DRAFT

Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

Author/Modeler(s): Evie Witten
Lead Author Phone: (907) 276-3133 (#107) **E-mail:** akfrcc@alaska.net
First Draft Date: March 3, 2004 **Most Recent Edit:** August 5, 2004
Status: In development **PNV Code:** BSPI

Potential Natural Vegetation (PNV) Name: Black Spruce Interior

Fire regime group: IV
Geographic Area: Interior and western Alaska

Physical Stetting Description:
Black Spruce Interior PNV sites are widespread and common throughout interior and parts of western Alaska on cold, mostly poorly-drained terrain. Soils range from poorly drained Cryaquepts, to Cryochrepts to well-drained alluvial gravels. Permafrost is usually present at depths ranging from 30 cm to over 1 meter, but may be absent from stands growing on coarse alluvium or on shallow soils over bedrock (Viereck et al 1992). Upland black spruce sites occupy north-facing slopes and ridge tops. Lowland black spruce sites occupy old river terraces, small valley bottoms, lake margins and lower north-facing slopes (Viereck and Little 1972). Open treeline forests occur up to approximately 750 meters in elevation (Viereck et al 1986).

Biophysical Classification:
The Black Spruce Interior PNV type occurs in the following ecoregions described by Nowacki et al (2001):

- Intermontane Boreal
- Bering Taiga
- Arctic Tundra - Brooks Range Foothills (P1)
- Alaska Range Transition - Alaska Range (B3)

Deleted: (

The following community types described by Viereck et al (1992) are included in the Black Spruce Interior PNV group:
IA1k – Closed Black Spruce Forest (black spruce sites)
IA2f – Open Black Spruce Forest (black spruce sites)
IA3d – Black Spruce Woodland (black spruce sites)
IA3e – Black Spruce-White Spruce Woodland
IB1d – Closed Paper Birch forest (black spruce understory & sites)
IB1e – Closed Quaking Aspen Forest (severely burned black spruce sites)
IB1f – Closed Paper Birch-Quaking Aspen Forest (black spruce sites)
IC1a – Closed Spruce-Paper Birch Forest (black spruce sites)
IC1c – Closed Spruce-Paper Birch-Quaking Aspen Forest
IC1d – Closed Quaking Aspen-Spruce Forest (black spruce sites)
IC2a – Open Spruce-Paper Birch Forest (black spruce sites)
IC2b – Open Quaking Aspen-Spruce Forest (sere in black spruce/white spruce mixed type)

Identification of Key Characteristics of the PNV and Confuser PNVs:
Common species include black spruce (*Picea mariana*) and mosses (*Sphagnum* spp., *Hylocomium splendens*, *Pleurozium schreberi*) or lichens (*Cladina* and *Cladonia* spp). Low shrubs usually limited to black spruce sites and treeline sites include Labrador tea (*Ledum*

groenlandicum and *L decumbens*), Bog cranberry *(Vaccinium oxycoccus*), bog blueberry *(V. uliginosum*), and Mountain cranberry *(V. vitis-idaea)* (Dyrness et al 1983). Woodland horsetail (*Equisetum sylvaticum)* and cloudberry *(Rubus chamaemorus*) are commonly found in black spruce and mixed white and black spruce stands (Dyrness et al 1983). *Eriophorum* spp. and bigelow sedge *(Carex bigelowii)* are also common on black spruce sites.

This PNV is similar to the Black Spruce Southcentral PNV which occurs south of the Alaska Range and has a longer fire return interval and slightly different successional pathways. In some locations this PNV can be confused with the White Spruce PNV because black and white spruce often mix, especially on sites with transitional moisture and thermal conditions.

Natural Fire Regime Description:
Most fires in Black Spruce Interior PNV are either crown or ground fires of enough intensity to kill overstory trees. Usually some of the organic layer remains. (Viereck 1983). Fires tend to be large – 50,000 hectares or larger. Ecologically significant fires usually occur during the exceptional fire years and cover 200,000 + hectares (Viereck 1983). During most fire years a small number of large fires account for most of the total area burned (Gabriel and Tande 1983). Mean fire return interval estimates include:

- 25-40 years (Yarie 1983) (range estimate for interior Alaska)
- 36 years (Yarie 1983) (for the Porcupine River area)
- 50-100 years (Heinselman 1978, Viereck 1983) (for interior Alaska),
- 130 years (Heinselman 1981) (open spruce-lichen – Alaska taiga)
- 100 years (Heinselman 1981) (closed black spruce – Alaska taiga)
- 80-90 years (Rowe et al 1974) (for the MacKenzie Valley)
- 50-70 years (Viereck et al 1986) (for interior Alaska)
- 70-100 years (Christiansen 1988) (for spruce-lichen wooland)
- 80 yrs (40-120 year range) (personal communication; FRCC experts' workshop March 2004)

Fire in thermokarst areas causes melting of permafrost and deepening of the soil active layer. Fire on soil with ice wedges may produce ditches 2-3 cm deep that remain active 40-50 years after the fire (Viereck 1973). Post fire regeneration is characteristically rapid and dominated by revegetation via rhizomes, root and stump sprouts of species that survive the fire (Schaefer 1993, Viereck 1975, Van Cleve and Viereck 1981). Regeneration of black spruce tends to occur over one to two decades after a fire event (Black & Bliss, 1980; Sirois & Payette, 1989 (Black and Bliss 1980, Sirois and Payette 1989)). Where the organic layer is mostly consumed by fire, vegetative reproduction is much reduced and sites are captured more by light-seeded 'invader' species (Heinselman 1981).

Other Natural Disturbance Description:
The thaw pond cycle (disturbance leads to thawing of permafrost and ponding) and paludification (Sphagnum layer buildup and saturation) are important disturbances on black spruce sites (Viereck et al 1986, Foote 1983, Viereck 1975).

Natural Landscape Vegetation-Fuel Class Composition:
The natural vegetation structure is a mosaic of the seral stages described below, with open spruce forests being the dominant late-development type. Black spruce is the climax indicator species.

Natural Scale of Landscape Vegetation-Fuel Class Composition and Fire Regime:

Typical landscapes in this PNV exist in a mosaic with relatively warmer and drier white spruce and riparian white spruce sites, non-forested wetlands and at the attitudinal and latitudinal limits of the PNV, shrub and tundra types.

Uncharacteristic Vegetation-Fuel Classes and Disturbance:
If natural fires are suppressed over time, more contiguous blocks of class E would develop across the landscape. Insect (ips) disturbance and disease would probably also increase, particularly in closed stands on colder sites where the moss layer is thick and soils more nutrient deprived.

PNV Model Classes and Descriptions:

Class	Modele d Percent of Landscape	Description
A: 0-30 years Early Seral moss, herb, shrub and sapling	26%	Moss, herbs, seedlings of trees and shrubs establish 3 months to 3 years post fire (Foote 1983). Shrubs and saplings 1.4 to 7 m tall typically begin capturing sites 4-5 years post fire. Tall shrub and sapling layer characterized by 60-100% canopy closure. Tree saplings may include spruce, hardwoods or both.
B: 30-90 years Mid-development, closed or open spruce	25%	Black spruce overtops shrubs and gains dominance. Tree density may be < or > 60% depending on site conditions.
C: 30-90 years Mid-development, open or closed hardwoods or mixed hardwood/spruce	21%	Hardwoods or hardwoods and spruce overtop shrubs and gain dominance. Early in this age class trees are at least 2.5 cm d.b.h. and 4-8 m tall (Foote 1983). Spruce may occur as an understory, subdominant, 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.
D: 90-300 years Late-development, open spruce	20%	Spruce gains dominance over hardwoods (if previously present). Tree canopy cover is < 60% and maybe < 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.
E: 90-300 years Late-development, closed spruce	8%	Site is dominated by mature black spruce with > 60% canopy closure. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens.
Total:	100%	

Deleted: m

Modeled Fire Frequency and Severity:

	Mean Probabilit y	Mean Fire Frequency (years) (inverse of	Description

		probability)	
Replacement fire	1.23	80	Based on literature and expert input
Mosaic fire	0.23	435	Based on literature and expert input
All Fire	1.56	65	Based on literature and expert input
Other disturbances			

Modeled Fire Severity Composition:

	Percent All Fires	Description
Replacement fire	75	Based on literature and expert input
Non-replacement fire	25	Based on literature and expert input
All Fire	100	

Further Analysis:

References

Black, R.A. and L.C. Bliss. 1980. Reproductive ecology of Picea mariana (Mill.) B.S.P. at tree line near Inuvik, NWT, Canada. Ecological monographs, 50:331-354.

Christiansen, J.A. 1988. A spruce-lichen woodland in northern Alaska: post-fire regeneration and community dynamics. MS Thesis, U. of Washington, College of Forest Resources.

Dyrness, C.T., K. Van Cleve, and M.J Foote. 1983. Vegetation, soils, and forest productivity in selected forest types in interior Alaska. Can J For Res. Vol 13: 703-720.

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. U.S. Department of Agriculture, Forest Service. Pacific Northwest Research Station. 108 p.

Gabriel, H.W. and G.F. Tande. 1983. A regional approach to fire history in Alaska. BLM Alaska TR-83-9.

Heinselman, M.L. 1981. Fire and succession in the conifer forests of northern North America. In: West, D.C., H.H. Shugart, and D.B. Botkin. Forest succession: concepts and application. Springer-Verlag, New York. Chapeter 23.

Nowacki, G., Spencer, P., Brock, T., Fleming, M., and R. Jorgenson 2001. Narrative descriptions for the ecoregions of Alaska and neighboring territories. National Park Service. Anchorage, Alaska (?). 17 p.

Personal communication experts' workshop, March 2-4 2004. Fire Regime Condition Class (FRCC) interagency experts' workshop to develop and review Potential Natural Vegetation (PNV) groups for Alaska. Anchorage, Alaska.

Rowe, J.S., J.L Bergsteinsson, G.A. Padbury, and R. Hermesh. 1974. Fire Studies in the Mackenzie Valley. ALUR Report 73-74-61. Arctic Land Use Research Program, Department of Indian Affairs and Human Development, Ottawa, Canada. 123 pp.

Schaefer, J.A. 1993. Spatial patterns in taiga plant communities following fire. Can J.

Deleted: EricNT

Bot 71:1568-1573

Sirois, L. and S. Payette. 1989. Postfire black spruce establishement in subarctic and boreal Quebec. Can. J. For. Res., 19: 1571-1580.

Van Cleve, K., Chapin, F.S., III; Flanagan, P.W. [and others]. 1986. Forest ecosystems in the Alaska taiga: a synthesis of structure and function. New York: Springer-Verlag. 230 p.

Van Cleve, K. and L. A Viereck. 1981. Forest succession in relation to nutrient cycling in Boreal Forest of Alaska. In: D.C. West, H.H. Shugart and D.B. Botkin eds. Forest succession: concepts and application. Springer-Verlag. New York.

Viereck L. A. 1983. The effects of fire in black spruce ecosystems of Alaska and northern Canada. In: Wein, R.W.; D.A MacLean, (eds.) The role of fire in northern circumpolar ecosystems. New York: John Wiley & Sons Ltd.: 201-220. Chapter 11.

Viereck L. A. 1983. The effects of fire in black spruce ecosystems of Alaska and northern Canada. In: Wein, R.W.; D.A MacLean, (eds.) The role of fire in northern circumpolar ecosystems. New York: John Wiley & Sons Ltd.: 201-220. Chapter 11.

Viereck, L.A. 1975. Forest ecology of the Alaska Taiga. In: Proceedings of the circumpolar conference on northern ecology; 1975 September; Ottawa, ON. National Research Council of Canada: I-1 to I-22.

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

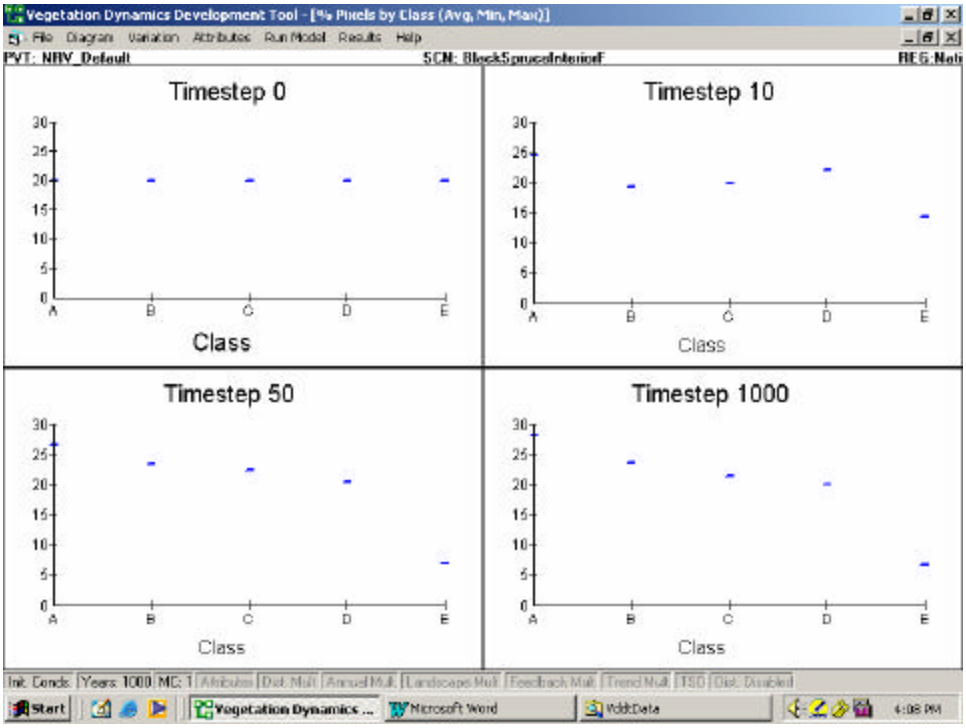
Viereck, L.A., Dyrness, C.T., Batten, A.R., and Wenzlick, K.J. 1992. The Alaska Vegetation Classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 p.

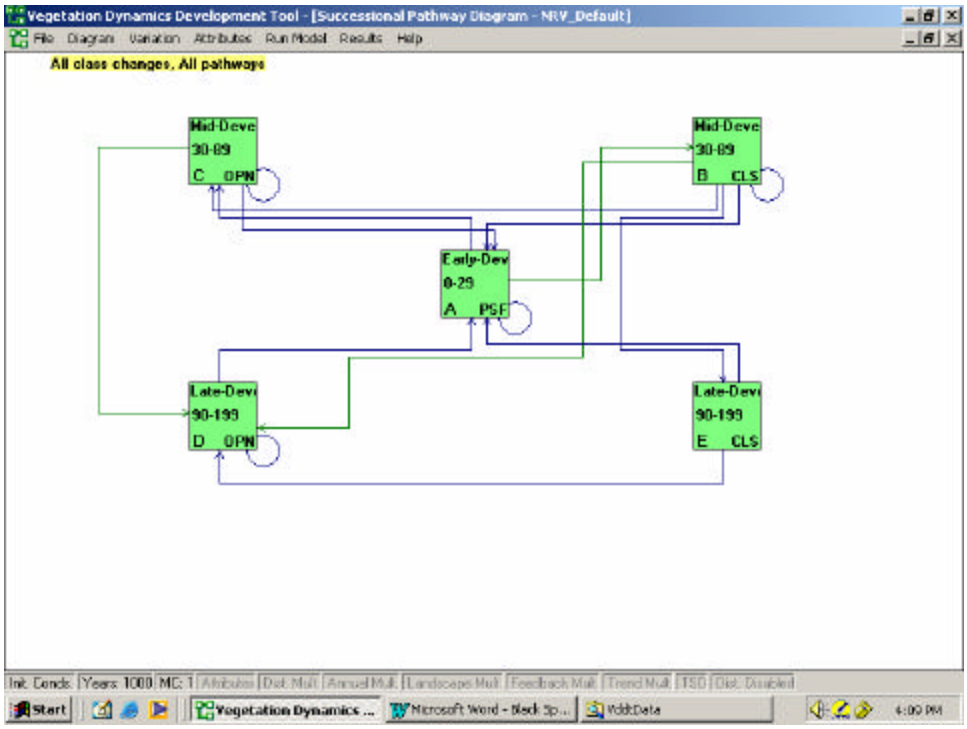
Viereck L. A., K. Van Cleve, and C.T. Dyrness, 1986. Forest ecosystem distribution in the taiga environment. In: Van Cleve, K.; Chapin, F.S., III; Flanagan, P.W. [and others], eds. Forest ecosystems in the Alaska taiga: a synthesis of structure and function. New York: Springer Verlag: 22-43. Chapter 3.

Viereck L. A. and E.L. Little, Jr.. 1972. Alaska Trees and Shrubs. USDA Forest Service, Agriculture Handbook No. 410. Washington, D.C. 265 p.

Yarie J. 1983. Forest community classification of the Porcupine River Drainage, interior Alaska, and its application to forest management. USDA Forest Service GTR PNW-154.

VDDT Model Diagrams:


Vegetation Dynamics Development Tool - [% Pixels by Class (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: BlackSpruceInteriorF
Timestep 0
Timestep 10
Timestep 50
Timestep 1000
Class
A B C D E
Init. Conds: Years: 1000 MC: 1
Start
Vegetation Dynamics ...
Microsoft Word
WddData
4:08 PM


Vegetation Dynamics Development Tool - [Successional Pathway Diagram - NRV_Default]
File Diagram Variation Attributes Run Model Results Help
All class changes, All pathways
Mid-Deve
30-89
C OPN
Mid-Deve
30-89
B CLS
Early-Dev
0-29
A PSF
Late-Dev
90-199
D OPN
Late-Dev
90-199
E CLS
Init. Conds: Years: 1000 MC: 1
Start
Vegetation Dynamics ...
Microsoft Word - Black Sp...
WddData
4:09 PM