17060

North American Arctic Wet Sedge Tundra and Polygonal Ground

BpS Model/Description Version: Nov. 2024

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

Reviewer: Robin Innes

Vegetation Type

Herbaceous Wetlands

Map Zones

67, 68, 69, 70, 71, 72, 73, 76

Geographic Range

This Biophysical Setting (BpS) occurs throughout arctic Alaska, typically in lowland regions, from the Bristol Bay lowlands in southwestern Alaska and the Kotzebue Sound lowlands of west-central Alaska, to the Beaufort Coastal Plain in northern Alaska, and the North Slope on the Arctic Ocean. It also occurs in other scattered locations of arctic Alaska where ice-wedge processes occur and may be found as small patches in alpine areas (Viereck et al. 1992, III.A.3.a).

Biophysical Site Description

This ecological system occurs on wet sites (typically with 0-19% visible surface water) and areas where ice-wedge processes occur, with >25% cover of sedge species. Sites are flat to sloping in valley bottoms, basins, low-center polygons, water tracks, and adjacent to streams (Boggs et al. 2008). It also includes patterned wetlands such as ribbed fens. Wet sedge meadows are also found on large to small floodplains, which support the various wetlands that form in oxbows, wet depressions, low-lying areas, and abandoned channels. Soils range from acidic to non-acidic, are saturated during the summer, and have an organic horizon over silt with permafrost, although on floodplains, permafrost is absent (Boggs et al. 2008). Patch size is small to moderate and may be linear. Species diversity is much higher than in the freshwater marsh systems. Sites that dominate the Beaufort Coastal Plain ecoregion occur on ice-wedge polygons and thaw-lake cycle (Nowacki et al. 2001). The ice-wedge polygons generally occur on level surfaces (0-2° slopes), and the ice wedges may be 2 m wide at the top. Polygon diameter ranges from several to more than 30 meters. In addition to the Beaufort Coastal Plain, ice-wedge polygons are a common feature on level ground within foothills and mountains, on glacial drift, and on lacustrine and floodplain terrace surficial deposits.

Vegetation Description

Sites typically occur on low-center polygons and polygon centers have standing water, marsh, and wet sedge vegetation. Sites on polygon perimeters also typically support wet sedge vegetation. Sites are usually dominated by *Carex aquatilis* and *Eriophorum angustifolium but* may also be dominated or co-dominated by *Carex glareosa, Carex rotundata, Carex rariflora, Carex chordorrhiza, Carex rostrata, Carex saxatilis, Carex utriculata, Eriophorum russeolum*, and *Eriophorum scheuchzeri*. *Dupontia fisheri* may also occur. Dwarf-shrubs such as *Salix fuscescens, Salix pulchra, Andromeda polifolia, Betula nana, Empetrum nigrum, Ledum palustre ssp. decumbens*, *Vaccinium vitis-idaea,* and *Vaccinium uliginosum* may be common but make up <25% cover. Moss species include *Drepanocladus* spp., *Sphagnum* spp., *Polytrichum strictum*, and *Hylocomium splendens*. More elevated perimeters support low shrubs and tussocks. *Eriophorum vaginatum* is the primary tussock-former in most sites, but *Carex bigelowii* may dominate some sites. *Carex aquatilis* and *Eriophorum angustifolium* are the dominant and indicator species for this type; other species make up less than 10% of the sites.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| CAAQ | *Carex aquatilis* | Water sedge |
| ERAN6 | *Eriophorum angustifolium* | Tall cottongrass |
| CABI5 | *Carex bigelowii* | Bigelow's sedge |
| BENA | *Betula nana* | Dwarf birch |
| SAPU15 | *Salix pulchra* | Tealeaf willow |
| LEPAD | *Ledum palustre ssp. decumbens* | Marsh labrador tea |
| VAVI | *Vaccinium vitis-idaea* | Lingonberry |
| VAUL | *Vaccinium uliginosum* | Bog blueberry |

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

Disturbance Description

This system occurs within a variety of successional processes, including thaw lakes, strangmoors, polygonal ground, ice-wedge polygons, oriented lakes, water tracks, and adjacent to streams (Boggs et al. 2008). The successional processes of this system are slow (i.e., on the scale of 1,000s of years) and the seral stages are unclear (personal communication Arctic modeling meeting April 2008). Wet sedge tundra can be an early-seral stage in the thaw pond cycle which starts with the collapse of a permafrost plateau resulting in a wet depression often with open water. This is colonized by marsh species or *Sphagnum* species or a combination of both. Sedges eventually invade, and the wet sedge-*Sphagnum* system develops. If organic matter buildup or permafrost uplift the surface, then this system may be seral to the dwarf-shrub-*Sphagnum* system. This system, in turn, may be seral to the permafrost plateau-dwarf-shrub-lichen system. The seral sequence may not be unidirectional, and the timeframe is unclear, possibly taking hundreds of years.

In floodplains, primary succession on the Yukon-Kuskokwim Delta may move rapidly from aquatic bed to marsh to wet sedge and, possibly, wet low-tall shrub. An alternate wetland pathway is mesic sites supporting low or tall willows moving to wet low-tall shrub to wet sedge to tussocks, but this last stage is no longer part of floodplain dynamics. Primary succession on the Beaufort Coastal Plain progresses slowly from gravel bars to tall willow (possibly persisting for 300 years) or alder-willow, then to wet low willow (possibly persisting for 500 years). Paludification may lead to wet sedge (possibly persisting for 1,000-2,000 years), and permafrost formation may lead to tussock tundra, but this last stage is no longer part of the floodplain dynamics.

Ice wedge polygons are formed by large ice wedges which grow in thermal contraction cracks in permafrost. Low center polygons indicate that ice wedges are actually growing and that sediments are being actively upturned. High center polygons indicate that erosion, deposition, or thawing is more prevalent than the up-pushing of the sediments along the sides of the wedge. Ice-wedge polygons are typically part of a spatially coarser thaw lake cycle. Most of the land on the Beaufort Coastal Plain (Nowacki et al. (2001) ecoregion 1) is polygonal ground and pond complexes. Peterson and Billings (1978) found that low center polygons evolve into high center polygons on the edge of the Meade River Sand Bluffs (100 km south of Barrow, Alaska). The time scale on successional processes for this BpS is long.

In 2013, an extensive literature 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 reported that fire severity is influenced by site characteristics and pre-fire plant community composition. Shrubs in this BpS are typically top killed by fire (Innes 2013); however, a study by Racine et al. (2004) on the Seward Peninsula found that cover of *Carex aquatilis* recovered to near pre-burn levels within three years after a 1977 fire.

Fire Frequency

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

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 and may be linear.

Adjacency or Identification Concerns

Issues or Problems

Much of the tundra fire regime information is from the Seward Peninsula and Noatak River Watershed areas where fire is relatively more frequent than in other areas of the state (Innes 2013). Native Uncharacteristic Conditions

Comments

10/2021 This description was updated by NatureServe staff and Kori Blankenship based on the updated Ecological Systems classification for Alaska. Edits focused on adjusting the Geographic Range, Biophysical Site Descriptions, and Vegetation Description sections.

In 2021 NatureServe merged Alaska Arctic Polygonal Ground Wet Sedge Tundra (BpS 17060) and Alaska Arctic Wet Sedge Meadow (BpS 16980) into one Ecological System called North American Arctic Wet Sedge Tundra and Polygonal Ground. Kori Blankenship merged the BpS concepts into this unified description.

For LANDFIRE National 17060 and 16980 were created by Kori Blankenship and Keith Boggs and reviewed by Janet Jorgenson.

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 | A | A | A | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 25-50 | A | A | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | >50 | A | A | 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 100 Mid Development 1 - All Structures

Indicator Species

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

Description

This class represents the North American Arctic Wet Sedge Tundra and Polygonal Ground system.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Mid1:ALL | 0 | Mid1: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** |

References

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

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, M. Russo, K. Schulz, K. Snow, J. Teague, and R. White. 2003-present. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

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].

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.

Peterson, K.M. and W.D. Billings. 1978. Geomorphic processes and vegetational change along the Meade River sand bluffs in northern Alaska. Arctic. 31(1): 7-23.

Racine, Charles H. 1979. The 1977 tundra fires in the Seward Peninsula, Alaska: effects and initial revegetation. BLM-Alaska Technical Report 4. Anchorage, AK: U.S. Department of the Interior, Bureau of Land Management, Alaska State Office. 51 p. [8330]

Racine, Charles; Allen, Jennifer L.; Dennis, John G. 2006. Long-term monitoring of vegetation change following tundra fires in Noatak National Preserve, Alaska. Report No. NPS/AKRARCN/NNTR-2006/02. Fairbanks, AK: U.S. Department of the Interior, National Park Service, Alaska Region, Arctic Network Inventory and Monitoring Program. 37 p. [86029]