LANDFIRE Biophysical Setting Model

Biophysical Setting 6817130 Alaska Arctic Active Inland Dune

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field **Date** 6/4/2008

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Vegetation Type

Barren

Map Zone

68

Model Zone

☑ Alaska
☐ California
☐ Great Basin
☐ Great Lakes
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Dominant Species*

SAGL	BRINP
SAAL	LEMO8
SANI10	CHLA13
SARI4	CAOB4

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Active Inland Dunes are a minor but widespread system across the Alaskan arctic and boreal forest regions. It occurs from the Bristol Bay lowlands in southwestern AK to the North Slope on the Arctic Ocean. It also occurs in the Alaskan boreal region as isolated features. Some of the most noteworthy active areas are the Kobuk Dunes in western AK and the Carcross Dunes in the southern Yukon.

Biophysical Site Description

The following information was taken from the draft Arctic and Boreal Ecological Systems descriptions with minor modifications (Boggs et al. 2008, Boucher et al. 2008):
Active inland dunes occur 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 and the Carcross Dunes in the southern Yukon, Dunes are also common where rivers have cut through sandsheets, and new dunes are still forming along rivers with high sediment loads and outwash deposits. These active dunes share many floristic elements and geomorphic processes (Parker and Mann, 2000). The main disturbance process is the transport and deposition of sand. Common landforms include transverse and longitudinal dunes, sand sheets, desert pavements, blowouts, and interdune slacks. The dunes or blowouts are dry to mesic sand deposits, and the slacks may be wet silts and sands.

Vegetation Description

Active dunes support a unique assemblage of plant species, but plant cover is typically sparse and discontinuous. Three dominant map classes occur within arctic active dune systems: tall willows, mesic

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herbaceous and wet sedge. Low- and tall-willow communities are dominated by Salix glauca, Salix alaxensis, Salix richardsonii (= Salix lanata) and Salix niphoclada (= Salix brachycarpa ssp. niphoclada), along with Bromus inermis var. pumpellianus (= Bromus pumpellianus) (Parker 1998). The mesic herbaceous class includes Leymus mollis, Bromus inermis var. pumpellianus and Chamerion latifolium (= Epilobium latifolium) (Peterson and Billings 1978, Komarkova and Webber 1980). Additional herbaceous species include Carex obtusata, Carex lachenalii, Festuca rubra, Festuca brachyphylla, Astragalus alpinus and others. Ponds and wet depressions may occur in the slacks and support the wet herbaceous class dominated by Carex aquatilis and Arctophila fulva (Boggs et al. 2008).

Disturbance Description

The following paragraph was taken from the draft Arctic and Boreal Ecological Systems descriptions with minor modifications (Boggs et al 2008, Boucher et al. 2008):
The main disturbance process is the transport and deposition of sand. The location and formation of dunes depend primarily on the availability of sand and wind direction. In western Alaska, the prevailing sand transport direction is from southeast to northwest. Vegetation on the downwind side of the dune is gradually being buried in sand, while on the windward side vegetation is reestablishing. With in the dune complex, a wide variety of moisture regimes occur. Interdune slacks may feature wetland habitats while xeric conditions prevail on active deposition surfaces. Tundra vegetation has stabilized most of these sand deposits, but small blowouts and areas of active transport and deposition still exist.

A variety of successional trajectories are possible and in some cases the time-scales over which vegetation changes occur are long (Peterson and Billings 1978). For these reasons, this BpS is represented with a 1-box model.

The following information regarding dune succession along the Meade River was summarized from Peterson and Billings (1978):
The erosion and deposition of sand by wind in the tundra, although modified by permafrost, produces patterns of colonization and stabilization similar to those produced in temperate regions. The Meade River area has an extensive, well-sorted sand deposit of marine origin with underlying sediments and rock. The river has cut through the sands to bedrock and produced bluffs and cutbanks as much as 10 m in height. In the area many oriented lakes are producing small bluffs, while the edges of drained lake basins are also marked by bluffs.

Vegetation change along the bluffs is associated with:
1. River bank erosion or lake erosion
2. Thermokarst erosion
3. Wind erosion and deposition of sand (augmented by animals)
4. Autogenic vegetation succession (soil development)

Winds are either east-northeast or west-southwest in the area and control orientation of dunes (Livingstone 1954, Carson and Hussey 1959.). Bluffs which face the prevailing winds show the most effects of wind erosion and deposition of sands. Windward facing bluffs from which river courses or lake margins have receded are rounded in form and generally have a number of small but active elliptical blowouts. Dunes are most common wherever bluffs occur on the leeward side of an exposed riverbar. Sand carried from the bar by wind is dropped on the bluff face and bluff edge (Walker 1967). The bluff only stabilizes when the relief is reduced through erosion and also, adjacent source-areas of sand (river bars) have themselves become stabilized.

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Elymus arenarius invades the open sand, though it seldom provides more than 10% cover. Dryas integrifolia may also invade small temporarily stable sites or areas with less sand deposition. Vegetation is often temporary as sand moves. Willows may also invade with Salix alaxensis restricted to river bars. Moving onto the dunes S. lunata is found first and then S. glauca farthest from the river. S. niphoclada may be intermixed with the other willows.

The higher climbing dunes are blown into large, flattened parabolic forms with Dryas integrifolia and Arctostaphylos rubra surrounding the outer margins. These dunes often impede drainage of adjacent tundra causing very wet and very dry habitats to abut each other. Parbolic dunes are eventually blown out into flat tongue-shaped deposits (sand tongues) which may support upland tundra vegetation. In well-drained sites, autogenic succession culminates in a lichen-heath vegetation type (Alectoria spp., Diapensia lapponica, Vaccinium vitis-idaea and Ledum palustre).

Small dunes will also form on river bars surrounded by willows, mostly Salix glauca. These local dunes areas provide highly specialized niches for certain plant species such as Mertensia drummondii, Polemonium boreale, Artemisia glomerata and Brayia pilosa.

Late-lying snowbeds on dunes provide protection from the wind and ensures increased soil moisture. These mesic steep areas often have closed vegetation dominated by Arctagrostis lutifolia, Polygonum bistorta, Saxifraga punctata, Petasites frigid, Oxyria digyna, Ranunculus nivalis and Cetraria cucullata

On old wind-modified dunes succession may begin with Elymus arenarius, then proceed to Elymus arenarius and Carex obtusata. Lichens and small forbs (Campanula lasiocarpa) invade followed by Rhacomitrium and Cetraria. Eventually the Elymus dies and Cassiope telragon invades. Finaly Hierochloe alpina and Poa arctica invade moist sites.

Blowout formation can be rapid, but soil formation of the latter stages of development may take hundreds of years to develop. Plus stabilization of sand deposits is facilitated by permafrost, which typically rises as vegetation cover increases.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Small or large patch.

Issues/Problems

This BpS expanded and contracted throughout the late Holocene in response to variations in climate, moisture, storm 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).

Comments

This model was developed by Kori Blankenship with input from Keith Boggs based on the draft Arctic and Boreal Ecological Systems descriptions (Boggs et al. 2008, Boucher et al. 2008). Carolyn Parker is a suggested reviewer for this type.

Vegetation Classes

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Class A **100 %**

Mid Development 1 All Structures

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

SALIX	Upper
BRINP	Upper
LEMO8	Upper
CHLA13	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	Open Shrub (25-74% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Tall Shrub (>1.5m)	Tall Shrub (>1.5m)
Tree Size Class	None	

- [x] Upper layer lifeform differs from dominant lifeform.

Herbs or shrubs can be present in the upper layer.

Description

Zero plus years

This class represents the Active Inland Dune system which can be dominated by bare ground, tall willows, mesic herbaceous or wet sedge types.

No disturbances modeled.

Class B **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

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Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- [ ] Herbaceous
- [ ] Shrub
- [ ] Tree

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover		
Height		
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** NA

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement					
Mixed					
Surface					
All Fires					

Fire Intervals (FI):
Fire interval is expressed in years for each fire severity class and for all types of fir combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inver of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

- [ ] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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