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Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

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Potential Natural Vegetation (PNV) Name: Upland White Spruce Interior

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

Physical Stetting Description:
Upland White Spruce Interior PNV sites are widespread and common throughout interior and parts of western and southcentral Alaska on relatively warm (south, west, and east aspects), well-drained upland terrain, especially south-facing loess-covered slopes adjacent to rivers (Viereck et al 1986). These are the most productive forest sites in the Alaska taiga. Upland White Spruce Interior sites also occur near timberline to elevations of approximately 750 m (Viereck et al 1986) where stands tend to be open (< 60% canopy cover) and white and black spruce may be mixed (Viereck et al 1992). Soils are largely derived from glacial or other depositional processes, and include ablation till, glacial outwash, alluvium, colluvium and loess. Typical soils include Cryaquepts, Cryochrepts and Cryofluvents, and range from somewhat acid to almost basic (Viereck et al 1992). Permafrost is usually absent.

Biophysical Classification:
The Upland White Spruce Interior PNV type occurs in the following ecoregions described by Nowacki et al (2001):
- Intermontane Boreal
- Nulato Hills section of the Bering Taiga
- Bering Tundra

The following level IV community types described by Viereck et al (1992) are included in the Upland White Spruce Interior PNV group:

IA1j – Closed White Spruce Forest
IA2e – Open White Spruce Forest
IA3c – White Spruce Woodland
IB1d – Closed Paper Birch forest (white spruce understory & sites)
IB1e – Closed Quaking Aspen Forest (white spruce sites)
IB1f – Closed Paper Birch-Quaking Aspen Forest (white spruce sites)
IB2a – Open Paper Birch Forest
IB2b – Open Quaking Aspen Forest
IB3a – Paper Birch Woodland (possible - successional status unknown)
IC1a – Closed Spruce-Paper Birch Forest (white spruce sites)
IC1b – Closed White Spruce-Paper Birch-Balsam Poplar (Black Cottonwood)
IC1d – Closed Quaking Aspen-Spruce Forest (white spruce sites)
IC2a – Open Spruce-Paper Birch Forest (white spruce sites)

Identification of Key Characteristics of the PNV and Confuser PNVs:

Site indicator species include white spruce (*Picea glauca*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), soapberry (*Shepherdia canadensis)*, *Arctostaphylos uva-ursi*, and prickly rose *(Rosa acicularis*) (Dyrness et al 1983). High bush cranberry (*Viburnum edule)*, twinflower *(Linnaea borealis)*, and field horsetail (*Equisetum*) are also good indicators of warm, well-drained sites (Foote 1983). Ericaceous species (i.e. *Vaccinium uliginosum*, *V. vitis-idaea)* are frequently found on both white spruce and black spruce sites, and thus are not ideal site indicators.

This PNV is similar to the Riparian Spruce Hardwood PNV, which occurs on river terraces throughout the same region and where flooding is a more important disturbance and fire is less frequent. The Upland White Spruce Interior PNV is also very similar to the Upland Spruce Hardwood PNV which occurs south of the Alaska Range in the Matanuska and Susitna River valleys and in the Copper River Basin. These two upland spruce types share many of the same site requirements and species, but the Upland Spruce Hardwood PNV is subject to greater insect disturbance than is the Upland White Spruce Interior PNV. On some sites this PNV can be confused with the Black Spruce Interior and the Black Spruce Southcentral PNVs because black and white spruce often mix, especially on sites with transitional moisture and thermal conditions. The Upland White Spruce Interior and two Black Spruce PNVs also share many understory species in common.

Natural Fire Regime Description:
The Upland White Spruce Interior fire regime is characterized by crown fires & severe surface fires. Fires tend to be large – 50,000 hectares or larger. During most fire years a small number of large fires account for most of the total area burned (Gabriel and Tande 1983). Ecologically significant fires usually occur during the exceptional fire years and cover 200,000 + hectares (Viereck 1983). Usually some of the organic layer remains (Viereck 1983). Mean fire return interval estimates include:

- 100-200 yrs (Yarie 1981).
- 113 yrs (Yarie 1983) (Porcupine River area)
- 50-70 years (Foote 1983) (for white & black spruce/*Betula gladulosa* woodlands at treeline)
- 50-150 yrs (Duchesne and Hawkes 2000)
- 113-238 yrs (Rowe 1972) (for Kluane National Park)
- 100-150 years (Heinselman 1981) (for spruce lichen woodlands of western boreal region)
- 150 - 200 yrs (80-200 year range) (personal communication experts' workshop March 2004)

Good white spruce seed crops occur approximately every third (Duchesne and Hawkes 2000) to twelfth year (Viereck 1973). The effective dispersal distance is approximately two tree heights (45-60 m) (Viereck 1973). Post fire regeneration of white spruce increases when fires occur late summer of a good seed year. Pure white spruce stands do not commonly re-establish following fire because a combination of abundant seed and proper seed bed conditions are required for white spruce regeneration (Foote 1983). If seed trees are eliminated over large areas, aspen will likely colonize site and slow the re-establishment of white spruce (Duchesne and Hawkes 2000).

Fire severity is an important factor in determining postburn successional pathways in the Alaska taiga (Foote 1983, Payette 1992, Boucher 2003). Except in the case of a severe burn, post fire succession in boreal forests tends to return 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). 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:
Fire is the dominant natural disturbances in this PNV, however periodic insect outbreaks also play an important role. Windthrow gap disturbances, including individual tree blowdowns and occasional stand blowdown events, are also important in stand development within the Upland White Spruce Interior PNV.

Natural Landscape Vegetation-Fuel Class Composition:
The natural vegetation structure is a mosaic of the seral stages described below. White spruce is the climax indicator species.

Natural Scale of Landscape Vegetation-Fuel Class Composition and Fire Regime:
This PNV exists within landscape mosaics composed of the Black Spruce Interior PNV (on relatively colder and wetter forest sites), the Riparian White Spruce (on river terraces), the Non-Forested Wetland PNV, and at the attitudinal and latitudinal limits of the PNV, shrub and tundra types. White Spruce Interior sites are typically patchy and exist on south-, west-, and east-facing slopes and well-drained upland terrain.

Uncharacteristic Vegetation-Fuel Classes and Disturbance:

PNV Model Classes and Descriptions:

Class	**Modeled Percent of Landscape**	**Description**
A: 0 -35 years Post disturbance regeneration: Herb, shrub and sapling regeneration – through shrub/sapling stage	15%	Vegetative reproduction of shrubs (e.g., *Rosa acicularis Viburnum edule, Salix spp*) and hardwoods from shoots and suckers. Light-seeded herbs establish. White spruce seedlings rarely present (Foote 1983) unless seed trees remained after fire and they produced a good seed crop. Quaking aspen and paper birch may be present in densities of 30,000 stems/ha at 1-2 m in height. Near the end of this class dense tall shrubs and/or saplings are in the overstory, with herbs, tree seedlings, and litter below. Mosses and lichens exist but are not an important component. Trees may include hardwoods and spruce.
B: 30 –150 years Closed conifer, hardwood or mixed stands	11%	Young trees become dominant in the overstory, *Rosa acicularis*, *Viburnum edule,* and *Linnaea borealis* are commonly in the understory. Lichens and feathermosses become established. Overstory trees may be present at densities of approximately 2,300 stems/acre (Foote 1983).
C: 30-150 years Open conifer, hardwood or mixed stands	10%	Young trees become dominant in the overstory. *Rosa acicularis*, *Viburnum edule,* and *Linnaea borealis* are commonly in the understory. Lichens and feathermosses become established. Overstory trees may be present at densities of approximately 2,300 stems/acre (Foote 1983).
D:		Open spruce stands with tree canopy closure of < 60%.

150-400 years Open spruce	47%	Hardwoods, if present, occupy < 25% of the tree canopy. In older stands, hardwoods may no longer be present in the overstory, however occasional hardwoods may remain. The understory may include various combinations of tall shrubs, low shrubs, herbs, mosses and lichens.
E: 150-400 years Closed spruce	17%	Site is dominated by mature white spruce with > 60% canopy closure. Hardwoods, if present, occupy < 25% of the tree canopy. In older stands, hardwoods may no longer be present in the overstory, however occasional hardwoods may remain. 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 probability)	Description
Replacement fire	0.38	265	Based on literature and expert input
Mosaic fire	0.14	715	Based on literature and expert input
All Fire	0.52	190	Based on literature and expert input
Insects open stands	0.68	150	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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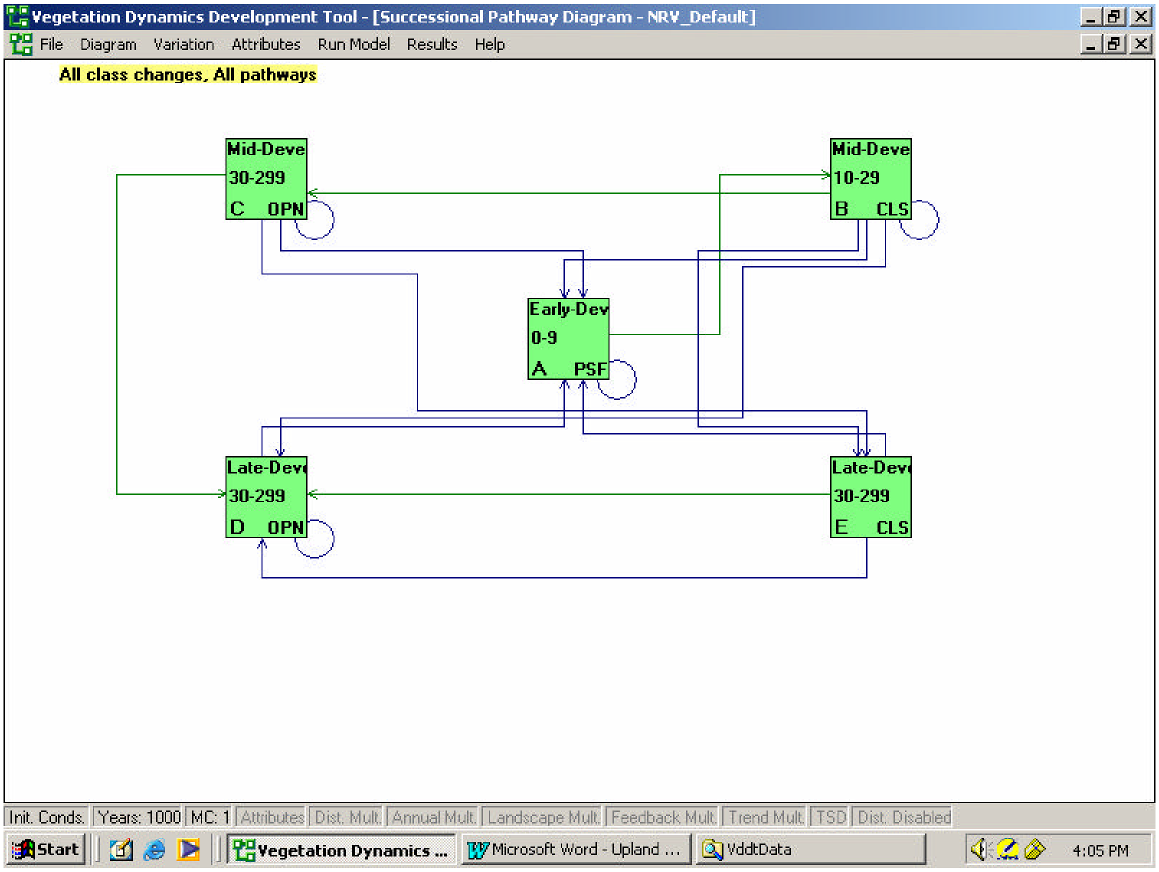
VDDT Model Diagrams: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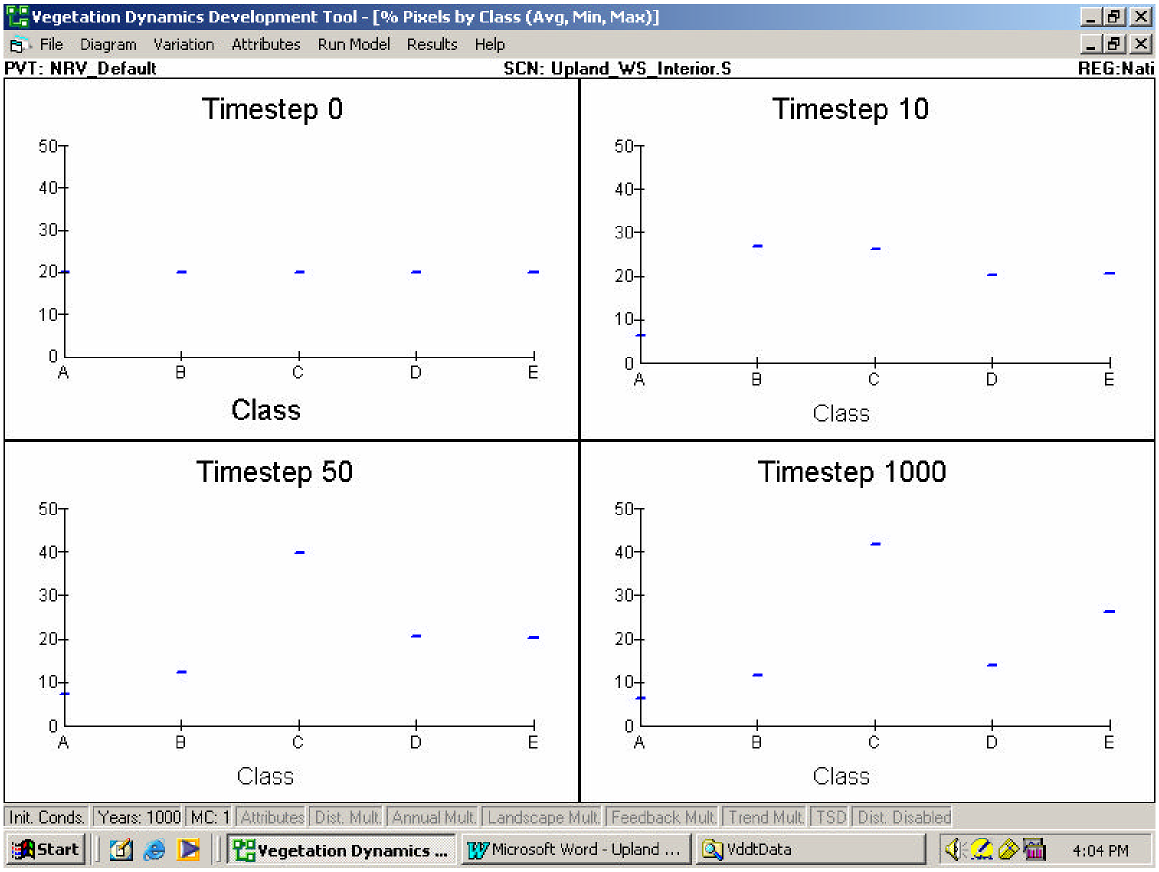
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