16441

Alaskan Pacific Sitka Spruce Forest and Beach Ridge -- Sitka Spruce Forest

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Vegetation Type

Forest and Woodland

Map Zones

73, 75, 76, 77, 78

Geographic Range

This system is found along the Gulf Coast of Alaska and the North Pacific, in the perhumid and subpolar rainforest zones. It is present in a narrow coastal band (likely 1 to several km wide) on the west side of Cook Inlet including portions of Katmai and Lake Clark National Parks. The northern extent of Sitka spruce is near the Johnson River.

Biophysical Site Description

This BpS occurs in an area where the boreal and maritime regions of AK overlap. Sitka spruce occurs on rolling bedrock hills and valleys where there is a strong maritime influence and warm, wet coastal storms occur. Soils tend to be well-drained, deep and well-developed (except in areas where spruce is invading meadows and shrublands). In the northern portion of its range (Kodiak Island, Kenai Fjords, and Prince William Sound) Sitka spruce if found from sea level to treeline. In SE AK Sitka spruce if often associated with disturbed sites and karst substrates.

The biophysical environment of the Kodiak Archipelago is unique in that vegetation communities on these islands are still responding to the retreat of Pleistocene glaciers and ash deposition from the 1912 Katmai eruption (Fleming and Spencer 2007). Fleming and Spencer (2007, p. 5) note that: “Sitka spruce forest is actively moving south along the island of Kodiak, perhaps as much as a mile/century [the source of this claim is unknown (personal communication, Page Spencer)]. This succession replaces alder, salmon and elderberry and forb meadows with dense spruce forest. Preferred wildlife habitats with grasses, sedges and forbs, and prolific berry crops, are being replaced with dense conifers.”

Vegetation Description

Picea sitchensis is the dominant tree species and is stunted in some areas (especially on Shuyak and Afognak Islands). Oplopanax horridus and mosses are common in the understory of open stands (Fleming and Spencer 2007). Closed stands tend to have a very sparse understory that may include Oplopanax horridus, Vaccinium ovalifolium, Sambucus racemosa, Alnus crispa ssp. sinuata, Rubus spectabilis and feather mosses (e.g. Hylocomium splendens and Rhytidiadelphus loreus) (Fleming and Spencer 2007). Calamagrostis canadensis and Menyanthes trifoliata are also present in some forest openings. In Lake Clark National Park near the northern extent of this BpS, a broader range of species is present including Picea glauca which may hybridize with Picea sitchensis. In this area, the characteristic moss understory found in the Kodiak Archipelago is absent.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PISI | Picea sitchensis | Sitka spruce |
| OPHO | Oplopanax horridus | Devilsclub |
| VAOV | Vaccinium ovalifolium | Oval-leaf blueberry |
| SARA2 | Sambucus racemosa | Red elderberry |
| ALVIS | Alnus viridis ssp. sinuata | Sitka alder |
| RUSP | Rubus spectabilis | Salmonberry |
| HYSP70 | Hylocomium splendens | Splendid feather moss |
| RHLO70 | Rhytidiadelphus loreus | Loreus goose neck moss |

Disturbance Description

Primary succession of Picea sitchensis forest in the Kodiak Archipelago begins with rich forb meadows. Overtime, Alnus crispa ssp. sinuata invades, fills in and Sambucus racemosa and Rubus spectabilis are added to the species mix. Eventually Picea sitchensis will start to invade. The timing of the transition to Picea sitchensis appears to be a function of the timing of the Pleistocene glacial retreat, seed source and seed advancement. As the Picea sitchensis trees become denser, the first generation closed Picea sitchensis forest develops with Vaccinium ovalifolium, Oplopanax horridus and feather mosses in the understory. After about 150-300yrs the trees start to senesce, small scale blow down occurs and a multi age stand develops. In the forest gaps left after tree death or blowdown a rich shrub layer with Alnus crispa ssp. sinuata, Oplopanax horridus and Calamagrostis canadensis competes with the young Picea sitchensis trees. Over long time scales, these forests become more open. In areas with beaver activity, ponds can form that when drained turn into muskegs which dry and can again support Picea sitchensis trees.

In the Katmai area Picea sitchensis advancement appears to be slower than on Kodiak (personal communication, Page Spencer). It is unclear how well the Kodiak successional sequence applies to Picea sitchensis forest on the south end of the Kenai Peninsula which appears to be better developed and is the likely seed source for Picea sitchensis invading the Kodiak Archipelago.

Wind disturbances at both small and large scales play a fundamental role in shaping forest dynamics in Southeast Alaska (Harris and Farr 1974, Nowacki and Kramer 1998). Wind disturbance characteristics change over a continuum dependent on landscape features (e.g., exposure, position on the landscape, topography). Distinct wind disturbance regimes grade from exposed landscapes where recurrent, large-scale wind events prevail to wind-protected landscapes where small-scale canopy gaps predominate. Blowdowns in southeast Alaska range in size from 1 to 1,000 acres and disproportionately occur as smaller patches (typically < 50 acres) (Nowacki and Kramer 1998).

Some research suggests that frequent, small-scale wind events have a larger impact on these forests than the relatively less frequent, large-scale blowdowns (Harcombe 1986). Stem-snap and resultant canopy gaps are more likely to occur in old growth forests and mean gap size tends to be larger in old growth forests than in mature forests (Nowacki and Kramer 1998). The direction of gap-maker tree falls is significantly aligned with the direction of prevailing winds.

Catastrophic winds commonly cause large-scale blowdown throughout southeast Alaska (Deal et al 1991). Depending on intensity, wind can create single-generation stands with uniform canopies or multi-generation stands with diverse canopy and size structures. Intervals between complete blowdowns tend to be long with forests cycling through stand initiation, stem exclusion, and understory reinitiation stages, eventually reaching the old growth stage (at about 350 years).

In 2017, a comprehensive literature search for fire history information in Alaskan Pacific maritime ecosystems found a single study. In the Kenai Mountains Potkin (1997) sampled two stands containing spruce and hemlock trees and reported subsurface charcoal 1270 years +/- 40 BP at one site and no soil charcoal at a second site (Potkin 1997).

Other important disturbances include avalanches, landslides and tectonic movement.

Fire Frequency

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

Scale Description

Matrix

Non-Fire Disturbances

Adjacency or Identification Concerns

Open sitka spruce forests are often intermixed with alder and forb meadows (Fleming and Spencer 2007).

Issues or Problems

Sitka spruce sites represent a unique biophysical environment with unique successional dynamics it is difficult to model them using the LANDFIRE methodology which 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 areas where spruce is actively invading.

In dense spruce forest where secondary succession characterized by gap dynamics has begun, the disturbance is occurring on a fine scale as individual or small groups of trees die or are windthrown. The small forest openings created by these dynamics are likely not mappable using the LANDFIRE methodology; the state-and-transition model for this BpS attempts to capture broader scale dynamics.

It is unclear how well the dynamics described in the Disturbance Description for the Kodiak Archipelago apply to the Kenai and west Cook Inlet parts of the distribution of this BpS.

Native Uncharacteristic Conditions

Logging on Kodiak Island and on the Kenai Peninsula south of Seldovia has created more early successional forests than would exist otherwise.

Comments

REVIEW NEEDED:

* In 2021 NatureServe merged Alaskan Pacific Maritime Sitka Spruce Beach Ridge (16540), Alaskan Pacific Maritime Periglacial Woodland and Shrubland (16500), and Alaskan Pacific Maritime Sitka Spruce Forest (16440) to create one revised Ecological System called Alaskan Pacific Sitka Spruce Forest and Beach Ridge. Currently each of the original BpS has its own model and description. Should any or all of these BpS be merged and represented by one or two BpS models and descriptions?
* How should this model differ from the Alaskan Pacific Maritime Western Hemlock ForestBpS model (16460)?
* What are the indicator species for the states?
* What is a reasonable estimate for the proportion of states?

In 2021 Kori Blankenship updated the state-and-transition model for this BpS. During LANDFIRE National it was thought that the states of this type would be difficult to map using LANDIFRE methods. While this may still be the case, Blankenship felt it was important to construct at least a conceptual model to represent the dynamics of the BpS. Blankenship used information from the Fire Regime Condition Class Coastal Forest model by Karen A. Murphy and Evie Witten and the LANDFIRE Alaskan Pacific Maritime Western Hemlock Forest

BpS model by Sheila Spores and reviewed by Paul Alaback, Roy Josephson, and Tom DeMeo. In addition to model changes, Blankenship added to the disturbance regime and succession classes section of the model description which was developed during LANDIFRE National largely based on work in the Kodiak Archipelago (Fleming and Spencer 2007) and conversations with Page Spencer.

Succession Classes

Class A 3 Early Development 1 - All Structures

Structural Information

Tree Size Class: Seedling/Sapling <5"

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISI | Picea sitchensis | Sitka spruce | Upper |
| OPHO | Oplopanax horridus | Devilsclub | Upper |
| VAOV | Vaccinium ovalifolium | Oval-leaf blueberry | Upper |
| SARA2 | Sambucus racemosa | Red elderberry | Upper |

Description

Post disturbance stand initiation

Herbs, shrubs and tree seedlings grow from seeds, sprouts and advance regeneration. Within five years following disturbance, a vigorous shrub layer develops, and will often persist past age 20yrs. Thirty years is used as the estimate of the end of this stage (Alaback 1984, DeMeo et al. 1992). By age 50, shrub cover is reduced past the pre-disturbance level (DeMeo et al. 1992). Post disturbance conifer regeneration will depend on the pre disturbance stand composition and the type of disturbance. Hemlock is more likely to regenerate following windthrow whereas spruce is more likely to regenerate if mineral soil is exposed (e.g. after a landslide).

Class B 12 Mid Development 1 - Closed

Structural Information

Tree Size Class: Med. 9–20" (swd)/11–20" (hwd)

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISI | Picea sitchensis | Sitka spruce | Upper |

Description

Stem exclusion

Tree canopy closes and shade in-tolerant species in the understory are lost. Forest structure becomes stratified, with slower-growing, shade tolerant conifer species forming lower canopy strata. Some trees are thinned from the stand due to lack of resources (e.g., light, growing space, nutrients, etc.). Spruce and hemlock dominate. Understory can be completely void of vegetation, therefore no understory species are listed as indicators for this class.

Class C 27 Late Development 1 - Closed

Structural Information

Tree Size Class: Large 20" – 40"

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISI | Picea sitchensis | Sitka spruce | Upper |
| OPHO | Oplopanax horridus | Devilsclub | Lower |
| VAOV | Vaccinium ovalifolium | Oval-leaf blueberry | Lower |
| SARA2 | Sambucus racemosa | Red elderberry | Lower |

Description

Understory re-initiation

As the overstory ages, new species of shade-tolerant forbs and shrubs appear on the forest floor. Eventually larger tree-fall gaps, which are not subject to closure by lateral extension, begin to appear in the overstory, thus allowing for conifer regeneration and the beginning of gap-phase replacement. A two-aged, two-layered stand forms.

Larger tree-fall gaps, which are not subject to closure by lateral extension, begin to appear in the overstory, thus allowing for conifer regeneration and the beginning of gap-phase replacement. A two-aged, two-layered stand forms.

Class D 58 Late Development 2 - Closed

Structural Information

Tree Size Class: Very Large 40.0"+

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PISI | Picea sitchensis | Sitka spruce | Upper |
| OPHO | Oplopanax horridus | Devilsclub | Lower |
| VAOV | Vaccinium ovalifolium | Oval-leaf blueberry | Lower |
| SARA2 | Sambucus racemosa | Red elderberry | Lower |

Description

Old growth

It takes about 350 years from stand initiation to reach the old growth stage (Nowacki and Kramer, 1998). Multi-aged, multi-layered stand with continuing gap-phase replacement. Tree mortality is generally balanced with growth from newly established seedlings. Large, decadent trees, standing snags, coarse woody debris, overhead gaps and regeneration patches are all present.

References

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