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Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

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Potential Natural Vegetation (PNV) Name: Coastal Boreal Transition Forest

Fire regime group: V
Geographic Area: Kenai Peninsula in Southcentral Alaska

Physical Stetting Description:
The Coastal Boreal Transition Forest PNV occurs only on the western side of the Kenai Peninsula, primarily on the Kenai Lowland but also at lower elevations in the northwestern Kenai Mountains regions (Ager 1999). The Kenai lowland forms a broad plateau extending from the 2000 m mountains westward 40-65 km to Cook Inlet. The lowland geomorphology consists of hilly morainal belts, flat glacial lakebeds, outwash plains, and multi-terraced river channels. Elevations generally range from 15 to 100 m. Average annual precipitation ranges from approximately 450-670 mm/yr (Leslie 1989), with the climate grading from coastal to the west to more continental to the east. The Coastal Boreal Transition Forest PNV occurs on the more well-drained sites within the region and exits within a mosaic of 1) the Black Spruce Southcentral PNV (on poorly-drained sites), 2) the Riparian Spruce Hardwood PNV (on river terraces), and 3) the Kenai Mountains Hemlock (at mid elevations in the Kenai Mountains). Soils are largely derived from glacial or other depositional processes, and include ablation till, glacial outwash, alluvium and colluvium.

Biophysical Classification:
The Coastal Boreal Transition Forest PNV occurs in the following ecoregions described by Nowacki et al (2001):

- Alaska Range Transition – Cook Inlet Basin (B5)

The following level IV community types described by Viereck et al (1992) are included in the Coastal Boreal Transition Forest PNV group:

IA1j – Closed White Spruce Forest
IA2e – Open White Spruce Forest
IB1d – Closed Paper Birch Forest
IB1e – Closed Quaking Aspen Forest
IB1f – Closed Paper Birch-Quaking Aspen Forest
IB2a – Open Paper Birch Forest
IB2b – Open Quaking Aspen Forest
IC1A – Closed Spruce-Birch Forest
IC1d – Closed Quaking Aspen-Spruce Forest
IC2a – Open Spruce-Paper Birch Forest
IC2d – Open Spruce-Balsam Poplar
IC3a – Spruce-Paper Birch Woodland

IIIA1d – Midgrass-herb (sere on forest sites near coast)
IIIA2a – Bluejoint Meadow (sere following fire on white/Lutz spruce sites)

IIIA2b – Bluejoint-Herb (sere following fire on white/Lutz spruce sites)
IIIA2c – Bluejoint-Shrub (sere following fire on white/Lutz spruce sites)

IIIB2b – Fireweed (early sere following fire on white/Lutz spruce sites)
IIIB2c – Large Umbel (sere on white/Lutz spruce sites)

Identification of Key Characteristics of the PNV and Confuser PNVs:
The Coastal Boreal Transition Forest PNV is transitional between the coastal Sitka spruce (*Picea sitchensis*) rainforests of the south-coastal region and the white spruce (*P. glauca*) –paper birch (*Betula papyrifera)* boreal forests of the arid interior of Alaska (Berg 2004). This PNV contains a diverse mixture of Pacific coastal forest and boreal forest floras, varying in composition from area to area depending on topography and drainage conditions. Common tree species include white spruce, paper birch, balsam poplar (*Populus Balsamifera*), quaking aspen (*P. tremuloides*) and mountain hemlock (*Tsuga mertensiana*). Lutz spruce (*Picea lutzii* Little) may also be well represented. Sitka spruce may be present as a minor component (<10% canopy cover) in stands near the coastal limits of the Coastal Boreal Transition Forest PNV, but forests with a greater proportion of Sitka spruce should be considered part of the Coastal Forests PNV.

Common shrub and herb species include those characteristic of boreal habitats including narrowleaf labrador tea (*Ledum groenlandicum*), soapberry (*Shepherdia canadensis*), and prickly rose (*Rosa acicularis*), and others that are more characteristic of south coastal habitats, including devil's club (*Oplopanax horridus*), Sitka mountain ash (*Sorbus sitchensis*) and salmonberry (*Rubus spectabilis*).

On the west side of the Kenai Peninsula extending through and beyond the Tustumena Lake area, the Coastal Boreal Transition PNV is most similar to the Upland Spruce Hardwood Southcentral Forest PNV which occurs in the Matanuska and Susitna Valleys and in the Copper River Basin. The principal difference between these two PNVs is the length of the fire return interval (approximately 600 years in the Coastal Boreal Transition vs. 200 years in the Upland Spruce Hardwood) due to differences in climate. On the east side of the Kenai Peninsula, the Coastal Boreal Transition PNV grades into the Mountain Hemlock PNV at higher elevations in the Kenai Mountains. These two PNVs may be confused because mountain hemlock may be present on both PNV sites, but as a lower overall percentage of the overstory species in the Coastal Boreal Transition sites. In some areas, the Coastal Boreal Transition PNV resembles to the Coastal Forests PNV which occurs in Southeast Alaska, especially with respect to understory species. The Coastal Boreal Transition PNV may have only a small percentage of Sitka spruce (<10%), while Sitka spruce is the dominant spruce species in the Coastal Forests PNV.

Natural Fire Regime Description:
Although lightning strikes and natural fires are rare in the region, wild fires play an infrequent but important role in the disturbance regime of the Coastal Boreal Transition Forest PNV (Potkin 1997). Under the natural the fire regime of this PNV fires were infrequent but large (USDA Forest Service 2002).

Estimates of mean fire return interval (MFI) include:
- 800 years (Berg 2004)
- 600 years (personal communication FRCC experts' workshop March 2004)
- 600 years (570-3010 year range) (Potkin 1997) (5 locations in the Kenai Mountains)

Other Natural Disturbance Description:

Spruce bark beetle (*Dendroctonus rufipennis*) infestations are a major natural disturbance of the Coastal Boreal Transition Forest PNV. Beetle outbreaks that thin stands and produce a growth release in surviving trees occur on average every 50 years in white and Lutz spruce forests on the Kenai Peninsula (Berg 2004). Spruce bark beetle outbreaks that produce a more substantial thinning occur at longer intervals, with the last two severe infestations occurring in the 1870s-1880s and 1987 –present (Berg 2004). The bark beetle outbreak that began in 1987 on the Kenai Peninsula has killed over 1.3 million acres of spruce (USDA Forest Service 2002). Berg (2004) found no association between spruce bark beetle mortality and fire in the past.

When the canopy of these forests is thinned by spruce bark beetle-mortality, bluejoint grass (*Calamagrostis canadensis)* may proliferate rapidly from its pre-disturbance low level network of rhizomatous roots and may develop into a think, seedling excluding sod within a few years (Berg 2004). Boucher (2003) found that rapid spread of Calamagrostis occurs primarily on sites with deep, loamy soils.

Other natural disturbances include wind, avalanche and landslides. Windthrow gap disturbances are important in both spruce and hemlock recruitment in these forests (Potkin 1997).

Natural Landscape Vegetation-Fuel Class Composition:
The natural vegetation structure is a mosaic of the seral stages described in the tables below.

Fire severity is an important factor in determining postburn successional pathways in the Alaska taiga (Foote 1983), including the closely related Coastal Boreal Transition Forest PNV on the Kenai lowlands (Berg 2000) and Kenai Mountains (Boucher 2003). Except in the case of a severe burn, post fire succession in boreal forests returns to the pre-disturbance forest cover type, however the rate of change and species composition may vary (Foote 1983, Payette 1992, Boucher 2003). Post fire regeneration is characteristically rapid and dominated by revegetation via rhizomes and root and stump sprouts of species that survive the fire (Schaefer 1993, Viereck 1975, Van Cleve and Viereck 1981). In locations where the organic layer is mostly consumed by fire vegetative reproduction is reduced and sites are captured more by light-seeded 'invader' species (Heinsleman 1981).

Natural Scale of Landscape Vegetation-Fuel Class Composition and Fire Regime:
The Coastal Boreal Transition Forest PNV exits within a mosaic of the Black Spruce Southcentral PNV (on poorly-drained, lowland sites on the west side of the Kenai Peninsula), the Riparian Spruce Hardwood PNV (on river terraces on the west side of the Peninsula), and the Kenai Mountains Hemlock (at mid elevations in the Kenai Mountains). Under the natural the fire regime of this PNV fires were infrequent but large (USDA Forest Service 2002). During most fire years a small number of large fires account for most of the total area burned (Gabriel and Tande 1983).

On the Kenai Peninsula, drought weather conditions resulting from the 1912 Katmai eruption have been suggested to contribute to large scale fires from 1913-1915. Approximately 20,000 acres (or 7.4% of the total forested area) burned during this period on the Chugach National Forest (this figure includes fire in all PNVs present on the landscape).

Uncharacteristic Vegetation-Fuel Classes and Disturbance:
The present landscape of the western Kenai Peninsula reflects human-caused fires that occurred over the last 100 years, creating areas of early successional plant communities, which include large stands of broadleaved forests (Potkin 1997). Over 99% of the fires occurring on the Kenai Peninsula portion of the Chugach National Forest between 1914 and 1997 were ignited by human actions (Potkin 1997). These human-caused fires have generally increased the richness and

patchiness of the vegetation at the landscape scale (USDA Forest Service 2002). The large number of acres burned on the Kenai Peninsula during settlement caused conversion of some mature spruce stands to grass, brush and broadleaf tree vegetation types. Prior to the settlement period of the late 1800s, the majority of the age structures of the coniferous forest surveyed by Potkin (1997) were likely in the late successional stages (Langille 1904 in Potkin 1997) and conifers were likely dominant.

Following spruce bark beetle outbreaks on the Kenai Peninsula grass and other fine vegetation increased (Holsten et al 1995). Fire spreads rapidly through this type of vegetation; indeed the majority of fires (most of which were human caused) on the Kenai Peninsula portion of the Chugach National Forest between 1914 and 1997 occurred in grassland vegetation (Potkin 1997). Standing and downed beetle killed trees increase the amount of both fine, flashy fuels and heavy fuels. Spruce bark beetle outbreaks are increasing in frequency and severity in southcentral Alaska due to the warming climate (Berg 2004), making this pattern uncharacteristic for the PNV.

PNV Model Classes and Descriptions:

Class	**Modeled Percent of Landscape**	**Description**
A: 0 -35 years Post disturbance regeneration: herbaceous to tall shrub-sapling	5%	If moderate severity burn, vegetative reproduction of shrubs (e.g., *Rosa acciularis, Viburnum edule, Salix spp.*) and birch and aspen from shoots and suckers. Light-seeded herbs establish where mineral soil exposed. White and Lutz spruce seedlings rare, but may be present if mineral soil was exposed, seed trees remained after fire and they produced a good seed crop (Foote 1983). If severe fire on loamy soil, *Calamagrosits* may spread rapidly from rhizomes and capture large percentage of site (Boucher 2003). Later in this class dense tall shrubs (*Alnus spp.* and *Salix spp.*) and/or saplings are in the overstory, and herbs, tree seedlings, and litter below. Mosses and lichens exist but are not an important component. If *Calamagrostis* captures site, it may persist throughout this class.
B: 30-130 years Mid-development: closed conifer, hardwood, or mixed	10%	Tree saplings gain canopy dominance over shrubs. Tree species may include spruce, hardwoods or both. *Rosa aciularis, Ribes triste, Equisetum* spp. and *Linnaea borealis* are commonly in the understory. Mosses and lichens become established.
C: 30-130 years Mid-development open conifer, hardwood, or mixed	15%	Young trees become dominant in the overstory. Calamagrostis, if dominant in Class A diminishes in importance. *Rosa acciularis, Ribes triste, Equisetum* spp. and L*innea borealis* are commonly in the understory. Lichens and mosses become established.
D: 130-400 years late-development, open conifer,	65%	Open spruce, hardwood or mixed stands with tree density < 60%. Hardwoods, if present and mixed with spruce, lose dominance in overstory during this phase. Occasional hardwoods may remain. The understory may include various

hardwood, or mixed		combinations of tall shrubs, low shrubs, herbs, mosses and lichens.
E: 130-400 years Late-development, closed conifer, hardwood, or mixed	5%	Site is dominated by mature conifers with > 60% canopy closure. Hardwoods, if present and mixed with spruce, lose dominance in overstory during this phase. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens (see common species above).
Total:	100%	

Modeled Fire Frequency and Severity:

	Mean Probability	Mean Disturbance Frequency (years) (inverse of probability)	Description
Replacement fire	.0014	715 years	Based on literature and expert input
Mosaic fire	.0002	5,000 years	Based on literature and expert input
All Fire	.0016	625 yrs	Based on literature and expert input
Insect opens stand	.0206	50 years	Based on literature and expert input

Modeled Fire Severity Composition:

	Percent All Fires	Description
Replacement fire	90%	Based on literature and expert input
Non-replacement fire	10%	Based on literature and expert input
All Fire	100%	

Further Analysis:

- Need more detailed info on scale of fires.

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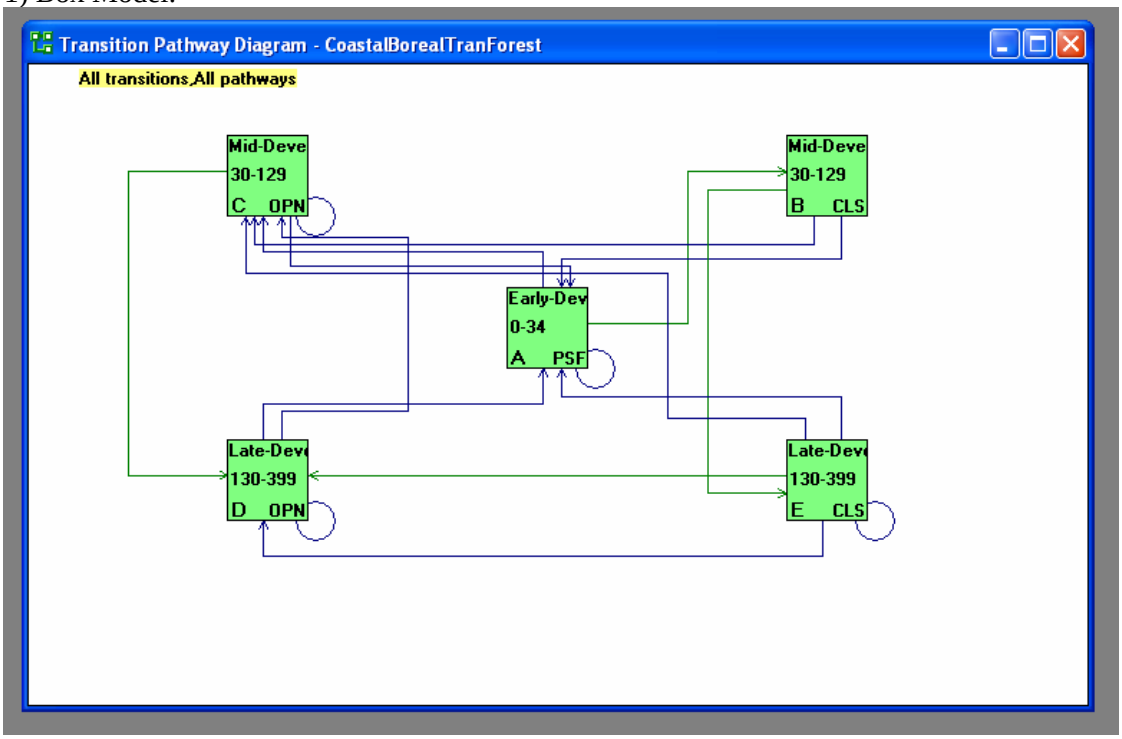
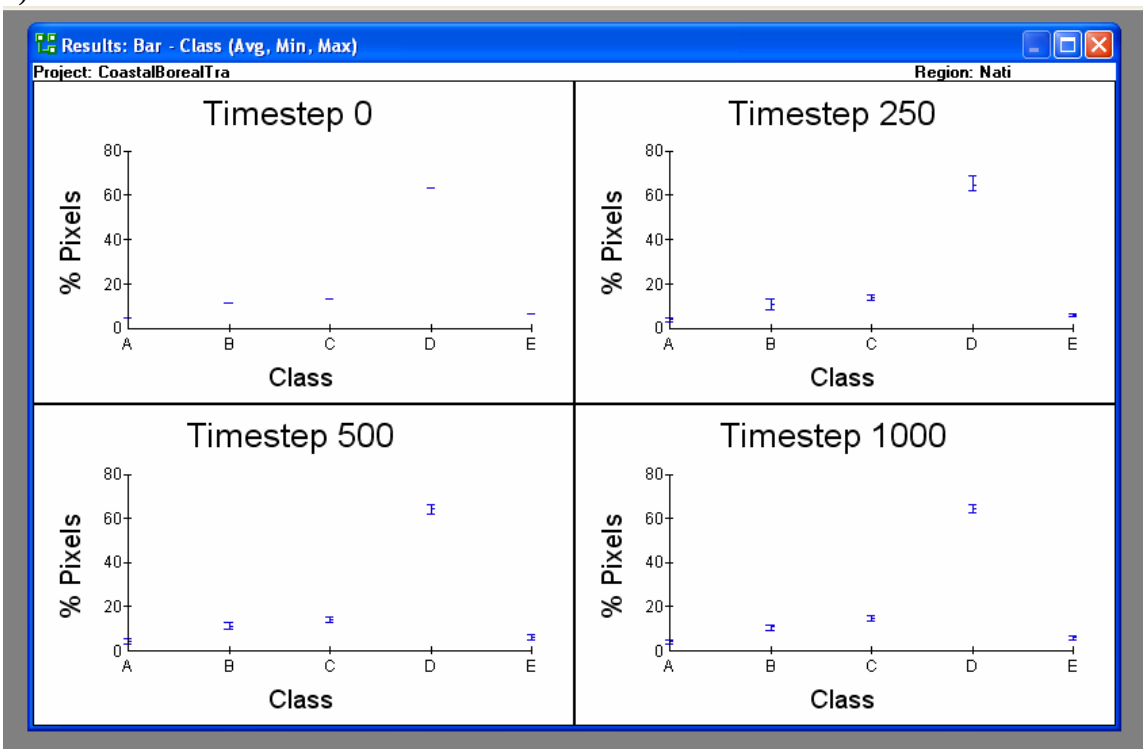
VDDT Model Diagrams:

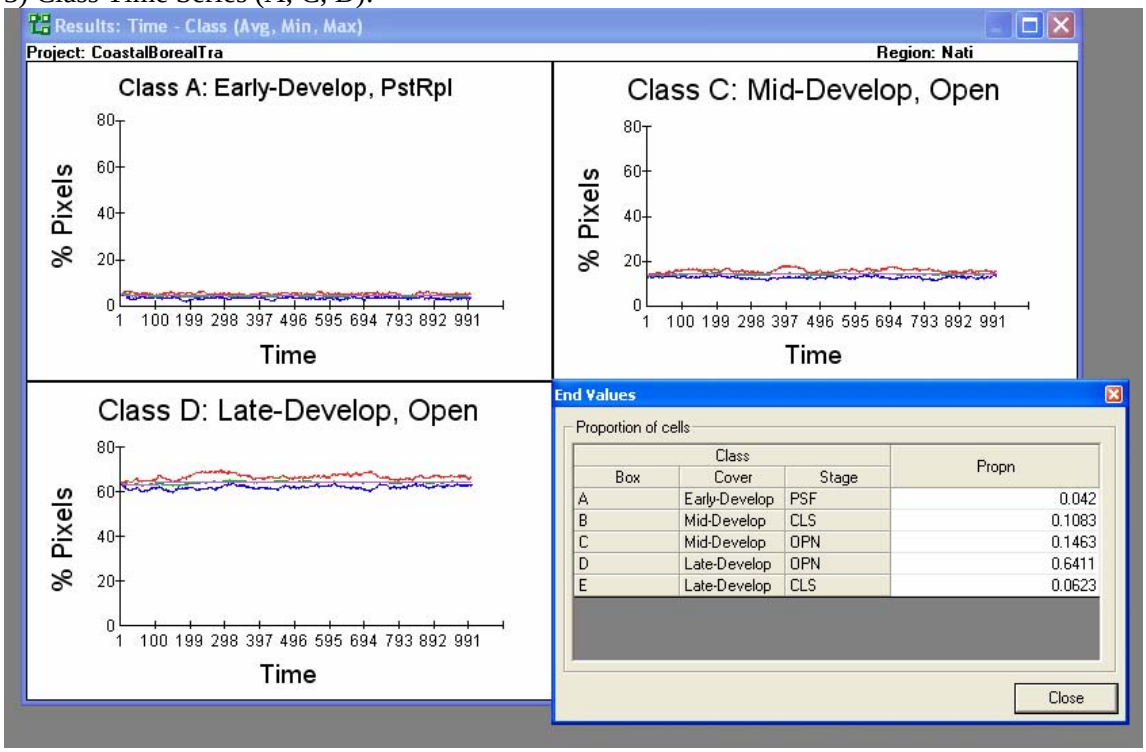
1) Box Model:



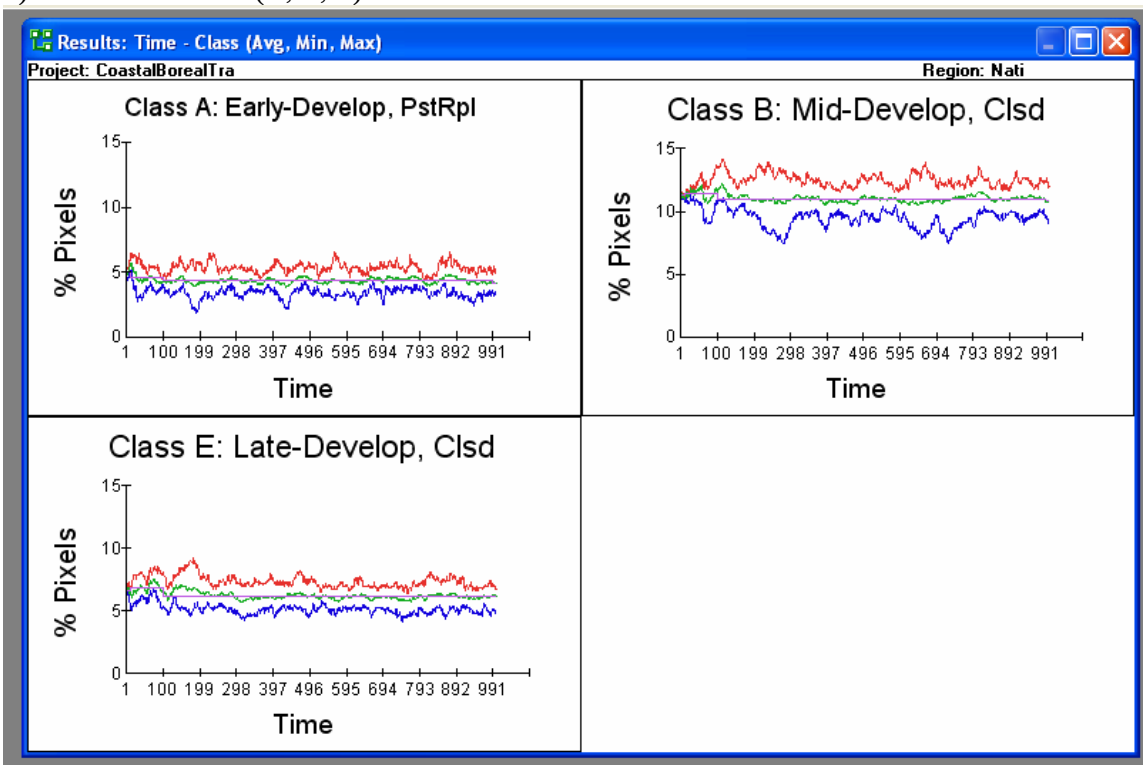
2) Class Distribution:



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



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



5) Fire Disturbance Time Series