16822

Alaska Arctic Scrub Birch-Ericaceous Shrubland - Frequent Fire

Model Date: 06/10/08 Report Date: 9/11/15

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| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Colleen Ryan | colleen\_ryan@tnc.org | Janet Jorgenson | Janet\_Jorgenson@fws.gov |
| Kori Blankenship | kblankenship@tnc.org | None | None |
| Keith Boggs | Ankwb@uaa.alaska.edu | None | None |

Reviewer: Robin Innes

Vegetation Type

Upland Shrubland

Map Zones

68, 69, 72

Model Splits or Lumps

This BpS is split into multiple models:

The Arctic Birch Ericaceous Shrub system was split into a frequent and an infrequent fire model.

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 system is found on mesic mountain and hill slopes and flats predominantly above treeline. The soils are mesic and generally mineral with a well-decomposed organic layer (Viereck et al. 1992, II.C.2.c). Permafrost is normally present (Viereck et al. 1992, II.C.2.c).

Vegetation Description

The following information was slightly modified from the draft Arctic Ecological Systems description (Boggs et al. 2008):

The total low- and tall-shrub cover is >25%, and Betula nana, Vaccinium uliginosum, or Ledum palustre ssp. decumbens typically dominate or codominate. Salix spp. (such as Salix pulchra) do not dominate but may codominate. This system does not include tussock-dominated (>35% tussocks) sites. Dwarf-shrubs such as Empetrum nigrum and Vaccinium vitis-idaea may be common under the low-shrub layer. Herbaceous species are sparse but include Arctagrostis latifolia, Poa arctica, Senecio congestus and Carex bigelowii. Feathermosses (Hylocomium splendens and Pleurozium schreberi) and lichens may be common.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| BENA | Betula nana | Dwarf birch |
| VAUL | Vaccinium uliginosum | Bog blueberry |
| LEPAD | Ledum palustre ssp. decumbens | Marsh labrador tea |
| SAPU15 | Salix pulchra | Tealeaf willow |
| SABA3 | Salix barclayi | Barclay's willow |
| EMNIN | Empetrum nigrum ssp. nigrum | Black crowberry |
| VAVI | Vaccinium vitis-idaea | Lingonberry |
| HYSP70 | Hylocomium splendens | Splendid feather moss |

Disturbance Description

In 2013 an extensive search was done by FEIS staff to locate information for a synthesis on fire regimes of Alaskan tundra communities (Innes 2013). This synthesis found that studies providing information on fire frequency in tundra ecosystems generally do not differentiate among plant communities and that for tundra types mean fire-return intervals from 50 to >1,000 years were reported (Innes 2013). When fires burn, stand-replacing crown fires are common (Innes 2013).

Selected fire return interval estimates for this BpS include:

-There is little information about fire regimes in the arctic region of Alaska (Viereck and Schandelmeier 1980).

-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, based on post-1900 records)

-611yr fire rotation for Noatak River watershed (all vegetation below 600m which is predominantly tundra; Racine et al. 1985, based on post-1900 records)

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.

-Bryophyte cover increased rapidly, reaching 75-100% in 2-3 yrs.

-Dominant species, not present in unburned low shrub tundra, included Ceratodon purpureus, Marchantia polymorpha, Polytricum spp., Arctagrostis latifolia, Poa arctica, Senecio congestus and Carex bigelowii became established.

-Shrub recovery ranged from nearly 0-100% within in eight years, with willows recovering at one site.

This community appears to be stable over time according to Viereck et al. (1992, II.C.2.c) but this model includes successional dynamics related to fire.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Min FI** | **Max FI** | **Percent of All Fires** |
| Replacement | 251 |  |  | 100 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| **All Fires** | **251** |  |  | **100** |

Scale Description

Large patch or matrix forming.

Non-Fire Disturbances

Adjacency or Identification Concerns

This type tends to grade into tussock shrub communities as moisture increases or dwarf shrub fellfields as moisture decreases with wind exposure (Viereck et al. 1992, II.C.2.c).

Issues or Problems

Experts at the Arctic meeting agreed on the model classes, but they noted that there is no solid data to support either fire frequencies or the frequency of open vs. closed classes. In this draft model, alternate succession probabilities were set to create a ratio of open to closed classes that approximately matched Torre Jorgenson's estimate that this type would be 20% closed in the Seward/Yukon-Kuskokwim Delta regions (frequent fire model) and 5% closed on the North Slope (infrequent fire model).

Most of the fire regime literature available for tundra ecosystems in Alaska is from the Seward Peninsula and Noatak River Watershed where fire occurs more frequently than other regions of the state (Innes 2013). Little is known about fire history in arctic tundra communities in northern and northwestern Alaska (Innes 2013).

Native Uncharacteristic Conditions

The current conditions should be similar to the reference condition. According to Innes 2013: “Because most of the area occupied by tundra in Alaska is sparsely populated and has little road access, fire regimes in tundra may not differ much from historical regimes [Chapin et al. 2000, DeWilde and Chapin 2006, Heinselman 1981]. As of 2006, about 66% of interior Alaska was considered to have an essentially "natural" fire regime, with few human ignitions, negligible suppression activity, and many large, lightning-caused fires.” Innes 2013 provides information about climate change and Alaska tundra communities.

Comments

QUESTIONS FOR REVIEW

How should the Alaska Arctic Scrub Birch-Ericaceous Shrubland - Infrequent Fire and Alaska Arctic Scrub Birch-Ericaceous Shrubland - Frequent Fire BpS be distinguished geographical for mapping and modeling? This question is prompted by reviewer Robin Innes who states: “Divisions by zone between these two BpSs [Alaska Arctic Scrub Birch-Ericaceous Shrubland - Infrequent Fire and Alaska Arctic Scrub Birch-Ericaceous Shrubland - Frequent Fire] raise some questions. The information I found was mostly from the Seward Peninsula, Noatak River Watershed, and North Slope. These data showed the highest fire frequency on the Seward Peninsula and in the Noatak River watershed (zone 68) and considerably shorter fire frequencies to the North (zone 67 and part of 68) and South (zone 72 and 76). Gabriel and Tande (1983) suggest that burned area and occurrence of lightning-caused fire are intermediate to that in the Seward Peninsular and North Slope in zones 69 and 72. Unfortunately, this source does not provide fire rotations intervals for these regions. See text and tables for further clarification. Based upon the information available I would also assume that 16901/16902 and 16821/16822 would have a similar division among zones between frequent and infrequent fires, but they are inconsistent.

Here is a map of the distribution of lightning-caused fires from 1957-1979 from Gabriel and Tande (1983), which suggests most fires occur in a band in central Alaska, but not so much in zones 67, northern 68, 69 or 76:



Likely the distribution between frequent and infrequent is not clear cut by zone, but follows a gradient, depending upon whether the pixels are near to or far from boreal forest cover. There are also elevational gradients evident.

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

**Model Parameters**

*Using Track Changes in Word you may suggest changes to any of the parameters indicated in the following tables. If you wish to see how those changes impact model results, go to the “Simulation Model Review Instructions” section on* <http://www.landfirereview.org/models.html>*. If you do not wish to edit and run the actual model, the TNC LANDFIRE will do so and if requested provide the reviewer with the results.*

**Deterministic Transitions**

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Late1:OPN | 4 |
| Late1:OPN | 5 | Late1:OPN | 999 |
| Late2:CLS | 25 | Late2:CLS | 999 |

**Probabilistic Transitions**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** |  **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| ReplacementFire | Early1:ALL | Early1:ALL | 0.0040 | 250 | No | 0 |
| ReplacementFire | Late1:OPN | Early1:ALL | 0.0040 | 250 | Yes | 0 |
| AltSuccession | Late1:OPN | Late2:CLS | 0.0012 | 833 | Yes | 0 |
| ReplacementFire | Late2:CLS | Early1:ALL | 0.0040 | 250 | Yes | 0 |

Succession Classes

Class A 5 Early Development 1 - All Structures

Structural Information

Tree Size Class: None

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| FEAL | Festuca altaica | Altai fescue | Upper |
| HIAL3 | Hierochloe alpina | Alpine sweetgrass | Upper |
| CACA4 | Calamagrostis canadensis | Bluejoint | Upper |
| CHAN9 | Chamerion angustifolium | Fireweed | Upper |

Description

After fire, herbaceous species such as Festuca altaica and Hierochloe alpina typically dominate. Low shrubs can resprout following fire, quickly regaining dominance of a site. This class may persist for more than 5yrs if fire severity is high enough to remove the organic layer.

Class B 75 Late Development 1 - Open

Structural Information

Tree Size Class: None

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| BENA | Betula nana | Dwarf birch | Upper |
| VAUL | Vaccinium uliginosum | Bog blueberry | Upper |
| LEPAD | Ledum palustre ssp. decumbens | Marsh labrador tea | Upper |
| SALIX | Salix | Willow | Upper |

Description

This class represents an open shrub stage. Under appropriate conditions, the canopy can close around age 25, causing a transition to class C, but most sites will remain open indefinitely. This class is dominated by shrubs, often Betula nana, Vaccinium uliginosum, Ledum decumbens, Salix pulchra, S. barclayi or other Salix spp. may also be common (Viereck 1979, Viereck et al. 1992). Dwarf shrubs such as Empetrum nigrum and Vaccinium vitis-idaea may be common under the low shrub layer.

Class C 20 Late Development 2 - Closed

Structural Information

Tree Size Class: None

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| BENA | Betula nana | Dwarf birch | Upper |
| VAUL | Vaccinium uliginosum | Bog blueberry | Upper |
| LEPAD | Ledum palustre ssp. decumbens | Marsh labrador tea | Upper |
| SALIX | Salix | Willow | Upper |

Description

This class represents a mature closed canopy shrub class that may occur on a minority of sites where conditions are appropriate. The canopy will close in around age 25. This class is dominated by shrubs, often Betula nana, Vaccinium uliginosum, Ledum decumbens, Salix pulchra, S. barclayi or other Salix spp. may also be common (Viereck 1979, Viereck et al. 1992). Dwarf shrubs such as Empetrum nigrum and Vaccinium vitis-idaea may be common under the low shrub layer.

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