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Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

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Potential Natural Vegetation (PNV) Name: Black Spruce Interior

Fire regime group: IV

Geographic Area: Interior and western Alaska

Physical Setting 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)

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 spruces 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 woodland)
- ❑ 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 altitudinal 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 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 | Modeled Percent of Landscape | Description |
|---|------------------------------|---|
| A: 0-30 years Early Seral moss, herb, shrub and sapling | 25% | 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 | 20% | Hardwoods or hardwoods and spruce overtop shrubs and gain dominance. Early in this age class trees are at least 2.5 cm DBH and 4-8 m tall (Foote 1983). 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. |
| 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 | 10% | 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% | |

Modeled Fire Frequency and Severity:

| | Mean Probability | Mean Fire Frequency (years) (inverse of | Description |
|--|------------------|---|-------------|
| | | | |

| | | | |
|------------------|-------|--------------|--------------------------------------|
| | | probability) | |
| Replacement fire | .0116 | 85 | Based on literature and expert input |
| Mosaic fire | .0039 | 255 | Based on literature and expert input |
| All Fire | .0155 | 65 | Based on literature and expert input |
| Insect Path Open | .0001 | 10000 | Based on literature and expert input |
| WindWethStress | .0007 | 1430 | Based on literature and expert input |

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:

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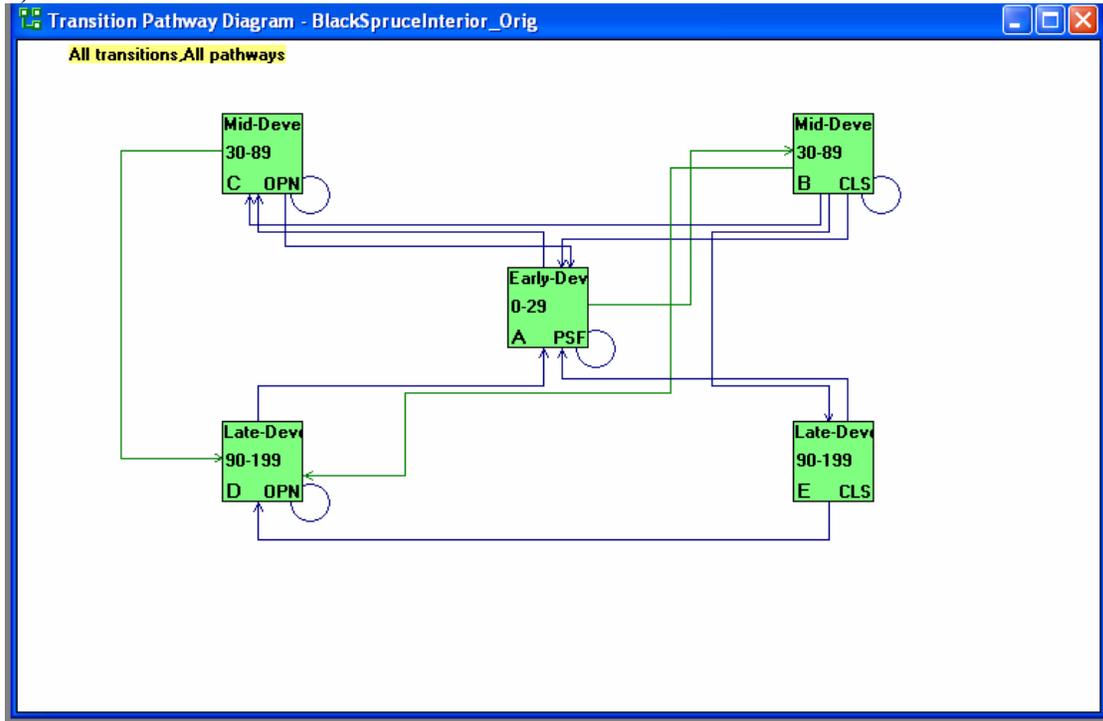
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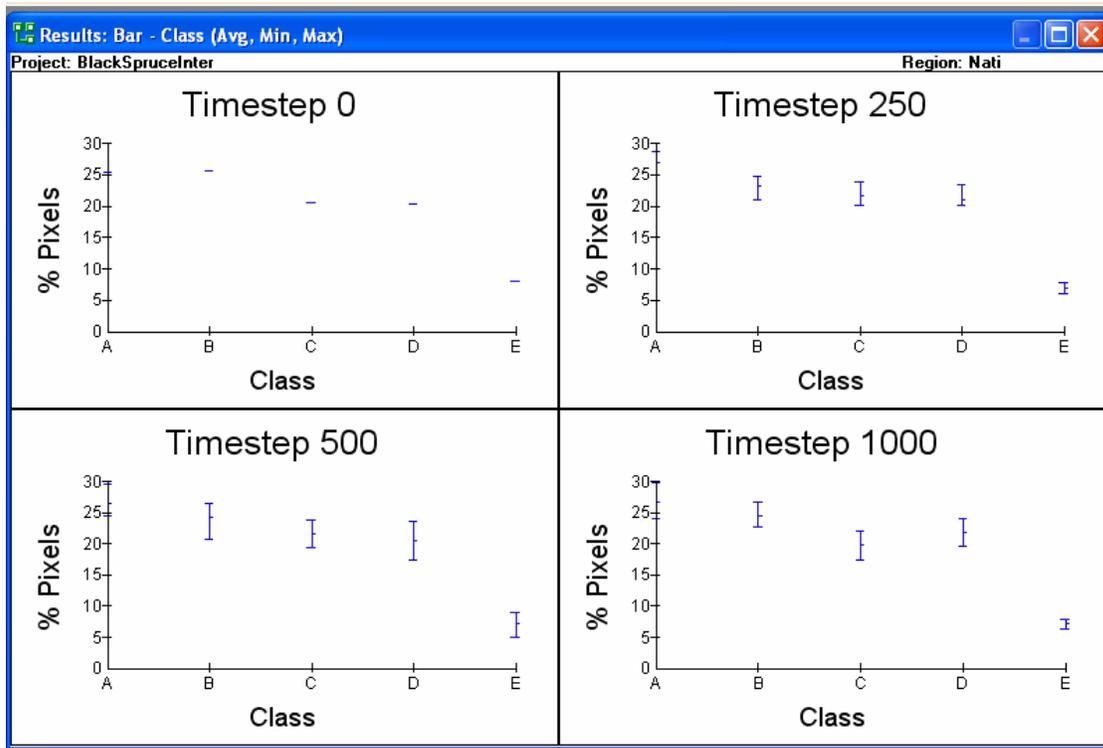
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VDDT Model Diagrams:

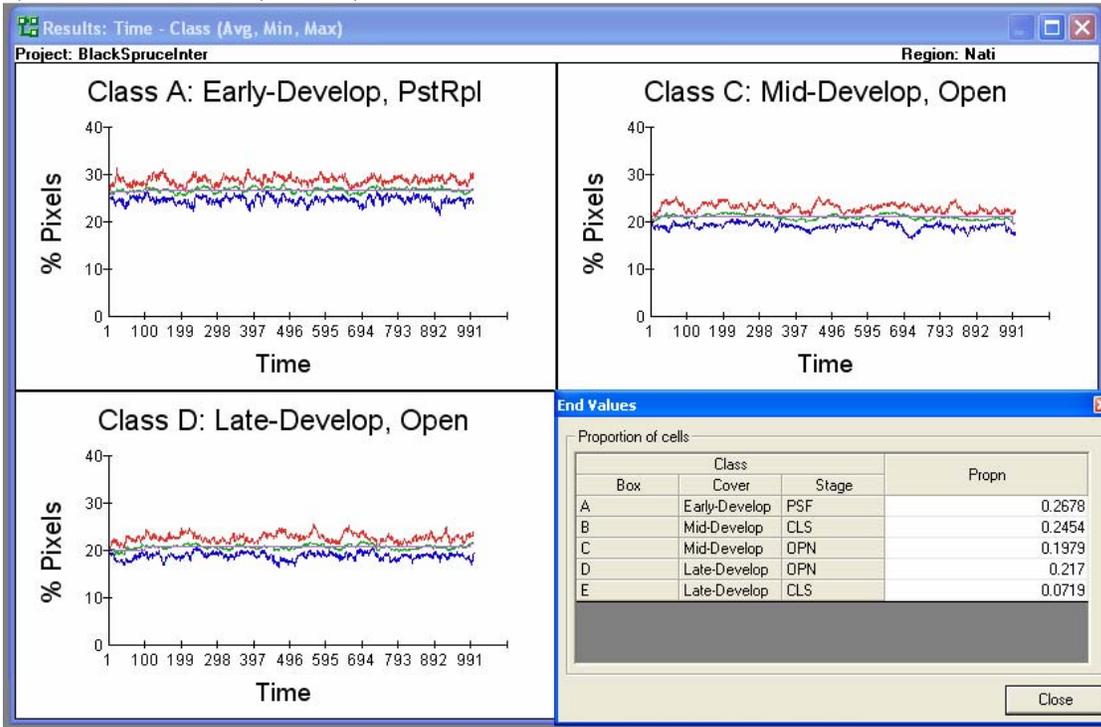
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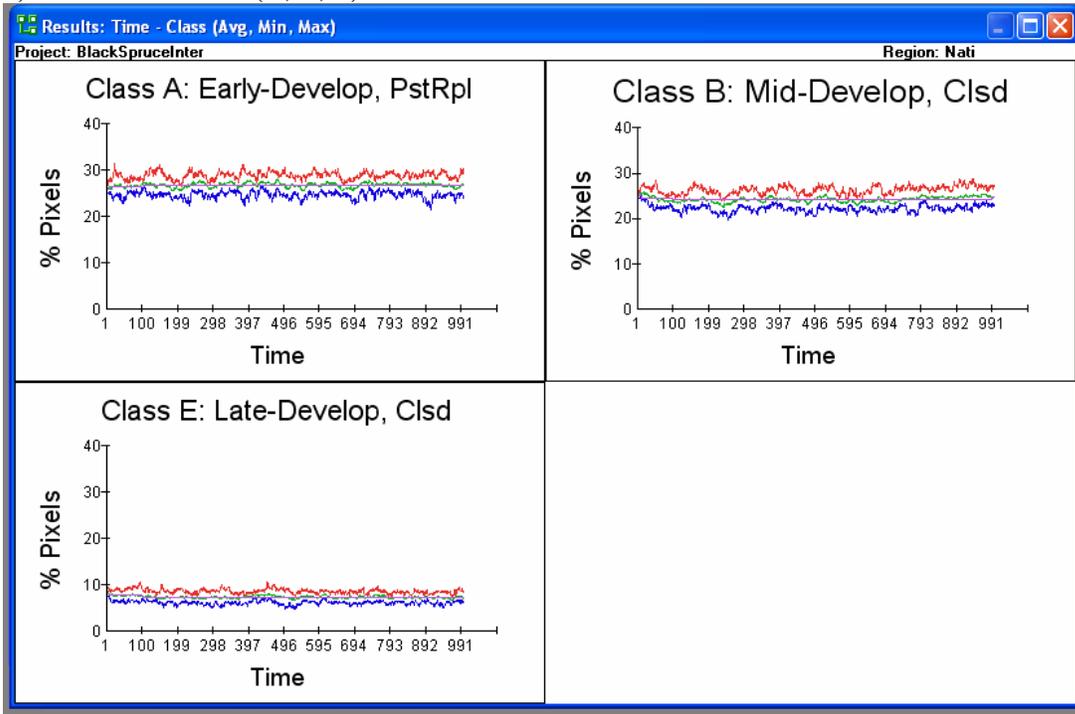
2) Class Distribution:



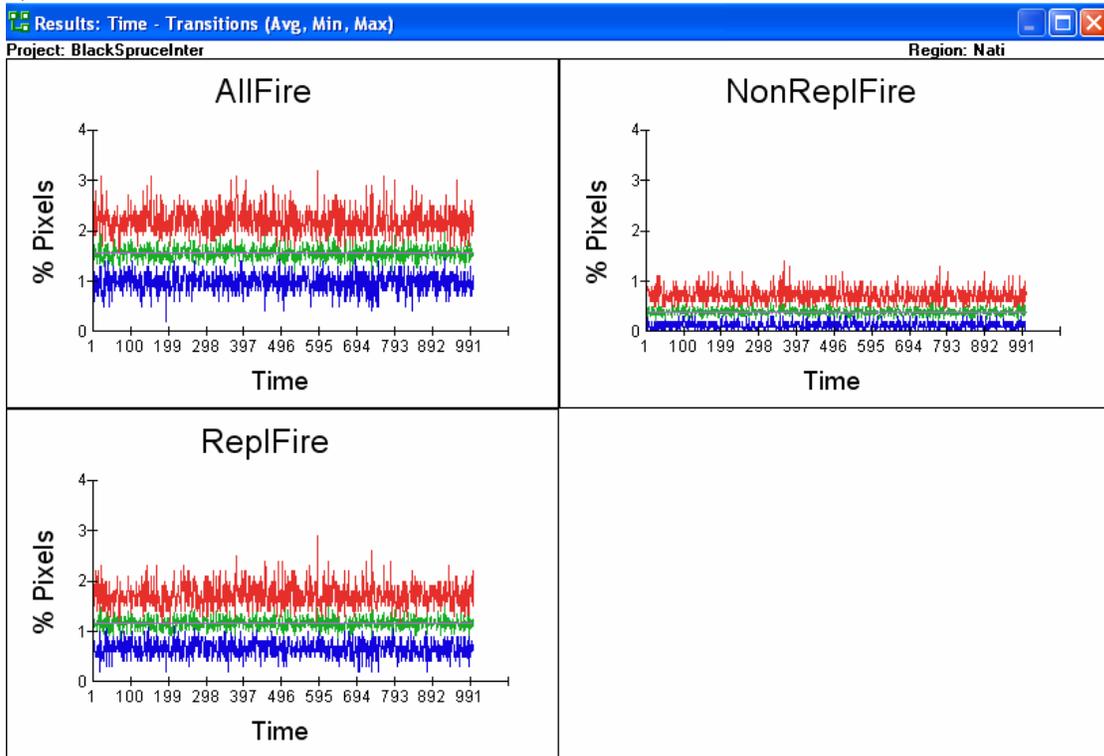
3) Class Time Series (A, C, D):



4) Class Time Series (A, B, E):



5) Fire Disturbance Time Series



6) Insect/Wind Disturbance:

