LANDFIRE Biophysical Setting Model

Biophysical Setting 7216941 Alaska Arctic Tussock Tundra - Frequent Fire

☑ *This BPS is lumped with: see below*

☑ *This BPS is split into multiple models: Alaska Arctic Tussock Tundra, Alaska Arctic Shrub-Tussock Tundra and Alaska Arctic Tussock-Lichen Tundra were lumped and then split into two models based on differences in the FRI.*

General Information

Contributors (also see the Comments field **Date** 9/6/2008

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Vegetation Type

Wetlands/Riparian

Map Zone

72

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 SAPU15
VAUL LEPAD
CABI5 EMNI
BENA

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This BpS is found in arctic AK within Nowakii et al. (2001) ecoregions 4, 5, 7 and the south side of the Brooks Range (ecoregion 3).

Biophysical Site Description

This type is common in valleys and slopes throughout the western arctic and the south side of the Brooks Range, AK. These sites are cold, poorly drained, and underlain by mesic, silty mineral soils with a shallow surface organic layer surrounding the tussocks (Viereck et al. 1992). Permafrost is present.

Vegetation Description

Eriophorum vaginatum is the primary tussock-former in most sites, but Carex bigelowii may dominate some sites. Calamagrostis canadensis, Arctagrostis latifolia and Chamerion latifolium may be common. Shrubs include Betula nana, Salix pulchra, Ledum palustre ssp. decumbens, Vaccinium spp. (e.g. Vaccinium vitis-idaea and Vaccinium uliginosum) and Empetrum nigrum. Mosses (Sphagnum spp., Polytrichum strictum and Hylocomium splendens) may form a nearly continuous mat between tussocks. Lichens are more common on the drier tussock tundra sites in western Alaska and may include Flavocetraria cucullata, Cetraria islandica, Cladonia spp., Cladina rangiferina and Thamnolia subuliformis.

Acidic sites have more ericaceous shrubs and Sphagnum and less Eriophorum spp, Betula nana and Carex bigelowii. Acidic sites also have more organic matter buildup and the tussocks tend to be larger.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100-year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement seve

Disturbance Description

There is little information about fire regimes in the arctic region of AK (Viereck and Schandelmeier 1980). Mean fire return interval estimates for tussock tundra ecosystems include:
-50-300yrs (personal communication FRCC experts' workshop March 2004)
-According to lake-core records, the fire-return interval is approximately 240yrs on the Seward Peninsula, and 1,000yrs+ on the Beaufort Coastal Plain (Jennifer Allen pers. comm.).
-260yr (s.d. 170) fire return interval for past 1500yrs for Noatak National Preserve (preliminary data from Higuera et al. 2008)
-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)
-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).

Racine et al. (1987) studied low shrub tundra post-fire vegetation recovery on the Noatak and Seward Peninsulas and found the following:
-Postfire increases in soil thaw in tussock tundra stabilized or returned to prefire levels within 5-6yrs.
-In shrub tussock tundra and tussock tundra, Eriophorum vaginatum recovers within 5-6 yrs, but low shrubs take longer. Eriophorum vaginatum, Carex spp, Calamagrostis spp. and Epilobium angustifolium seedlings increased, but few survived after 10yrs.
-Following fire, bryophytes and lichens are largely destroyed. Bryophytes, including Marchantia polymorpha and Ceratodon purpueus rapidly develop in the inter-tussock spaces and replace the original community. These species appear to reach a maximum cover 3-4 yrs post fire and then decline as vascular overstory develops.
-Fire is important in maintaining the survival of Eriophorum vaginatum. Without disturbances such as fire or frost action the Eriophorum vaginatum tussocks become colonized by low shrubs, mosses and lichens. These growth forms eventually replace the tussocks. Fire removes this competition and stimulates their vegetative growth and reproductive output. To survive fire, Eriophorum vaginatum relies and utilizes its tussocks from which it is well insulated by tightly bunched live and dead tillers and shallow buried seed.

A study on the Seward Peninsula by Racine et al. (2004) found that tussock shrub tundra fully recovered 24 yrs after fire. Ledum palustre ssp. decumbens, Vaccinium uliginosum and Salix pulchra recovered quickly, but Betula nana recovered more slowly. Eriophorum vaginatum recovered within seven years and Carex bigelowii partially recovered.

Frost action, polygonal ground and thermokarst dynamics are widespread and continuous disturbances within the Tussock Tundra type. Change in the arctic and subarctic climate is another source of disturbance that is currently affecting tundra ecosystems.

Adjacency or Identification Concerns

This type can be found adjacent to most other BpS in the arctic.

Native Uncharacteristic Conditions

Scale Description

This type can be found in large or small patches and is sometimes matrix forming.

Issues/Problems

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Comments

This model was based on input from the experts who attended the LANDFIRE Fairbanks, Arctic (April 08) modeling meeting and was refined by Colleen Ryan, Kori Blankenship and Keith Boggs.

Vegetation Classes

Class A 5%

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.

Classes A and C should be mapped based on EVT if possible. Class C represents Alaska Arctic Tussock-Lichen Tundra.

Description

0-14yrs

This class is characterized by tussock forming sedges. Common species include Eriophorum vaginatum, Carex bigelowii and Rubus chamaemorus. Cottongrass and sedges regrow from rhizomes. Grasses, including Calamagrostis canadensis, Arctagrostis latifolia, and Chamerion latifolium (= Epilobium latifolium), may be common, especially for the first 5-10yrs. Mosses (Sphagnum spp., Polytrichum strictum and Hylocomium splendens) may form a nearly continuous mat between tussocks.

Succession to class B. Replacement MFRI = 250yrs.

Class B 75%

Late Development 1 All Structures

Upper Layer Lifeform

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

Indicator Species* and Canopy Position

ERVA4	Upper
BENA	Upper
LEPAD	Upper
VAUL	Upper

Structure Data (for upper layer lifeform)

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

☐ Upper layer lifeform differs from dominant lifeform.

Description

15yrs+

Shrubs resprout quickly after fire, becoming the dominant, upper-level canopy layer in 10-15yrs. Common species include Betula nana, Ledum palustre ssp. decumbens., Vaccinium uliginosum and V. vitis-idaea. This class has >35% cover of sedges in a tussock growth form, and the combined cover of dwarf- and low shrubs is >25%.

This class can persist in the absence of disturbance. Alternate succession to class C occurs on a minority of sites (probability=.001). Replacement MFRI = 250 yrs.

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Class C 20 %

Late Development 2 All Structures

Upper Layer Lifeform
- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

CLADO3	Upper
ERVA4	Upper
CABI5	Upper
	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.

Classes A and C should be mapped based on EVT if possible. Class C represents Alaska Arctic Tussock-Lichen Tundra.

Description

80yrs+

This class is characterized by >35% cover of sedges in a tussock growth form, <25% shrub cover, and >25% lichen cover. Dwarf-shrubs may be common. Eriophorum vaginatum is the primary tussock-former in most stands, but Carex bigelowii may dominate some sites. Lichens may include Flavocetraria cucullata (= Cetraria cucullata), Cetraria islandica, Cladonia spp., Cladina rangiferina and Thamnolia subuliformis. This class tends to occur on drier sites.

This class can persist in the absence of disturbance. Replacement MFRI = 250 yrs.

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

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Fire Regime Group:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Additional Disturbances Modeled

- [ ] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	254.7			0.00393	99
Mixed					
Surface					
All Fires	255			0.00395	

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.

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