LANDFIRE Biophysical Setting Model

Biophysical Setting **6916280** **Western North American Boreal Low Shrub-Tussock Tundra**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

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Vegetation Type
Upland Shrubland

Map Zone
69

Model Zone
☑ Alaska
☐ California
☐ Great Basin
☐ Great Lakes
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Dominant Species*

ERVA4	LEPAD
CABI5	VACCI
BENA	CACA4
SAPU15	ARCTA

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

This BpS occurs in the boreal and the northern section of the Sub-boreal region of AK. It is found on lowland to subalpine sites.

Biophysical Site Description

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Permafrost is usually present at depths of 30-50 cm. Soils are generally acidic, 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. Tussock communities occur on gentle slopes, terraces, and old alluvial deposits. Sites are often underlain by silty mineral soils with a surface peat layer 10 to 40 cm thick surrounding the tussocks (Viereck et al 1992).

Vegetation Description

The following information was taken from the draft Boreal Ecological Systems description (NatureServe 2008):
Boreal Low Shrub-Tussock Tundra is a common lowland system dominated by tussock sedges and low shrubs. Eriophorum vaginatum is the primary tussock-former in most stands, but Carex bigelowii may be the dominant tussock sedge on some sites. Other indicator species include Betula nana (includes B. glandulosa), Salix pulchra, Ledum decumbens (Ledum palustre L. ssp. Decumbens), Vaccinium vitis-idaea, V. uliginosum, Empetrum nigrum, and Carex spp. Grasses, including Calamagrostis canadensis and Arctagrostis spp., may also be present. Lichens are scarce (with the possible exception of Peltigera canina).

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Disturbance 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 in tundra ecosystems, while Racine et al (1983; 1985) 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 by fire (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:
-50-300yrs (personal communication FRCC experts' workshop March 2004)
-260yr (s.d. 170) fire return interval for past 1500yrs for Noatak National Preserve (preliminary data from Higuera et al. 2008)
-180-1,460yrs in forest shrubzone and 9,320yrs in shrub subzone in northern Quebec; shorter cycle west of Hudson's Bay/in interior zone (Payette et al 1989)
-612yrs for Noatak River watershed (all vegetation types) (Racine et al 1983)
-611yr fire rotation for Noatak River watershed (all vegetation below 600m which is predominantly tundra) (Racine et al 1985)
-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)

On interior and southcentral Alaska Tussock Tundra sites the thaw pond cycle (disturbance leads to thawing of permafrost and ponding) and paludification (Sphagnum layer buildup and saturation) are important disturbances. On the Seward Peninsula and western Alaska, frost action creates polygonal ground and other periglacial features and is a widespread, small-scale and continuous disturbance.

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

Adjacency or Identification Concerns

The Boreal Low Shrub-Tussock Tundra is similar to the Arctic Tussock Low Shrub Tundra system (and the Tussock Tundra 2 PNV) that occurs in Alaska's arctic and has a longer mean fire return interval

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(NatureServe 2008). Geographic location is the best determinant between these two systems.

Native Uncharacteristic Conditions

Scale Description

Vegetation found in large patches.

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 10yrs in the Buckland Valley and surrounding highlands of the Seward Peninsula. Racine et al (1983) found that 40 fires burned 100,000 ha (1000 km2) in the 30,000 km2 watershed of the Noatak River between 1956 and 1981. Racine et al (1985) found a minimum fire size of .4 ha, a maximum fire size of 45,800 ha and a mean fire size of 1310 ha from 1956-1983 in the Noatak River watershed, an area dominated by tundra vegetation. Of the 79 fires in analyzed by Racine et al (1985), nearly half were between 1 and 10 ha in size. Forty-three percent of wildland fires occurring in interior Alaska occur in treeless areas, primarily tundra bogs and fens (Viereck 1975).

Issues/Problems

Comments

This model was created for the boreal region of AK and did not receive review for other parts of the state.

This model was based on the FRCC Guidebook PNVG model for Tussock Tundra 1 (TT1; Murphy and Witten 2006) and input from the experts who attended the LANDFIRE Fairbanks (Nov. 07) modeling meeting and was refined by Jennifer Allen. Much of the text in the Disturbance Description and Scale Description portion of this report were taken from the TT1 description (Murphy and Witten 2006).

Vegetation Classes

Class A **10 %**

Early Development 1 All Structures

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

ERVA4	Upper
CABI5	Upper
CACA4	Upper
ARCTA	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Herbaceous	Herbaceous
Height	Herbaceous	Herbaceous
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

0-14yrs

Mesic herbaceous-graminoid-tussock-sedge. 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 6-10yrs post fire. Grasses (Calamagrostis and Arctagrostis) are locally important following fire.

Succession to class B. Replacement MFRI = 175yrs.

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Class B 75 %

Mid Development 1 Closed

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

BENA	Upper
SALIX	Upper
ERVA4	Upper
CABI5	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open Shrub (25-74% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Dwarf Shrub (< 20 cm)	Low Shrub (20 cm to 1.5 m)
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Classes B and C should be mapped based on EVT if possible. Class B is represented by Mixed Shrub-Sedge Tussock Tundra/Bog and class C by tussock-shrub-lichen. If these types are not mapped, B can be considered a low shrub class and C a dwarf shrub class for mapping.

Description

15yrs+

Low shrub-tussock. Tussocks dominated by Eriophorum (cottongrass), Carex spp. (sedges). Common shrub species include Betula nana, Salix spp. And Vaccinium uliginosum. Lichens begin to re-establish but do not reach former abundance until 50-120yrs following fire. Fire is difficult to detect even in the early stages of this class; however, the proportions of species differ 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 50-120yrs post fire. Lichens, if present, have < 25% cover.

This class can persist in the absence of disturbance or follow an alternate succession pathway to class C (probability = 0.001). Replacement MFRI = 175yrs causes transition to class A.

Class C 15 %

Mid Development 1 Open

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

BENA	Upper
SALIX	Upper
ERVA4	Upper
PECA60	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open Shrub (25-74% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Dwarf Shrub (< 20 cm)	Low Shrub (20 cm to 1.5 m)
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Classes B and C should be mapped based on EVT if possible. Class B is represented by Mixed Shrub-Sedge Tussock Tundra/Bog and class C by tussock-shrub-lichen. If these types are not mapped, B can be considered a low shrub class and C a dwarf shrub class for mapping.

Description

80yrs+

Dwarf shrub-lichen-tussock. Tussocks are dominated by shrubs and lichens. Species composition is similar

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to that in Class B, but lichen cover is >25%.

This class can persist in the absence of disturbance. Replacement MFRI = 200yrs causes transition to class A. Mixed fire (MFRI = 2000yrs) maintains this class.

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	180			0.00556	98
Mixed	9999			0.00010	2
Surface					
All Fires	177			0.00567	

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fir combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inver of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

☐ Insects/Disease ☐ Native Grazing ☐ Other (optional 1)
☐ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

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