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Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

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Potential Natural Vegetation (PNV) Name: Upland Spruce Hardwood Southcentral

Fire regime group: V
Geographic Area: Susitna & Matanuska Valleys, Copper River Basin in Southcentral Alaska

Physical Stetting Description:
Upland Spruce Hardwood Southcentral PNV sites are widespread and common throughout southcentral Alaska on relatively warm (south, west, and east aspects), well-drained upland terrain, especially south-facing slopes. Many of these sites are among the most productive forest sites in southcentral Alaska. Upland Spruce Hardwood Southcentral 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 with hardwoods. Soils are largely derived from glacial or other depositional processes, and include ablation till, glacial outwash, alluvium and colluvium and loess. Permafrost is usually absent.

Biophysical Classification:
The Upland Spruce Hardwood Southcentral PNV occurs in the following ecoregions described by Nowacki et al (2001):

- Alaska Range Transition: Cook Inlet Basin (B5), Copper River Basin (B8)

The following level IV community types described by Viereck et al (1992) are included in the Upland Spruce Hardwood Southcentral 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
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)
IC2d – Open Spruce-Balsam Poplar (SC only)
IC3a – Spruce-Paper Birch Woodland (SC only)

Identification of Key Characteristics of the PNV and Confuser PNVs:
Site indicator species include white spruce (*Picea glauca*), paper birch (*Betula papyrifera)*, balsam poplar (*Populus Balsamifera*), quaking aspen (*P. tremuloides*), soapberry *(Shepherdia canadensis)*, *Arctostaphylos uva-ursi*, and prickly rose (*Rosa acicularis)* (Dyrness et al 1983). High bush cranberry *(Viburnum edule)*, twinflower *(Linnea 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 and floodplains throughout the same geographic region and where flooding is a more important disturbance than fire. In some locations, this PNV can also be confused with the Black Spruce Southcentral PNV because black and white spruce often mix, especially on sites with transitional moisture and thermal conditions. The White Spruce Interior PNV, which occurs north of the Alaska Range, has similar species composition and structure, with hardwoods occurring in the mid-development successional stages. The Interior PNV has a shorter mean fire return interval (MFI) and a longer interval between insect disturbances.

The Coastal Boreal Transition Forest PNV, which occurs on the Kenai Peninsula, is also similar but on most sites it includes more understory species typical of the Southeast Alaska coast (e.g., Devil's club (*Oplopanax horridus*), Sitka mountain ash (*Sorbus sitchensis*) and Salmonberry (*Rubus spectabilis*). While these two PNVs may appear to be similar in species composition and structure, the coastal climate of the Kenai produces fewer naturally-occurring fires than does the more interior climate where the Upland White Spruce PNV occurs. Therefore, the Coastal Boreal Transition Forest PNV has a significantly longer MFI.

Natural Fire Regime Description:
The Upland Spruce Hardwood Southcentral Fire regime is characterized by crown fires and severe surface fires. Fires tend to be large – 50,000 hectares or larger. Ecologically significant fires usually occur during the exceptional fire years. 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:

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

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 both 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 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). Where the organic layer is mostly consumed by fire vegetative reproduction is much reduced and sites are captured more by light-seeded 'invader' species (Heinsleman 1981).

Other Natural Disturbance Description:
Spruce bark beetle (*Dendroctonus rufipennis*) infestations are a major natural disturbance of the Upland Spruce Hardwood Southcentral 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 in the region (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 in Southcentral Alaska 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 history.

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 develop into a thick, 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.

Natural Landscape Vegetation-Fuel Class Composition:
The natural vegetation structure is a mosaic of the seral stages described in the table below. White spruce, paper birch, and balsam poplar, are the climax indicator species.

Natural Scale of Landscape Vegetation-Fuel Class Composition and Fire Regime:
This PNV exists within a landscape mosaic composed of the Black Spruce Southcentral 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. Upland Spruce Hardwood Southcentral sites are typically patchy and exist on south-, west- and east-facing slopes and well-drained upland terrain.

Uncharacteristic Vegetation-Fuel Classes and Disturbance:
Similar to the Kenai Peninsula, the present vegetation mosaic in some other parts of Southcentral Alaska likely reflects human-caused fires that occurred over the last 100 years (Potkin 1997). These human-caused fires have generally increased the richness and patchiness of the vegetation at the landscape scale (USDA Forest Service 2002) and created areas of early successional plant communities including large stands of broadleaved forests.

Following the spruce bark beetle outbreaks on the Kenai Peninsula grass and other fine vegetation increased (Shulz 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 (personal communication FRCC experts' workshop March 2004), making this pattern uncharacteristic for this PNV.

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	19%	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	8%	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	34%	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: 150-400 years Open spruce	17%	Open spruce stands with tree canopy closure of < 60%. 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	22%	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	0.39	255 years	Based on literature and expert input
Mosaic fire	0.10	1,000 years	Based on literature and expert input
All Fire	0.49	200 years	Based on literature and expert input
Insect replaces stand	0.33	300 years	
Insect opens stand	1.58	65 years	

Modeled Fire Severity Composition:

	Percent All Fires	Description
Replacement fire	80	Based on literature and expert input
Non-replacement fire	20	Based on literature and expert input
All Fire	100%	

Further Analysis:

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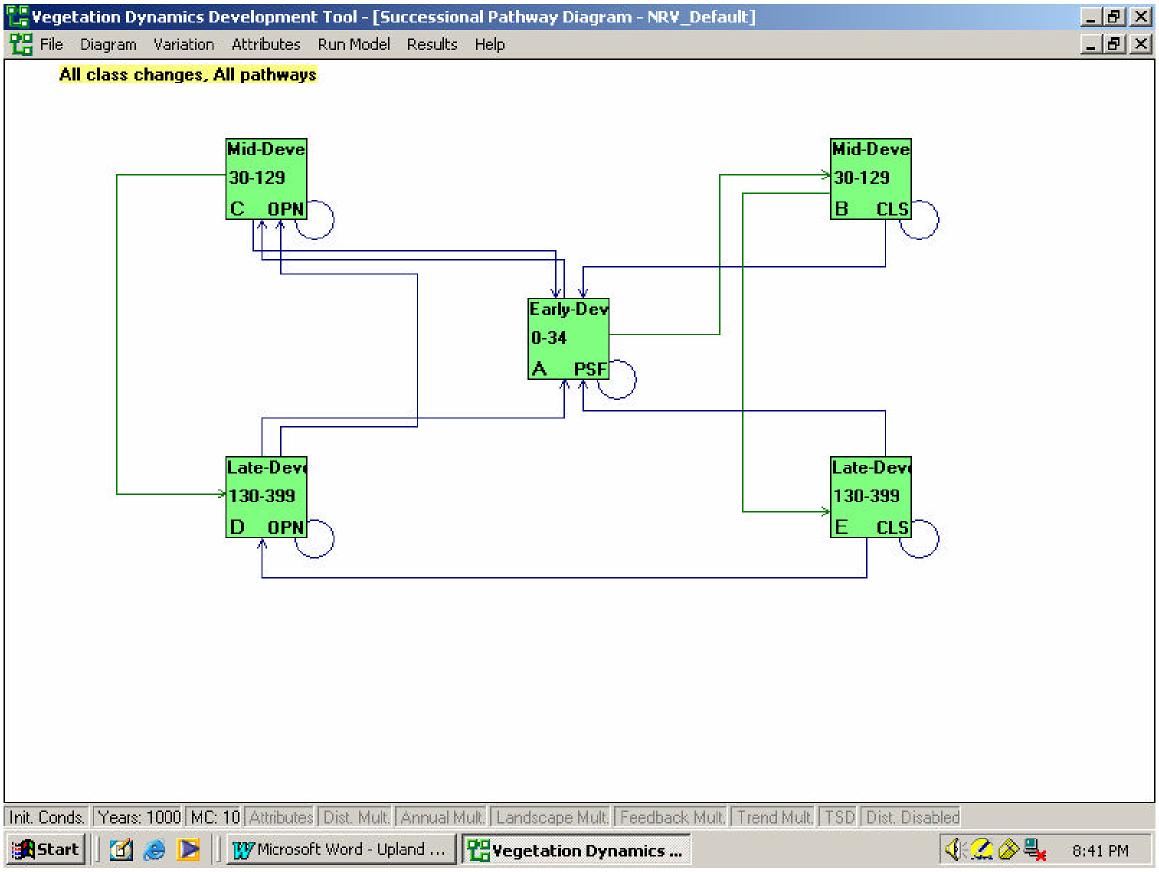
VDDT Model Diagrams: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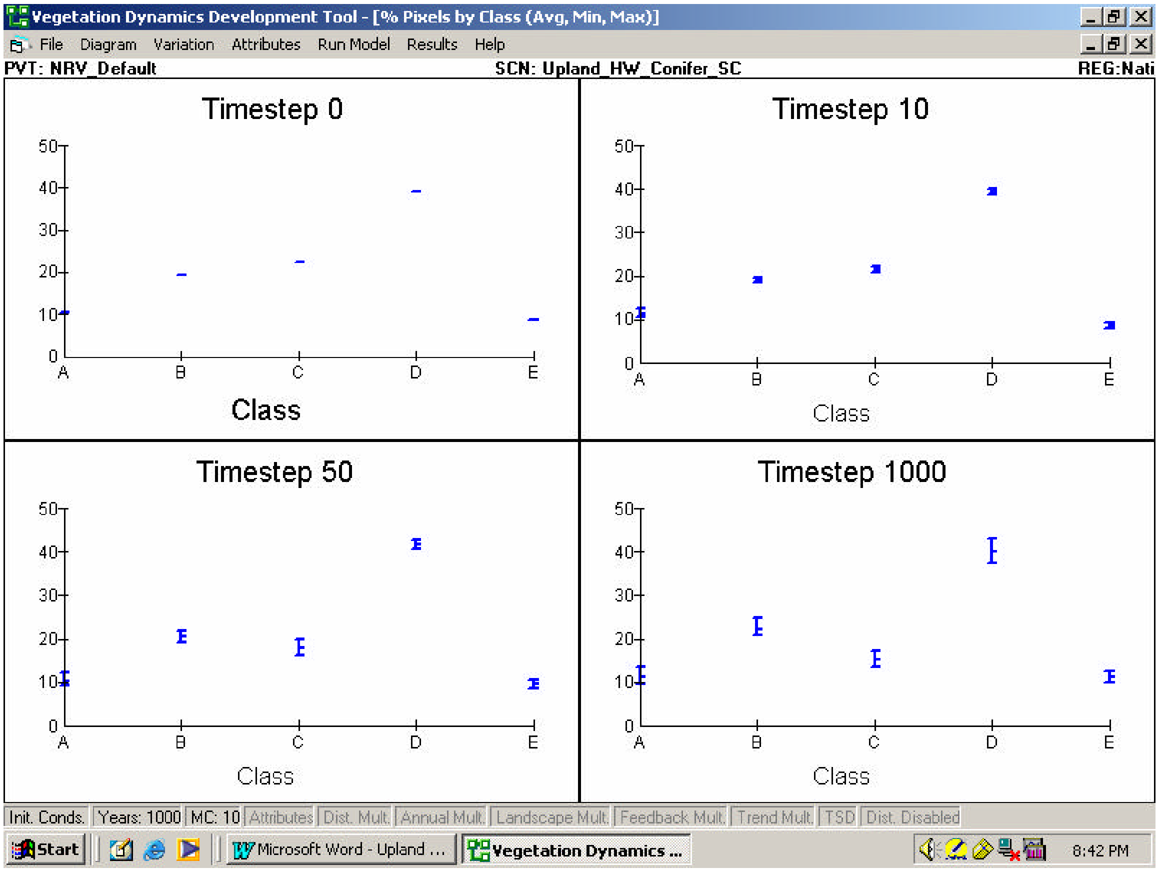
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