LANDFIRE Biophysical Setting Model

***Biophysical Setting* 7816500** **Alaskan Pacific Maritime Periglacial Woodland and Shrubland**

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

General Information

Contributors (also see the Comments field **Date** 9/15/2008

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Vegetation Type
Upland Shrubland

Map Zone
78

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

Dominant Species*

ALVIS	CHLA13
POBA2	RUSP
PISI	EQVA
SALIX	DRDR

General Model Sources
- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Geographic Range
This system is found from Kodiak Island south through southeast AK.

Biophysical Site Description
This system occurs on sites recently exposed through deglaciation since the end of the Little Ice Age, as well as on Sitka spruce forests on recently uplifted landscapes (e.g. landscapes <500yrs old; Kenai Fjords, Yakutat, Glacier Bay, Kodiak Island, islands in Prince William Sound). Soils are shallow, stony, and well-drained to excessively well-drained. Substrates include glacial till, residuum and colluvium. Soil profile development is lacking or minimal.

Vegetation Description
Common early successional or pioneer communities are initially dominated by non-vascular plants (e.g. Mosses - Racomitrium canescens, Pohlia nutans, Drepanocladus aduncus; Lichens – Stereocaulon tomentosum, Cladonia crispata, Cladina portentosa) and later early-seral herbaceous or shrubs species can capture the site. Common herbaceous species may include Calamagrostis canadensis, Chamerion angustifolium, C. latifolium, Heracleum maximum, Lupinus nootkatensis, Equisetum arvense, Athyrium filix-femina, Dryopteris expansa, Phegopteris connectilis, Streptopus amplexifolius, Pyrola spp., Carex mertensii and Epilobium spp. Mid-seral shrub communities are frequently dominated by Alnus viridis ssp. sinuata though Salix alaxensis, Salix barclayi or Salix sitchensis may also be abundant. Later-seral transitional forest communities support either Populus balsamifera or a mix of Populus balsamifera and Picea sitchensis. Subalpine fir occurs in limited areas usually near mainland corridors to interior ecosystems (e.g. Skagway area, Taku River valley and possibly the Stikine River). Picea sitchensis often forms a dense layer below the overstory of Populus balsamifera. Other common transitional forest

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understory species include Rubus spectabilis, Alnus viridis ssp. Sinuata, Salix sitchensis and Oplopanax horridus. Transitional forest communities are generally found on older landscapes at low elevations near the maximum glacial extent. The latest seral stage considered in this modeled is dominated by Picea sitchensis and characterized by a rich moss ground layer. Common understory species in this stage include Rubus spectabilis, Sambucus racemosa, Oplopanax horridus and Ribes bracteosum (Cooper 1923). Herbaceous species may include Aspidium spinulosum, Polystichum braunii, Asplenium filix-foemina, Ophyrys cordata, Actaca arguta, Pyrola secunda and Moneses uniflora (Cooper 1923). Mosses include Hylocomium proliferum, Rhytidia-delphus triqueterus and R. squarrosus (Cooper 1923).

Disturbance Description

The following in one conceptual model for how succession will proceed on recently deglaciated sites: Primary succession on recently deglaciated terrain (glacial till or bedrock shields) usually begins with colonization of bare rock and soil by lichens and mosses, followed by grasses and forbs, then by shrub species such as alder and willow. The rate and direction of succession is variable and depends on initial site conditions and species interactions (Chapin et al. 1995). On glacial till substrates, Alnus viridis ssp. sinuata and/or Salix spp. dominate the site within about 20yrs. On bedrock substrates, mosses and herbaceous species may persist longer due to the lack of microsites for shrub establishment. Disturbance-prone sites may remain dominated by Alnus viridis ssp. sinuata. Dryas drumondii and Alnus viridis ssp. sinuata help to fix nitrogen in the soil facilitating the growth of trees but seed dispersal is also an important factor in the successional dynamics of a recently deglaciated site (Chapin et al. 1995). After about 50yrs a transitional forest system characterized by Populus balsamifera ssp. trichocarpa and Picea sitchensis can emerge through the tall shrub canopy. Picea sitchensis eventually gains dominance in the canopy and over long time scales (not considered in this model) mountain hemlock or possibly sloping peatland systems may develop. This transition to a hemlock-spruce forest is evident at Glacier Bay where bark beetles killed some of the even-age Sitka spruce approximately 140yrs after colonization, yielding a multi-age forest favoring more western hemlock (Paul Hennon, personal communication).

Age ranges mentioned in this description and given in the VDDT model should be considered approximations. Rates of succession will be highly variable based on substrate, landform, and elevation. Avalanche and rock slides will slow development on high angle slopes. On low angle slopes with finer glacial deposits succession will proceed more rapidly.

Avalanches, rock slides, glacial flow and windthrow are the primary disturbances that affect this type and are included in the VDDT model. Windthrow is more likely in this BpS than other maritime forests because the trees are shallow rooted in young soils. Some areas are also prone to periodic glacial outburst floods, also known as jokulhlaups, which may occur annually, but since this is not a widespread phenomenon across the range of this BpS it was not included in the VDDT model.

Adjacency or Identification Concerns

A variety of vegetation types could be found adjacent to this BpS depending on substrate, landform and elevation. Most adjacent undisturbed areas on low to mid elevation valley landscapes are western hemlock or spruce-hemlock forest, depending on age and local site factors.

Although the Alaskan Pacific Hypermaritime Sitka Spruce Beach Ridge BpS occur on recently uplifted sites, they are considered a separate BpS.

Native Uncharacteristic Conditions

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Scale Description

Matrix

Issues/Problems

Although periglacial sites represent a unique biophysical environment with unique successional dynamics it is difficult to model them using the LANDFIRE methodology which is designed for dealing with secondary succession and assumes that overtime an equilibrium condition will be reached and that the percent of the landscape in each seral stage varies with in a certain range (i.e. the natural or historic range of variability). These modeling assumptions do not apply to recently deglaciated or uplifted sites where plants colonize newly exposed ground and modify the biophysical environment over time.

The current model is partially based on age ranges and seral stage descriptions from Reiners et al. 1971 and Cooper 1923. Snow avalanche, rock slide, glacial flow and windthrow (only in the forest stages) are believed to be primary disturbances affecting recently deglaciated sites. They are therefore included in the VDDT model. There are no data to support the probabilities assigned to them. The probabilities were assigned in a relative sense, assuming that probability of non-wind disturbance, especially avalanches and rock slides, was most prevalent but decreased overtime as vegetation developed, soil stabilized and distance from the glacier increased. The class percents from this model should not be used as a reference condition to calculate fire regime condition class. It is likely that class percents vary widely overtime and from site to site.

This model was largely developed based on studies in Glacier Bay which may not be representative of other periglacial environments. Walker (1995) found that conditions at Glaciar Bay favored more rapid growth and succession than at other sites in Alaska.

Comments

This model was based on input from experts who attended the LANDFIRE Juneau Modeling Meeting (Feb. 08) and refined by Rick Turner. Sclass age ranges and descriptions are partially based on a chronosequence of sites in primary succession at Glacier Bay, AK (Reiners et al. 1971, p. 56). Review comments resulted in minor descriptive edits to the model description and quantitative changes to the VDDT model. Model changes included the addition of a Sitka Spruce forest stage (class D) and the addition of windthrow disturbance in the Spruce-Cottonwood Transitional Forest (class C) and Sitka Spruce Forest (class D) stages.

Vegetation Classes

Class A 5%

Early Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

DRDR	Upper
EQVA	Upper
CHLA13	Upper
ALVIS	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open Shrub (25-74% shrub cover)	Open Shrub (25-74% shrub cover)
Height	Dwarf Shrub (< 20 cm)	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Shrubs, herbs or nonvascular plants may be the dominant upper layer lifeform.

Description

0-19yrs

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Pioneer: Non-Vascular plants, Dryas, Sparse Willows, Poplar and Alder

After ice retreat the first vascular plants to colonize a site include Equisetum variegatum, Carex ssp., Chamerion ssp. Dryas drummondii will dominate on some surfaces forming a vegetative mat. Common herbaceous species include Calamagrostis canadensis, Chamerion angustifolium, C. latifolium, Heracleum maximum, Lupinus nootkatensis, Equisetum arvense, Athyrium filix-femina, Dryopteris expansa, Phegopteris connectilis, Streptopus amplexifolius, Pyrola spp., Carex mertensii and Epilobium spp. Scattered Salix ssp, Alnus viridis ssp. Sinuata and Populus balsamifera ssp. trichocarpa seedlings may be present.

Succession to class B. Snow avalanches or rock slides (represented as Option 1 in the model; probability = 0.01) can reset the age of this class. Glacial outwash sedimentation that smothers vegetation (represented as Option 2 in the model; probability = 0.01) can also reset the age of this class.

Class B **10 %**

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Indicator Species* and Canopy Position

ALVIS	Upper
SAAL	Upper
SASI2	Upper
SABA3	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Closed Shrub (> 75% shrub cover)	Closed Shrub (> 75% shrub cover)
Height	Low Shrub (20 cm to 1.5 m	Tall Shrub (>1.5 m)
Tree Size Class	Seedling/Sapling <5"	

☐ Upper layer lifeform differs from dominant lifeform.

Description

20-49yrs

Alder-Willow Thicket

Alnus viridis ssp. sinuata often dominates the species composition, though Salix alaxensis, Salix sitchensis or Salix barclayi may also be abundant. The relative abundance of Salix species can be quite variable. Scattered pole sized cottonwoods may be present in this stage.

Succession to class C. Snow avalanches or rock slides (represented as Option 1 in the model; probability = 0.005) can cause a transition to class A.

Class C **25 %**

Late Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

POBA2	Upper
PISI	Upper
ALVIS	Lower
SALIX	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Open (25-59% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, presence of hardwoods distinguishes Class C from Class D.

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Description

50-149yrs

Spruce-Cottonwood Transition Forest

This stage is typically found on older deglaciated landscapes at lower elevations near the maximum glacial extent. Populus balsamifera or a mix of Populus balsamifera and Picea sitchensis dominate. Common understory shrubs include Rubus spectabilis, Alnus viridis ssp. sinuata, Salix sitchensis and Oplopanax horridus.

Succession to class D. Rock slides (represented as wind/weather/stress in the model; probability = 0.001) can cause a transition to class A. Snow avalanches (represented as wind/weather/stress in the model; probability = 0.001) causes a transition to class B. Windthrow (represented as wind/weather/stress in the model: probability = 0.002) can cause a transition to class B.

Class D **60 %**

Late Development 2 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Indicator Species* and Canopy Position

PISI	Upper
RUSP	Lower
SARA2	Lower
OPHO	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	Closed (60-100% tree cover)	Closed (60-100% tree cover)
Height	Tree (> 3 m)	Tree (> 3 m)
Tree Size Class	Med. 9–20" (swd)/11–20" (hwd)	

☐ Upper layer lifeform differs from dominant lifeform.

For mapping, absence of hardwoods distinguishes class D from class C.

Description

150yrs+

Sitka Spruce Forest

Picea sitchensis eventually gains canopy dominance over the hardwoods. Tsuga heterophylla and Tsuga mertensiana seedlings and saplings may be present and a rich moss understory develops (Reiners et al. 1971). As the forest matures, Tsuga heterophylla will likely gain dominance but then the Mt. Hemlock Forest BpS model would apply. Alnus viridis ssp. sinuata and Salix spp. are present in more open stands. Common understory species include Rubus spectabilis, Sambucus racemosa, Oplopanax horridus and Ribes bracteosum (Cooper 1923). Herbaceous species may include Aspidium spinulosum, Polystichum braunii, Asplenium filix-foemina, Ophyrys cordata, Actaca arguta, Pyrola secunda and Moneses uniflora (Cooper 1923). The characteristic moss covering the ground is dominated by Hylocomium proliferum, Rhytidia-delphus triqueterus and R. squarrosus (Cooper 1923).

This class will persist in the absence of disturbance. Rock slides (represented as wind/weather/stress in the model; probability = 0.001) can cause a transition to class A. Snow avalanches (represented as wind/weather/stress in the model; probability = 0.001) causes a transition to class B. Windthrow (represented as wind/weather/stress in the model: probability = 0.002) can cause a transition to class B.

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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
- ☑ 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
- ☐ Native Grazing
- ☑ Other (optional 1) Snow avalanches or rock slides
- ☑ Wind/Weather/Stress
- ☐ Competition
- ☑ Other (optional 2) Glacial outwash sedimentation

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