16831

North American Arctic Mesic Sedge-Willow Tundra - Frequent Fire

BpS Model/Description Version: Nov. 2024

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| --- | --- | --- | --- |
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Vegetation Type

Upland Shrubland

Map Zones

68

Model Splits or Lumps

This Biophysical Setting (BpS) was split into frequent and infrequent fire variants so regional differences in fire frequency could be represented. The frequent fire variant applies to map zone 68 within level 2 ecoregions (Nowacki et al. 2001): Intermontane Boreal and Bering Tundra. In all other areas the infrequent fire variant applies.

Geographic Range

This BpS occurs throughout arctic AK and in MZ76, from the Bristol Bay lowlands in southwestern AK to the North Slope on the Arctic Ocean.

Biophysical Site Description

This system is common on mountain and hill slopes, drained lake basins, stabilized dunes, and snow beds (Boggs et al. 2008). Permafrost is present.

Vegetation Description

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

The mesic sedge-willow tundra system is codominated by sedges and dwarf- and low-shrubs, although low-shrub cover is <25%; *Salix* cover is >20%. The dominant shrubs species are *Salix pulchra, Salix richardsonii* (= *Salix lanata*), *Betula nana* and *Vaccinium uliginosum*. The dominant sedges are *Carex aquatilis, Eriophorum angustifolium,* and *Carex microchaeta*. Other include *Petasites frigidus, Polemonium acutiflorum,* and *Sphagnum* spp.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| SAPU15 | *Salix pulchra* | Tealeaf willow |
| SARI4 | *Salix richardsonii* | Richardson's willow |
| BENA | *Betula nana* | Dwarf birch |
| VAUL | *Vaccinium uliginosum* | Bog blueberry |
| CAAQ | *Carex aquatilis* | Water sedge |
| ERAN6 | *Eriophorum angustifolium* | Tall cottongrass |
| CAMI4 | *Carex microchaeta* | Smallawned sedge |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

The successional status of this BpS is unclear but some communities appear to be stable (Viereck et al. 1992; II.C.2.h and II.D.1.b). Drier site conditions may lead to the development of tussock tundra while wetter site conditions may lead to the loss of shrubs and development of a wet sedge meadow community (Viereck et al. 1992; II.C.2.h.).

The fire regime of tundra systems varies from one region to another, making generalizations difficult (Viereck and Schandelmeier 1980), and rapid recovery following fire makes fire frequency difficult to determine (Wein 1971). Sedge-dryas dominated sites would likely burn with the adjacent tussock tundra, but the wetter sedge-willow dominated sites likely would not carry fire (personal communication Arctic modeling meeting April 2008). Charcoal sediment-based estimates of fire frequency for tundra in the Brook Range and to the north report fire frequencies of well over 1000 years (Sae-Lim et al. 2019). More frequent fire has been reported for arctic tundra in the Noatak Watershed and Yukon-Kuskokwim Delta (Sae-Lim et al. 2019).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 253 | 100 |  |  |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 253 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Patch size is small to large.

Adjacency or Identification Concerns

This BpS may occur adjacent to tussock tundra. It could be confused with Arctic Mesic-Wet Willow Shrubland but is distinguished by the sedge component.

Issues or Problems

In 2015 an extensive search was done by FEIS staff to locate information for a synthesis onfFire regimes of Alaskan alder and willow shrublands (Innes 2015). At that time, the scientific literature about fire regimes in Alaskan alder and willow shrublands was scarce. Descriptions of fire ignition, season, pattern, and size specific to alder and willow shrublands were not found in the literature. In 2013, a similar review was done for Alaska tundra systems (Innes 2013). This report notes: “Due to a scarcity of information, LANDFIRE's Biophysical Settings Models lack information on fire regimes for most of the Alaskan tundra communities included in this review. A lack of fire records hinders knowledge of fire regimes in many communities. Where fire records are available, their quality is often noted as a concern.”

Native Uncharacteristic Conditions

For discussion on contemporary changes in this BpS see Innes 2015.

Comments

1/2023 Kori Blankenship split the BpS model and description into frequent and infrequent fire model variants based on feedback from participants in the virtual Tundra Work Session held in the winter 2022. For the frequent fire model, it was assumed that fire would be less frequent than the tussock tundra and shrub-tussock tundra BpS. It was difficult to select a fire frequency for the infrequent fire variant because studies report frequencies of ~1600 to 6000 years for tundra ecosystems in and north of the Brooks Range and from ~140 to 6000 in the Yukon-Kuskokwim Delta ecoregion (Sae-Lim et al. 2019). Because fire is generally so infrequent, fire related successional dynamics are not included in this model. Reviewer feedback is needed to refine the geographic range of the frequent and infrequent fire model variants.

For 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 input from experts who attended the LANDFIRE Arctic Modeling Meeting (April 2008) and the draft Arctic Ecological Systems description (Boggs et al. 2008).

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | B | B | B | B | B | B | B | B | B | B |
| Shrub | 0.5-1.0 | B | B | B | B | B | B | B | B | B | B |
| Shrub | 1.0-3.0 | B | B | B | B | B | B | B | B | B | B |
| Shrub | >3.0 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 25-50 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | >50 | B | B | UN | UN | UN | UN | UN | UN | UN | UN |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 4 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CAMI4 | *Carex microchaeta* | Smallawned sedge | Upper |
| CAAQ | *Carex aquatilis* | Water sedge | Upper |
| ERAN6 | *Eriophorum angustifolium* | Tall cottongrass | Upper |

Description

In the first year following fire *Eriophorum* (cottongrass) and *Carex* spp. (sedges) regrow via rhizomes, most vascular species begin to recover, and shrubs sprout from rootstock. Sedges often capture the site 6-10yrs post fire.

*Maximum Tree Size Class*  
None

Class B 96 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SAPU15 | *Salix pulchra* | Tealeaf willow | Upper |
| SARI4 | *Salix richardsonii* | Richardson's willow | Upper |
| BENA | *Betula nana* | Dwarf birch | Upper |
| VAUL | *Vaccinium uliginosum* | Bog blueberry | Upper |

Description

Shrub cover returns to pre-burn levels about 10 years post fire (Frost et al. 2020).

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Late1:ALL | 9 |
| Late1:ALL | 10 | 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** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.004 | 250 | Yes | 0 |
| Replacement Fire | Late1:ALL | Early1:ALL | 0.004 | 250 | Yes | 0 |

References

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