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Fire Regime Condition Class (FRCC) Interagency Guidebook Reference Conditions

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Potential Natural Vegetation (PNV) Name: Tussock Tundra 2

Fire regime group: V
Geographic Area: Brooks Range foothills, Brooks Range, Beaufort Coastal Plain, Bristol Bay lowlands, Yukon-Kuskokwim Delta, Ahklun Mountains

Physical Stetting Description:
Tussock Tundra 2 PNV sites are widespread and common throughout arctic and much of western Alaska (excluding the Seward Peninsula) on flats, gentle slopes with gradients up to 10 percent, and alpine sites (Viereck et al 1992). Permafrost is usually present at depths of 30-50 cm. Soils are generally poorly drained, gleyed, and often with a poorly decomposed organic horizon at the surface, which may constitute most of the active layer. Frost scars are common.

Deleted: Peninsual

Biophysical Classification:
The Tussock Tundra 2 PNV occurs in the following ecoregions described by Nowacki et al (2001):

- Arctic Tundra - Brooks Range foothills (P1), Brooks Range (P3), Beaufort Coastal Plain (P9)
- Bering Taiga –Bristol Bay lowlands (P6), Yukon-Kuskokwim Delta (P8), Ahklun Mountains (P10)

The following community types described by Viereck et al (1992) are included in Tussock Tundra Bering & Arctic PNV group:

IIB1a – Closed Tall Willow Shrub (may succeed to tussock tundra as permafrost table rises)
IIB2a – Open Tall Willow Shrub (sere on tussock tundra sites)
IIB2d – Open Tall Alder-Willow Shrub (sere on tussock tundra sites)
IC2a – Open Low Mixed Shrub-Sedge Tussock Tundra
IIC1a – Closed Low Shrub Birch Shrub (sere on river terraces)
IIC2b – Open Low Mixed Shrub-Sedge Tussock Bog
IIC2l – Open Low Alder Shrub (successional relations unknown – likely sere in shrub-tussock tundra type)
IIIA2a – Bluejoint Meadow (sere in tussock tundra sequence on some sites on Seward Peninsula)
IIIA2d – Tussock Tundra (climax on poorly drained flats, plateaus, benches, and gentle slopes in northern and western Alaska)
IIIA3a – Wet Sedge Meadow Tundra (complex successional relations – may succeed to or from tussock tundra)

Identification of Key Characteristics of the PNV and Confuser PNVs:
The Tussock Tundra 2 PNV is dominated by sedges in a tussock growth form. *Eriophorum vaginatum* (cottongrass) is the primary tussock-former in most stands. Other indicator species include *Carex bigelowii* (bigelow sedge), *Carex spp.* (sedges), *Betula nana* (Dwarf white birch), *Ledum decumbens* (Labrador tea), *Vaccinium vitis-idaea* (Mountain cranberry), *V. uliginosum* (Bog blueberry), and *Empetrum nigrum* (Crowberry). Grasses, inc luding *Calamagrostis*

canadensis and *Arctagrostis* spp. may also be present. Mosses *(Sphagnum* ssp.*)* may be absent or a minor constituent; lichens, including *Cetraria cucullata*, *C. islandica*, *Cladonia* spp., *Cladina rangiferina* (Reindeer lichen), and *Thamnolia subuliformis* are often, but are not always abundant.

The Tussock Tundra 2 PNV is very similar to the Tussock Tundra 1 PNV, which occurs in interior Alaska, on the Seward Peninsula, in Nulato Hills region of western Alaska, and the Alaska Range transition region and which has a shorter mean fire return interval (MFI). Geographic location is the best determinant between Tusscok Tundra 1 and Tussock Tundra 2. The Tussock Tundra 2 PNV is also similar to the Dwarf Shrub Tundra PNV which shares many of the same species and occurs in much the same region but lacks the tussock growth form.

Natural Fire Regime Description:
The fuel layer in sedge-shrub tussock tundra is dense and continuous and leads to large, fast spreading fires (Duchesne and Hawkes 2000, Racine et al 1987). Racine (1979) found much variation in burn intensity on a landscape scale on the Seward Peninsula, from completely unburned to intensely burned. These patterns are related to variations in topography and the composition, moisture content and soil organic accumulations of the plant communities. Fires in *Eriophorum* tussock tundra types tend to be light because of the wet soil profile (Wein 1971). Burns in this type usually consume all aerial woody and herbaceous plant material and litter; regeneration is vigorous via rhizomes and root sprouts. Racine (1979) found that burning was generally less severe in the tussock-shrub and sedge-shrub tundras than in the birch and ericaceous shrub tundra of the Seward Peninsula. He found that tundra burns were patchy, with unburned communities and unburned patches within burned communities.

More fires occur near the forest-tundra ecotone and spread further if trees are present (Heinselman 1981). Wein (1976) reports that July and August are the most common months for lightning fires to occur in tundra ecosystems, while Racine et al (1983) found that distinct fire seasons occur in both June and July in the Noatak River watershed. Subsidence and thermal erosion following fire is usually minimal in tundra ecosystems (Walker 1996).

In most areas of tussock-shrub tundra on the Seward Peninsula, less than one half of accumulated organic soil layer was removed (Racine 1979). Thaw depths increased to reach into the mineral soils, but were not greatly increased except where organics were removed. Frost features were made more conspicuous, and soil nutrient concentrations (K and P) increased locally.

Mean fire return interval estimates for tussock tundra ecosystems include:

- 50-300 years (personal communication, FRCC experts' workshop March 2004)
- 180-1,460 years in forest shrubzone and 9,320 years in shrub subzone in northern Quebec; shorter cycle west of Hudson's Bay/in interior zone (Payette et al 1989)
- 612 years for Noatak River watershed (all vegetation types) (Racine et al 1983)
- Fire interval yet to be determined (Racine et al 1987)
- Rapid recovery following fire makes fire frequency difficult to determine (Wein 1971)
- The fire regime of tundra systems are likely quite variable from one region to another making generalizations difficult (Viereck and Schandelmeier 1980)

Other Natural Disturbance Description:
Frost action, which creates polygonal ground and other periglacial features, is a widespread, small-scale and continuous disturbance within the Tussock Tundra 2 PNV.

Change in the arctic and subarctic climate is another source of disturbance currently affecting tundra ecosystems.

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

Natural Scale of Landscape Vegetation-Fuel Class Composition and Fire Regime:
Tundra vegetation types cover vast expanses of the landscape in arctic and western Alaska. Typical landscapes in these regions include the Tussock Tundra 2 PNV within a mosaic of other tundra types, including sedge dwarf shrub and wet sedge-grass meadow types.

Wien (1976) reports many tundra fires in the 1 to 100 ha size range and few large (thousands of ha) fires. Racine (1979) reports that in 1977 lightning-caused fires burned 35,480 ha on the Seward Peninsula, with one fire burning 9,440 ha. Jandt and Meyers (2000) report that large fires (>200,000 ha) occur about every 10 years in the Buckland Valley and surrounding highlands of the Seward Peninsula. Racine et al (1983) found that 40 fires burned 100,000 ha (1000 km^2) in the 30,000 km^2 watershed of the Noatak River between 1956 and 1981.

Fourty-three percent of wildland fires occurring in interior Alaska occur in treeless areas, primarily tundra bogs and fens (Viereck 1975).

Uncharacteristic Vegetation-Fuel Classes and Disturbance:
Uncharacteristic vegetation-fuel classes and disturbances result in different percentages of seral classes than those listed below for the Tussock Tundra 2 model.

PNV Model Classes and Descriptions:
Vegetation communities in the Tussock Tundra 2 PNV typically follow one of two alternate successional pathways; one which develops tussocks with shrubs following disturbance, and one which further develops a significant lichen component.

Class	**Modeled Percent of Landscape**	**Description** (After: Walker 1996, Racine et al 1983, Wein 1971, Auclair 1983, personal communication FRCC experts' workshop March 2004, Jandt and Meyers 2000)
A: 0-15 years Post disturbance cottongrass/sedge	3%	First year following fire *Eriophorum* (cottongrass) and *Carex* spp. (sedges) regrow via rhizomes, most vascular species begin to recover, shrubs sprout from rootstock. Sedges often capture site 6-10 years post fire. Grasses (*Calamagrostis* and *Arctagrostis*) are locally important following fire.
B: 10-250 years Tussock/shrub tundra	40%	Tussocks dominated by *Eriophorum* (cottongrass), *Carex* spp. (sedges) Lichens begin to re-establish but do not reach former abundance until 50-120 years following fire. Fire is difficult to detect even in the early stages of this class, however the proportions of species differs from the pre-burn community, with very few lichens, fewer shrubs and more sedges, grasses and cottongrass. Former abundances of all species are typically reached 50-120 years post fire. Lichens, if present, have < 25% cover.
C: 80-300 years	57%	Tussocks are dominated by shrubs and lichens. Species composition is similar to that in Class B, but lichen cover

Lichen/tussock/ shrub		is >25%.
Total:	100%	

Modeled Fire Frequency and Severity:

	Mean Probability	Mean Fire Frequency (years) (inverse of probability)	Description
Replacement fire	.16	625	Based on literature and expert input
Mosaic fire	.02	5000	Based on literature and expert input
All Fire	.18	560	Based on literature and expert input
Other disturbances			

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:

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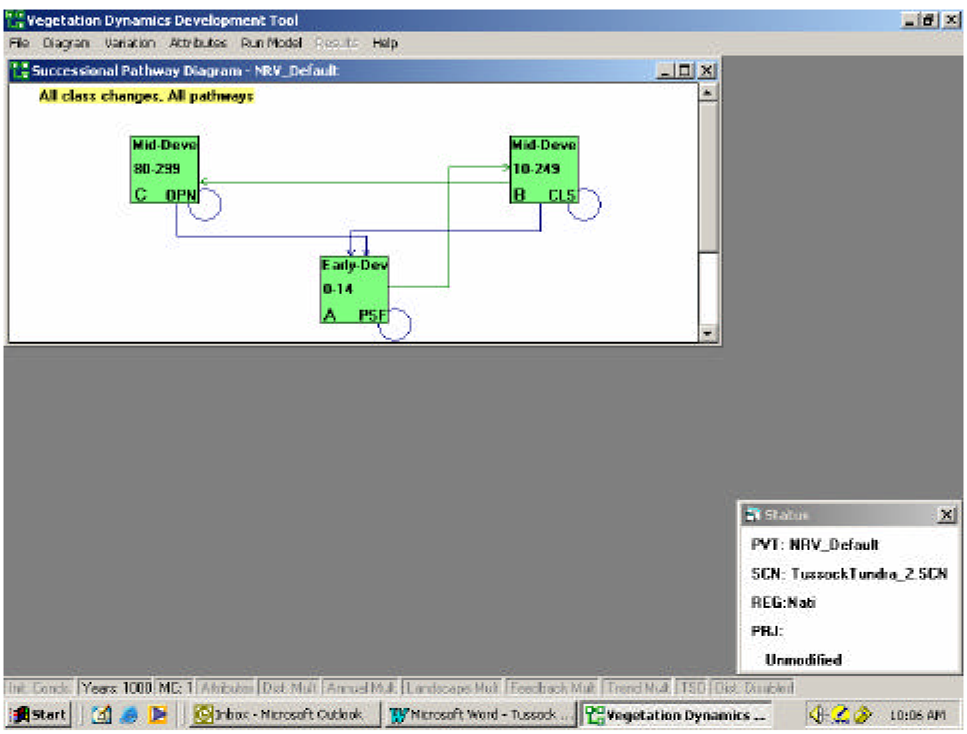
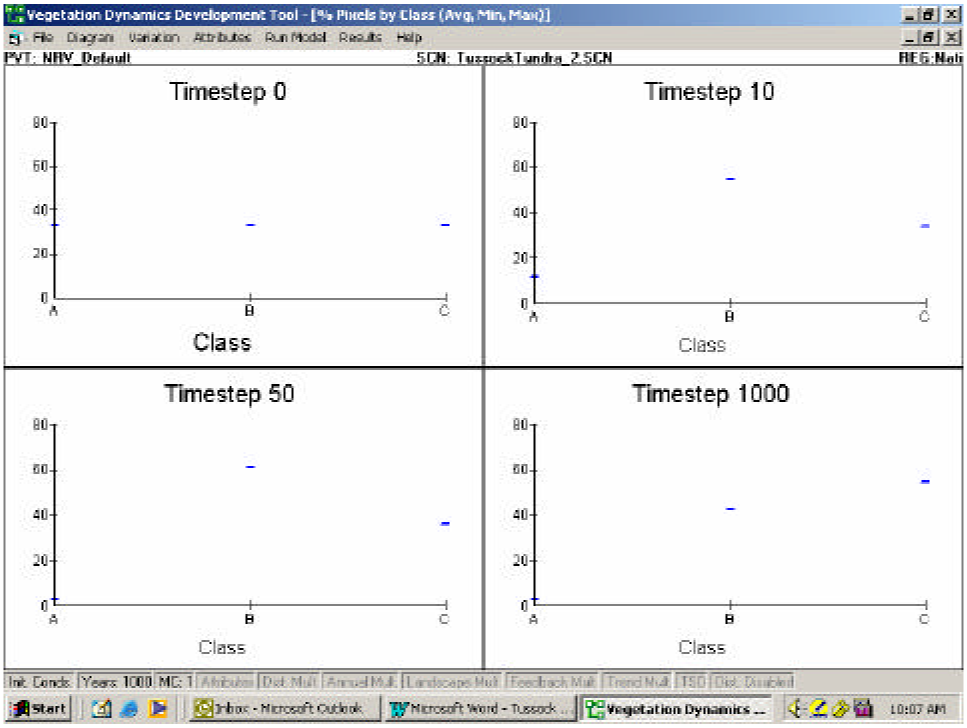
VDDT model diagrams:




Vegetation Dynamics Development Tool - [% Pixels by Class (Avg, Min, Max)]
File Diagram Variation Attributes Run Model Results Help
PVT: NRV_Default
SCN: TussockTundra_2.SCN
Timestep 0
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