16821

Alaska Arctic Scrub Birch-Ericaceous Shrubland - Infrequent Fire

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

|  |  |  |  |
| --- | --- | --- | --- |
| **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

67, 68, 76

Model Splits or Lumps

This BpS is split into multiple models:

The Alaska Arctic Scrub Birch-Ericaceous Shrubland system was split into a frequent and an infrequent fire model.

Geographic Range

This BpS is found in arctic AK except within ecoregions 4, 5, 7 and south of the Brooks Range in ecoregion 3 (Nowakii et al. 2001). It is also found in MZ76.

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 may 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

Expert input at the Arctic Modeling meeting (April 08) estimated a MFRI for this type of about 1000yrs. Racine et al. (1983) found a MFRI of 612yrs for Noatak River watershed (all vegetation types) based on post-1900 records. Racine et al (1985) found a 611yr fire rotation for Noatak River watershed (all vegetation below 600m which is predominantly tundra) based on post-1900 records.

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).

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

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Min FI** | **Max FI** | **Percent of All Fires** |
| Replacement | 904 |  |  | 100 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| **All Fires** | **902** |  |  | **100** |

Scale Description

Large patch or matrix

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).

To attain the landscape percentages desired, modelers had to use a very low alternate succession probability. A better solution would have been to restrict the age at which alternate succession can occur to around age 25, since it is expected that most sites will close in at that age or not at all. But this solution violates LANDFIRE modeling rules, so modelers used a very low probability of alternate succession instead.

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.

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 based on input from the experts who attended the LANDFIRE National 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 | 0.0010 | 1,000 | No | 0 |
| ReplacementFire | Late1:OPN | Early1:ALL | 0.0010 | 1,000 | Yes | 0 |
| AltSuccession | Late1:OPN | Late2:CLS | 0.0001 | 10,000 | Yes | 0 |
| ReplacementFire | Late2:CLS | Early1:ALL | 0.0020 | 500 | 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. This class may persist for more than 5yrs (up to 25yrs) on some sites, but this possibility was not included in this draft of the model.

Class B 90 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 class. 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 5 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 stage 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.

References

Anderson, J.H. 1974. Plants, Soils, Phytocenology and Primary Production of the Eagle Summit Tundra Biome Site. US Tundra Biome Data Report 74-42. Ecosystem Analysis Studies, US International Biological Program, US Arctic Research Program. 142 p.

Batten, A.R. 1977. The vascular floristics, major vegetation units, and phytogeography of the Lake Peters area, northeastern Alaska. M.S. thesis. University of Alaska, Fairbanks, AK. 330 p.

Batten, A.R., Murray, D.F., Dawe, J.C. 1979. Threatened and Endangered Plants in selected areas of the BLM Fortymile Planning Unit. File Report for Contract No. YA-512-CT8-162. USDI BLM AK State Office 701 C street, Anchorage, AK 99513. 127 p.

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.

Hanson, H.C. 1951. Characteristics of some grassland, marsh, and other plant communities in western Alaska. Ecol. Monogr. 21 (4):317-378.

Hanson, H.C. 1953. Vegetation types in northwestern Alaska and comparisons with communities in other arctic regions. Ecology 34(1): 11 1-140.

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.

Hettinger, L.R. and A.J. Janz. 1974. Vegetation and soils of northeastern Alaska. Arct. Gas Biol. Rep. Ser. 21, 206 p. North. Eng. Serv., Co., Ltd., Edmonton, Can.

Hulten, E. 1966. Contributions to the knowledge of flora and vegetation of the southwestern Alaskan mainland. Sven. Bot. Tidskr. 60(1): 175-1 89.

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].

Jorgenson, M.T. 1984. The response of vegetation to landscape evolution on glacial till near Toolik Lake, Alaska. Pages 134-142 in Inventorying forest and other vegetation of the high latitude and high altitude regions: Proceedings of an International Symposium, Society of American Foresters Regional Technical Conference. Fairbanks, AK. Society of American Foresters, Bethesda, MD.

Nowacki, G., P. Spencer, M. Fleming, T. Brock and T. Jorgenson. 2001. Unified ecoregions of Alaska. U.S. Department of the Interior, U.S. Geological Survey. Open file-report 02-297. 2 page map.

Pegau, R.E. 1968. Reindeer range appraisal in Alaska. M.S. thesis. University of Alaska, Fairbanks, AK. 130 p.

Pegau, R.E. 1972. Caribou investigations-analysis of range. In: Pegau, R.E. and J.E. Hemming (ed.). Caribou report. Volume 12. Progress report. Federal Aid in Wildlife Restoration, Projects W-17-2 and W-17-3, Job 3.3R. Alaska Dept. of Fish and Game, Juneau, AK: 1-216.

Racine. 1979. Climate of the Chucki-Imuruk area. Pages 32-37 in H. R. Melchior, ed., Biological Survey of the Bering Land Bridge National Monument. Alaska Cooperative Park Studies Unit, University of Alaska Fairbanks, Fairbanks, AK.

Racine, C.H., Dennis, J.G., and W.A. Patterson. 1983. An analysis of the tundra fire regime in the Noatak River Watershed, Alaska. USDOI BLM Report.

Racine, C.H.; J.G. Dennis and W.A. Patterson III. 1985. Tundra fire regimes in the Noatak River Watershed, Alaska: 1956-83. Arctic 38:194-200.

Steigers, W.D., D. Helm, J.G. MacCracken, [and others]. 1983. Alaska Power Authority, Susitna Hydroelectirc Authority, environmental studies--subtask 7.12: 1982 plant ecology studies. Final Report. University of Alaska, Agricultural Experiment Station, Palmer. 288 pp.

Viereck, L.A. 1962. Range survey: Sheep and goat investigations. Job completion report: Federal aid in wildlife restoration. W-6-R-3. Department of Fish and Game, Alaska work plan E, Job 2a. 21 pp.

Viereck, L.A. 1963. Sheep investigations: survey of range ecology. Project W-6-R-4, Work plan E. Job 2-A. Alaska Department of Fish and Game, Juneau, AK.

Viereck, L.A. 1979. Characteristics of treeline plant communities in Alaska. Holarctic Ecology. 2: 228-238.

Viereck, L.A. and E.L. Little. 1972. Alaska Trees and Shrubs. USDA Forest Service Ag. Handbook 410. University of Alaska Press, Fairbanks, Alaska. 265 p.

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.

Webber, P.J., Komarkova, V., Walker, D.A. and E. Werbe. 1978. Vegetation mapping and response to disturbance along the Yukon River-Prudhoe Bay Haul Road. In: Brown, J. (principal investigator). Ecological baseline investigations along the Yukon River-Prudhoe Bay Haul Road, Alaska. Hanover, NH: Corps of Engineers, U.S. Army Cold Region Research and Engineering Laboratory: 25-87.

Young, S.B. and C.H. Racine. 1978. Ecosystems or the proposed Katmai western extension, Bristol Bay Lowlands, Alaska. Final report. Contributions from the Center for Northern Studies, Wolcott, VT. 94 pp.