16901

North American Arctic Dwarf-Shrub Lichen Tundra – Frequent Fire

Model Date: 10/17/08 Report Date: 9/11/15

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| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |

Reviewer: Robin Innes

Vegetation Type

Upland Shrubland

Map Zones

68, 69, 72, 76

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). In MZ76 this type is found in Nowacki ecoregions 8, 9 and 10.

Biophysical Site Description

This is a common system on acidic and non-acidic substrates in the hills and mountains of arctic AK. Common slope positions include valleys, sideslopes, late-lying snowbeds, summits and ridges. Sites are typically dry to mesic. Sites with >25% lichen cover tend to be exposed to the wind and accumulate little winter snow (Viereck et al. 1992). Non-acidic sites are more common near floodplains, on carbonate substrates and loess deposition areas. This system does not occur on flat thaw-lake plains.

Vegetation Description

Dwarf-shrub cover is >25%, dominated by dwarf-shrubs other than Dryas spp. and lichen cover may exceed 25% particularly on exposed sites. Herbaceous cover varies from a trace to 75%. Dwarf -shrubs that dominate or codominate the system are Cassiope tetragona, Empetrum nigrum, Vaccinium uliginosum, Salix reticulata, Salix arctica, Salix rotundifolia and Arctostaphylos alpina. Cassiope tetragona is more common on non-acidic sites, and Empetrum nigrum dominates this system in its southern range. Other shrubs include Betula nana, Dryas octopetala, Dryas integrifolia, Ledum palustre ssp. decumbens, Loiseleuria procumbens, Vaccinium vitis-idaea, Salix phlebophylla, Saxifraga oppositifolia, Rhododendron lapponicum and Arctostaphylos rubra. Common herbaceous species include Hierochloe alpina, Boykinia richardsonii, Carex microchaeta, Carex scirpoidea, Geum glaciale, Pedicularis lanata, Eriophorum angustifolium ssp. triste, Equisetum spp., Antennaria alpine and Festuca altaica. Mosses such as Rhytidium rugosum, Aulacomnium turgidum, Distichium capillaceum, Racomitrium lanuginosum, Dicranum elongatum and Polytrichum sp. may be common. On non-acidic sites common lichens include Flavocetraria cucullata, Flavocetraria spp., Stereocaulon spp., Alectoria nigricans and Thamnolia vermicularis but Cladonia and Cladina species are uncommon. On acidic sites dominant lichens are Cladina rangiferina and/or Cladina stellaris.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| CATE11 | Cassiope tetragona | White arctic mountain heather |
| EMNI | Empetrum nigrum | Black crowberry |
| VAUL | Vaccinium uliginosum | Bog blueberry |
| SALIX | Salix | Willow |
| ARAL2 | Arctostaphylos alpina | Alpine bearberry |
| BENA | Betula nana | Dwarf birch |
| CABI5 | Carex bigelowii | Bigelow's sedge |
| CAMI4 | Carex microchaeta | Smallawned sedge |

Disturbance Description

In 2013 an extensive search was done by Fire Effects Information System 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).

Pre and post fire monitoring data in a dwarf shrubland on Seward Peninsula offers one possible successional trajectory for this community (Racine et al. 2004). On a site burned in 1977 plot data indicated that during the first three years after fire, bryophytes (Ceratodon purpureus and Marchantia polymorphha) dominated the site. Carex bigelowii, Chamerion angustifolium (= Epilobium angustifolium) and Calamagrostis canadensis also increased. By 10yrs, the site was graminoid dominated. Shrubs, including Ledum palustre, Vaccinium vitis-idaea, Empetrum nigrum and Betula nana, were slow to recover or had not recovered on the sites within 24yrs. Cover of Salix pulchra increased after the fire from 1% on the control site to 4-22% on various burned plots. It is unclear how well this successional sequence represents a “reference” condition for Arctic Dwarf-Shrubland. The authors note that the 1977 fire on their study site “accelerated the predicted effects of climate warming on arctic tundra by increasing the percent cover of deciduous shrubs (Racine et al. 2004, p. 9).”

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Min FI** | **Max FI** | **Percent of All Fires** |
| Replacement | 249 |  |  | 100 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| **All Fires** | **249** |  |  | **100** |

Scale Description

Small to large patch

Non-Fire Disturbances

Adjacency or Identification Concerns

Issues or Problems

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

REVIEW QUESTIONS:

QUESTIONS FOR REVIEW

How should the North American Arctic Dwarf-Shrub Lichen Tundra – Frequent Fire and North American Arctic Dwarf-Shrub Lichen Tundra – Infrequent Fire BpS be distinguished geographical for mapping and modeling? This question is prompted by reviewer Robin Innes who states: “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 Peninsula 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.

In 2021 the name of this BpS was changed from Alaska Arctic Dwarf-Shrubland - Frequent Fire to North American Arctic Dwarf-Shrub Lichen Tundra – Frequent Fire in response to changes to the Ecological Systems classification.

During LANDFIRE National this system was created for the AK Arctic region and did not receive review for other regions in the state. This model was created by Kori Blankenship and Keith Boggs based on the draft Arctic Ecological Systems description (Boggs et al. 2008) and a successional sequence documented by Racine et al. (2004).

The modelers estimated that the fire return interval for this type was similar to that of the Alaska Arctic Tussock Tundra - frequent fire model.

**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:ALL | 19 |
| Late1:ALL | 20 | Late1:ALL | 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:ALL | 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** |
| CABI5 | Carex bigelowii | Bigelow's sedge | Upper |
| CAMI4 | Carex microchaeta | Smallawned sedge | Upper |
| CHANA2 | Chamerion angustifolium ssp. angustifolium | Fireweed | Upper |
| CACA4 | Calamagrostis canadensis | Bluejoint | Upper |

Description

Immediately post-fire bryophytes (e.g. Polytrichum sp., Ceratodon purpureus and Marchantia polymorpha) and sedges dominate the site (Racine et al. 2004).

Class B 95 Late Development 1 - All Structures

Structural Information

Tree Size Class: None

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CATE11 | Cassiope tetragona | White arctic mountain heather | Upper |
| EMNI | Empetrum nigrum | Black crowberry | Upper |
| VAUL | Vaccinium uliginosum | Bog blueberry | Upper |
| SALIX | Salix | Willow | Upper |

Description

Dwarf shrubs recapture the site within 24yrs (Racine et al. 2004). Low shrubs can occur but with <25% cover. Vaccinium, Salix, Arctostaphylos and Ledum spp. tend to recover more quickly than Empetrum nigrum which has shallow rhizomes that are more susceptible to moderate and high severity fire.

References

Boggs et al. 2008. International Ecological Classification Standard: Terrestrial Ecological Classifications. Draft Ecological Systems Description for the Alaska Arctic Region.

Chapin, F. S., III; McGuire, A. D.; Randerson, J.; Pielke, R., Sr.; Baldocchi, D.; Hobbie, S. E.; Roulet, N.; Eugster, W.; Kasischke, E.; Rastetter, E. B.; Zimov, S. A.; Running, S. W. 2000. Arctic and boreal ecosystems of western North America as components of the climate system. Global Change Biology. 6(Supplement 1): 211-223.

DeWilde, La'ona; Chapin, F. Stuart, III. 2006. Human impacts on the fire regime of interior Alaska: interactions among fuels, ignition sources, and fire suppression. Ecosystems. 9(8): 1342-1353.

Heinselman, Miron L. 1981. Fire intensity and frequency as factors in the distribution and structure of northern ecosystems. In: Mooney, H. A.; Bonnicksen, T. M.; Christensen, N. L.; Lotan, J. E.; Reiners, W. A., technical coordinators. Fire regimes and ecosystem properties: Proceedings of the conference; 1978 December 11-15; Honolulu, HI. Gen. Tech. Rep. WO-26. Washington, DC: U.S. Department of Agriculture, Forest Service: 7-57.

Innes, Robin J. 2013. Fire regimes of Alaskan tundra communities. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us

/database/feis/fire\_regimes/AK\_tundra/all.html [2016, June 28].

Racine, C., R. Jandt, C. Meyers and J. Dennis. 2004. Tundra fire and vegetation change along a hillslope on the Seward Peninsula, Alaska, U.S.A. Arctic, Antarctic, and Alpine Research. 36(1): 1-10.

Viereck, L.A., C.T. Dyrness, A.R. Batten, K.J. Wenzlick. 1992. The Alaska vegetation classification. Pacific Northwest Research Station, USDA Forest Service, Portland, OR. Gen. Tech. Rep. PNW-GTR286. 278 p.