussocks are dominated by shrubs and lichens. Species composition is similar

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to that in class B, but lichen cover is >25%.

This class can persist in the absence of disturbance. Replacement MFRI = 200yrs causes transition to class A. Mixed fire (MFRI = 2000yrs) maintains this class.

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **IV**

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	180			0.00556	98
Mixed	9999			0.00010	2
Surface					
All Fires	177			0.00567	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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LANDFIRE Biophysical Setting Model

Biophysical Setting 7016290 Western North American Boreal Tussock Tundra

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

General Information

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Vegetation Type
Upland Grassland/Herbaceous

Map Zone
70

Model Zone
- ☑ Alaska
- ☐ California
- ☐ Great Basin
- ☐ Great Lakes
- ☐ Northeast
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- ☐ Southeast
- ☐ S. Appalachians
- ☐ Southwest

Dominant Species*

ERVA4	BENA
CABI5	LEPAD
VAOX	SPHAG2
CHCA2	PLSC70

General Model Sources
- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Geographic Range
This BpS occurs in the boreal and the northern section of sub-boreal region of AK. It is found on lowland to subalpine sites.

Biophysical Site Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Permafrost is usually present at depths of 30-50cm. Soils are generally poorly drained, gleyed, and often with a poorly decomposed organic horizon at the surface, which may constitute most of the active layer. Frost scars are common. Tussock bog communities occur on lowlands of boreal and boreal transition AK, on filled-in sloughs on flood plains and on cold, poorly drained slopes and terraces. These sites are underlain by wet, silty mineral soils with a surface peat layer 10-40cm thick surrounding the tussocks (Viereck et al 1992).

Vegetation Description
The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Boreal Tussock Tundra is dominated by sedges in a tussock growth form. Eriophorum vaginatum is the primary tussock-former in most stands and Carex bigelowii is also common. On wetter sites, Oxycoccus spp. (Vaccinium oxycoccos) and Chamaedaphne calyculata may be present. Total shrub cover is <25%, although shrubs such as Betula nana (including B. glandulosa), Ledum decumbens (Ledum palustre L. ssp. Decumbens), Vaccinium spp. may be present. Mosses (Sphagnum spp., Pleurozium schreberi, Hylocomium splendens) may form a nearly continuous mat between tussocks. Lichens may be a

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significant component on some sites.

Disturbance Description

The fuel layer in sedge-shrub tussock tundra is dense and continuous and leads to large, fast spreading fires (Duchesne and Hawkes 2000, Racine et al 1987). Racine (1979) found much variation in burn intensity on a landscape scale on the Seward Peninsula, from completely unburned to intensely burned. These patterns are related to variations in topography and the composition, moisture content and soil organic accumulations of the plant communities. Fires in Eriophorum tussock tundra types tend to be light because of the wet soil profile (Wein 1971). Burns in this type usually consume all aerial woody and herbaceous plant material and litter; regeneration is vigorous via rhizomes and root sprouts. Racine (1979) found that burning was generally less severe in the tussock-shrub and sedge-shrub tundras than in the birch and ericaceous shrub tundra of the Seward Peninsula. He found that tundra burns were patchy, with unburned communities and unburned patches within burned communities.

More fires occur near the forest-tundra ecotone and spread further if trees are present (Heinselman 1981). Wein (1976) reports that July and August are the most common months for lightning fires in tundra ecosystems, while Racine et al (1983; 1985) found that distinct fire seasons occur in both June and July in the Noatak River watershed. Subsidence and thermal erosion following fire is usually minimal in tundra ecosystems (Walker 1996).

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-50-300yrs (personal communication FRCC experts' workshop March 2004)
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Change in the arctic and subarctic climate is another source of disturbance that is currently affecting tundra ecosystems.

Adjacency or Identification Concerns

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Native Uncharacteristic Conditions

Scale Description

Vegetation found in large patches

Wien (1976) reports many tundra fires in the 1-100ha size range and few large (thousands of ha) fires. Racine (1979) reports that in 1977, lightning-caused fires burned 35,480ha on the Seward Peninsula, with one fire burning 9440ha. Jandt and Meyers (2000) report that large fires (>200,000ha) occur about every 10yrs in the Buckland Valley and surrounding highlands of the Seward Peninsula. Racine et al (1983) found that 40 fires burned 100,000ha (1000km2) in the 30,000km2 watershed of the Noatak River between 1956 and 1981. Racine et al (1985) found a minimum fire size of 0.4ha, a maximum fire size of 45,800ha and a mean fire size of 1310ha from 1956-1983 in the Noatak River watershed, an area dominated by tundra vegetation. Of the 79 fires in analyzed by Racine et al (1985), nearly half were between one and 10ha in size. Forty-three percent of wildland fires occurring in interior AK occur in treeless areas, primarily tundra bogs and fens (Viereck 1975).

Issues/Problems

Experts at the Fairbanks meeting indicated the need for a late seral sphagnum tussock bog stage that would develop as a result of paludification in class B. The VDDT model does not include that stage because it would be hard to distinguish for mapping using LANDFIRE methods.

This model is based in part on data from the Seward Peninsula, which is not part of the boreal region. In particular, much of the data on fire regimes comes from the Seward and Noatak areas, both of which are part of the Arctic region.

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and refined by Jennifer Allen. Much of the text in the Disturbance Description, Scale Description and Succession Class Descriptions in this report were taken from the Tussock Tundra 1 PNVG model description (Murphy and Witten 2006).

This model was origioanlly developed with two herbaceous classes: a Mesic Graminoid Tussock and a Wet Graminoid Tussock class. When it was determined that the LANDFIRE project would not be able to distingusish these classes using a Viereck et al. (1992) based existing vegetation map, these two classes were lumped into what is now class A.

Vegetation Classes

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Class A 85 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

ERVA4	Upper
CABI5	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

Mesic graminoid tussocks dominates for the first 10yrs or longer. First year following fire Eriophorum (cottongrass) and Carex spp. (sedges) regrow via rhizomes, most vascular species begin to recover, shrubs sprout from rootstock. Sedges often capture site 6-10yrs post fire. Grasses (Calamagrostis and Arctagrostis) are locally important following fire. A high severity fire can lead to increased shrub development (class C), whereas a low to moderate severity fire typically leads to the development of a wet graminoid tussock stage.

Wet graminoid tussock can dominate some sites developing about 10yrs post fire. It is the most common stage after a low to moderate severity fire. Over time paludification results in the development of a sphagnum tussock bog (the model does not include the sphagnum tussock bog stage because it would be hard to distinguish for mapping using LANDFIRE methods).

This class persists in the absence of disturbance or will follow an alternate successional pathway to class B (probability = 0.001). Replacement MFRI = 175yrs.

Class B 15 %

Late Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

CHCA2	Upper
VAOX	Upper
ERVA4	Upper
CABI5	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)	Dwarf Shrub (< 20 cm)
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

10yrs+

Dwarf shrub, tussock. Most common stage after a high severity fire. Tussocks dominated by Eriophorum (cottongrass) and Carex spp. (sedges). Common shrubs include Oxycoccus spp. (Vaccinium oxycoccus), Chamaedaphne calyculata, Betula nana, Ledum decumbens and Vaccinium. Lichens begin to re-establish but do not reach former abundance until 50-120yrs following fire. Fire is difficult to detect even in the early stages of this class, however the proportions of species differs from the pre-burn community, with very few lichens, fewer shrubs and more sedges, grasses and cottongrass. Former abundances of all species are typically reached 50-120yrs post fire.

This class persists in the absence of disturbance. Replacement MFRI = 175yrs.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **IV**

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	175			0.00571	100
Mixed					
Surface					
All Fires	175			0.00573	

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Additional Disturbances Modeled

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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016300** **Western North American Boreal Wet Black Spruce-Tussock Woodland**

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

General Information

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

Modeler 1	Kori Blankenship	kblankenship@tnc.org	**Reviewer**	Lisa Saperstein	Lisa_Saperstein@fws.gov
Modeler 2	Robert Lambrecht	Robert_Lambrecht@fws.gov	**Reviewer**	Stuart Chapin	fffsc@uaf.edu
Modeler 3			**Reviewer**		

Vegetation Type
Wetlands/Riparian

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*

PIMA	VAVI
BENA	ERVA4
LEPAD	CABI5
VAUL	RUCH

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
Boreal Wet Black Spruce-Tussock Woodland is found throughout interior AK from the southern slopes of the Brooks Range to southcentral AK (not including the sub-boreal region) and west to the limit of tree growth (NatureServe 2008).

Biophysical Site Description
This type is found on north-facing slopes, gentle hills, and inactive alluvial surfaces underlain by permafrost (NatureServe 2008). Soils are poorly drained and consist of tussocks over peat or mineral soil (Jorgenson et al. 2001, Boggs and Sturdy 2005).

Vegetation Description
Picea mariana is the dominant tree species and occurs in open stands. Tussock-forming sedges contribute at least 25% of the vegetation cover (NatureServe 2008). Common understory shrubs include Betula nana (including B. glandulosa), Ledum palustre ssp. Decumbens., Vaccinium uliginosum and V. vitis-idaea. Herbaceous species include Eriophorum vaginatum, Carex bigelowii and Rubus chaememorus (NatureServe 2008). Mosses may be abundant and include Sphagnum spp. and Hylocomium splendens (Jorgenson et al. 2001, Boggs and Sturdy 2005).

Disturbance Description
Fire is the primary disturbance in this system. Fire severity is generally sufficient to kill the overstory. Mean fire return interval estimates in boreal AK range from 25-130yrs (Rowe et al.1974, Yarie 1983, Heinselman 1978, Heinselman 1981, Viereck 1983, Viereck 1986).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Under appropriate conditions, this system can originate from a very late seral stage of the Boreal Black Spruce Dwarf-tree Peatland system.

Adjacency or Identification Concerns

This system tends to occur on a continuum between the Boreal Black Spruce Dwarf-tree Peatland system and the Boreal Low Shrub-Tussock Tundra system. Boreal Wet Black Spruce-Tussock Woodland occurs on sites that are slightly higher and drier than tussock-shrub sites and slightly lower and wetter than wet black spruce sites.

The herb and shrub classes of this system are similar in structure and composition to the herb and shrub classes of the Boreal Low Shrub-Tussock Tundra system, but the Boreal Low Shrub-Tussock Tundra system occurs where site conditions prevent trees from invading.

Native Uncharacteristic Conditions

Scale Description

Large patch (Small patch)

Issues/Problems

Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and refined by Robert Lambrecht. Torre Jorgenson provided some information on the relationships between this system and adjacent systems.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ERVA4	Upper
CABI5	Upper
RUCH	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-9yrs

This class is characterized by tussock forming sedges. Common species include Eriophorum vaginatum, Carex bigelowii and Rubus chaememorus.

Succession to class B. Replacement MFRI = 150yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B 20 %

Mid Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

BENA	Upper
LEPAD	Upper
VAUL	Upper
VAVI	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open Shrub (25-74% shrub cover)	Open Shrub (25-74% 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

10-49yrs

Shrubs resprout quickly after fire, becoming the dominant, upper-level canopy layer in 10-15yrs. Common species include Betula nana, Ledum palustre ssp. decumbens., Vaccinium uliginosum and V. vitis-idaea.

Succession to class C. Replacement MFRI = 150 yrs.

Class C 75 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PIMA	Upper
BENA	Lower
LEPAD	Lower
VAUL	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Woodland (10-24% tree cover)	Open (25-59% tree cover)
Height	Dwarf Tree (< 3 m)	Tree (> 3m)
Tree Size Class	Pole 5–9" (swd)/5–11" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

Description

50yrs+

This class is characterized by mature black spruce tussock forest (spruce cover generally 10-25%; tussock cover >25%). Overstory is dominated by Picea mariana. It is during this class when organic material begins to accumulate and a distinctive "active layer" appears, affecting fire behavior depending upon how dry it gets.

This class can persist in the absence of disturbance. Replacement MFRI = 150yrs. Mixed fire (MFRI = 500yrs) will maintain this class.

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **IV**

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	152			0.00658	81
Mixed	667			0.0015	19
Surface					
All Fires	124			0.00809	

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
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016310 Western North American Boreal Alpine Dwarf-Shrub Summit

☑ *This BPS is lumped with: see below*

☐ *This BPS is split into multiple models: This BpS is lumped with: Western North American Boreal Alpine Dwarf-Shrub-Lichen Shrubland*

General Information

Contributors (also see the Comments field **Date** 4/16/2008

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Modeler 2	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type

Upland Shrubland

Map Zone

70

Model Zone

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

Dominant Species*

DRYAS	DILA
VAUL	LOPR
EMNI	SALIX
VAVI	ARRU

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This system is found in the alpine and subalpine areas of the boreal and sub-boreal regions in AK. To the southwest, the range includes the Ahklun Mountains and to the west it extends to the Nulato Hills (Ecoregions 9 and 7, Nowacki et al. 2001).

Biophysical Site Description

These systems occur on exposed, windswept summits and ridges on alpine and subalpine sites. Soils are thin, stony, and well drained to excessively well-drained. These sites typically do not accumulate much winter snow (Viereck et al 1992).

Vegetation Description

Canopy cover can be sparse due to extreme exposure. Common shrubs include Dryas spp. (e.g. Dryas integrifolia), Vaccinium uliginosum, Empetrum nigrum, Vaccinium vitis-idaea, Diapensia lapponica, Loiseuria procumbens, dwarf Salix spp. (e.g. Salix arctica, S. rotundifolia and S. reticulata), Arctostaphylos rubra and A. alpina. Exposed rock and lichens can be abundant. Common lichens include Cladina rangiferina, C. stellaris, Cetraria cucullata, Stereocaulon spp., Alectoria nigricans and Thamnolia vermiculata. Herbaceous species include Hierochloe alpina, Polygonum bistorta, Anemone spp., Festuca spp. and Luzula spp. Mosses may be present but do not contribute much cover (Viereck et al 1992).

Disturbance Description

Alpine shrub systems likely represent a relatively stable topopoedaphic climax, but little is known about their successional dynamics (Viereck et al. 1992). Vegetation in these areas is controlled by wind

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

desiccation and a short growing season. There is little information about fire in this system. It is possible that fires caused by lightning strikes could affect small patches of vegetation but likely would not spread due to the sparse cover of fine fuel and barren areas acting as fire breaks.

Adjacency or Identification Concerns

Adjacent systems include Western North American Boreal Alpine Dwarf-Shrubland or barren alpine classes (including talus and bedrock). Since this BpS is a combination of two systems, the identifying criteria for both systems apply: identifiers for the Alpine Dwarf-Shrub-Lichen Shrubland system are greater than 25% lichen cover and greater than 25% dwarf shrub cover, identifiers for the Alpine Dwarf-Shrub Summit system are less than 25% vascular plant cover and abundant exposed rock.

Native Uncharacteristic Conditions

Scale Description

Vegetation can be found in small or large patches. Fires are typically quite small and their spread is inhibited by lack of fuel continuity.

Issues/Problems

Comments

This model was developed by Kori Blankenship in consultation with Tina Boucher.

Vegetation Classes

Class A 100 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

VAUL	Upper
EMNI	Upper
VAVI	Upper
DRYAS	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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

Sparse, open or closed dwarf shrubs dominate. Exposed rock and lichens can be abundant. Commons species listed in the vegetation description.

This BpS is relatively stable over time. Continual wind disturbance (probability = 1) maintains this BpS.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** NA

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement					
Mixed					
Surface					
All Fires					

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

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

Nowacki, G., P. Spencer, M. Fleming, T. Brock and T. Jorgenson. 2001. Unified ecoregions of Alaska. U.S. Department of the Interior, U.S. Geological Survey. Open file-report 02-297. 2 page map.

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016330** **Western North American Boreal Alpine Mesic Herbaceous Meadow**

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

General Information

Contributors (also see the Comments field **Date** 4/24/2008

Modeler 1	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 2	Colleen Ryan	colleen_ryan@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Upland Grassland/Herbaceous

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*
CABI5
BENA
ARAL2
EMNI

General Model Sources
- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

Geographic Range
This system occurs on gentle slopes in subalpine and lower alpine environments throughout boreal AK (NatureServe 2008).

Biophysical Site Description
This system occurs on alpine and subalpine slopes. It tends to occur in small patches in a matrix with dwarf or low shrub systems. Soils are moist to mesic.

Vegetation Description
Carex bigelowii is the dominant species. Other common species may include Luzula confusa and lichens. Dwarf shrubs such as Arctostaphylos alpina, Empetrum nigrum, Salix pulchra and Betula nana are usually present, but contribute less than 25% to the canopy cover (NatureServe 2008, Boggs and Sturdy 2005). Wetter sites may include more sedges and Salix spp. This system may form a mosaic with dwarf and low shrub systems.

Disturbance Description
Little is known about the disturbance regime of this system. It tends to occur adjacent to low shrub and alpine tundra systems and even in a patchy mosaic with dwarf and low shrub systems. Because these adjacent systems burn, it is likely that some fire will carry through the Alpine Mesic Herbaceous Meadow system, especially in drier periods. Fire frequency is likely to depend on the adjacent vegetation. For this model, the fire return interval was estimated at twice that of the adjacent Western North American Boreal Mesic Scrub Birch-Willow Shrubland BpS.

Little is known about post-fire dynamics, but Carex bigelowii is expected to maintain its dominance. Dwarf shrubs are likely to resprout or establish gradually over time, but will remain a minor component of

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the system.

Adjacency or Identification Concerns

There is no species overlap between boreal and sub-boreal herbaceous alpine meadow types. Slope position may also be different: Carex macrochaeta types usually occur just above subalpine alder on straight or concave slopes.

This system often occurs in a patchy mosaic with low and dwarf shrub types (Betula nana and ericaceous dwarf shrub types).

Native Uncharacteristic Conditions

Scale Description

Small to large patch

Issues/Problems

Comments

Because no data are available about the dynamics of this fairly minor system, this model was based on best estimates, considering vegetation and site characteristics and the dynamics of adjacent vegetation types.

Page Spencer is a suggested reviewer for this system.

Vegetation Classes

Class A 100%

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CABI5	Upper
BENA	Upper
ARAL2	Upper
EMNI	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus
Mesic herbaceous.

In interior AK, Carex bigelowii is the dominant species. Other herbaceous species, including Luzula confusa, are frequently present, along with a well-developed lichen layer. Dwarf shrubs such as Arctostaphylos alpina, Empetrum nigrum, and Betula nana are present, but contribute <25% to the canopy cover (Boggs and Sturdy 2005).

Although this system tends to be fairly moist, litter accumulation will provide enough fuel to carry a fire during dry periods. Because the most likely source of fire is the adjacent Boreal Low Shrub system, fire frequency for this system was assigned to be half that of the Boreal Low Shrub BpS.

This BpS is relatively stable over time. Replacement MFRI = 400yrs.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	400			0.0025	99
Mixed					
Surface					
All Fires	400			0.00252	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Boggs, K. and Sturdy, M. 2005. Plant associations and post-fire vegetation succession in Yukon-Charley Rivers National Preserve. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage. Prepared For: National Park Service, Landcover Mapping Program, National Park Service-Alaska Support Office, Anchorage, AK 99501.

Boggs, K., A. Garibaldi, J. Stevens, J. Grunblatt and T. Helt. 2001. Denali National Park and Preserve Landcover mapping project. Volume 2: Landcover classes and plant associations. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, 707 A Street, Anchorage, AK. 164 pp.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7016351** **Western North American Boreal Alpine Ericaceous Dwarf-Shrubland - Complex**

☑ *This BPS is lumped with: see below*
☐ *This BPS is split into multiple models: Western North American Boreal Alpine Dryas Dwarf-Shrubland (BpS 1634)*

General Information

Contributors (also see the Comments field **Date** 4/16/2008

Modeler 1	Kori Blankenship	kblankenship@tnc.org	**Reviewer**
Modeler 2	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Upland Shrubland

Map Zone
70

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

Dominant Species*

CATE11	ARCTO3
EMNI	DRIN4
VAUL	DROC
HAST3	LEPAD

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
This type occurs from subalpine to alpine locations in the boreal and sub-boreal regions of AK.

Biophysical Site Description
This BpS is commonly found in alpine valleys and on sideslopes, low summits and ridges. Sites are well-drained and mesic to somewhat dry and are likely to retain late-lying snow.

Vegetation Description
This type eoncompasses a wide range of species and plant communities. Ericaceous or dryas (especially Dryas integrifolia and/or Dryas octopetala) dwarf shrubs typically dominate. Total lichen cover is <25% and may include Cetraria, Cladina, Cladonia and Stereocaulon. Common dwarf shrub include Cassiope tetragona (more common north of the Alaska Range), Empetrum nigrum, Vaccinium uliginosum, Harrimanella stellariana (more common south of the Alaska Range) and Arctostaphylos spp. Other shrubs that may be common include Betula nana, Diapensia lapponica, Dryas octopetala, Ledum palustre ssp. decumbens, Vaccinium vitis-idaea, Salix reticulata, S. phlebophylla, S. rotundifolia, S. arctica and Oxytropis nigrescens. Common herbaceous species include Hierochloe alpine, Arnica lessingii, Carex bigelowii, Carex microchaeta, Senecio lugens, Minuartia arctica, Anemone parviflora, Ligusticum mutellinoides ssp. alpinum, Castilleja elegans, Poa arctica, Trisetum spicatum, Silene acaulis, Saxifraga spp., Campanula lasiocarpa, Anemone parviflora, Senecio lugens and Polygonum bistorta. Mosses such as Aulacomnium palustre, Hylocomium splendens, Pleurozium schreberi and Polytrichum and Rhacomitrium spp. may be common. Cassiope and Harimanella tundra sites occur on terrain that is well protected by snow in the winter, and often remains snow covered until the middle of the growing season (Viereck et al. 1992).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

Alpine shrub systems likely represent a relatively stable topopoedaphic climax, but little is known about their successional dynamics (Viereck et al. 1992). Vegetation in these areas is controlled by the alpine environment and short growing season. It is possible that fires caused by lightning strikes could affect small patches of vegetation but little is known about the frequency, severity or seasonality of fires in this BpS.

Adjacency or Identification Concerns

This BpS is distinguished by <25% cover lichen and >20% cover dryas dwarf shrubs. Adjacent systems include Western North American Boreal Alpine Dwarf-Shrub Summit, Western North American Boreal Alpine Mesic Herbaceous Meadow, Alaska Sub-boreal and Maritime Alpine Mesic Herbaceous Meadow or barren alpine classes (including talus or bedrock).

Native Uncharacteristic Conditions

Scale Description

Large patch

Issues/Problems

This BpS represents two Ecological Systems (Dryas Dwarf-Shrubland and Alpine Ericaceous Dwarf-Shrubland) and would be more appropriately named Alpine Dwarf Shrubland.

Comments

This model was created by Kori Blankenship in consultation with Tina Boucher.

Vegetation Classes

Class A **100 %**

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CATE11	Upper
EMNI	Upper
VAUL	Upper
DRIN4	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	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Zero years plus

Open or closed dwarf ericaceous or dryas shrubs dominate. Common species are listed in the vegetation description.

This BpS is relatively stable over time. Continual wind disturbance (probability = 1) maintains this BpS.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Fire Regime Group:** NA

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement					
Mixed					
Surface					
All Fires					

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire 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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Boggs, K., A. Garibaldi, J. Stevens, J. Grunblatt and T. Helt. 2001. Denali National Park and Preserve Landcover mapping project. Volume 2: Landcover classes and plant associations. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, 707 A Street, Anchorage, AK. 164 pp.

Boggs, K. and Sturdy, M. 2005. Plant associations and post-fire vegetation succession in Yukon-Charley Rivers National Preserve. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage. Prepared For: National Park Service, Landcover Mapping Program, National Park Service-Alaska Support Office, Anchorage, AK 99501.

DeVelice, R.L., Hubbard, C.J., Boggs, K. et al. 1999. Plant community types of the Chugach National Forest. Tech. Publ. R10-TP-76. Juneau, AK: USDA Forest Service, Alaska Region. 375 pp.

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

Viereck et al. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

LANDFIRE Biophysical Setting Model

Biophysical Setting 7016372 Western North American Boreal Alpine Floodplain - Higher Elevations

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *Western North American Boreal Alpine Floodplain was split into a lower elevation and an upper elevation BpS model. The lower elevation model applies in the subalpine zone within the tall shrub zone. The upper elevation model applies above the elevational limit of tall shrubs.*

General Information

Contributors (also see the Comments field **Date** 4/15/2008

Modeler 1	Tina Boucher	antvb@uaa.alaska.edu	**Reviewer**
Modeler 2	Kori Blankenship	kblankenship@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type

Upland Shrubland

Map Zone

70

Model Zone

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

Dominant Species*

SAAL
SALIX
ALVIS
CHLA13

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

The BpS is found in alpine and subalpine areas in the boreal and boreal transition regions of AK.

Biophysical Site Description

This system includes active and inactive alpine and subalpine floodplains of glacially and non-glacially fed streams (NatureServe 2008). Soils develop on alluvium and are typically shallow and well-drained (NatureServe 2008). This model applies to Alpine Floodplains that occur above the elevational limit of tall shrubs.

Vegetation Description

This system includes a range of floodplain vegetation including shrub (dwarf, low and tall), mesic herbaceous meadow, early seral forbs and barren gravel. Common species include Salix alaxensis, other Salix spp., Alnus viridis ssp. Sinuata, Betula nana, Chamerion latifolium, Lupinus spp. (L. nootkatnesis and L. arcticus), Mertensia paniculata, Crepis spp (C. nana and C. elegans) Achillea millefolium spp. Borealis, Erigeron acris and a variety of grasses (NatureServe 2008).

Disturbance Description

Frequent river channel migration and associated flooding and fluvial processes constitute the major disturbances in this type (NatureServe 2008). The probability of flooding is assumed to be higher in alpine floodplains compared with lower elevation floodplains because the alpine floodplains tend to have higher gradients and the landscape absorbs less runoff due to steep slopes and typically coarse substrates. The overall return interval for flooding in the alpine floodplain is estimated at about 20yrs, compared with 70-

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

75yrs in the floodplain forest and shrub systems.

Alpine floodplains and riparian areas generally act as fire breaks.

Adjacency or Identification Concerns

Floodplain systems may occur in the active and inactive part of the riparian zone, but abandoned floodplains are considered part of the adjacent upland. This model applies to the variant of this system that occurs above the elevational limit of tall shrubs. Adjacent systems may include Western North American Boreal Alpine Dwarf-Shrubland, Western North American Boreal Alpine Mesic Herbaceous Meadow, Alaska Sub-boreal and Maritime Alpine Mesic Herbaceous Meadow, Maritime High Alpine Herbaceous, Talus and Bedrock.

Native Uncharacteristic Conditions

Scale Description

Linear

Issues/Problems

The probability of flooding in the model is a best guess, not based on literature.

Comments

This model was developed based on input from the experts who attended the LANDFIRE Anchorage (Dec. 07) modeling meeting and refined by Tina Boucher and Kori Blankenship.

Vegetation Classes

Class A **35 %**

Early Development 1 All Structures

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CHLA13	Upper
LUPIN	Upper
MEPA	Upper
CREL	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

0-14yrs

Although it is not modeled, because LANDFIRE does not map sparsely vegetated areas, this class should be preceded by a sparse/gravel bar phase. This herbaceous class represents early seral vegetation that would come in on gravel bars or other sparsely vegetated areas in the floodplain. Common species include Chamerion latifolium, Lupinus spp. (L. nootkatnesis and L. arcticus), Mertensia paniculata, Crepis spp (C. nana and C. elegans) Achillea millefolium spp. borealis, Erigeron acris and a variety of grasses. Vegetation cover is generally open (10-50%) with large areas of exposed alluvium.

This class can succeed to a low shrub state (class B) or directly to a dwarf shrub state (class C).

Deterministic succession to class B. The alternate succession pathway to C (probability = 0.03) represents sites that would not support low shrubs. Flooding (probability = 0.08), represented by Option 1 in the model, resets

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the age of this class.

Class B 20 %

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

SAAL	Upper
SALIX	Upper
ALVIS	Upper
BENA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open Shrub (25-74% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Low Shrub (20 cm to 1.5 m)	Tall Shrub (>1.5 m)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

15yrs+

Willow and alder low shrubs. Common shrub species may include Salix alaxensis and other Salix spp., Alnus viridis ssp. sinuata and Betula nana.

This class may persist on some sites or may eventually transition to dwarf shrub (class C).

Alternate succession to class C occurs with a probability of 0.015. Flooding (probability = 0.03), represented by Option 1 in the model, causes a transition to class A.

Class C 45 %

Late Development 2 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

SALIX	Upper
SARE2	Upper
DRYAS	Upper
EMNI	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)	Dwarf Shrub (< 20 cm)
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

15yrs+

On higher elevation alpine flood plains, dwarf shrubs may replace the early seral herbaceous stage. Dominant shrubs may include one or more of the following : Salix spp., Salix reticulata, Dryas spp. or Empetrum nigrum. Low willows can still be present, but cover is <25%.

This class persists in the absence of disturbance. Flooding (probability = 0.03), represented by Option 1 in the model, causes a transition to class A.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** NA

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					
Mixed					
Surface					
All Fires					

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

References

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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve