16130

Western North American Boreal Active Inland Dune

BpS Model/Description Version: Nov. 2024

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| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Kori Blankenship | kblankenship@tnc.org | None | None |
| None | None | None | None |
| None | None | None | None |

Reviewer: Robin Innes, Blaine T. Spellman

Vegetation Type

Forest and Woodland

Map Zones

68

Geographic Range

This Biophysical Setting (BpS) occurs in the boreal region as isolated features in western AK and western Canada. It does not occur in southeast AK or Cook Inlet. Areas with active sand transport are relatively uncommon (Wolfe et al. 2011), but some of the most noteworthy active areas are the Carcross Dunes in southern Yukon and the Lake Athabasca Dunes in northern Saskatchewan.

Biophysical Site Description

Active inland dunes occur in boreal Alaska as remnants of a larger system of dunes and sand sheets that developed under the climatic conditions of the late Pleistocene. Strong storm winds carried glacio-fluvial silts and sands across vast areas of northwestern North America. Most of these sand deposits have been stabilized by forest and tundra vegetation, but areas of active transport and deposition still exist. Some of the most noteworthy active areas are the Kobuk Dunes in western Alaska, the Carcross Dunes in southern Yukon, and the Lake Athabasca Dunes in northern Saskatchewan. These active dunes share many floristic elements and geomorphic processes (Parker and Mann, 2000). The main disturbance process within this BpS is the transport and deposition of sand. Common landforms include transverse and longitudinal dunes, sand sheets, desert pavements, blowouts, and interdune slacks.

Vegetation Description

Active dunes support a unique assemblage of plant species, but plant cover is typically sparse and discontinuous. Three dominant habitat types occur within boreal active dune systems: grassy, dry mountainous, and boreal forest (Parker 1998). Common species may include *Picea glauca, Betula nana, Alnus* ssp., *Vaccinium* ssp., and *Empetrum* ssp.

Dunes of the Kobuk Valley feature four plant species listed as imperiled in Alaska: *Lupinus kuschei, Oxytropis kobukensis, Symphyotrichum yukonensis,* and *Corispermum ochotense var. alaskanum*. *Leymus arenarius*, usually restricted to a narrow strip along the coast, is also common on the Kobuk Dunes. Several Beringian endemics and species which are widely disjunct from their known distributions have also been documented (Parker and Mann, 2000). *Carex sabulosa*, a sedge know from only four other sites in North America, can be found in Yukon Territory in dune systems near Carcross and Kusawa Lake. However, this sedge does not occur in the Kobuk Dunes.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PIGL | *Picea glauca* | White spruce |
| BENA | *Betula nana* | Dwarf birch |
| ALNUS | *Alnus spp.* | Alder |
| VACCI | *Vaccinium spp.* | Blueberry |
| EMPET | *Empetrum spp.* | Crowberry |
| LEAR11 | *Leymus arenarius* | Sand ryegrass |
| LUKU | *Lupinus kuschei* | Yukon lupine |
| OXKO | *Oxytropis kobukensis* | Kobuk locoweed |

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

Disturbance Description

The main disturbance process is the transport and deposition of sand. In western AK, the prevailing sand transport direction is from southeast to northwest. During sand transport, vegetation on the downwind side of the dune is gradually being buried in sand, while vegetation on the windward side is reestablishing. Within the dune complex, a wide variety of moisture regimes and successional stages occur. Interdune slacks may feature wetland habitats while xeric conditions prevail on active deposition surfaces. Along the dune margins, varying stages of boreal forest succession exist.

Fire is not a major disturbance on active dunes. In June of 2013 an extensive search was done by Fire Effects Information System staff to locate information on fire regimes of active inland dunes with few results (Innes 2013). Dunes now covered by forest or tundra will have the fire regime characteristics of their dominant plant communities but may revert to active dunes after 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

Small or large patch

Adjacency or Identification Concerns

This BpS expanded and contracted throughout the late Holocene in response to variations in climate, moisture, storms, and fire frequency (Parker and Mann 2000). Given the remote location of these dunes, minor climatic variations are more likely to affect this BpS than human activity in the future (Parker and Mann 2000).

Issues or Problems

This BpS should be modeled with a barren sand dune stage to represent the dynamics of active transport and deposition on the dunes, but this is not included in the model because LANDFIRE does not map barren seral stages.

The modeler was not familiar with this system and no review of the model was obtained. The Vegetation Description should likely include more information on the herbaceous species, but the modeler was unable to find more information. Class A may need to be split to create separate herbaceous and shrub classes, but this was not done due to lack of information on class age ranges, successional dynamics, and species composition. This model needs to be refined and all quantitative information it contains reassessed by a knowledgeable expert.

Native Uncharacteristic Conditions

Comments

More information on active inland dunes can be found in the Fire Effects Information System Synthesis: [Fire regimes in Alaskan coastal herbaceous communities and active inland dunes](https://www.fs.fed.us/database/feis/fire_regimes/AK_coastal/all.html) (Innes 2013).

This model was developed by Kori Blankenship based on the draft Boreal Ecological Systems description and in consultation with Tina Boucher. Carolyn Parker is a suggested reviewer for this type.

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 | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | B | B | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | B | B | B | B | B | B | B | B | B | B |
| Tree | 25-50 | B | B | B | B | B | B | B | B | B | B |
| Tree | >50 | B | B | B | B | B | B | B | B | B | B |

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 65 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| LUKU | *Lupinus kuschei* | Yukon lupine | Upper |
| LEAR11 | *Leymus arenarius* | Sand ryegrass | Upper |
| ALNUS | *Alnus* spp. | Alder | Upper |
| VACCI | *Vaccinium* spp. | Blueberry | Upper |

Description

Herbaceous vegetation dominates this stage which persists as an open canopy over a small area of the active dune. As areas of the dune stabilize, shrub species may invade.

*Maximum Tree Size Class*  
Seedling/Sapling <5"

Class B 35 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PIGL | *Picea glauca* | White spruce | Upper |
| ALNUS | *Alnus* spp. | Alder | Mid-Upper |
| BENA | *Betula nana* | Dwarf birch | Lower |
| VACCI | *Vaccinium* spp. | Blueberry | Lower |

Description

Boreal Forest Stage. With long term dune stabilization boreal forest can develop. Common species include *Picea galuca*, *Alnus* spp., *Betula nana*, *Vaccinium* spp., and *Empetrum* spp.

*Maximum Tree Size Class*  
Pole 5–9" (swd)/5–11" (hwd)

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Early1:ALL | 999 |
| Late1:ALL | 75 | 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** |
| Alternative Succession | Early1:ALL | Late1:ALL | 0.001 | 1000 | Yes | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.5 | 2 | Yes | 0 |
| Optional 1 | Late1:ALL | Early1:ALL | 0.002 | 500 | Yes | 0 |

Optional Disturbances

Optional 1: Sand Deposition

References

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