



# Landcover Classes

## *Sitka National Historical Park*

Natural Resource Technical Report NPS/SITK/NRTR—2013/773





**ON THIS PAGE**

Sitka National Historical Park Visitor Center, showing landcover types along a coastal gradient  
Photograph by: Lindsey Flagstad

**ON THE COVER**

Map of landcover classes in Sitka National Historical Park  
Image by: Lindsey Flagstad

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## *Sitka National Historical Park*

Natural Resource Technical Report NPS/SITK/NRTR—2013/773

Lindsey Flagstad, Tina Boucher

Alaska Natural Heritage Program  
University of Alaska Anchorage  
707 A Street  
Anchorage, Alaska 99501

July 2013

U.S. Department of the Interior  
National Park Service  
Natural Resource Stewardship and Science  
Fort Collins, Colorado

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Please cite this publication as:

Flagstad, L., and T. Boucher. 2013. Landcover classes: Sitka National Historical Park. Natural Resource Technical Report NPS/SITK/NRTR—2013/773. National Park Service, Fort Collins, Colorado.

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## **Abstract**

The landcover classification, descriptions and map produced for Sitka National Historical Park (NHP) as part of this project provide both a reference and framework for future resource management and change detection. Sitka NHP is a relatively small park (47 hectares) situated on the coastal lowlands of Baranof Island in Southeast Alaska. The Park conserves a unique intersection of cultural and physical landscapes that are shaped equally by interactions among Native Alaskan, Russian and North American peoples as well as those among the land, river and sea. Development of a landcover map for the Park was highlighted as a necessary ecological inventory on which monitoring could be based (Moynahan and Johnson 2008). The landcover map presented here was manually digitized on current aerial photography in a GIS environment and field checked by vegetation survey. The landcover classes identified represent both natural and cultural vegetation and successional stages ranging from barren ground to old growth forest. Accompanying descriptions provide information on vegetation and site characteristics of each class and propose a placement within the National Vegetation Classification. The baseline information provided here can be used to assess the status, condition and trend of natural resources within the Park and because the landcover classes identified are common to the greater Alexander Archipelago ecoregion, this classification may inform vegetation work beyond the boundaries of Sitka NHP.

## **Acknowledgments**

The authors wish to thank the National Park Service, Inventory and Monitoring Program at the Alaska Regional Office for their financial and technical support of this project. Special thanks are given to Inventory Program Manager Parker Martyn, who ably guided and assisted our work and GIS specialist Beth Koltun, who assisted our work in both field and office. The logistical support provided by Sitka National Historical Park Biologist Craig Smith and his staff as well as the fine and editorial, geospatial and graphics assistance provided by Alaska Natural Heritage Program Research Technicians Casey Greenstein, Tina Kuo and Megumi Aisu was also greatly appreciated.

## Introduction

Sitka National Historical Park (herein also referred to as ‘the Park’ and ‘Sitka NHP’) conserves an intersection of historic and natural resources that is unique among park lands in Alaska. The interactions among Native Alaskan, Russian and North American peoples craft the cultural landscape, whereas the interactions among land, river and sea endlessly shape the physical landscape of the Park. In support of the effective management of the Park’s diverse resources, this report classifies, describes and delineates types of vegetated and nonvegetated landcover occurring within the Park.

### Study Area

Sitka National Historical Park occupies 47 hectares (116 acres) on the coastal lowlands of Baranof Island in Southeast Alaska’s Alexander Archipelago (Figure 1). Park lands are fronted by Sitka Sound and backed by the Verstovia and Gavin Mountains. Today, the Park is comprised of two separate units: the Russian Bishop’s House Unit and the Fort Site Unit. The Russian Bishop’s House Unit is a 1.2 ha (3 ac) parcel located in downtown Sitka that preserves an 1843 log structure that is one of few remaining examples of Russian colonial architecture in North America. The Fort Site Unit is a 45.8 ha (113 ac) parcel located on a forested coastal peninsula approximately one half mile east of the Bishop’s House. Lands comprising the Fort Site Unit were designated as a public park in 1890 to commemorate the 1804 battle between invading Russian traders and the native Tlingit Kiks.ádi Clan. The public park became Sitka National Monument in 1910 and Sitka National Historical Park in 1972 (Chaney et al. 1995). The Fort Site Unit is transected by the Indian River, which is an accessible and picturesque waterway supporting both resident and anadromous fish populations. For these reasons, the river has figured prominently in the historical subsistence and modern day recreational activities of residents and visitors (Smith-Middleton and Alanen 1998). The landscape position of the Park at the intersection of aquatic and terrestrial, salt and freshwater, lowland and upland systems makes it home to a remarkable diversity of habitat types.



Figure 1. Location of Sitka National Historical Park, Alaska.



Figure 2. Topography of Sitka National Historical Park, Alaska.

## Climate

Sitka's climate is moderated by its low elevation and proximity to the ocean. Its cool, hypermaritime climate is characterized by minor seasonal variation in temperature and high annual precipitation (Nowacki et al. 2000). Mean annual maximum temperature is 9.9°C (49.8°F) and mean annual minimum temperature is 4.5°C (40.1°F); mean annual precipitation is 218.8 cm (86.13 in) with 94.2 cm (37.1 in) falling as snow. The warmest months are July and August; the wettest months are September and October (ACRC undated).

## Geology

The tectonic, glacial and volcanic history of the Park has created a dynamic landscape that remains in flux today. Baranof Island is situated inboard of the Fairweather - Queen Charlotte Fault System, a transverse boundary along which the Pacific Plate is pushed northwest relative to the North American Plate. Movement along this margin has produced a highly deformed complex of northwest trending anticlines and synclines, and in intensely-faulted areas, vertical to steeply dipping beds (Yehle 1974). Coastlines, fjords, valleys and lakes are often aligned with these landscape-scale structures; the alignment of the Indian River through the Park is thought to follow a fault radial to the Fairweather - Queen Charlotte complex (Chaney et al. 1995).

Bedrock underlying the Sitka area is comprised of greywacke with interbedded argillite that was formed in the Jurassic to Cretaceous Periods and intruded in the Neogene to Cretaceous Periods to produce dikes of fine-grained igneous rock. Within the Park, bedrock outcrops at Merrill Rock, along the Riverview Trail and presumably at the head of the estuary. Unconsolidated materials within the Park are modern beach or elevated shore and deltaic material deposited in the Holocene Epoch. In lowland areas upgradient of the Park, muskeg deposits and a discontinuous mantle of volcanic ash typically overlie glacial drift (Yehle 1974).

The Edgecumbe volcanic field is located on southern Kruzof Island, which bounds Sitka Sound to the west. The field is comprised of the Mt. Edgecumbe stratovolcano and the domes and craters along the adjacent ridge (Wood and Kienle 1990). Tephra deposited from the Pleistocene Epoch eruption of the Mt. Edgecumbe volcano complex can be seen as five foot thick deposits in the Sitka area and have been identified up to 200 km away. The last known eruption of Mt. Edgecumbe, dated at 4,500 years before present (ybp), deposited a tephra layer that is visible in the Park's upland soils (Kriekhaus et al. 1993).

Glaciers advanced across the land that is now Sitka in the Pleistocene Epoch, and receded some time before 10,000 ybp. Their legacy is visible in the 'U' shape of the Indian River drainage and the glacial till that mantles the valley floors. The combination of isostatic, tectonic and volcanic forces has raised the region at a rate of 0.23 cm per year, which has produced a total gain of 10.7 m since deglaciation (Yehle, 1974).

## Soils

Within the Park, soil development parallels the stability of the landform. The youngest soils are represented by the soil order Entisol (soils with little or no evidence of development of pedogenic horizons) and occur on the beach, uplifted beach meadow and estuary. Intermediately-aged soils are represented by the soil order Inceptisol (soils of humid regions that have altered horizons) and are associated with the floodplain, stream terrace and uplifted beach landforms. The oldest soils are represented by the soil order Spodosol (soils with accumulations of organic

material and aluminum, with or without iron) and are found in the lowlands and moraine. Soils belonging to the order Andisol (soils dominated by short-range-order minerals, such as volcanic glass) and Histisol (soils dominated by organic material) are also associated with the older, more stable landforms in the Park. Andisols occur in areas of sufficient tephra deposition and Histosols typically overlay the few areas of shallow bedrock within the Park (summarized from Kriekhaus et al. 1993).

### Vegetation

The vegetation of Sitka National Historical Park is predominantly a coastal temperate rainforest codominated by western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*) needleleaf tree species; riparian vegetation along the Indian River consists of a broadleaf forest dominated by red alder (*Alnus rubra*); the Park coastline is fringed with tidal, estuarine and beach meadow communities.

Needleleaf forest canopies are typically closed with stand demographics ranging from age-stratified old growth to more even-aged secondary growth. Sitka spruce and western hemlock grow to 46 m and reach diameters of 0.6 - 1.5 m (USFS 1994). Fluting and buttressing is common on larger western hemlock trees, likely in response to wind stress. Broadleaf forest types are stands of closed, even-aged red alder that are restricted to disturbed sites.

The composition of broadleaf and needleleaf forest understories appears to depend largely on soil drainage and type. Sites with well-drained mixed organic-mineral soils support a dense growth of salmonberry (*Rubus spectabilis*); moderately-drained, mesic soils support huckleberry (*Vaccinium parvifolium*) and blueberry species (*Vaccinium ovalifolium*, *V. alaskaense*); well-drained, wet soils support devil's club (*Oplopanax horridus*) and poorly-drained organic soils develop to freshwater wetlands indicated by American skunkcabbage (*Lysichiton americanus*; Hart Crowser 2002). In general, *Rubus spectabilis* is associated with young, broadleaf or mixed forest types; *Oplopanax horridus* indicates seral needleleaf forest types and *Vaccinium* species are characteristic of mature needleleaf forest types.

Tidally-influenced communities transition from sparse marine algae to tidal flat communities dominated by alkali grasses and succulent forbs. Depending on topography and freshwater inputs in the upper tidal range, these tidal flat communities transition to either estuary communities dominated by salt-tolerant graminoids or coastal meadows characterized by dunegrass and large umbelliferous forbs.

A population of the rare fern *Polystichum setigerum* (G3 S3<sup>1</sup>) is present in the Park. This species appears to grow in moist to mesic river - forest ecotones, mixed conifer forests, cottonwood forests on floodplains, and rock outcrops from near sea level to 550 m (AKNHP unpublished).

The accessibility, small size and island location of Sitka NHP render it more vulnerable to invasion by nonnative plant species than other Alaska National Park Service units (Bono 2013). Moderately-invasive creeping buttercup (*Ranunculus repens*, 54<sup>2</sup>) is the most abundant and widespread nonnative species in the Park. The ability of creeping buttercup to invade and persist in forested habitats makes it particularly difficult to control (Rapp 2006). The ornamental tree European mountain ash (*Sorbus aucuparia*, 59) has escaped cultivation to become the most structurally dominant nonnative plant in the Park. European mountain ash invades edge habitats and in more disturbed ecotones dominates the tree canopy. The presence of four populations of the extremely-invasive reed canarygrass (*Phalaris arundinacea*, 83) along the Indian River is of major concern as it is a successful invader of riparian and wetland habitats. The extremely-invasive herb Japanese knotweed (*Fallopia japonica*, 87) was reported from the Park footbridge in 2001, and following intense control efforts has not been redetected since 2009. Despite the apparent eradication of Japanese knotweed from the Park the potential for reintroduction of this species from cultivated areas in Sitka is high (Bono 2013).

### Ecological Units

An ecological unit combines concepts of landform, vegetation and soil. Seven terrestrial ecological units have been described and mapped for the Park (distributions shown in Figure 2, descriptions are summarized from Kriekhaus et al. 1993):

- The **Estuary** unit is the wetland occupying the intertidal range at the mouth of the Indian River. Vegetation is dominated by salt-tolerant graminoids and forbs such as *Deschampsia* species, *Festuca rubra*, *Carex lyngbyei*, *Puccinellia* species, *Plantago maritima* and *Honckenya peploides*. Soils in the landward portions of the estuary are poorly-drained sands and gravels belonging to the Typic Cryaquept subgroup; soils on the seaward boundary of the estuary are poorly-drained sands belong to the Typic Cryaquept subgroup.

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<sup>1</sup> Conservation status ranks estimate elimination risk posed to an ecological community. Ranks range from G5 = Secure, G4 = Apparently Secure, G3 = Vulnerable, G2 = Imperiled, G1 = Critically Imperiled, GNR = not yet ranked, and consider the rarity, trend and threats to a given ecological community. Ranks are collaboratively designated by the conservation group NatureServe and their partner organizations on global (G) and statewide (S) levels.

<sup>2</sup> The invasiveness rank developed by the Alaska Natural Heritage Program for nonnative plant species in Alaska is calculated based on a species' ecological impacts, biological attributes, distribution and response to control measures. The ranks are scaled from 0 to 100, with 0 representing a plant that poses no threat to native ecosystems and 100 representing a plant that poses a major threat to natural ecosystems.



- The **Uplifted Beach Meadow** unit occurs in the concave coastal lands subject to tidal inundation during extreme high tides and storm tides. Vegetation grades from beach meadow species such as *Leymus mollis* and *Heracleum maximum* to an *Alnus rubra* forest with *Rubus spectabilis* understory. Soils are well-drained beach sands and gravels belonging to the Typic Cryofluvent subgroup.
- The **Uplifted Beach** unit occurs in the convex coastal lands that are not subject to tidal inundation. Vegetation is needleleaf forest dominated by *Tsuga heterophylla* and *Picea sitchensis* with a shrub understory comprised of *Vaccinium* species and *Oplopanax horridus*. Soils are well-drained peat over sand and gravel belonging to the Entic Cryumbrepts subgroup.
- The **Floodplain** unit flanks the Indian River and is subject to flooding during periods of extremely high runoff (every 20 to 50 years). Vegetation is an *Alnus rubra* forest with *Rubus spectabilis* understory. Soils in topographic highs are moderately- to well-drained peat over sandy loam belonging to the Typic Cryumbrept subgroup. Soils in topographic lows are poorly-drained peat over loam belonging to the Aquic Cryumbrept subgroup.
- The **Stream Terrace** unit represents the inactive floodplain of the Indian River that is only subject to flooding during high-intensity, long-duration storms (every 50 to 100 years). Vegetation is needleleaf forest codominated by *Tsuga heterophylla* and *Picea sitchensis* with a shrub understory of *Oplopanax horridus*, *Rubus spectabilis* and *Vaccinium* species. Soils are well-drained peat overlying loam that coarsens with depth; soils belong to the Typic Cryochrept subgroup.
- Genesis of the **Moraine** unit is not certain; the landform has the shape and orientation of a lateral moraine, but more likely represents the highest elevation of the uplifted beach (G. Smith pers. comm.). Regardless of the origin of this landform, its vegetation is *Tsuga heterophylla* forest with a depauperate understory. Soils are well-drained peat overlying gravelly loam belonging to the Humic Cryorthod subgroup.
- The **Lowlands** unit occurs at the highest elevation of the park, but is considered a lowland based on its position within the greater landscape. Vegetation is *Tsuga heterophylla* forest with a shrub understory of *Vaccinium* species. Soils on gently sloping to level areas are well- to poorly-drained peat overlying gravelly loam or sandy loam that belongs to the Humic Cryorthods and Spodic Halplocryand subgroups, respectively. A third soil type occurs on a bedrock knob and is a well-drained peat over sandy loam underlain by shallow greywacke. This soil belongs to the dysic Lithic Cryofolist subgroup.

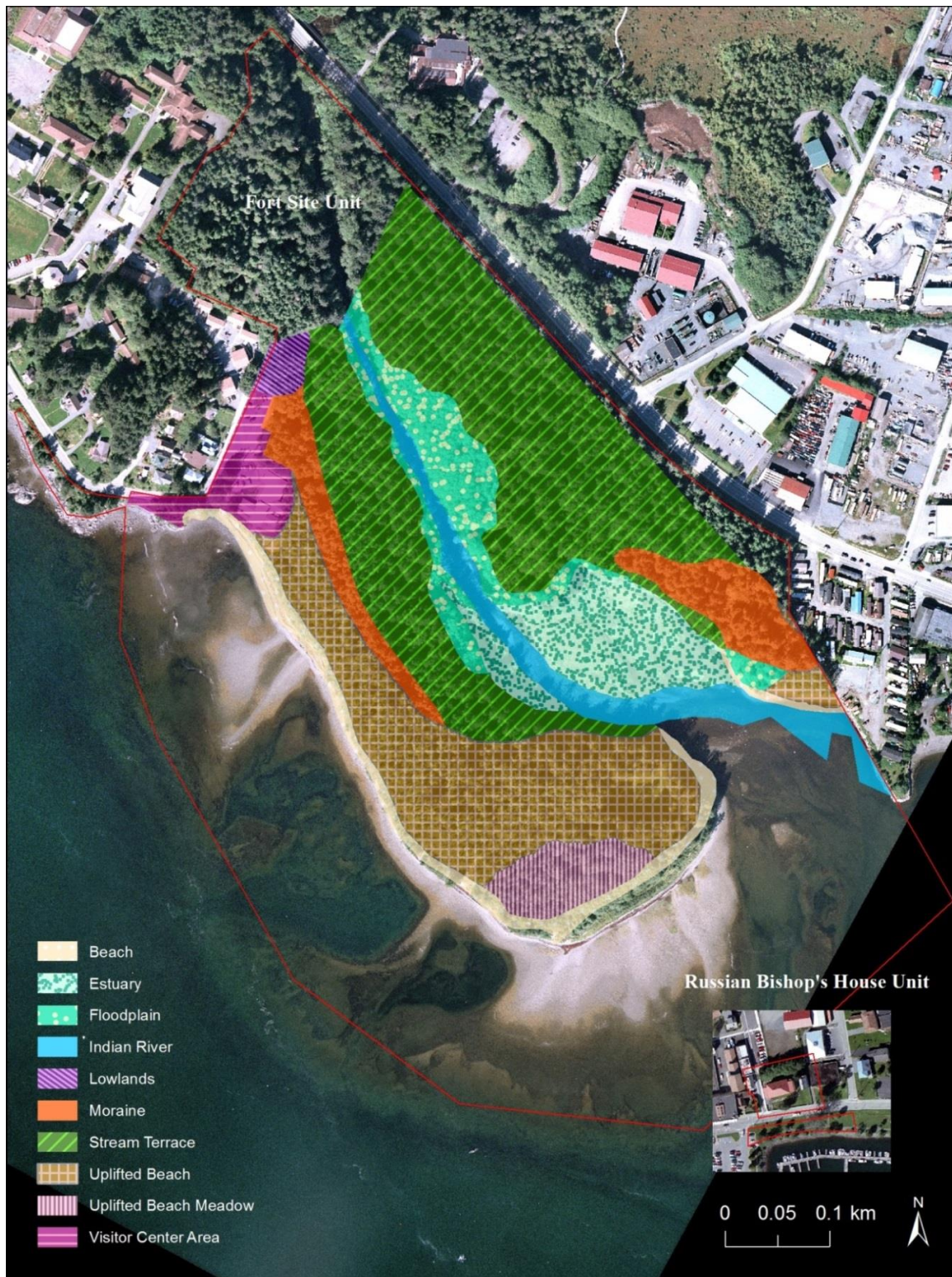


Figure 3. Distribution of ecological units occurring in Sitka National Historical Park, Alaska (modified from Kriekhaus et al. 1993). Ecological mapping was conducted prior to the 2001 acquisition of 6.5 acres of land from Sheldon Jackson College. For this reason, ecological units are not mapped for the northwest portion of the park.

## Disturbance

Significant anthropogenic disturbance is a condition of Sitka's long history of human habitation. The following presents a chronology of vegetation-disturbing activities within the Park as documented by Chaney et al. (1993) and Smith-Middleton and Alanen (1998):

1803	construction of the Kiks.ádi Tlingit Fort at the mouth of the Indian River
1827	construction of the first in a series of bridges across the Indian River
1869	construction of a road from Sitka to the Indian River by the U.S. Army
1884	construction of additional trails and two bridges by a crew of U.S. Marines and Native Alaskans
1888	construction of a suspension bridge across the Indian River
late 1800s and early 1900s	selective timber harvest by Russian and American settlers
1895	construction of the 'Point to Bridge' trail along the Indian River
1903	excavation of foundation pits for the erection of the Park's original totem poles
pre 1905	clearing of the forest understory by jail inmates
1906	construction of the Totem Trail
pre 1919	erection of a power line through the Park along the vegetation boundary between the forest and coast
1927	construction of a native blockhouse replica at the Park's southwestern corner, 100 feet of road reconstructed due to erosion along a bank of the Indian River
1939 - 1978	sporadic yet extensive gravel dredging at the mouth of the Indian River by various federal, state and private entities
1940	restoration of park totem poles requiring treatment with preservative and resetting; construction of pit toilets
1940 - 1941	harvest of timber by the U.S. Navy
1942	occupation of Park by the U.S. Army in support of WWII; erection of an aircraft observation post, two pyramid tents, a temporary building to serve as a mess hall and barracks, fire control station, search lights and several machine gun positions, reconstruction of a section of road that was destroyed by flooding
1944	restoration of occupied section of the park completed
1945	placement of 183 m (600 ft) of cribbing along the Indian River banks by U.S. Navy as the first of several erosion control projects; cribbing was washed out in a flood later the same year
1954	realignment of the abovementioned power line inland along Sawmill Creek Road
1958	closure of an asphalt plant that operated during the 1950s shoreward of the present day Russian Memorial
1959	demolition of the abovementioned blockhouse
1959	beginning of pulp mill operation at Sawmill Cove and subsequent wash-up of logs along the coastline
1961	placement of rip-rap along the Indian River for erosion control
1963	acquisition of the Sheldon Jackson Cottages located north of the present day Visitor Center; the cottages were burned by the fire department in 1965
1964 - 1965	construction of the Visitor Center
1966	construction of a new footbridge that was washed out the month after its completion
1967 - 1968	construction of the present day footbridge across the Indian River

1971 - 1973	totem pole preservation project; poles were taken down, moved to the fort site where they were soaked in vats of preservative and then re-erected
1980	construction of the Battleground Trail and a fitness trail on the east side of the river
1985	placement of additional rip-rap for erosion control along the Indian River
1993	closure of the pulp mill at Sawmill Cove
2011	construction of the Riverview Trail

Perhaps the most acute disturbances occurred in support of WWII. Fearing an imminent attack by Japanese forces, gravel was dredged from the mouth of the Indian River, an aircraft observation post was installed near the blockhouse replica, two pyramid tents, a temporary building to serve as a mess hall and barracks, fire control station, search lights and several machine gun and ammunition positions were constructed along the seaward side of Indian River Road. Gravel dredging caused significant modification to the shoreline and intertidal zone that remains visible in aerial photography today (Figure 1). The subsequent alternation of the Indian River's natural drainage pattern and gradient has intensified erosion along its lower stretches and threatens the integrity of the Fort Site (Chaney et al. 1995). Today, the largest human disturbance to the park is trampling from the 211,894 annual visitors (annual average from 2008 - 2012; NPS 2013b) along a network of established and social trails (Dudgeon 2006). The periodic addition of gravel to trails along the coast creates a semipermeable dam that is thought to impede the inundation of salt and brackish water during seasonal high tide and storm surge flooding (M. Shephard, Southwest Alaska Inventory and Monitoring Network Coordinator, pers. comm., 5-2013).

Significant natural disturbances in the Park include forest pests and pathogens, high-wind events, tidally-enhanced storm surges, as well as river flooding. The most significant forest pests and pathogens in Sitka are the spruce needle aphid, hemlock dwarf mistletoe and heart rot decay fungi (USFS 1994). Although dwarf mistletoe can kill trees in the park, typically forest pests and pathogens weaken rather than kill infected individuals, thereby increasing their susceptibility to more intense disturbances, such as windthrow. Thirty-one hazard trees, all weakened by pests and pathogens were identified in the Park in 1993 (USFS 1994).

High winds cause the greatest natural disturbances to Park vegetation. Southeast Alaska's temperate rainforests are susceptible to wind damage because of the combination of shallow root systems, poorly-drained soils, and high winds which often occur during peak rain events (Alaback 1990). Recent blowdown events in 1963, 1967, 1987 and 2004 opened gaps in the otherwise closed forest canopy and contribute to the shifting mosaic of successional stages across the Park. The December 2004 windstorm alone felled over 50 mature needleleaf trees within the Park (Dudgeon 2007). Although not well documented, it is likely that high tides magnified by high winds cause the inundation and subsequent weakening or death of salt-intolerant vegetation along the coast.

Similarly, river flooding erodes riverbanks, and uproots or inundates vegetation. Over-steepening of the Indian River gradient by the removal of gravel from the river's mouth has artificially increased the magnitude and scale of flooding. A major flood in 1942 eroded a swath of bank along the Indian River 3 - 15 m wide, and destroyed 61 m of road, 76 m of trail and the bridge over the Indian River; two army guards that happened to be on the bridge at the time were

drowned. Although not as well-documented, flooding in 1961 was reported to be of the same magnitude as the event in 1942. Iterations of the Indian River footbridge were washed away in 1961 and 1966.

### Succession

Isostatic uplift, sediment trapping behind driftwood and small-scale forest disturbances are the main successional drivers in Sitka NHP. Primary successional processes are initiated across coastal lands emerging through the intertidal zone, whereas secondary successional processes are initiated by disturbances that create openings in the otherwise closed canopy of Park forests. The trajectories of these processes largely depend on the topographic setting and degree of disturbance, respectively.

Along a rising coastline, tidal flat plant communities will migrate seaward to newly exposed land, while the upper tidal communities will pass out of tidal influence, allowing colonization by species from adjacent, nontidal communities. In the protected estuary formed at the mouth of the Indian River, tidal flat plant communities are expected to shift progressively from a sparse growth of halophytic grasses such as *Puccinellia nutkaensis* and succulent forbs such as *Cochlearia officinalis* towards a marsh community comprised of a denser and more diverse growth of salt- and flood-tolerant sedges and grasses such as *Carex lyngbyei* and *Deschampsia cespitosa*, respectively. Along the Park's semiexposed outer beach, this same tidal flat plant community will be colonized by salt-tolerant, yet flood-intolerant grasses such as *Leymus mollis* and large umbelliferous forbs such as *Heracleum maximum* and *Ligusticum scoticum*. As land rises above tidal influence, both the estuary and beach meadow communities will transition to the vegetation characteristic of the adjoining nontidal community (Batten et al. 1978, Boggs 2000, Cooper 1931).

In Sitka, the adjoining nontidal community is often comprised of young *Alnus rubra* underlain by a dense thicket of clonal *Rubus spectabilis*. *Alnus rubra* is a pioneer tree species common in disturbed open areas that is favored by high light levels and exposed, well-drained mineral soils; due to its tolerance of wet soils, *Alnus rubra* is common in riparian areas (Deal et al. 2004, Deal and Harrington 2006). With its high juvenile growth rates, *Alnus rubra* is ultimately replaced by longer-lived, shade-tolerant coniferous species with more sustained mature growth rates such as *Picea sitchensis* and *Tsuga heterophylla* (USFS 1994, Deal and Harrington 2006). In general, *Picea sitchensis* is more disturbance-tolerant and less shade-tolerant compared to *Tsuga heterophylla* and for these reasons is somewhat more common in the comparatively open and dynamic habitats towards the Indian River and coastline (USFS 1994). *Tsuga heterophylla* tends to colonize forests once their landforms become relatively stable.

The rate of primary successional change is well-captured in historical descriptions of park vegetation. In 1804 the fort site was open to the sea and river, whereas today, more than 200 years later, this maintained clearing is ringed by mature, closed-canopy forest (Smith-Middleton and Alanen 1998). Similarly, revisits to permanent vegetation monitoring plots along the Park's southernmost beach record a transition in landcover over 20 years from beach meadow (Kriekhaus et al. 1993) to red alder / salmonberry forest (LaBounty 2006 unpublished) to a red alder / salmonberry forest underlain by seral Sitka spruce (this study). Primary succession along the coast may have been accelerated by the presence of large (ca. 1 - 2 m diameter) cut logs that

escaped from the local pulp mill and washed ashore. Presumably, these logs trapped sediment and provided a protected microsite for early-seral plants to establish.

Secondary successional processes in Sitka forests are most commonly initiated by small-scale disturbances such as windthrow, pests or pathogens that through small gap succession contribute to a shifting mosaic of vegetation types and the complexity of forest structure and diversity (Deal et al. 2004). Such disturbances alter forest vigor and density, which through their relation to light interception by the canopy are thought to be the primary controlling factor in the secondary succession of southeast Alaska forests. In response to the favorable growth conditions created by overstory removal (more light, less competition with conifers), residual shrubs and tree seedlings have been shown to increase their growth with understory biomass peaking 15 - 25 years post-disturbance. During this phase of shrub and seedling regrowth, understory composition has been correlated to topsoil disturbance, with *Rubus spectabilis* colonizing highly disturbed sites and *Vaccinium alaskaense* and *V. parvifolium*, colonizing less disturbed sites. As the forest canopy closes, circa 25 - 35 years post disturbance, it has been shown that the presence of shrubs and herbs become greatly reduced and bryophytes and ferns begin to dominate the understory. This depauperate phase is particularly evident following blowdown in Sitka NHP and apparently distinguishes the needleleaf forests of southeast Alaska from most other forest types (Alaback 1982). Deciduous shrubs and herbs tend to reestablish around 140 - 160 years post-disturbance and continue to increase their abundance at the expense of bryophytes. Old-growth forest types dominated by *Tsuga heterophylla* are achieved in the final stages of succession. These forests are characterized by trees exceeding ages of 250 years, a multilayered canopy and presence of snags and coarse woody debris. The varied mesotopography and substrates of the forest floor in these older types supports a more diverse assemblage of plants, which is often dominated by *Vaccinium* shrubs and indicated by *Lysichiton americanus* (Alaback 1982, DeMeo et al. 1992). In Sitka NHP, similar old-growth forest types occupy the northern end of the Park whereas midseral forest types characterized by shrub stratum dominated by *Vaccinium* species or indicated by *Oplopanax horridus* types occupy the stream terraces of the Indian River.

Similar to quantifications of primary succession in Sitka NHP the rate of secondary succession is captured to some extent in historical descriptions of Park vegetation. Twenty years ago the USFS (1994) described the midseral forests flanking the Indian River (located within the Stream Terrace Ecological Unit of Kriekhaus et al. 1993) as, on the western side, dominated by *Picea sitchensis*, more highly disturbed and younger with an understory of *Rubus spectabilis* and *Oplopanax horridus* compared to, on the eastern side, a *Tsuga heterophylla*-dominated forest with an understory of *Vaccinium* species. In 2012 these midseral forests were mapped on the western side as Western Hemlock – Sitka Spruce / Blueberry Species Forest and on the eastern side as Sitka Spruce – Western Hemlock / Devil’s Club Forest. While a difference in forest type continues to be detected on either side of the Indian River this difference now appears to be more strongly associated with understory opposed to overstory composition. The current survey indicates that these midseral forests are generally codominated by *Picea sitchensis* and *Tsuga heterophylla* yet west of the river the forest understory is dominated by *Vaccinium* species and *Maianthemum dilatatum* whereas east of the river, forest understory is dominated by *Dryopteris expansa* and *Maianthemum dilatatum*. These transitions in understory composition suggest a successional sequence from *Rubus spectabilis* to *Vaccinium* species to *Dryopteris expansa* and *Maianthemum dilatatum* occurring on a decadal time scale.

### National Vegetation Classification

The landcover classes proposed herein were developed with reference to the Alaska Vegetation Classification (Viereck et al. 1992) as well as the plant association keys developed by DeMeo et al. (1992) and Martin et al. (1995) for the Tongass National Forest; however in an effort to comply with the developing national standard, the landcover classes identified for Sitka have been chiefly reconciled with the National Vegetation Classification (NVC). The NVC provides a consistent scheme allowing the production of uniform statistics about vegetation resources across the nation, based on vegetation data gathered at local, regional, or national levels (FGDC 2008) and is the classification used for landcover mapping for National Park units in the lower 48 states. The adoption of this standard in Alaska has been delayed by the paucity of formally described and accepted vegetation types at the lower floristic levels for our region.

The NVC is a hierarchical organization of cultural and natural vegetation. Cultural vegetation is defined as vegetation with a distinctive structure, composition, and development determined by regular human activity (Küchler 1969). Natural (including seminatural) vegetation is defined as vegetation where ecological processes primarily determine species and site characteristics; that is, vegetation comprised of a largely spontaneously growing set of plant species that are shaped by both site and biotic processes (Küchler 1969, Westhoff and van der Maarel 1973). Natural vegetation is further classified across eight levels defined by diagnostic growth forms at upper levels; on compositional similarity reflecting biogeographic differences, character species and dominant growth forms at intermediate levels; and on differential and dominant species and compositional similarity at lower floristic levels, in combination with specific physiognomic and habitat conditions. Within this classification the plant association is equivalent to a plant community.

Lower floristic levels have been drafted for Alaska, with the exception of some vegetation classes whose ranges extend to the Pacific Northwest; these classes have not undergone a formal review process. Unless otherwise noted, the Alliances and Associations listed in this report should be treated as provisional and checked against the NVC when finalized.

Table 1. Hierarchical organization of natural vegetation as proposed by the National Vegetation Classification standard.

Level	Description
<b>Class</b>	A vegetation classification unit of high rank (1st level) defined by broad combinations of dominant general growth forms adapted to basic moisture, temperature and/or substrate or aquatic conditions.
<b>Subclass</b>	A vegetation classification unit of high rank (2nd level) defined by combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position or that reflect overriding substrate or aquatic conditions.
<b>Formation</b>	A vegetation classification unit of high rank (3rd level) defined by combinations of dominant and diagnostic growth forms that reflect global macroclimatic conditions as modified by altitude, seasonality of precipitation, substrates and hydrologic conditions.
<b>Division</b>	A vegetation classification unit of intermediate rank (4th level) defined by combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant taxa that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology and disturbance regimes.
<b>Macrogroup</b>	A vegetation classification unit of intermediate rank (5th level) defined by combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and subcontinental to regional differences in mesoclimate, geology, substrates, hydrology and disturbance regimes.
<b>Group</b>	A vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and codominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology and disturbance regimes.
<b>Alliance</b>	A vegetation classification unit of low rank (7th level) containing one or more associations and defined by a characteristic range of species composition, habitat conditions, physiognomy and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation (Jennings et al. 2006). Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors and disturbance regimes.
<b>Associations</b>	A vegetation classification unit of low rank (8th level) defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy. Associations reflect topoedaphic climate, substrates, hydrology and disturbance regimes.

## Objectives

The landcover classification, descriptions and digital map produced for Sitka NHP as part of this project provide both a reference and framework for future resource management and change detection. This project provides the first landcover map for the Park, but is largely informed by the excellent work completed by Kriekhaus et al. (1993). Provisional plant alliances and associations are proposed for the Park in accordance with the draft NVC scheme.

This work was undertaken by the National Park Service Landcover Mapping Program, Inventory and Monitoring Program, Alaska Regional Office (AKRO) in cooperation with the Alaska Natural Heritage Program (AKNHP), University of Alaska Anchorage and in support of the Vital Signs Monitoring Plan for the Southeast Alaska Network (Moynahan and Johnson 2008). The goal of the NPS Inventory and Monitoring Program is to provide reliable and consistent information for assessing the status, condition and trend of key natural resources. Development of a landcover map for Sitka NHP was highlighted as a core ecological element (vital sign) necessary to provide a basic inventory on which this monitoring can be based (Moynahan and Johnson 2008) and resources can be managed.



## Literature Review

The following summarized the pertinent vegetation work that has been completed for Sitka NHP:

Ecological Inventory: Sitka National Historical Park (Kriekhaus et al. 1993): An inventory, classification and mapping of Park ecological units were conducted in 1993 to quantify the interactions between geology, vegetation and landform. This work identified seven terrestrial ecological units, nine plant associations and 14 soil classes. The plant associations and soil types occurring within each ecological unit were described but not mapped. The ecological units and their characteristic soils and vegetation are summarized in the 'Ecological Units' section of this report; the plant associations, which guided the landcover classification and mapping for this report, are listed in the 'Methods' section.

Vegetation Inventory and Forest Health Assessment: Sitka National Historical Park (USFS 1994): As a complement to the ecological inventory of the Park, vegetation inventory and forest health assessments were also conducted in 1993. This project placed 11 permanent vegetation plots to establish a baseline inventory of vegetation resources; species occurrence data included vascular but not nonvascular plants. Forest health was assessed from vegetation plot data in combination with hazard tree, insect and disease evaluations.

Physical and Cultural Landscapes of Sitka (Chaney et al. 1995): This report integrates the geologic, climatic and human history of the region to evaluate the archaeological potential of landforms within the Park. Among other syntheses, an evolution of landforms and their coarse-scale vegetation types from ca. 2600 BC to the present day is proposed.

Sitka National Historical Park Wetland Delineation (Hart Crowser 2002): Three nonjurisdictional, palustrine wetlands and three unvegetated riverine wetlands (the Indian River and its unnamed tributaries) were identified in the approximately 2.6 hectares tract that was appended to the northern end of Sitka NHP in 2001.

Nonvascular Plants of Sitka National Historical Park (LaBounty 2005): This inventory documents the presence of 114 bryophyte, 85 lichen, ten fern and one fern ally species within the Park and discusses their distribution relative to ecological units, mesohabitat and microhabitat.

Permanent Vegetation Plot Revisit (LaBounty unpublished): Ten of the 11 permanent vegetation plots (the estuary plot could not be relocated) placed by the USFS in 1993 were revisited by LaBounty in 2006. Original field sampling protocols were followed to allow direct comparisons between the two generations of plot data. Different from the original survey, both vascular and nonvascular species occurrence data were collected.

Invasive and Exotic Plant Species Management in Sitka National Historical Park (Bono 2013): The most recent in a series of annual reports on the status of nonnative plant species within the Park. Compared to most parks in Alaska, Sitka NHP is highly infested, with nonnative plants occupying 6% of the total park area (2.8 hectares). Species prioritized for control are the ornamental tree European mountain ash (*Sorbus aucuparia*), which is a widespread and abundant colonizer of midsuccessional vegetation types and the extremely invasive reed canary grass (*Phalaris arundinacea*), which represents a considerable threat to riparian habitats within the Park.

## Methods

The landcover classification, descriptions and map developed for Sitka NHP are based on current aerial photography and field checked by vegetation survey. To the extent possible, this project incorporated archival vegetation plot data collected in 1993 (Kriekhaus et al.) and 2006 (LaBounty unpublished). Prior to field work, draft landcover classes were premapped on aerial photography taken in 1999. Following field work, landcover classes were finalized on aerial photography taken in 2012 with reference to vegetation plot data collected in the same year.

### Sampling Design

Vegetation was sampled to identify and characterize the landcover types across the Park. Plots were located to capture the full variation of vegetation and to correlate the different vegetation types to their photographic signatures. Sampling intensity was guided by the size of the park, preexisting vegetation data, complexity of environment and inherent variability of the vegetation (NPS 1994). By Alaska standards, Sitka NHP is a relatively small park with a wealth of preexisting vegetation data; however, its transitional landscape position and high levels of disturbance amplify its environmental complexity and vegetation variability. For accessible parks of medium size (1 - 100km<sup>2</sup>), such as Sitka NHP, a sampling intensity that places plots in representative vegetation polygons across the entire park is recommended (NPS 1994). Long-term vegetation monitoring plots were established for the Park in 1993 and were resampled in 2006 (Kriekhaus et al. 1993, LaBounty unpublished). The species occurrence and abundance data collected for both the 1993 and 2006 surveys, as well as ecological units mapped as part of the 1993 effort, were used to premap the landcover polygons and place plots for the 2012 field work. To capture the variation in vegetation among units, novel combinations of vegetation and ecological units were identified in a GIS environment. A minimum of one plot was placed in the ecological unit/vegetation type polygon. For example, if a western hemlock / blueberry species forest polygon spanned the stream terrace and lowland ecological units, then two plots were proposed for the vegetation polygon with one located in each ecological unit type. Alternatively, if one ecological unit spanned two vegetation polygons, then two plots were proposed for the ecological unit with one located in each vegetation type. Professional judgment was used to place plots in the 6.5-acre parcel that was added to the northwest section of the Park after ecological units had been mapped. In an effort to maximize the information gained, supplemental vegetation plots were preferentially placed in areas with undersampled or unresolved vegetation or photosignatures as well as along the coastal and riparian gradients present in the Park.

### Field Methods

Field work was conducted June 25 - 29, 2012 by Lindsey Flagstad (AKNHP) and Beth Koltun (NPS). At each sample site a 100 m<sup>2</sup> or 400 m<sup>2</sup> vegetation plot was established, with plot size dependent on the physiognomy of the dominant vegetation. Smaller plots were completed for barren, sparse and herbaceous types, with plot dimensions increased for forested types. Plot boundaries were modified while maintaining total plot area to capture linear features.

All vascular and the dominant nonvascular plant taxa occurring within the plot were recorded, with dominance defined as those taxa with foliar cover exceeding 5%. Taxa that could not be accurately or efficiently identified in the field were collected and pressed for later identification. A complete species list is provided as Appendix B. Percent covers were estimated for all taxa, physiognomic groups (e.g. coniferous forest, tall shrub, forb) and categories of unvegetated

groundcover (e.g. gravel, cobble). Aerial cover is the vertical projection of an individual plant's foliage, or the outline collectively covered by all individuals of a species or physiognomic group on the ground as viewed from above (Brown 1954, Daubenmire 1959). Tree canopy covers were quantified using a densitometer; all other covers were estimated ocularly. These methods of cover estimation are considered equal and treated as such (Vora 1988). Where multiple strata of vegetation were present (e.g. tree, shrub, herb) total cover often exceed 100%. Height was recorded in meters for woody taxa and physiognomic groups.

Tree heights were captured using a Laser Technology Inc. TruPulse 360 rangefinder; all other heights were estimated ocularly. Latitude, longitude, elevation and positional error were recorded at the approximate center of each plot with a Trimble GeoXT 2008 hand-held GPS unit equipped with an external Hurricane model antenna. Due to the difficulty of achieving the positional accuracy necessary to log a point using the Trimble unit under a dense forest canopy in mountainous terrain, backup points were logged at lower accuracy using a Garmin 76CSx hand-held GPS unit. Terrain slope was measured using a clinometer and recorded in degrees from level. Aspect was measured using a hand-held compass and recorded in degrees from true north. Landform and moisture class were described in accordance with Kriekhaus et al. (1993) and Viereck et al. (1992), respectively. All data were recorded on field forms (Appendix D) for later entry to tabular (Microsoft Access) and spatial (ArcMap geodatabase) formats. Abiotic site data is summarized in Appendix C.

### **Mapping Methods**

Premapping of landcover class boundaries were manually digitized in ArcGIS 10 on an orthorectified color-infrared aerial photograph taken on August 1, 1999 at a scale of 1:12,000 and with a pixel ground resolution of 6 m (Tobler 1987). Landover types were premapped from patterns of tone, texture, color and contrast; vegetation types were preassigned from plot data collected by Kriekhaus et al. in 1993 and LaBounty in 2006 (unpublished).

Final mapping of landcover class boundaries was performed in ArcMap 10.1 on a true-color orthorectified mosaic of aerial photographs taken on August 29, 2012 at a scale 1:3,000 with a pixel ground resolution of 0.15 m (Tobler 1987). Mapping was manually adjusted where plot data indicated a different landcover type or the newer imagery suggested a different extent of the landcover class. A minimum mapping unit of one acre was applied when appropriate; however, many herbaceous communities whose extent were well-defined yet occupied less than one acre were delineated to add value to the map products. The distribution of forested wetlands was well below the minimum mapping unit of one acre set for this project and difficult to delineate under closed canopy. All manual digitizing was performed in Zone 8 of the Universal Transverse Mercator coordinate system (UTM8). All landcover class areas were calculated using the spatial analysis tools available in ArcGIS 10.1.

In accordance with the scope of work, existing (as opposed to potential) landcover was mapped in general accordance with the below-listed plant associations. These associations were described and correlated to ecological units, but not mapped, by Kriekhaus et al. (1993).

- western hemlock / blueberry
- western hemlock / devil's club
- Sitka spruce / devil's club – salmonberry

- Sitka spruce / salmonberry
- red alder / salmonberry
- red alder
- red alder – Sitka spruce / salmonberry
- grass – umbel
- estuarine communities

Different from the Kriekhaus associations, the landcover classes mapped for this project incorporate sparse, barren and cultural vegetation; they split estuarine communities into finer classes and combine several of the needleleaf forested classes to account for codominance of western hemlock and Sitka spruce and to also account for the difficulty in determining understory composition beneath a closed canopy. A dichotomous key to the landcover types of Sitka NHP was developed to document the current classification efforts as well as to provide a framework for future field identification and classification. Landcover class descriptions discussing vegetation, site characteristics, distribution, disturbance, succession and relationship to the National Vegetation Classification are given for each type.

### **Vegetation Classification**

Landcover classes developed for this project were reconciled with the draft NVC scheme to the extent possible. With the exception of a few landcover classes that approximate the association level, the Sitka landcover classes fall between the alliance and association levels. Placement in the NVC was informed by the draft hierarchy and Alaska group descriptions that were generously provided by their authors, and also by the catalogue of Plant Associations maintained by AKNHP, which compiles information on over 1,300 plant associations documented for Alaska.

### **Nomenclature**

Landcover class, plant alliance and plant association names were proposed based on professional judgment and review of ecological communities previously described for the area (see DeMeo et al. 1992, Martin et al. 1995, Kriekhaus et al. 1993). Alliances and associations were named in accordance with guidance set forth in the National Vegetation Classification (FGDC 2008). Taxonomy follows the standardized names provided by the PLANTS Database (USDA, NRCS 2013). Due to taxonomic uncertainty and the difficulty of efficiently separating *Vaccinium ovalifolium* from *V. alaskaense* in the field after flowering yet before the maturation of fruit, these shrubs are collectively referred to as *Vaccinium ovalifolium*.

## Results

The landcover classes described for Sitka NHP represent both natural and cultural vegetation and developmental stages ranging from barren ground to old growth forest. Fifteen landcover classes, based on 27 field vegetation plots, have been identified (Figure 3). Twelve of the landcover classes represent natural vegetation, two classes are unvegetated and one class represents cultural vegetation. Almost half of the total Park area is occupied by forested landcover classes (Table 2). Accordingly, the forest physiognomic class is represented by the greatest number of landcover classes and plant associations. Herbaceous, Sparse and Barren classes each occupy less than 10% of the total Park area and Shrublands are not represented. The distribution of landcover classes within the park is shown in Figure 4.

Table 2. Summary of area occupied and vegetation classes represented by physiognomic type in Sitka National Historical Park, Alaska.

Physiognomic Type <sup>1</sup>	Hectares	Percent Area	Number of Landcover Classes Represented	Number of Plant Associations Represented
<b>Forest</b>	22.5	47.8	7	14
<b>Herbaceous</b>	2.5	5.2	4	9
<b>Sparse or Barren</b>	4.0	8.6	2	none described
<b>Developed</b>	1.4	2.9	1	not applicable
<b>Water</b>	16.7	35.4	1	not applicable
<b>Total</b>	47.0	100.0	15	23

<sup>1</sup> Physiognomic Types are defined as follows:

Forest: natural vegetation with at least 10% cover of trees

Herbaceous: natural vegetation with less than 10% cover of woody plants; includes both forbs and graminoids

Sparse: natural vegetation of any type with at least 10% but less than 25% cover

Barren: natural vegetation of any type with less than 10% cover

Developed: cultural vegetation or areas occupied by more than 25% of constructed materials

Water: open fresh or salt water with less than 25% cover of vegetation



Figure 4. Vegetation plot and conceptual cross-section locations, Sitka National Historical Park, Alaska.

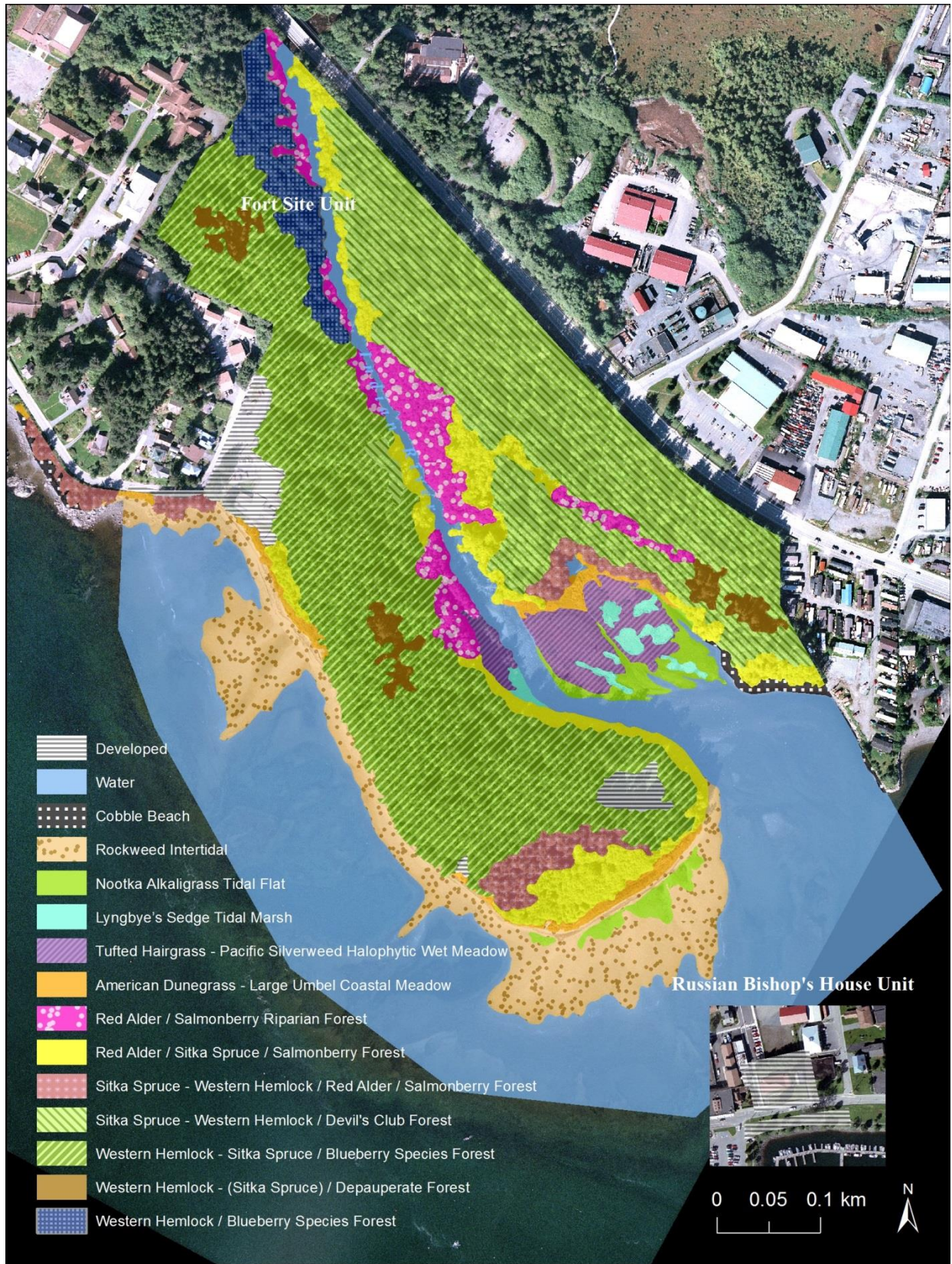


Figure 5. Landcover map, Sitka National Historical Park, Alaska.

Five of the landcover types described for Sitka NHP approximate the plant association level of the NVC. However, due to variability within the landcover classes and the difficulty of determining understory composition and extent through a closed canopy, the remaining landcover classes are classified at a coarser scale. The plant associations that are either equivalent to, or nested within a given landcover class are listed in the landcover class description. A total of 23 plant associations were assigned to landcover classes; seven have been formally described, and 16 are provisional plant associations that have been identified as occurring in Alaska by other authors but have not undergone formal review. None of the plant associations known or thought to occur in Sitka NHP are considered rare (with rarity defined as a conservation status of G1 or G2, S1 or S2), and although the range and extent of provisional plant associations is not completely known, it is thought that these associations commonly occur outside of the Park and that their distribution is relatively secure. Although not rare, the following plant associations occurring within Sitka NHP are considered vulnerable due to their inherent rarity, declining trend or threatened status at global (G) and state (S) levels:

<i>Picea sitchensis</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i> Woodland	G3 S4
<i>Picea sitchensis</i> - <i>Tsuga heterophylla</i> / <i>Oplopanax horridus</i> - <i>Rubus spectabilis</i> / <i>Gymnocarpium dryopteris</i> Forest	G3 S3
<i>Deschampsia cespitosa</i> - <i>Argentina egedii</i> Herbaceous Vegetation	G3 SNR
<i>Deschampsia cespitosa</i>	G4 S3

A total of 114 plant taxa, representing 39% of the total 367 taxa confirmed for Sitka NHP were documented during field work; trees are represented by seven taxa, shrubs by 13 taxa, graminoids by 22 taxa, forbs by 55 taxa, ferns by 5 taxa and nonvascular species by 12 taxa. The 102 vascular plant taxa documented in our survey represent 61% of the 168 vascular plants known to occur in the Park (NPS 2013a). Likely because the current survey recorded dominant nonvascular species and did not target microhabitats, the 12 nonvascular plant taxa documented represent only 6% of the 199 nonvascular plants known to occur in the Park (LaBounty 2005). Nonnative plants were represented by 14 taxa. The ornamental tree, European mountain ash (*Sorbus aucuparia*), is the only nonnative plant species that occurred at covers high enough to influence classification. Within disturbed mixed forest classes such as Sitka spruce – western hemlock / red alder / salmonberry and red alder / Sitka spruce / salmonberry, *Sorbus aucuparia* often codominated the broadleaf component; however, it was not included as a nominal species.

The diversity of natural vegetation and landcover types present in Sitka NHP is captured in beach, estuary and river ecological gradients. Conceptual cross-sections depicting these gradients are provided in Figures 5, 6, 7; the locations of these cross-sections are shown in Figure 3. Because the Park is situated along a rising coastline, the progression of landcover types across both the beach and estuary cross-sections mimics a generalized successional sequence whereas the sequence of landcover classes across the river cross-section is thought to reflect change in disturbance regime and soil moisture regime.



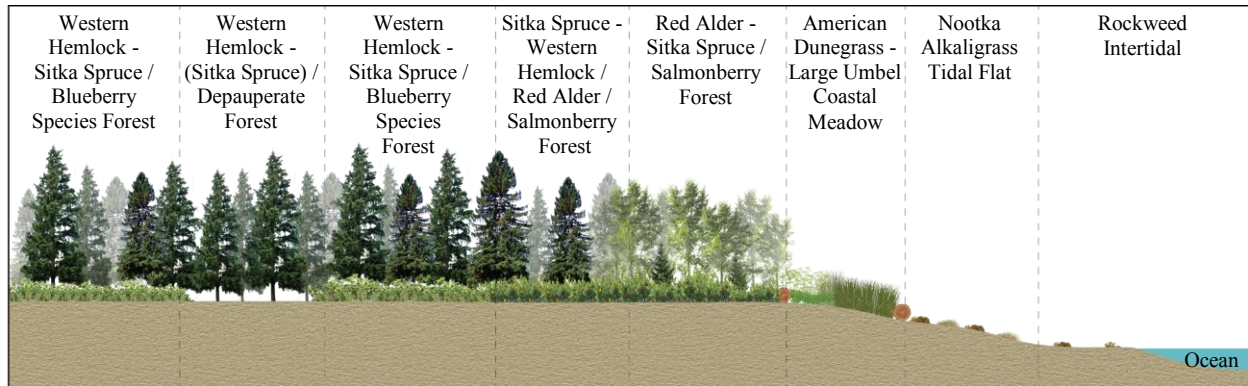


Figure 6. Conceptual cross-section of the landcover classes likely to be encountered across a beach ecological gradient in Sitka National Historical Park, Alaska.

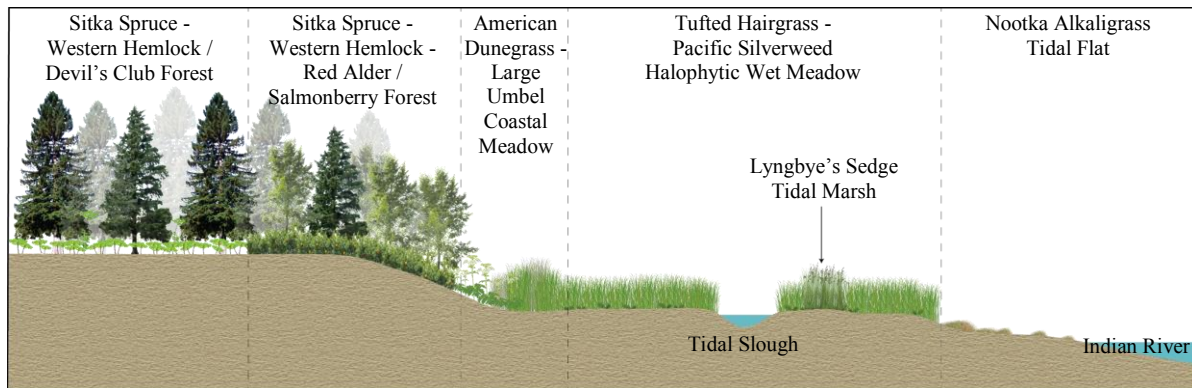


Figure 7. Conceptual cross-section of the landcover classes likely to be encountered across an estuarine ecological gradient in Sitka National Historical Park, Alaska.

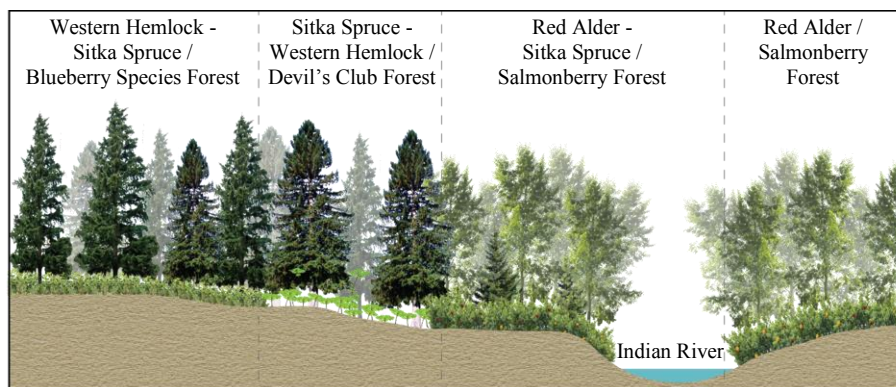


Figure 8. Conceptual cross-section of the landcover classes likely to be encountered across a riparian ecological gradient in Sitka National Historical Park, Alaska.

## Key to Sitka National Historical Park Landcover Classes

This dichotomous key can be used for the identification of landcover classes from vegetation plot data collected within Sitka NHP. For best results:

1. Locate a representative portion of the site in question. The vegetation and environment within the site should be relatively homogeneous.
2. Estimate the canopy cover for the diagnostic species used in the key.
3. Beginning with the Master Key, apply the couplets in sequential order to identify a landcover class.
4. To ensure accuracy, compare the written description of the landcover class with species composition, vegetation structure, and site characteristics. Ocular estimates can be imprecise, so if the site description does not fit the classification, revisit the key allowing a margin of +/- 5 percent in the cover cut levels.

### Master Key:

- 1a. Cultural vegetation: where vegetation displays a characteristic combination of dominant growth forms adapted to relatively intensive human manipulations ..... **Developed Landcover Class**
- 1b. Natural vegetation: where ecological processes primarily determine species and site characteristics..... 2
- 2a. Trees comprise more than 10% of total canopy cover ..... Forest (3)
- 2b. Trees comprise less than 10% of total canopy cover ..... 4
- 3a. Needleleaf species comprise at least 75% of tree cover ..... Needleleaf Forest Key
- 3b. Needleleaf species comprise less than 75% of tree cover ..... 5
- 4a. Total vegetation cover is less than 25%..... Barren and Sparse Vegetation Key
- 4b. Total vegetation cover is more than 25% ..... Herbaceous Vegetation Key
- 5a. Broadleaf species comprise more than 75% of tree cover ..... **Red Alder / Salmonberry Riparian Forest Landcover Class**
- 5b. Broadleaf or needleleaf species comprise 25 - 75% of the tree cover ..... **Red Alder / Sitka Spruce / Salmonberry Forest Landcover Class**

### Needleleaf Forest Key:

- 1a. *Tsuga heterophylla* contributes at least 75% of tree cover ..... 2
- 1b. *Tsuga heterophylla* or *Picea sitchensis* each contribute 25 to 75% of tree cover ..... 3
- 2a. Understory depauperate with respect to vascular plant species; moss species comprise more than 25% of ground cover ..... **Western Hemlock – (Sitka Spruce) / Depauperate Forest Landcover Class (in part)**

- 2b. Understory with well-developed shrub layer where *Vaccinium* species (*V. parvifolium*, *V. ovalifolium*, *V. alaskaense*) collectively comprise more than 25% cover .....  
 ..... **Western Hemlock / Blueberry Species Forest Landcover Class**
- 3a. *Alnus rubra* comprises at least 10% of tree cover.....  
 ..... **Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest Landcover Class**
- 3b. *Alnus rubra* comprises less than 10% of tree cover..... 4
- 4a. *Oplopanax horridus* cover is at least 5% .....  
 ..... **Sitka Spruce – Western Hemlock / Devil’s Club Forest Landcover Class**
- 4b. *Oplopanax horridus* cover is less than 5% ..... 6
- 6a. Understory depauperate with respect to vascular plant species; moss species comprise more than 25% of ground cover .....  
 ..... **Western Hemlock – (Sitka Spruce) / Depauperate Forest Landcover Class (in part)**
- 6b. Understory with well-developed shrub layer where *Vaccinium* species (*V. parvifolium*, *V. ovalifolium*, *V. alaskaense*) collectively comprise more than 25% cover .....  
 ..... **Western Hemlock – Sitka Spruce / Blueberry Species Forest Landcover Class**

Herbaceous Vegetation Key:

- 1a. Tidally-influenced communities where graminoid cover is dominated by halophytic *Puccinellia nutkaensis* and succulent forb species such as *Plantago maritima* var. *juncooides*, *Atriplex alaskensis*, *Cochlearia officinalis* and *Spergularia canadensis* are present .....  
 ..... **Nootka Alkaligrass Tidal Flat Landcover Class**
- 1b. Tidally-influenced communities where graminoid cover is dominated by *Carex Lyngbyei* .....  
 ..... **Lyngbye’s Sedge Tidal Marsh Landcover Class**
- 1c. Tidally-influenced communities where graminoid cover is dominated by *Deschampsia cespitosa* or *Deschampsia beringensis* and halophytic forb species such as *Argentina egedii* and *Plantago macrocarpa* are present .....  
 ..... **Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow Landcover Class**
- 1d. Coastal meadow communities where graminoid cover is dominated by *Leymus mollis* and large umbelliferous forb species such as *Heracleum maximum*, *Conioselinum chinense*, *Angelica lucida* and *Ligusticum scoticum* are present .....  
 ..... **American Dunegrass – Large Umbel Coastal Meadow Landcover Class**

Barren and Sparse Vegetation Key:

- 1a. Total vegetated cover is 10 - 25% and is dominated by marine algae .....  
 ..... **Rockweed Intertidal Landcover Class**
- 1b. Total vegetated cover is less than 10% ..... **Cobble Beach Landcover Class**

## Description of Landcover Class Fields

**Translated Name:** common names of nominal taxa

**Scientific Name:** scientific names of nominal taxa

The following rules apply to both scientific and translated nomenclature:

- Taxa occurring in the same strata are separated by a hyphen (-)
- Taxa occurring in different strata are separated by a forward slash (/)
- Taxa included parenthetically occur in the plant association with less consistency
- Taxa occurring in the uppermost stratum are listed first, followed successively by those in lower strata. Within the same stratum, the order of names generally reflects decreasing levels of dominance, constancy or diagnostic value of the taxa.
- Taxonomy is given in accordance with nomenclature accepted by the USDA PLANTS Database (USDA, NRCS 2013)

**Number of Plots Sampled:** number and site code of plots sampled that represent the landcover class. A site code included parenthetically indicates that plot data were used to inform the landcover class, but do not necessarily key to that landcover class. Anomalous plots are discussed in the 'Classification Comments for the Association Level' section of each landcover class description.

**Vegetation:** a summary of the floristic composition and physiognomy of the landcover class including the taxa observed, the vertical strata in which these taxa occur, and the minimum cover values required for inclusion in the class. Indicator species, the influence of mesohabitat and the variability of inconstant (nondiagnostic) species may also be discussed.

**Site Characteristics:** a summary of the landscape position and topography of the landcover class within the Park

**Landform:** the range of landforms on which the landcover class occurs

**Hydrologic Regime:** the range of hydrologic regimes characterizing the landcover class

**Slope:** the range of terrain slope values characterizing the landcover class measured in degrees from level

**Aspect:** the range of terrain aspects characterizing the landcover class measured in degrees from North

**Elevation:** the range of elevations characterizing the landcover class measured in meters above mean sea level

**Map Area:** the total area occupied by the landcover class given in hectares and percent of total Park land.

**Succession and Disturbance:** a summary of the successional and disturbance regimes that influence the stability and within-stand pattern of the type.

**Distribution:** distribution of the landcover class within the Park (unless otherwise noted) including comments on patch size. Large patches are 48.5 - 2023 hectares (120 - 5,000 acres), small patches are 0.4 - 48.5 hectares (1 - 120 acres) and linear patches are typically four times as

long as broad. As the total area of Sitka NHP is just less than 48.5 hectares (120 acres), all landcover classes within the Park occur as small patch types.

**Constancy and Cover (table):** constancy is defined as the percentage of plots in which a species occurred. Mean cover is defined as the average percent cover for that species across all plots in the landcover class. The range of cover lists the lowest and highest cover values recorded for a given taxon. All taxa with an average canopy cover of at least 1% across all plots in the landcover class are included. Plant heights are given for woody species only. For a complete species list for each landcover class see Appendix A.

**Placement of Landcover Class in the NVC Hierarchy (table):** the National Vegetation Classification (NVC) provides a consistent national vegetation classification in order to produce uniform statistics about vegetation resources across the nation based on vegetation data gathered at local, regional, or national levels (FGDC 2008). The Classification is a nested, hierarchical organization of existing cultural and natural vegetation. A provisional status indicates that the vegetation type has not been formally described but is expected to be added to the NVC in the future. Levels comprising the hierarchy are defined in Table 1. Please note the NVC organization, types and descriptions are drafts and are undergoing peer review.

**Classification Comments for the NVC Group Level:** the rationale for the placement of the landcover class within the group level of the NVC. Inclusion of nominal species may also be discussed. Classification comments from NatureServe are provided when available.

**Plant Association (table):** a list of plant associations known or expected to be included in the landcover class based on plot data collected in the present and previous studies. Listings include the associations' name, citations, identifier, conservation status and classification confidence. Plant associations accepted by NatureServe are assigned a unique identifier; associations that have been identified by the Alaska Natural Heritage Program but have not undergone formal description or review are designated as provisional.

**Classification Confidence for the NVC Association (field in table):** listed in the Plant Association table - a summary of the overall confidence level for the type. High: classification is based on quantitative analysis of verifiable, high-quality classification plots that are published in full or archived in a publically accessible database. Moderate: classification is lacking in either geographic scope or degree of quantitative characterization and subsequent comparison with related types but otherwise meets the requirements for a 'High' classification. Low: classification is based on plot data that are incomplete, not accessible to others or not published, or based on qualitative analysis, anecdotal information, or community descriptions that are not accompanied by plot data.

**Conservation Status of the NVC Association (field in table):** conservation status ranks estimate elimination risk posed to the component plant association(s). Ranks range from G5 = Secure, G4 = Apparently Secure, G3 = Vulnerable, G2 = Imperiled, G1 = Critically Imperiled, GNR = not yet ranked), and consider the rarity, trend and threats to a given ecological community. Ranks are collaboratively designated by the conservation group, NatureServe and their partner organizations on global (G) and statewide (S) levels. Global ranks are taken from NatureServe; state ranks are taken from the Alaska Natural Heritage Program Plant Association database.

**Classification Comments for the NVC Association:** the rationale for the placement of the plant associations within NVC and the landcover class. Inclusion of nominal species may also be discussed. Classification comments from NatureServe are provided when available.

**Conservation Status Justification for the NVC Association:** comments on the rarity, trend of, and threats to a given plant association. Rarity assesses the range extent, area of occupancy and number of occurrences of the community. Threats assess the overall threat impact to, or the intrinsic vulnerability of, the community. Trends assess the short and long-term direction of rarity of the community. Rank information is taken directly from NatureServe (2013) and is included when available.

## Description of Landcover Classes

### Red Alder / Salmonberry Riparian Forest Landcover Class

*Alnus rubra* / *Rubus spectabilis* Riparian Forest Landcover Class

**Number of Plots Sampled:** 4 (SITK03, 06, 15, 21)

**Vegetation:** A closed-canopy, broadleaf forest type where *Alnus rubra* and *Sorbus aucuparia* comprise more than 75% of the total tree cover. The typically even-aged stand of *Alnus rubra* is underlain by a dense shrub stratum of *Rubus spectabilis* with a constant yet minor cover of *Sambucus racemosa*. The presence of *Rubus spectabilis* in the understory indicates more stable ground within the riparian zone (DeMeo et al. 1992). The forb *Maianthemum dilatatum* is abundant and often present; the forb *Streptopus amplexifolius* and the ferns *Athyrium filix-femina* and *Dryopteris expansa* are constantly present at low cover. In more stable areas, a regenerative substratum of *Picea sitchensis*, and less commonly, *Tsuga heterophylla* saplings are present. The nonnative tree *Sorbus aucuparia* is more common in human-disturbed habitats.

**Site Characteristics:** Occurring on low-elevation, frequently disturbed sites; often associated with riparian environments.

**Landform:** floodplain, stream terrace

**Hydrologic Regime:** mesic - wet

**Slope:** 3 - 28°

**Aspect:** 40° (west bank) or 230° (east bank)

**Elevation:** 1.3 - 16.0 m

**Map Area:** 1.6 hectare, 3.3%

**Succession and Disturbance:** An early-successional type that likely develops from sparse floodplain vegetation and in the absence of disturbance presumably develops towards a Sitka spruce forest type. Disturbance is fluvial and includes seasonal flooding.

**Distribution:** Occurring as small, linear patches along riparian corridors or other disturbed areas such as trail alignments.



**Constancy and Cover:** The red alder / salmonberry forest landcover class is supported by vegetation data collected from four plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Tree</b>				
<i>Alnus rubra</i>	100	66	60 - 75	16 - 25
<i>Picea sitchensis</i>	75	8	5 - 15	4 - 6
<i>Tsuga heterophylla</i>	75	6	3 - 10	6 - 7.9
<i>Sorbus aucuparia</i>	25	2	-	10.7
<b>Shrub</b>				
<i>Rubus spectabilis</i>	100	58	50 - 65	1.6 - 3
<i>Ribes bracteosum</i>	75	4	2 - 10	1 - 1.2
<i>Sambucus racemosa</i>	75	10	8 - 20	2.5 - 5
<i>Oplopanax horridus</i>	25	3	-	1.2
<i>Vaccinium parvifolium</i>	25	1	-	1.5
<b>Forb</b>				
<i>Streptopus amplexifolius</i>	100	2	-	-
<i>Maianthemum dilatatum</i>	75	21	-	-
<i>Osmorhiza</i> sp.	75	2	-	-
<i>Tiarella trifoliata</i>	75	6	-	-
<i>Viola glabella</i>	75	5	-	-
<i>Aruncus dioicus</i>	25	1	-	0.8
<i>Cardamine oligosperma</i>	25	1	-	-
<i>Prenanthes alata</i>	25	1	-	-
<b>Fern</b>				
<i>Athyrium filix-femina</i>	100	2	-	-
<i>Dryopteris expansa</i>	100	4	-	-
<b>Nonvascular</b>				
<i>Eurhynchium oreganum</i>	75	10	-	-
<i>Rhytidiadelphus loreus</i>	75	11	-	-
<i>Hylocomium splendens</i>	50	4	-	-
<i>Plagiomnium insigne</i>	50	8	-	-
<i>Polytrichastrum alpinum</i>	50	3	-	-
<i>Rhizomnium glabrescens</i>	50	4	-	-
<i>Climacium dendroides</i>	25	3	-	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following NVC hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Temperate Swamp & Flooded Forest
Division	Western North American Flooded & Swamp Forest
Macrogroup	Vancouverian Flooded & Swamp Forest
Group	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> – <i>Alnus rubra</i> Lowland Riparian Forest & Woodland
Alliance	Red Alder Wet Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:** Stands in the *Populus balsamifera* ssp. *trichocarpa* – *Alnus rubra* Lowland Riparian Forest & Woodland Group are linear in character, occurring on floodplains or lower terraces of rivers and streams. Major broadleaf dominant species are *Alnus rubra*, *Populus balsamifera* ssp. *trichocarpa*, *Salix lucida* ssp. *lasiandra*, (and *Acer macrophyllum* and *Fraxinus latifolia* in the southern part of the group's range). Conifers tend to increase with succession in the absence of major disturbance. Conifer-dominated types



are relatively uncommon and not well-described; *Picea sitchensis* is an important species, with the importance of *Abies grandis* and *Thuja plicata* increasing in the southern part of the group's range. Key understory diagnostic species include *Rubus spectabilis*, *Oplopanax horridus*, *Maianthemum dilatatum* and *Cornus sericea* (NatureServe 2013).

**Plant Associations:** The red alder / salmonberry landcover class is considered equivalent to the *Alnus rubra* / *Rubus spectabilis* Plant Association.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Alnus rubra</i> / <i>Rubus spectabilis</i> Forest	Douglas 1971, Hebda and Biggs 1981, Christy 1993	CEGL000639	moderate	G4 SNR

**Classification Comments for the NVC Associations:** This type typically occurs along the upland margin of wetlands and on the floodplains of streams and rivers. Soils range from alluvium to veneers of muck and peat. It may be seasonally flooded and soils are usually saturated year-round. *Alnus rubra* forms a nearly closed canopy and *Rubus spectabilis* can be the only species in the understory (Kunze 1994). Although plot SITK21 is located along a walking trail and does not represent a riparian environment, it is included in this landcover class on the basis of its vegetation, level of disturbance and successional stage, which approximate the red alder / salmonberry landcover type.

## Red Alder / Sitka Spruce / Salmonberry Forest Landcover Class

*Alnus rubra* / *Picea sitchensis* / *Rubus spectabilis* Forest Landcover Class

**Number of Plots Sampled:** 5 (SITK08, 11, 16, 20, [26])

**Vegetation:** A closed-canopy, mixed forest type where broadleaf or needleleaf species comprise 25 - 75% of the total tree cover. The dominant broadleaf species is *Alnus rubra*; in disturbed sites the nonnative tree *Sorbus aucuparia* is often present as a minor (<25%) component of the canopy. Needleleaf species are present as a regenerative substratum comprised of *Picea sitchensis* and less commonly *Tsuga heterophylla* saplings. *Rubus spectabilis* is a constant and abundant component of the shrub stratum with *Sambucus racemosa* as an occasional and typically minor component. In the understory, *Maianthemum dilatatum* and *Trisetum canescens* are fairly constant and present at low cover. The presence of *Picea sitchensis* often indicates disturbed soil (DeMeo et al. 1992).

**Site Characteristics:** Occurring on low-elevation, infrequently disturbed sites; associated with riparian and coastal environments.

**Landform:** floodplain, stream terrace, uplifted beach, uplifted beach meadow

**Hydrologic Regime:** mesic

**Slope:** 0 - 34°

**Aspect:** 160 - 255°

**Elevation:** 2.7 – 7.7 m

**Map Area:** 2.4 hectare, 5.2%

**Succession and Disturbance:** A midsuccessional type likely developing from red alder / salmonberry types and presumably seral to Sitka spruce forest types. Shade-intolerant, high juvenile-growth alder is replaced by shade tolerant and high mature-growth conifers (Deal and Harrington 2006). Disturbance is most commonly related to river flooding or coastal processes such as salt spray.

**Distribution:** Occurring as small, linear patches directly upgradient of regular tidal or fluvial influence. Where this type borders tidally influenced areas in Southeast Alaska, the transition from herbaceous to forested communities is sharp and typically coincident with a shift in geomorphology (del Moral and Watson 1978).



**Constancy and Cover Table:** The red alder / Sitka spruce / salmonberry forest landcover class is supported by vegetation data collected from five plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Tree</b>				
<i>Alnus rubra</i>	100	49	15 - 65	7 - 20.3
<i>Picea sitchensis</i>	100	20	5 - 30	4 - 19.2
<i>Sorbus aucuparia</i>	80	9	5 - 20	6
<i>Tsuga heterophylla</i>	80	14	5 - 40	1 - 15.7
<b>Shrub</b>				
<i>Rubus spectabilis</i>	100	31	5 - 80	1.3 - 5
<i>Sambucus racemosa</i>	80	19	2 - 70	1.2 - 5
<i>Alnus viridis</i> ssp. <i>sinuata</i>	60	4	5 - 10	1.3 - 5
<i>Vaccinium parvifolium</i>	60	1	1 - 3	0.8 - 1.6
<i>Vaccinium ovalifolium</i>	40	1	1 - 2	1 - 1.6
<i>Menziesia ferruginea</i>	20	2	-	1.4
<i>Ribes glandulosum</i>	20	1	-	0.3
<b>Forb</b>				
<i>Maianthemum dilatatum</i>	80	10	2 - 25	-
<i>Conioselinum chinense</i>	60	1	-	-
<i>Ranunculus repens</i>	60	2	2 - 5	-
<i>Tiarella trifoliata</i>	60	2	<1 - 10	-
<i>Geum macrophyllum</i>	40	2	1 - 10	-
<i>Heracleum maximum</i>	40	1	-	-
<i>Trifolium repens</i>	20	1	-	-
<b>Graminoid</b>				
<i>Trisetum canescens</i>	80	2	<1 - 4	-
<b>Fern</b>				
<i>Athyrium filix-femina</i>	60	3	1 - 10	-
<b>Nonvascular</b>				
<i>Rhytidiadelphus loreus</i>	60	6	8 - 10	-
<i>Eurhynchium oreganum</i>	40	5	5 - 20	-
<i>Plagiomnium insigne</i>	40	1	2 - 5	-
<i>Rhizomnium glabrescens</i>	40	2	3 - 5	-
<i>Pleurozium schreberi</i>	20	2	-	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following NVC hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Temperate Swamp & Flooded Forest
Division	Western North American Flooded & Swamp Forest
Macrogroup	Vancouverian Flooded & Swamp Forest
Group	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> – <i>Alnus rubra</i> Lowland Riparian Forest & Woodland
Alliance	red alder Wet Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:** Stands in the *Populus balsamifera* ssp. *trichocarpa* – *Alnus rubra* Lowland Riparian Forest & Woodland Group are linear in character, occurring on floodplains or lower terraces of rivers and streams. Major broadleaf dominant species are *Alnus rubra*, *Populus balsamifera* ssp. *trichocarpa*, *Salix lucida* ssp. *lasiandra*, (and *Acer macrophyllum* and *Fraxinus latifolia* in southern parts of the group's range). Conifers tend to increase with succession in the absence of major disturbance. Conifer-dominated types are

relatively uncommon and not well-described; *Picea sitchensis* is an important species, with the importance of *Abies grandis* and *Thuja plicata* increasing in the southern part of the group's range. Key understory diagnostic species include *Rubus spectabilis*, *Oplopanax horridus*, *Maianthemum dilatatum* and *Cornus sericea* (NatureServe 2013).

**Plant Associations:** The following plant associations are known or thought to occur within the red alder / Sitka spruce / salmonberry forest landcover class. Different from the Sitka type, salmonberry is not represented in the *Alnus rubra* association described by del Moral and Watson (1978).

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Alnus rubra</i>	del Moral and Watson 1978	provisional	low	G5 S4

**Classification Comments for the NVC Association Level:** Plot SITK26 represents a sliver of forest sandwiched between the beach and Lincoln Street that is infested by the nonnative broadleaf tree species *Sorbus aucuparia*. The plot keys to a red alder / Sitka spruce / salmonberry landcover class, but is mapped as a Sitka spruce – western hemlock / red alder / salmonberry landcover type on the assumption that this site would likely develop a closed canopy dominated by needleleaf species if the effects of habitat fragmentation and nonnative species were removed.

## Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest Landcover Class

*Picea sitchensis* – *Tsuga heterophylla* / *Alnus rubra* / *Rubus spectabilis* Forest Landcover Class

**Number of Plots Sampled:** 3 (SITK[12], 18, [26])

**Vegetation:** A closed-canopy needleleaf forest type where *Picea sitchensis* or *Tsuga heterophylla* each contribute 25 to 75% to the total tree cover; *Alnus rubra* comprises at least 10% of tree cover. Canopy structure can be irregular with forest openings and multiple layers.

**Site Characteristics:** Occurring on low-elevation, infrequently disturbed sites; associated with former and current beach environments.

**Landform:** beach, uplifted beach meadow, uplifted beach, stream terrace

**Hydrologic Regime:** mesic

**Slope:** 0 - 12°

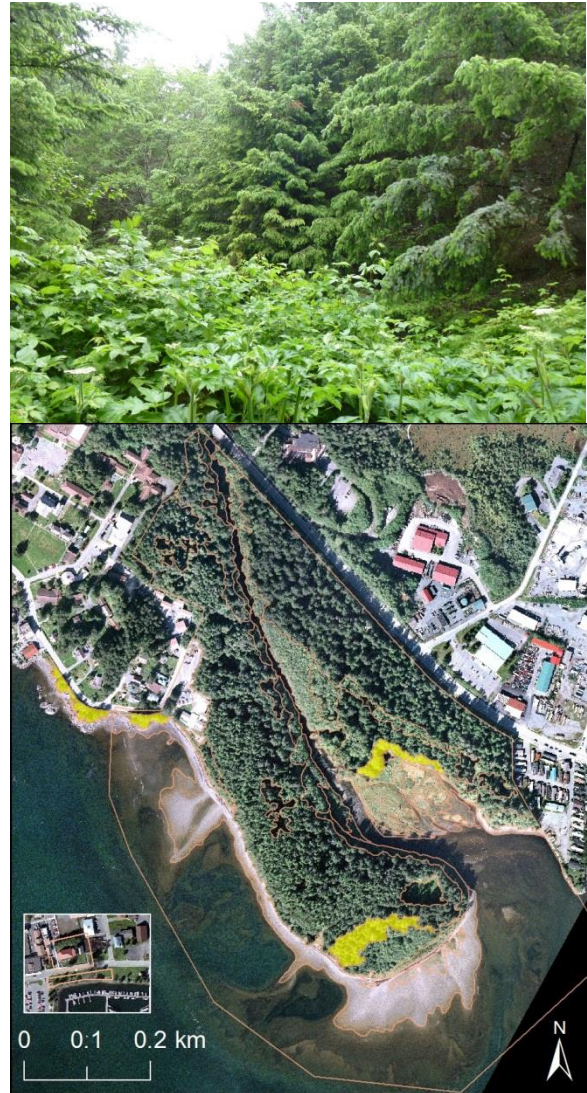
**Aspect:** 120 - 180°

**Elevation:** 2.9 - 7.3 m

**Map Area:** 1.0 hectare, 2.1%

**Succession and Disturbance:** A midsuccessional type likely developing from the red alder / Sitka spruce / salmonberry type and presumably seral to Sitka spruce and western hemlock forest types. This type is associated with former and current beach environments; however, due to the position of this type above tidal range, disturbances are likely limited to salt-spray and storm surges.

**Distribution:** Occurring as a small patch type on moderately-disturbed or semistable substrates.



**Constancy and Cover Table:** The Sitka spruce – western hemlock / red alder / salmonberry forest landcover class is supported by vegetation data collected from a single plot but is informed

by historical data collected by Kriekhaus et al. (1993) and LaBounty (unpublished). Percent covers are given for species with greater than 1% cover; heights are given for woody species only.

Species	Canopy cover (%)	Height (m)
<b>Tree</b>		
<i>Picea sitchensis</i>	35	16
<i>Tsuga heterophylla</i>	25	14
<i>Alnus rubra</i>	20	12
<b>Shrub</b>		
<i>Rubus spectabilis</i>	20	1.4
<i>Sambucus racemosa</i>	10	2
<i>Vaccinium ovalifolium</i>	5	1.2
<i>Alnus viridis</i> ssp. <i>sinuata</i>	2	3
<b>Forb</b>		
<i>Maianthemum dilatatum</i>	28	-
<i>Tiarella trifoliata</i>	6	-
<i>Viola glabella</i>	4	-
<i>Streptopus amplexifolius</i>	2	-
<b>Fern</b>		
<i>Dryopteris expansa</i>	6	-
<i>Athyrium filix-femina</i>	4	-
<b>Nonvascular</b>		
<i>Rhytidiadelphus loreus</i>	8	-
<i>Plagiomnium insigne</i>	5	-
<i>Plagiothecium undulatum</i>	5	-
<i>Hylocomium splendens</i>	2	-
<i>Polytrichum</i> sp.	2	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Cool Temperate Forest
Division	Vancouverian Cool Temperate Forest
Macrogroup	Vancouverian Lowland & Montane Rainforest
Group	<i>Picea sitchensis</i> Forest
Alliance	Sitka spruce / red alder Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:**

*Tsuga heterophylla* is very often codominant within the *Picea sitchensis* Forest Group. The vegetation types comprising this group occupy the outermost coastal fringe where salt spray is prominent as well as riparian

terraces and valley bottoms near the coast where there is major fog accumulation. The understory is rich with shade-tolerant shrubs and ferns, such as *Gaultheria shallon*, *Menziesia ferruginea*, *Oplopanax horridus*, *Rubus spectabilis*, *Vaccinium ovalifolium*, *Vaccinium ovatum*, *Athyrium filix-femina*, *Polystichum munitum*, *Dryopteris* spp., and/or *Blechnum spicant*, as well as a high diversity of mosses (NatureServe 2013).

**Plant Associations:** The following plant association is known or thought to occur within the Sitka spruce – western hemlock / red alder / salmonberry forest landcover class. Different from the Sitka type, which is a closed canopy type with *Tsuga heterophylla* contributing at least 25% of the total tree cover, Martin et al. (1995) describe an open forest type with less than 15% cover of *Tsuga heterophylla*; DeMeo et al. (1992) describe a closed forest type with less than 10% *Tsuga heterophylla*.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Picea sitchensis</i> - <i>Alnus rubra</i> / <i>Rubus spectabilis</i> Woodland	DeMeo et al. 1992, Martin et al. 1995	CEGL003253	high	G3 S4

**Classification Comments for the NVC Association:** Plot data for SITK12 indicates a red alder / Sitka spruce / salmonberry Forest; however, the extent is less than the minimum mapping unit of one acre and for this reason was not delineated. Plot SITK26 represents a sliver of forest sandwiched between the beach and Lincoln Street that is infested by the nonnative broadleaf tree species, *Sorbus aucuparia*. The plot keys to a red alder / Sitka spruce / salmonberry landcover class, but is mapped as a Sitka spruce – western hemlock / red alder / salmonberry landcover type on the presumption that this site would likely develop a closed canopy dominated by needleleaf species if the effects of habitat fragmentation and nonnative species were removed.

**Conservation Status Justification for the NVC Association:** The *Picea sitchensis* - *Alnus rubra* / *Rubus spectabilis* Woodland plant association that is expected to occur in this landcover class is considered vulnerable. It is widespread throughout southeastern Alaska yet restricted to older floodplain positions along rivers. The association's landscape position limits the stand area to small patches or stringers that range from 0.4 - 40 hectares (1 - 100 acres) in size. Little effort has gone into locating examples of the plant association, and there are an unknown number of occurrences. Few sites are threatened by human disturbance, and many sites are protected due to their inclusion in the streamside protection zone for salmon (NatureServe 2013).

## Sitka Spruce – Western Hemlock / Devil's Club Forest Landcover Class

*Picea sitchensis* – *Tsuga heterophylla* / *Oplopanax horridus* Forest Landcover Class

**Number of Plots Sampled:** 3 (SITK07, [14], 22)

**Vegetation:** A closed-canopy needleleaf forest type where *Picea sitchensis* or *Tsuga heterophylla* each contribute 25 to 75% to the total tree cover; *Alnus rubra* comprises less than 10% of tree cover and *Oplopanax horridus* cover is at least 5%. *Menziesia ferruginea*, *Vaccinium ovalifolium* and *V. parvifolium* are constant yet low cover components of the shrub stratum. In the understory, *Maianthemum dilatatum* and *Dryopteris expansa* are both constant and abundant. The mosses *Rhizomnium glabrescens* and *Hylocomium splendens* are constant components of the nonvascular groundcover. The codominance of *Tsuga heterophylla* is thought to indicate a transition to upland habitats, while the presence of *Oplopanax horridus* in the understory indicates the most stable ground within the riparian zone (DeMeo et al. 1992).

**Site Characteristics:** Occurring at low-elevations and across relatively flat land. Found on stable landforms, particularly in areas of soil water movement, such as old channels of the Indian River (Kriekhaus et al. 1993). Mesotopography can be hummocky.

**Landform:** floodplain, stream terrace or uplifted beach

**Hydrologic Regime:** mesic

**Slope:** 0 - 2°

**Aspect:** 135°

**Elevation:** 4.3 – 8.2 m

**Map Area:** 6.8 hectare, 14.6%

**Succession and Disturbance:** A midsuccessional type presumably developing from the Sitka spruce – western hemlock / red alder / salmonberry type and likely seral to western hemlock – (Sitka spruce) / blueberry types. Disturbance is windthrow.

**Distribution:** Occurring as a small patch type on stable substrates.





**Constancy and Cover Table:** The Sitka spruce – western hemlock / devil’s club forest landcover class is supported by vegetation data collected from three plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Tree</b>				
<i>Picea sitchensis</i>	100	40	35 - 45	26 - 50
<i>Tsuga heterophylla</i>	100	48	30 - 75	4 - 50.6
<b>Shrub</b>				
<i>Menziesia ferruginea</i>	100	4	2 - 8	1.6 - 2.5
<i>Oplopanax horridus</i>	100	8	8 - 10	1.8 - 3
<i>Vaccinium ovalifolium</i>	100	8	2 - 15	0.6 - 2.5
<i>Vaccinium parvifolium</i>	100	6	1 - 15	0.3 - 3
<i>Rubus spectabilis</i>	67	8	3 - 20	1.8 - 2
<b>Forb</b>				
<i>Maianthemum dilatatum</i>	100	46	38 - 60	-
<i>Tiarella trifoliata</i>	100	1	<1 - 2	-
<i>Streptopus amplexifolius</i>	67	2	1 - 5	-
<i>Moneses uniflora</i>	33	1	-	-
<i>Streptopus lanceolatus</i> var. <i>roseus</i>	33	1	-	-
<b>Fern</b>				
<i>Dryopteris expansa</i>	100	22	10 - 35	-
<i>Athyrium filix-femina</i>	67	12	15 - 20	-
<i>Gymnocarpium dryopteris</i>	67	6	2 - 15	-
<b>Nonvascular</b>				
<i>Hylocomium splendens</i>	100	8	5 - 15	-
<i>Rhizomnium glabrescens</i>	100	28	5 - 50	-
<i>Rhytidiadelphus loreus</i>	67	10	5 - 25	-
<i>Polytrichum</i> sp.	33	3	-	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Cool Temperate Forest
Division	Vancouverian Cool Temperate Forest
Macrogroup	Vancouverian Lowland & Montane Rainforest
Group	<i>Picea sitchensis</i> Forest
Alliance	Sitka spruce – western hemlock / devil’s club Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:** *Tsuga heterophylla* is very often codominant within the *Picea sitchensis* Forest Group. The vegetation types comprising this group occupy the outermost coastal fringe where salt spray is prominent as well as riparian terraces and valley bottoms near the coast where there is major fog accumulation. The

understory is rich with shade-tolerant shrubs such as *Oplopanax horridus*, *Rubus spectabilis*, *Menziesia ferruginea*, *Vaccinium ovalifolium* and *Gaultheria shallon* (and *Vaccinium ovatum* in the southern portion of the range), the ferns *Athyrium filix-femina*, *Polystichum munitum*, *Dryopteris* spp., and/or *Blechnum spicant*, as well as a high diversity of mosses (NatureServe 2013).

**Plant Associations:** The following plant associations are known or thought to occur within the Sitka spruce – western hemlock / devil’s club forest landcover class. The occurrence of both the *Tsuga heterophylla* – *Picea sitchensis* / *Oplopanax horridus* and *Picea sitchensis* - *Tsuga heterophylla* / *Oplopanax horridus* - *Rubus spectabilis* / *Gymnocarpium dryopteris* Forest plant associations are supported by plot data collected for this project. Although the latter association

is only known from British Columbia, it is considered very similar to southeast Alaska associations that are dominated by *Picea sitchensis*, *Tsuga heterophylla*, *Oplopanax horridus* and/or *Rubus spectabilis* (Meidinger et al. 2011). Due to variation in understory composition, the *Picea sitchensis* / *Oplopanax horridus* and *Picea sitchensis* / *Oplopanax horridus* - *Rubus spectabilis* associations are suspected to occur within this landcover class. Although not indicated by its nomenclature, the *Picea sitchensis* / *Oplopanax horridus* association includes a similar range of *Tsuga heterophylla* cover (25 - 44%), but is characterized by higher cover of *Oplopanax horridus* (25 - 57%). Similarly, the *Picea sitchensis* / *Oplopanax horridus* - *Rubus spectabilis* association can include up to 41% *Tsuga heterophylla* cover but is also characterized by higher cover of *Oplopanax horridus* (30 - 50%).

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Tsuga heterophylla</i> – <i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	DeVelice et al. 1999	provisional	low	G4 S4
<i>Picea sitchensis</i> - <i>Tsuga heterophylla</i> / <i>Oplopanax horridus</i> - <i>Rubus spectabilis</i> / <i>Gymnocarpium dryopteris</i> Forest	Green and Klinka 1994	provisional	low	G3 S3
<i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	DeMeo et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999, Boggs 2000, Boggs et al. 2008a, Boggs et al. 2008b	provisional	low	G5 S5
<i>Picea sitchensis</i> / <i>Oplopanax horridus</i> - <i>Rubus spectabilis</i>	Stephens et al. 1969, Neiland 1971a, Alaback 1980, DeMeo et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999, Boggs et al. 2008a	provisional	low	G5 S5

**Classification Comments for the NVC Association:** Plot SITK14 keys to Sitka spruce – western hemlock / devil’s club but is mapped as Sitka spruce – western hemlock / blueberry species based on the constant presence of *Vaccinium* species and irregular presence of devil’s club in forests on the eastern side of the Indian River, as well as archival plot data (Kriekhaus et al. 1993, LaBounty unpublished).

## Western Hemlock – Sitka Spruce / Blueberry Species Forest Landcover Class

*Tsuga heterophylla* – *Picea sitchensis* / *Vaccinium* Species Forest Landcover Class

**Number of Plots Sampled:** 1 (SITK[14])

**Vegetation:** A closed-canopy needleleaf forest type where *Picea sitchensis* or *Tsuga heterophylla* each contribute 25 to 75% to the total tree cover; *Alnus rubra* comprises less than 10% of tree cover, *Oplopanax horridus* cover is less than 5% and *Vaccinium* species (*V. parvifolium*, *V. ovalifolium*, *V. alaskaense*) collectively comprise more than 25% cover of the well-developed shrub layer. *Maianthemum dilatatum* is an abundant and common component of the understory. This type represents a transition from riparian *Picea sitchensis* to upland *Tsuga heterophylla* (DeMeo et al. 1992).

**Site Characteristics:** Occurring on low-elevation, relatively flat and stable sites. Mesotopography can be hummocky.

**Landform:** uplifted beach, stream terrace, lowlands

**Hydrologic Regime:** mesic

**Slope:** 1°

**Aspect:** 120°

**Elevation:** 74 m

**Map Area:** 9.1 hectare, 19.3%

**Succession and Disturbance:** A late-successional type presumably developing from the Sitka spruce – western hemlock / red alder / salmonberry or Sitka spruce – western hemlock / devil’s club forest types and likely seral to the western hemlock / blueberry type. Disturbance is windthrow.

**Distribution:** Occurring as a small patch type on stable substrates.



**Constancy and Cover Table:** The western hemlock – Sitka spruce / blueberry species forest landcover class is supported by vegetation data collected from a single plot but is informed by historical data collected by Kriekhaus et al. (1993) and LaBounty (unpublished). Percent covers are given for species with greater than 1% cover; heights are given for woody species only.

Species	Canopy cover (%)	Height (m)
<b>Tree</b>		
<i>Tsuga heterophylla</i>	75	4 - 50.6
<i>Picea sitchensis</i>	35	50
<b>Shrub</b>		
<i>Vaccinium ovalifolium</i>	15	2.5
<i>Vaccinium parvifolium</i>	15	3
<i>Menziesia ferruginea</i>	8	2.5
<i>Oplopanax horridus</i>	8	3
<b>Forb</b>		
<i>Maianthemum dilatatum</i>	40	-
<i>Streptopus amplexifolius</i> var. <i>amplexifolius</i>	1	-
<i>Streptopus amplexifolius</i> var. <i>chalmazatus</i>	1	-
<b>Fern</b>		
<i>Dryopteris expansa</i>	10	-
<b>Nonvascular</b>		
<i>Rhizomnium glabrescens</i>	50	-
<i>Hylocomium splendens</i>	5	-
<i>Rhytidiadelphus loreus</i>	5	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Cool Temperate Forest
Division	Vancouverian Cool Temperate Forest
Macrogroup	Vancouverian Lowland & Montane Rainforest
Group	<i>Picea sitchensis</i> Forest
Alliance	Sitka spruce - western hemlock / rusty menziesia Mesic Forest Alliance

**Classification Comments for the NVC**

**Group Level:** *Tsuga heterophylla* is very often codominant within the *Picea sitchensis* Forest Group. The vegetation types comprising this group occupy the outermost coastal fringe where salt spray is prominent as well as riparian terraces and valley bottoms near the coast where there is major fog accumulation. The understory is

rich with shade-tolerant shrubs and ferns, such as *Gaultheria shallon*, *Menziesia ferruginea*, *Oplopanax horridus*, *Rubus spectabilis*, *Vaccinium ovalifolium*, *Vaccinium ovatum*, *Athyrium filix-femina*, *Polystichum munitum*, *Dryopteris* spp., and/or *Blechnum spicant*, as well as a high diversity of mosses (NatureServe 2013).

**Plant Associations:** The following plant associations are known to occur within the Sitka spruce – western hemlock / blueberry species forest landcover class. Both the *Picea sitchensis* - (*Tsuga heterophylla*) / *Vaccinium* spp. and *Picea sitchensis* - *Tsuga heterophylla* / *Vaccinium* spp. - *Menziesia ferruginea* associations are characterized by high *Picea sitchensis* (36-55%) and *Tsuga heterophylla* covers (21-57%), with only one study (Shephard 1995) listing *Tsuga heterophylla* constancy less than 100%. In the shrub stratum, *Vaccinium* species are present at

high cover (25-55%) in all associations and *Menziesia ferruginea* and *Oplopanax horridus* are often present.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Picea sitchensis</i> - ( <i>Tsuga heterophylla</i> ) / <i>Vaccinium</i> spp.	DeMeo et al. 1992, Shephard 1995, Martin et al. 1995, Boggs et al. 2008a, Boggs et al. 2008b	provisional	low	G5 S5
<i>Picea sitchensis</i> - <i>Tsuga heterophylla</i> / <i>Vaccinium</i> spp. - <i>Menziesia ferruginea</i>	Stephens et al. 1969, Neiland 1971a	provisional	low	G4 S4

**Classification Comments for the NVC Association:** Plot SITK14 keys to Sitka spruce – western hemlock / devil’s club but is mapped as Sitka spruce – western hemlock / blueberry species based on the constant presence of *Vaccinium* species and irregular presence of devil’s club in forests on the eastern side of the Indian River, a pattern that is supported by archival plot data (Kriekhaus et al. 1993, LaBounty unpublished).

**Western Hemlock – (Sitka Spruce) / Depauperate Forest Landcover Class**  
*Tsuga heterophylla* – (*Picea sitchensis*) / Depauperate Forest Landcover Class

**Number of Plots Sampled:** 3 (SITK02, 05, 23)

**Vegetation:** A closed-canopy needleleaf forest type where *Tsuga heterophylla* or *Picea sitchensis* contributes 75% to the total tree cover. The understory is depauperate with respect to vascular plant species; moss species comprise more than 25% of ground cover. Snags and abundant woody debris are common.

**Site Characteristics:** Occurring on low-elevation, relatively flat sites within a larger matrix of mature, closed-canopy needleleaf forests.

**Landform:** stream terrace, lowland

**Hydrologic Regime:** mesic

**Slope:** 0 - 5°

**Aspect:** 45 - 340°

**Elevation:** 5.2 - 11.5 m

**Map Area:** 0.6 hectare, 1.3%

**Succession and Disturbance:** The genesis of this type is not completely known; however, the small patch size and few, discrete occurrences within the Park suggest that its development is driven by gap successional processes. Presumably, a small-scale, high-intensity disturbance event such as windthrow creates a gap in the canopy that is small enough to preclude significant increase in light availability, but is severe enough to cause mortality in most trees. Park staff report that the patches delineated in the southwest and southeast quadrants of the Park can be traced to the 1967 and 2004 windstorms, respectively (USFS 1994, Dudgeon 2006). Low light in combination with abundant seed from the surrounding, intact forest is thought to promote the growth of a dense, even-aged stand of needleleaf trees at the expense of vascular understory species. This is a mid- to late-successional phase common to coastal *Picea sitchensis* – *Tsuga heterophylla* forests in southeast Alaska in the period 30 - 200 years post-disturbance (Alaback 1982). Stands are susceptible to infection by dwarf mistletoe, a parasitic flowering plant that requires a conifer host for survival and is favored by small-scale disturbance (Hennon et al. 2001)

**Distribution:** Occurring as small, discrete patches that are presumed to be previously disturbed but are currently stable.



**Constancy and Cover Table:** The western hemlock – (Sitka spruce) / depauperate forest landcover class is supported by vegetation data collected from three plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Tree</b>				
<i>Sorbus aucuparia</i>	100	7	5 - 10	10 - 20
<i>Tsuga heterophylla</i>	100	67	45 - 95	15 - 30
<i>Picea sitchensis</i>	67	30	5 - 15	30 - 33.9
<b>Shrub</b>				
<i>Vaccinium parvifolium</i>	100	1	1 - 2	0.25 - 1
<b>Forb</b>				
<i>Moneses uniflora</i>	100	1	<1 - 2	-
<i>Streptopus amplexifolius</i>	67	1	-	-
<b>Fern</b>				
<i>Dryopteris expansa</i>	100	3	2 - 5	-
<b>Nonvascular</b>				
<i>Plagiothecium undulatum</i>	100	9	5 - 12	-
<i>Rhizomnium glabrescens</i>	100	31	15 - 60	-
<i>Hylocomium splendens</i>	67	2	<1 - 5	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Cool Temperate Forest
Division	Vancouverian Cool Temperate Forest
Macrogroup	Vancouverian Lowland & Montane Rainforest
Group	<i>Tsuga heterophylla</i> - <i>Chamaecyparis nootkatensis</i> Forest
Alliance	Western hemlock Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:** The *Tsuga heterophylla* - *Chamaecyparis nootkatensis* Forest Group includes western hemlock - Sitka spruce forests initially identified for the Alaska maritime systems classification. At lower elevations, these forests occur at sea level or adjacent to hypermaritime forests dominated by *Picea sitchensis*.

Characteristic shrubs include *Vaccinium ovalifolium*, *Oplopanax horridus*, *Rubus spectabilis*, and *Menziesia ferruginea*; the herbaceous component includes abundant ferns and forbs, such as *Blechnum spicant*, *Dryopteris expansa*, *Gymnocarpium dryopteris*, and *Lysichiton americanus* (NatureServe 2013).

**Plant Associations:** Plant associations have not been described for the western hemlock – (Sitka spruce) / depauperate forest landcover class. A *Tsuga heterophylla* / *Hylocomium splendens* association that is also depauperate with respect to vascular plant species was previously described by DeVelice et al. (1999); however, ground cover is not dominated by *Rhizomnium glabrescens*.

## Western Hemlock / Blueberry Species Forest Landcover Class

*Tsuga heterophylla* / *Vaccinium* Species Forest Landcover Class

**Number of Plots Sampled:** 1 (SITK04)

**Vegetation:** A closed-canopy needleleaf forest type where *Tsuga heterophylla* contributes 75% to the total tree cover. *Vaccinium* species (*V. parvifolium*, *V. ovalifolium*, *V. alaskaense*) collectively comprise more than 25% cover of the well-developed shrub layer. This is an old growth type with a multilayered canopy, snags and downed woody debris; tall and large diameter individuals of *Picea sitchensis* may be present. In the understory, *Vaccinium* species occupy the higher microsites while *Lysichiton americanus* is present in areas of ponded water (Martin et al. 1995). *Oplopanax horridus* is present on wet yet aerated soils, and *Menziesia ferruginea* is restricted to the drier areas. *Dryopteris expansa* designates highly productive areas (DeMeo et al. 1992). Woody debris and other raised microsites provide important growing sites for tree saplings in poorly drained areas (DeMeo et al. 1992).

**Site Characteristics:** Occurring at low elevations, across level ground and on stable landforms in the Park. Mesotopography is hummocky, with small pockets of ponded water.

**Landform:** moraine, lowlands, uplifted beach and parts of the stream terrace

**Hydrologic Regime:** mesic - wet

**Slope:** 2°

**Aspect:** 80°

**Elevation:** 5 m

**Map Area:** 0.9 hectare, 2.0%



**Succession and Disturbance:** A late-successional type that typically develops from *Picea sitchensis*-dominated forests with increase in elevation (del Moral and Watson 1978) or substrate stability (Kriekhaus et al. 1993). Within the Park, the lower presence of *Tsuga heterophylla* relative to *Picea sitchensis* in the *Alnus rubra* classes and smaller diameter and height of *Tsuga heterophylla* in classes where it is codominant with *Picea sitchensis* suggests replacement of *Picea sitchensis* by *Tsuga heterophylla*. Disturbance is most commonly windthrow.

**Distribution:** Occurring as a small patch type on relatively undisturbed, stable substrates.

**Constancy and Cover Table:** The western hemlock / blueberry species forest landcover class is supported by vegetation data collected from a single plot but is informed by historical data



collected by Krieckhaus et al. (1993) and LaBounty (unpublished). Percent covers are given for species with greater than 1% cover; heights are given for woody species only.

Species	Canopy cover (%)	Height (m)
<b>Tree</b>		
<i>Tsuga heterophylla</i>	70	30.1
<i>Picea sitchensis</i>	20	36.5
<b>Shrub</b>		
<i>Vaccinium parvifolium</i>	60	3
<i>Menziesia ferruginea</i>	15	3
<i>Oplopanax horridus</i>	5	2
<i>Rubus spectabilis</i>	5	2
<b>Forb</b>		
<i>Maianthemum dilatatum</i>	35	-
<i>Cornus canadensis</i>	8	0.01
<i>Streptopus amplexifolius</i>	8	-
<i>Rubus pedatus</i>	5	0.01
<i>Lysichiton americanus</i>	3	-
<i>Moneses uniflora</i>	2	-
<i>Tiarella trifoliata</i>	2	-
<i>Coptis aspleniifolia</i>	1	-
<b>Fern</b>		
<i>Dryopteris expansa</i>	10	-
<i>Gymnocarpium dryopteris</i>	5	-
<i>Athyrium filix-femina</i>	3	-
<b>Nonvascular</b>		
<i>Rhizomnium glabrescens</i>	50	-
<i>Pleurozium schreberi</i>	10	-
<i>Hylocomium splendens</i>	5	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy. Please note that the *Tsuga heterophylla* / *Vaccinium* spp. / *Lysichiton americanus* Forest association is nested under the alternate hierarchy, which diverges at the Formation level.

Level	Description
Class	Forest to Open Woodland
Subclass	Temperate & Boreal Forest
Formation	Cool Temperate Forest
Alternate Formation	Temperate Flooded & Swamp Forest Formation
Division	Vancouverian Cool Temperate Forest
Alternate Division	Vancouverian Flooded & Swamp Forest
Macrogroup	Vancouverian Lowland & Montane Rainforest
Alternate Macrogroup	Vancouverian Flooded & Swamp Forest
Group	<i>Tsuga heterophylla</i> - <i>Chamaecyparis nootkatensis</i> Forest
Alternate Group	<i>Tsuga heterophylla</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i> Hardwood-Conifer Rich Swamp
Alliance	western hemlock Forest Alliance (provisional)
Alternate Alliance	western hemlock / American skunkcabbage Wet Forest Alliance (provisional)

**Classification Comments for the NVC Group Level:** The *Tsuga heterophylla* - *Chamaecyparis nootkatensis* Forest Group includes western hemlock - Sitka spruce forests initially identified for the Alaska maritime systems classification. At lower elevations, these forests occur at sea level or adjacent to hypermaritime forests dominated by *Picea sitchensis*. Characteristic shrubs include *Vaccinium ovalifolium*, *Oplopanax horridus*, *Rubus spectabilis*, and *Menziesia ferruginea*; the herbaceous component includes abundant ferns and forbs, such as *Blechnum spicant*, *Dryopteris expansa*, *Gymnocarpium dryopteris*, and *Lysichiton americanus* (NatureServe 2013).

**Plant Associations:** The following plant associations are known or thought to occur in the western hemlock / blueberry species forest landcover class. The occurrence of the *Tsuga heterophylla* / *Vaccinium ovalifolium* Forest association is supported by plot data. The remaining associations are expected to occur based on observed variation in the understory.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Tsuga heterophylla</i> / <i>Vaccinium ovalifolium</i> Forest	Fox 1983, DeMeo et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999	provisional	low	G5 S5
<i>Tsuga heterophylla</i> / <i>Vaccinium ovalifolium</i> / <i>Dryopteris expansa</i> Forest	Pawuk and Kissinger 1989, DeMeo et al. 1992, Martin et al. 1995, Shephard 1995, DeVelice et al. 1999	CEGL003230	moderate	G5 S4
<i>Tsuga heterophylla</i> / <i>Vaccinium ovalifolium</i> - <i>Menziesia ferruginea</i> Forest	Martin et al. 1995, DeVelice et al. 1999	CEGL003236	moderate	G4 S5
<i>Tsuga heterophylla</i> / <i>Vaccinium ovalifolium</i> - <i>Oplopanax horridus</i> Forest	Worley 1977, Borchers et al. 1989, Pawuk and Kissinger 1989, DeMeo et al. 1992, DeVelice et al. 1994, Martin et al. 1995, Shephard 1995	CEGL003232	moderate	G5 S5
<i>Tsuga heterophylla</i> / <i>Vaccinium</i> spp. / <i>Lysichiton americanus</i> Forest	DeMeo et al. 1992, Martin et al. 1995, DeVelice et al. 1999, Boggs 2000, Boggs et al. 2008a	provisional	low	G4 S4

**Classification Comments for the NVC Association:** The *Tsuga heterophylla* / *Vaccinium ovalifolium* - *Oplopanax horridus* Forest association is characterized by an uneven-aged, moderate to dense tree overstory that is dominated by *Tsuga heterophylla*, although *Picea sitchensis* may codominate in some stands. The shrub layer is dominated by a moderate cover of *Oplopanax horridus*, *Vaccinium ovalifolium* and *Vaccinium alaskaense*; forb, graminoid, and fern layers are typically sparse. In many stands, bryophytes form a dense carpet consisting mainly of *Sphagnum* species, *Hylocomium splendens* and *Rhytidiadelphus loreus* (NatureServe 2013). Although *Vaccinium parvifolium* is dominant in the representative plot, observations made in 2012 and archival plot data (Kriekhaus et al. 1993, LaBounty unpublished) indicate that it is often replaced by *Vaccinium ovalifolium* within the landcover class. For this reason the species of *Vaccinium* is not specified in the landcover class name.

## Nootka Alkaligrass Tidal Flat Landcover Class

*Puccinellia nutkaensis* Tidal Flat Landcover Class

**Number of Plots Sampled:** 1 (SITK09)

**Vegetation:** A tidally-influenced herbaceous type where graminoid cover is dominated by halophytic *Puccinellia nutkaensis* and succulent forb species such as *Plantago maritima* var. *juncooides*, *Atriplex alaskensis*, *Cochlearia officinalis* and *Spergularia canadensis* are present.

**Site Characteristics:** Occurring in the intertidal zone of medium- to low-energy shorelines. Sites are inundated daily to twice daily by salt water.

**Landform:** beach

**Hydrologic Regime:** brackish – very wet

**Slope:** 1°

**Aspect:** 142°

**Elevation:** 2.5 m, intertidal zone

**Map Area:** 0.7 hectare, 1.4%

**Succession and Disturbance:** An early-successional type, which along rising shorelines, develops from the adjacent seaward community and is seral to the adjacent, landward type. In the Park, the Nootka alkaligrass type is located seaward of dunegrass and large umbel types and landward of the rockweed type. Disturbance is tidal.

**Distribution:** Occurring as a small patch linear type along protected and semi-exposed shorelines.

**Constancy and Cover Table:** The Nootka alkaligrass tidal flat landcover class is supported by vegetation data collected from a single plot but is informed by historical data collected by Kriekhaus et al. (1993) and LaBounty (unpublished). Percent covers are given for species with greater than 1% cover; heights are given for woody species only.



Species	Canopy cover (%)	Height (m)
<b>Forb</b>		
<i>Plantago maritima</i> var. <i>juncooides</i>	10	-
<i>Atriplex alaskensis</i>	5	-
<i>Spergularia canadensis</i>	3	-
<i>Glaux maritima</i>	2	-
<i>Zostera marina</i>	1	-
<b>Graminoid</b>		
<i>Puccinellia nutkaensis</i>	30	-

Species	Canopy cover (%)	Height (m)
<b>Nonvascular</b>		
<i>Fucus distichus</i>	10	-
Alga, Brown	5	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Shrubland & Grassland
Subclass	Temperate & Boreal Grassland & Shrubland
Formation	Salt Marsh
Division	Temperate & Boreal Pacific Coastal Salt Marsh
Macrogroup	North American Pacific Coastal Salt Marsh
Group	<i>Carex lyngbyei</i> - <i>Schoenoplectus maritimus</i> - <i>Glaux maritima</i> Temperate Pacific Tidal Salt & Brackish Marsh
Alliance	Nootka alkaligrass Tidal Alliance (provisional)

**Classification Comments for the NVC Group Level:** The *Carex lyngbyei* - *Schoenoplectus maritimus* - *Glaux maritima* Temperate Pacific Tidal Salt & Brackish Marsh Group is primarily associated with estuaries or coastal lagoons.

Low marshes are located in areas that flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids, especially *Carex lyngbyei*, *Carex ramenskii*, *Cochlearia*

*groenlandica*, *Distichlis spicata*, *Eleocharis palustris*, *Glaux maritima*, *Hippuris tetraphylla*, *Honckenya peploides*, *Plantago maritima*, *Puccinellia* spp., *Salicornia virginica*, *Schoenoplectus americanus*, *Schoenoplectus maritimus*, *Spergularia canadensis*, and *Triglochin maritima* (NatureServe 2013).

**Plant Associations:** The following plant associations are known or expected to occur in the Nootka alkaligrass tidal flat landcover class. The *Puccinellia nutkaensis* - *Glaux maritima* and *Puccinellia nutkaensis* - *Spergularia canadensis* associations are characterized by 2 - 38% cover of *Glaux maritima* and 1 - 16% cover of *Spergularia canadensis*, respectively.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Puccinellia nutkaensis</i>	Cooper 1931, Streveler et al. 1973, Batten et al. 1978, Vince and Snow 1984, Boggs 2000, Boggs et al. 2003, Boggs et al. 2008a, Boggs et al. 2008b	provisional	low	G4 S4
<i>Puccinellia nutkaensis</i> - <i>Glaux maritima</i>	Crow 1977, Crow and Koppen 1977	provisional	low	G4 S4
<i>Puccinellia nutkaensis</i> - <i>Spergularia canadensis</i>	Crow 1977, Crow and Koppen 1977	provisional	low	G4 S4

**Conservation Status Justification for the NVC Association:** As a species, *Puccinellia nutkaensis* has been assigned a G4? rank indicating that it is apparently secure, but that the rank is questionable (NatureServe 2013). By extension, the conservation status of plant associations dominated by *Puccinellia nutkaensis* has been downgraded to apparently secure.

## Lyngbye's Sedge Tidal Marsh Landcover Class

*Carex lyngbyei* Tidal Marsh Landcover Class

**Number of Plots Sampled:** No plots sampled.

**Vegetation:** A tidally-influenced herbaceous wetland type comprised of nearly monotypic stands of *Carex lyngbyei*. *Triglochin maritima* and *Argentina egedii* are common associates.

**Site Characteristics:** Occurring on low-energy sediment shores with freshwater influence. Inundation expected during high tide or river flooding events.

**Landform:** estuary

**Hydrologic Regime:** brackish - wet

**Slope:** 0°

**Aspect:** NA

**Elevation:** 3 m, hightidal

**Map Area:** 0.3 hectare, 0.6%

**Succession and Disturbance:** An early-successional type, which along rising shorelines, develops from the adjacent seaward community and is seral to the adjacent, landward type. In the Park the Lyngbye's sedge type is located seaward of hairgrass types and landward of Nootka alkaligrass types. Disturbance is tidal and/or fluvial.

**Distribution:** Occurring as a small patch type along protected shores where freshwater enters the ocean; often mosaicked with *Deschampsia* types.

**Placement of Landcover Class in the NVC**

**Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:



Level	Description
Class	Shrubland & Grassland
Subclass	Temperate & Boreal Grassland & Shrubland
Formation	Salt Marsh
Division	Temperate & Boreal Pacific Coastal Salt Marsh
Macrogroup	North American Pacific Coastal Salt Marsh
Group	<i>Carex lyngbyei</i> - <i>Schoenoplectus maritimus</i> - <i>Glaux maritima</i> Temperate Pacific Tidal Salt & Brackish Marsh
Alliance	Lyngbye's sedge Herbaceous Marsh Alliance (provisional)

**Classification Comments for the NVC Group Level:** The *Carex lyngbyei* - *Schoenoplectus maritimus* - *Glaux maritima* Temperate Pacific Tidal Salt & Brackish Marsh Group is primarily associated with estuaries or coastal lagoons. Low marshes are located in areas that flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids, especially *Carex lyngbyei*, *Carex ramenskii*, *Cochlearia groenlandica*, *Distichlis spicata*, *Eleocharis palustris*, *Glaux maritima*, *Hippuris tetraphylla*, *Honckenya peploides*, *Plantago maritima*, *Puccinellia* spp., *Salicornia virginica*, *Schoenoplectus americanus*, *Schoenoplectus maritimus*, *Spergularia canadensis*, and *Triglochin maritima* (NatureServe 2013).

**Plant Associations:** The *Carex lyngbyei* herbaceous vegetation is a widespread and well-documented association that is known to occur in the Lyngbye's sedge tidal marsh landcover class.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Carex lyngbyei</i> Herbaceous Vegetation	Viereck et al. 1992, Kunze 1994, Kagan et al. 2004, MacKenzie and Moran 2004; and from the AKNHP Plant Association Database: Griggs 1936, Hanson 1951, Frohne 1953, Klein 1965, Stephens and Billings 1967, Crow 1968, Neiland 1971b, Streveler et al. 1973, Crow and Koppen 1977, Scheierl and Meyer 1977, Streveler and Worley 1977, Batten et al. 1978, del Moral and Watson 1978, McCormick and Pichon 1978, Racine and Anderson 1979, Ritchie et al. 1981, Wibbenmeyer et al. 1982, Byrd 1984, Friedman 1984, Vince and Snow 1984, Rosenberg 1986, Craighead et al. 1988, Stone 1993, Shephard 1995, DeVelice et al. 1999, Boggs 2000, Boggs et al. 2003, Boggs et al. 2008a, Turner 2010	CEGL003369	moderate	G4 S5

**Classification Comments for the NVC Association Level:** The Lyngbye's sedge landcover type is documented within plot data from SITK17 and 19; however, plots specific to this landcover type were not completed.

## Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow Landcover Class

*Deschampsia cespitosa* - *Argentina egedii* Halophytic Wet Meadow Landcover Class

**Number of Plots Sampled:** 2 (SITK[17], [19])

**Vegetation:** A tidally-influenced herbaceous wetland type where graminoid cover is dominated by *Deschampsia cespitosa* or *Deschampsia beringensis* and halophytic forb species, such as *Argentina egedii* and *Plantago macrocarpa*, are present. Plant species are both flood and salt tolerant. The proportion of forbs tends to increase landward (Kriekhaus et al. 1993).

**Site Characteristics:** Occurring along low-energy sediment shores with freshwater influence. Inundation expected during extreme high tide or river flooding events.

**Landform:** estuary

**Hydrologic Regime:** brackish - mesic

**Slope:** 2°

**Aspect:** 100°

**Elevation:** 2.2 - 4.9 m, hightidal zone

**Map Area:** 1.0 hectare, 2.1%

**Succession and Disturbance:** An early-successional type, which along rising shorelines, develops from the adjacent seaward community and is seral to the adjacent, landward type. In the Park, Lyngbye's sedge and Nootka alkaligrass types are located seaward of the hairgrass type. The type of adjacent inland communities appears to depend on topography; across abrupt transitions in topography the hairgrass type grades directly to red alder forest types, whereas across gradual transitions the hairgrass type often grades to a dunegrass coastal meadow. Disturbance is tidal and/or fluvial.

**Distribution:** Occurring as a small patch type along protected shores where freshwater enters the ocean; often mosaicked with *Carex lyngbyei* types.





**Constancy and Cover Table:** The tufted hairgrass – Pacific halophytic wet meadow landcover class is supported by vegetation data collected from two plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Forb</b>				
<i>Achillea millefolium</i>	100	10	5 - 15	-
<i>Argentina egedii</i>	100	18	15 - 20	-
<i>Conioselinum chinense</i>	100	2	-	-
<i>Honckenya peploides</i>	100	8	<1 - 15	-
<i>Ligusticum scoticum</i>	100	6	2 - 10	-
<i>Atriplex alaskensis</i>	50	1	-	-
<i>Claytonia sibirica</i>	50	1	-	-
<i>Cochlearia groenlandica</i>	50	1	-	-
<i>Fritillaria camschatcensis</i>	50	1	-	-
<i>Heracleum maximum</i>	50	3	-	-
<i>Maianthemum dilatatum</i>	50	1	-	-
<i>Plantago macrocarpa</i>	50	5	-	-
<i>Plantago maritima</i>	50	2	-	-
<b>Graminoid</b>				
<i>Agrostis exarata</i>	100	15	10 - 20	-
<i>Carex lyngbyei</i> *	100	23	20 - 25	-
<i>Deschampsia cespitosa</i>	100	33	25 - 40	-
<i>Festuca rubra</i> ssp. <i>aucta</i>	100	14	10 - 18	-
<i>Hordeum brachyantherum</i>	100	9	8 - 10	-
<i>Leymus mollis</i>	100	8	5 - 10	-
<i>Carex macrochaeta</i>	50	3	-	-
<i>Poa pratensis</i> ssp. <i>irrigata</i>	50	1	-	-
<i>Puccinellia nutkaensis</i>	50	1	-	-
<i>Triglochin maritima</i>	50	1	-	-
<b>Nonvascular</b>				
<i>Fucus distichus</i>	50	3	-	-

\*see classification comments for the plant association level

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Shrubland & Grassland
Subclass	Temperate & Boreal Grassland & Shrubland
Formation	Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland
Division	Western North American Freshwater Shrubland, Wet Meadow & Marsh
Macrogroup	Western North American Temperate Lowland Wet Shrubland, Wet Meadow & Marsh
Group	<i>Deschampsia beringensis</i> - <i>Argentina egedii</i> - <i>Carex obnupta</i> Vancouverian Freshwater Coastal Marsh & Meadow
Alliance	Bering's tufted hairgrass Tidal Alliance (provisional)

**Classification Comments for the NVC Group Level:** The *Deschampsia cespitosa* – *Argentina egedii* Herbaceous Vegetation Association is classified under the *Carex lyngbyei* - *Schoenoplectus maritimus* - *Glaux maritima* Temperate Pacific Tidal Salt & Brackish Marsh Group by NatureServe (2013); however, it is perhaps better placed in the *Deschampsia beringensis* - *Argentina egedii* - *Carex obnupta* Vancouverian Freshwater Coastal Marsh & Meadow, which is described as wet meadows dominated by a wide variety

of graminoids and forbs, including *Deschampsia beringensis*, *Festuca rubra*, *Argentina egedii* etc., with *Carex lyngbyei* often dominating in sloughs and wet depressions (NatureServe 2013).

**Plant Associations:** The following plant associations are known or expected to occur in the tufted hairgrass – pacific silverweed halophytic wet meadow landcover class.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Deschampsia cespitosa</i> - <i>Argentina egedii</i> Herbaceous Vegetation	Christy et al. 1998, Kagan et al. 2004	CEGL003383	moderate	G3 SNR
<i>Deschampsia cespitosa</i>	DeVelice et al. 1999	provisional	low	G4 S3
<i>Deschampsia beringensis</i> - <i>Festuca rubra</i>	Hanson 1951, Batten et al. 1978	provisional	low	G4 S4
<i>Deschampsia beringensis</i>	Hanson 1951, Stephens and Billings 1967, Seguin 1977, Batten et al. 1979, Ritchie et al. 1981, DeVelice et al. 1999, Boggs 2000, Boggs et al. 2008a	provisional	low	G5 S5

**Classification Comments for the NVC Association:** The Lyngbye’s sedge landcover type is described from SITK17 and 19 plot data; for this reason cover of *Carex lyngbyei* is inflated for the tufted hairgrass – Pacific silverweed Halophytic Wet Meadow type.

## American Dunegrass – Large Umbel Coastal Meadow Landcover Class

*Leymus mollis* – Large Umbel Coastal Meadow Landcover Class

**Number of Plots Sampled:** 1 (SITK10)

**Vegetation:** A coastal meadow herbaceous type where graminoid cover is dominated by *Leymus mollis* and large umbelliferous forb species, such as *Heracleum maximum*, *Conioselinum chinense*, *Angelica lucida* and *Ligusticum scoticum*, are present. *Galium aparine* and *Chamerion angustifolium* are also common and abundant.

**Site Characteristics:** Occurring in the supratidal zone fronting medium- to low-energy shorelines. Sites receive some input of salt or brackish water either through salt spray, extreme high tides or storm surges.

**Landform:** beach

**Hydrologic Regime:** brackish - mesic

**Slope:** 4°

**Aspect:** 122°

**Elevation:** 2.9 m, supratidal zone

**Map Area:** 0.5 hectare, 1.1%

**Succession and Disturbance:** An early-successional type, which along rising shorelines, develops from the adjacent seaward community and is seral to the adjacent, upgradient type. In the Park the dunegrass – large umbel type is found upgradient of the Cobble Beach, rockweed Intertidal, Nootka alkaligrass or tufted hairgrass – Pacific silverweed types. The type of adjacent inland communities appears to depend on topography; across abrupt transitions in topography, coastal meadows grade directly to needleleaf forest types, whereas across gradual transitions coastal meadows often grade to red alder / salmonberry types. Tidal disturbance is expected to be limited to extreme high tides and storm surges.

**Distribution:** Occurring as small linear patches along semi-exposed shorelines and protected estuary margins.

**Constancy and Cover Table:** The American dunegrass – large umbel coastal meadow landcover class is supported by vegetation data collected from a single plot but is informed by historical data collected by Kriekhaus et al. (1993) and LaBounty (unpublished). Percent covers are given for species with greater than 1% cover; heights are given for woody species only.



Species	Canopy cover (%)	Height (m)
<b>Shrub</b>		
<i>Rubus spectabilis</i>	5	1.6
<b>Forb</b>		
<i>Galium aparine</i>	20	-
<i>Chamerion angustifolium</i>	15	-
<i>Heracleum maximum</i>	15	-
<i>Atriplex alaskensis</i>	8	-
<i>Honckenya peploides</i>	5	-
<i>Ranunculus repens</i>	5	-
<i>Vicia nigricans</i> ssp. <i>gigantea</i>	5	-
<i>Conioselinum chinense</i>	3	-
<i>Angelica lucida</i>	1	-
<i>Epilobium ciliatum</i> ssp. <i>glandulosum</i>	1	-
<i>Taraxacum officinale</i>	1	-
<b>Graminoid</b>		
<i>Leymus mollis</i>	20	-
<b>Nonvascular</b>		
<i>Eurhynchium praelongum</i>	5	-
<i>Rhytidiadelphus squarrosus</i>	5	-

**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Shrubland & Grassland
Subclass	Temperate & Boreal Grassland & Shrubland
Formation	Temperate & Boreal Scrub & Herb Coastal Vegetation
Division	Pacific North American Coast Scrub & Herb Vegetation
Macrogroup	Pacific Coastal Cliff & Bluff Vegetation
Group	<i>Leymus mollis</i> – <i>Leymus arenarius</i> – <i>Abronia latifolia</i> Dune Scrub & Herb
Alliance	American dunegrass Coastal Beach Herbaceous Alliance (provisional)

**Classification Comments for the NVC Group Level:** Grassland communities in the *Leymus mollis* – *Leymus arenarius* – *Abronia latifolia* Dune Scrub & Herb Group are described as occurring on cobble beaches and on dunes that become higher and further away from beach and are dominated by *Leymus mollis* or *Festuca rubra* and may include other graminoids such as *Poa eminens*, *Hordeum brachyantherum* and *Deschampsia*

*beringensis*, and forbs such as *Abronia latifolia*, *Achillea millefolium* var. *borealis*, *Angelica genuflexa*, *Angelica lucida*, *Claytonia sibirica*, *Fragaria chiloensis*, *Heracleum maximum*, *Honckenya peploides*, *Lathyrus japonicus* var. *maritimus*, *Ligusticum scoticum*, *Lupinus nootkatensis*, *Potentilla villosa* and *Senecio pseudoarnica* (NatureServe 2013).

**Plant Associations:** The following plant associations are known or expected to occur in the American dunegrass – large umbel coastal meadow landcover class.

Association Name	Citations	Unique Identifier / Status	Classification Confidence	Conservation Status
<i>Elymus arenarius</i> - <i>Heracleum lanatum</i> - <i>Angelica lucida</i>	Byrd 1984	provisional	low	GNR SNR
<i>Elymus arenarius</i>	Griggs 1936, Hanson 1951, 1953, Bank 1951, Klein 1959, Spetzman 1959, Johnson et al. 1966, Stephens and Billings 1967, Shacklette et al. 1969, Young 1971, Ugolini and Walters 1974, George et al. 1977, Batten et al. 1978, Racine and Anderson 1979, Meyers 1985, Rosenberg 1986, DeVelice et al. 1999, Boggs 2000	provisional	low	G5 S5

## Rockweed Intertidal Landcover Class

*Fucus distichus* Intertidal Landcover Class

**Number of Plots Sampled:** 1 (SITK01)

**Vegetation:** A tidally-influenced type where total vegetated cover is 10 - 25% and is dominated by marine algae such as *Fucus distichus*.

**Site Characteristics:** Occurring along medium-energy, rocky shorelines where wave energy is sufficient to mobilize beach sediments and limit the growth of marine algae. Unvegetated ground cover is predominantly cobble but includes sand and gravel.

**Landform:** beach

**Hydrologic Regime:** brackish - very wet

**Slope:** 0°

**Aspect:** not applicable

**Elevation:** 1.4 m, intertidal zone

**Map Area:** 3.8 hectare, 8.1%

**Succession and Disturbance:** The rockweed landcover class is typically located downgradient of either Nootka alkaligrass Tidal Flat or American dunegrass - Large Umbel Coastal Meadow types. Disturbance is tidal.

**Distribution:** Occurring as small, somewhat linear patches along semi-exposed shorelines. The somewhat orthogonal patches in Sitka NHP are relict from gravel dredging activity between 1939 and 1978.

**Constancy and Cover Table:** The rockweed intertidal landcover class is supported by vegetation data collected from a single plot.

Percent covers are given for species with greater than 1% cover; heights are given for woody species only.

Species	Canopy cover (%)	Height (m)
<b>Nonvascular</b>		
<i>Fucus distichus</i>	20	-
Alga, Marine	2	-



**Placement of Landcover Class in the NVC Hierarchy:** Both the landcover class and its attendant plant associations are nested under the following hierarchy:

Level	Description
Class	Aquatic Vegetation
Subclass	Saltwater Aquatic Vegetation
Formation	Benthic Macroalgae Saltwater Vegetation Formation
Division	Temperate Intertidal Shore Division
Macrogroup	Temperate Pacific Intertidal Shore
Group	<i>Vaucheria longicaulis</i> – <i>Enteromorpha</i> spp. North American Intertidal Algal Flat
Alliance	Intertidal Rockweed Alliance (provisional)

**Classification Comments for the NVC Group Level:** The vegetation types in the *Vaucheria longicaulis* – *Enteromorpha* spp. North American Intertidal Algal Flat Group are described as forming a narrow band along oceanic inlets and as being more extensive at the mouths of larger rivers. Algae are the dominant vegetation on mud or gravel flats where sparse vascular vegetation is present due to tidal inundation of salt water (NatureServe 2013).

**Plant Associations:** Plant associations have not been described for this landcover class

## Cobble Beach Landcover Class

### Cobble Beach Landcover Class

**Number of Plots Sampled:** No plots sampled.

**Vegetation:** A tidally-influenced type where total vegetated cover is less than 10%.

**Site Characteristics:** Occurring along medium-energy, rocky shorelines where wave energy is sufficient to mobilize the beach sediments and limit the growth of marine algae. Unvegetated ground cover is predominantly cobble but includes sand and gravel.

**Landform:** beach

**Hydrologic Regime:** brackish – very wet

**Slope:** 5 - 10°

**Aspect:** various

**Elevation:** intertidal zone

**Map Area:** 0.2 hectare, 0.4%

**Succession and Disturbance:** Cobble beach is typically located downgradient from mixed forest classes where *Alnus rubra* represents the broadleaf component and *Picea sitchensis* is the dominant needleleaf species, for example: red alder / Sitka spruce / salmonberry or Sitka spruce – western hemlock / red alder / salmonberry Forests. Disturbance is tidal.

**Distribution:** Occurring as small, linear patches along semi-exposed shorelines.

**Classification Comments for the NVC:** In its draft form, the NVC standard does not extend to Barren types. For this reason, the Cobble Beach Landcover Class proposed for Sitka NHP is not placed in the hierarchy of the current NVC.





## Developed Landcover Class

Developed Landcover Class

**Number of Plots Sampled:** 4 (SITK13, 24, 25, 27)

**Vegetation:** A cultural vegetation type displaying a characteristic combination of dominant growth forms adapted to relatively intense human manipulations. Dominant species are those remnant from the site's predisturbance conditions, such as *Picea sitchensis*, *Alnus rubra*, *Rubus spectabilis* and *Athyrium filix-femina*, but also include widespread and common nonnative species such as *Ranunculus repens*, *Taraxacum officinale*, *Trifolium repens* and *Poa annua*.

**Site Characteristics:** Site characters vary depending on the purpose of development and may have been modified during the process of development. Developed sites are generally located on flat ground close to water.

**Landform:** uplifted beach, lowland

**Hydrologic Regime:** mesic

**Slope:** 0 - 4°

**Aspect:** 140 - 200°

**Elevation:** 2.9 – 7.1 m

**Map Area:** 1.4 hectare, 2.9%

**Succession and Disturbance:** Disturbance is human.

**Distribution:** Small patches have been developed to support visitation (Visitor Center) or commemorate cultural history landmarks (Russian Bishop's House, 1804 fort site and battleground).



**Constancy and Cover Table:** The developed landcover class is supported by vegetation data collected from four plots. Constancy and percent cover are given for species with greater than 1% cover; heights are given for woody species only.

Species	Constancy	Canopy Cover (%)		Height (m)
		Average	Range	Range
<b>Tree</b>				
<i>Alnus rubra</i>	100	11	5 - 20	10 - 19
<i>Picea sitchensis</i>	100	18	2 - 35	6.5 - 27
<i>Sorbus aucuparia</i>	75	5	2-10	2 - 12
<i>Tsuga heterophylla</i>	75	13	2 - 45	3 - 25
<i>Pinus contorta</i>	25	1	-	5.5
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	25	2	-	21.8
<b>Shrub</b>				
<i>Rubus spectabilis</i>	100	16	1 - 50	1.2 - 2
<i>Ribes laxiflorum</i>	50	1	1	0.6
<i>Rosa rugosa</i>	50	3	2 - 10	1.2 - 1.6
<i>Sambucus racemosa</i>	50	1	-	1.2 - 7
<i>Vaccinium ovalifolium</i>	50	3	2 - 10	1
<i>Vaccinium parvifolium</i>	50	3	1 - 10	1
<i>Alnus viridis</i> ssp. <i>sinuata</i>	25	1	-	6
<i>Menziesia ferruginea</i>	25	4	-	-
<i>Salix sitchensis</i>	25	2	-	2
<b>Forb</b>				
<i>Ranunculus repens</i>	100	9	5 - 10	-
<i>Taraxacum officinale</i>	100	5	4 - 5	-
<i>Trifolium repens</i>	100	18	10 - 25	-
<i>Cerastium fontanum</i>	75	2	2 - 5	-
<i>Digitalis purpurea</i>	75	1	0 - 2	-
<i>Heracleum maximum</i>	75	2	2 - 4	-
<i>Maianthemum dilatatum</i>	75	2	1 - 5	-
<i>Ligusticum scoticum</i>	25	1	-	-
<i>Plantago major</i>	25	1	-	-
<i>Tiarella trifoliata</i>	25	1	-	-
<b>Graminoid</b>				
<i>Poa annua</i>	100	21	10 - 35	-
<i>Poa pratensis</i>	50	6	10 - 15	-
<i>Festuca rubra</i>	25	1	-	-
Grass, perennial	25	5	-	-
<i>Luzula divaricata</i>	25	1	-	-
<i>Poa pratensis</i> ssp. <i>pratensis</i>	25	8	-	-
<i>Trisetum canescens</i>	25	1	-	-
<b>Fern</b>				
<i>Athyrium filix-femina</i>	100	1	0 - 2	-
<b>Nonvascular</b>				
Moss	75	8	2 - 24	-
<i>Plagiomnium insigne</i>	25	1	-	-
<i>Rhizomnium glabrescens</i>	25	1	-	-

**Classification Comments for the NVC:** The Federal Geographic Data Committee (FGDC) Vegetation Subcommittee is in the process of drafting a standard for the classification of cultural vegetation that is not currently available to the public. Different from the 1997 FGDC standard, cultural vegetation will be treated as separate from natural vegetation in the new standard (FGDC 2008). In light of this significantly different treatment and the highly provisional nature of the draft standard, the Developed Landcover Class proposed for Sitka NHP is not placed in the hierarchy of the current NVC.

## **Conclusions and Recommendations**

The landcover classification, descriptions and digital map produced for Sitka NHP as part of this project provide both a reference and framework for future resource management and change detection. Development of a landcover map for the Park was highlighted as a necessary inventory on which monitoring could be based and resources can be managed (Moynahan and Johnson 2008). The landcover classes identified herein are common to the larger Alexander Archipelago ecoregion and thus can inform vegetation classification efforts beyond park boundaries. The finer characterization of forest understories and subsequent delineation of forested wetlands, depauperate habitats and blowdown areas would add to the utility of this map and further promote the assessment of the status, condition and trend of key natural resources in this unique park.

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# Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes

The Lyngbye's sedge Tidal Marsh and Cobble Beach landcover classes do not appear in this appendix as they are not supported by plot data

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)			
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov		
Tree																											
	<i>Alnus rubra</i>	100	66	100	49	100	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	11
	<i>Callitropsis nootkatensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1
	<i>Picea sitchensis</i>	75	8	100	20	100	35	100	40	100	35	67	30	100	20	-	-	-	-	-	-	-	-	-	-	100	18
	<i>Pinus contorta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1
	<i>Populus balsamifera ssp. trichocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	2
	<i>Sorbus aucuparia</i>	25	2	80	9	-	-	-	-	-	-	100	7	-	-	-	-	-	-	-	-	-	-	-	-	75	5
	<i>Tsuga heterophylla</i>	75	6	80	14	100	25	100	48	100	75	100	67	100	70	-	-	-	-	-	-	-	-	-	-	75	13
Shru																											
	<i>Alnus viridis ssp. sinuata</i>	-	-	60	4	100	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1
	<i>Menziesia ferruinea</i>	-	-	20	2	-	-	100	4	100	8	-	-	100	15	-	-	-	-	-	-	-	-	-	-	25	4
	<i>Oplopanax horridus</i>	25	3	20	< 1	-	-	100	8	100	8	-	-	100	5	-	-	-	-	-	-	-	-	-	-	25	< 1
	<i>Ribes bracteosum</i>	75	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Ribes glandulosum</i>	-	-	20	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Ribes laxiflorum</i>	25	< 1	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	1
	<i>Rosa rugosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	3
	<i>Rubus parviflorus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1
	<i>Rubus spectabilis</i>	100	58	100	31	100	20	67	8	-	-	-	-	100	5	-	-	-	-	-	100	5	-	-	100	16	
	<i>Salix sitchensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	2
	<i>Sambucus racemosa</i>	75	10	80	19	100	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	1	

**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)			
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov		
Shrub (continued)																											
	<i>Vaccinium ovalifolium</i>	-	-	40	1	100	5	100	8	100	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	3
	<i>Vaccinium parvifolium</i>	25	1	60	1	-	-	100	6	100	15	100	1	100	60	-	-	-	-	-	-	-	-	-	-	50	3
Forb																											
	<i>Achillea millefolium</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	100	10	-	-	-	-	-	-	-	-
	<i>Angelica lucida</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	1	-	-	-	-	-	-
	<i>Argentina egedii</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	100	18	-	-	-	-	-	-	-	-
	<i>Aruncus dioicus</i>	25	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Atriplex alaskensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	50	1	100	8	-	-	-	-	-	-
	<i>Cardamine oligosperma</i>	25	1	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Cardamine oligosperma</i> var. <i>kamtschatica</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Centaurea montana</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Cerastium fontanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	2	
	<i>Chamerion angustifolium</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	15	-	-	-	25	< 1	
	<i>Claytonia sibirica</i>	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	50	1	-	-	-	-	-	-	-	-
	<i>Cochlearia groenlandica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	1	-	-	-	-	-	-	-	-
	<i>Conioselinum chinense</i>	-	-	60	1	-	-	-	-	-	-	-	-	-	-	-	-	100	2	100	3	-	-	-	-	-	-
	<i>Coptis asplenifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	100	1	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Cornus canadensis</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	100	8	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Digitalis purpurea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	1	
	<i>Epilobium</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1	

**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)	
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov
Forb (continued)																									
	<i>Epilobium ciliatum</i> ssp. <i>glandulosum</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	1	-	-	-	-
	Forb, perennial	-	-	-	-	-	-	-	-	-	-	33	< 1	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Fragaria chiloensis</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Fritillaria camschatcensis</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	50	1	-	-	-	-	-	-
	<i>Galium aparine</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	20	-	-	-	-
	<i>Geum macrophyllum</i>	25	< 1	40	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1
	<i>Geum macrophyllum</i> var. <i>macrophyllum</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Glaux maritima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	100	2	50	< 1	-	-	-	-	-	-	-
	<i>Heraclium maximum</i>	25	< 1	40	1	-	-	-	-	-	-	-	-	-	-	-	-	50	3	100	15	-	-	75	2
	<i>Honckenya peploides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	8	100	5	-	-	-	-
	<i>Leucanthemum vulgare</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1
	<i>Ligusticum scoticum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	6	-	-	-	-	25	1
	<i>Lysichiton americanus</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	100	3	-	-	-	-	-	-	-	-	-	-
	<i>Maianthemum dilatatum</i>	75	21	80	10	100	28	100	46	100	40	67	< 1	100	35	-	-	50	1	-	-	-	-	75	2
	<i>Moneses uniflora</i>	25	< 1	-	-	-	-	33	1	-	-	100	1	100	2	-	-	-	-	-	-	-	-	-	-
	<i>Myosotis asiatica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	< 1
	<i>Oenanthe sarmentosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Osmorhiza</i> sp.	75	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Osmorhiza depauperata</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)		
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	
Forb (continued)																										
	<i>Osmorhiza purpurea</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Plantago macrocarpa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	5	-	-	-	-	-	-	-
	<i>Plantago major</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1	-
	<i>Plantago maritima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	2	-	-	-	-	-	-	-
	<i>Plantago maritima</i> var. <i>juncoides</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	10	-	-	-	-	-	-	-	-	-
	<i>Prenanthes alata</i>	25	1	20	< 1	-	-	33	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1	
	<i>Ranunculus</i> sp.	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Ranunculus repens</i>	-	-	60	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	-	-	100	9	-
	<i>Ranunculus uncinatus</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Rubus pedatus</i>	25	< 1	-	-	-	-	33	< 1	-	-	-	-	100	5	-	-	-	-	-	-	-	-	-	50	< 1
	<i>Sagina maxima</i> ssp. <i>crassicaulis</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Spergularia canadensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	3	50	< 1	-	-	-	-	-	-	-
	<i>Stellaria crispa</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Streptopus amplexifolius</i>	100	2	40	< 1	100	2	67	2	-	-	67	1	100	8	-	-	-	-	-	-	-	-	-	-	-
	<i>Streptopus amplexifolius</i> var. <i>amplexifolius</i>	-	-	-	-	-	-	33	< 1	100	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Streptopus amplexifolius</i> var. <i>chalazatus</i>	-	-	-	-	-	-	33	< 1	100	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest		Red Alder / Sitka Spruce / Salmonberry Forest		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest		Sitka Spruce – Western Hemlock / Devil's Club Forest		Western Hemlock – Sitka Spruce / Blueberry Species Forest		Western Hemlock – (Sitka Spruce) / Depauperate Forest		Western Hemlock / Blueberry Species Forest		Nootka Alkaligrass Tidal Flat		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow		American Dunegrass – Large Umbel Coastal Meadow		Rockweed Intertidal		Developed		
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	
Forb (continued)																										
	<i>Streptopus lanceolatus</i> var. <i>roseus</i>	25	< 1	-	-	-	-	33	1	-	-	33	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Taraxacum officinale</i>	-	-	20	< 1	100	< 1	-	-	-	-	-	-	-	-	-	-	50	< 1	100	1	-	-	100	5	
	<i>Tiarella trifoliata</i>	75	6	60	2	100	6	100	1	100	< 1	67	< 1	100	2	-	-	-	-	-	-	-	-	25	1	
	<i>Trifolium repens</i>	-	-	20	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	18	
	<i>Vicia nigricans</i> ssp. <i>gigantea</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	-	-	-	-	
	<i>Viola</i> sp.	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Viola glabella</i>	75	5	-	-	100	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Zostera marina</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	1	-	-	-	-	-	-	-	-	
Graminoid																										
	<i>Agrostis exarata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	15	-	-	-	-	-	-	
	<i>Calamagrostis canadensis</i> var. <i>langsdoerffii</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Carex</i> sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1		
	<i>Carex gmelinii</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	<i>Carex lyngbyei</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	23	-	-	-	-	-	-	
	<i>Carex macrochaeta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	3	-	-	-	-	-	-	
	<i>Dactylis glomerata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1		
	<i>Deschampsia cespitosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	33	-	-	-	-	-	-	
	<i>Festuca rubra</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1		



**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)		
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	
Graminoid (continued)																										
	<i>Festuca rubra</i> ssp. <i>aucta</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	14	-	-	-	-	-	-	
	<i>Festuca rubra</i> ssp. <i>pruinosa</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1	
	Grass, perennial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	5	
	<i>Hordeum brachyantherum</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	100	9	-	-	-	-	-	-	
	<i>Juncus haenkei</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Leymus mollis</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	100	8	100	20	-	-	25	< 1	
	<i>Lolium perenne</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	< 1	
	<i>Luzula divaricata</i>	25	< 1	60	< 1	100	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1	
	<i>Poa annua</i>	-	-	40	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	21	
	<i>Poa pratensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	6	
	<i>Poa pratensis</i> ssp. <i>irrigata</i>	-	-	20	< 1	-	-	-	-	-	-	-	-	-	-	-	-	50	1	-	-	-	-	-	-	
	<i>Poa pratensis</i> ssp. <i>pratensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	8	
	<i>Puccinellia nutkaensis</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	30	50	1	-	-	-	-	-	-	
	<i>Triglochin maritima</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	1	-	-	-	-	-	-	
	<i>Trisetum canescens</i>	25	< 1	80	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1	
Fern																										
	<i>Athyrium filix-femina</i>	100	2	60	3	100	4	67	12	-	-	-	-	100	3	-	-	-	-	-	-	-	-	-	100	1

**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)		
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	
Fern (continued)																										
	<i>Cryptogramma acrostichoides</i>	25	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Dryopteris expansa</i>	100	4	20	< 1	100	6	100	22	100	10	100	3	100	10	-	-	-	-	100	< 1	-	-	25	< 1	
	<i>Gymnocarpium dryopteris</i>	50	< 1	-	-	100	< 1	67	6	-	-	-	-	100	5	-	-	-	-	-	-	-	-	-	-	
	<i>Polypodium glycyrrhiza</i>	-	-	20	< 1	100	< 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nonvascular																										
	Alga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	< 1	-	-	-	-	-	-	
	Alga, Brown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	-	-	-	-	-	-	-	-	
	Alga, Freshwater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	< 1	-	-	-	-	-	-	
	Alga, Marine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	2	-	-	
	<i>Climacium dendroides</i>	25	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Eurhynchium oregonum</i>	75	10	40	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Eurhynchium praelongum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	-	-	-	-	
	<i>Fucus distichus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	10	50	3	-	-	100	20	-	-	
	<i>Hylocomium splendens</i>	50	4	-	-	100	2	100	8	100	5	67	2	100	5	-	-	-	-	-	-	-	-	-	-	
	Moss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	8	
	<i>Plagiomnium insigne</i>	50	8	40	1	100	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	1	
	<i>Plagiothecium undulatum</i>	-	-	20	< 1	100	5	-	-	-	-	100	9	-	-	-	-	-	-	-	-	-	-	-	-	
	<i>Pleurozium schreberi</i>	-	-	20	2	-	-	-	-	-	-	-	-	100	10	-	-	-	-	-	-	-	-	-	-	

**Appendix A: Constancy (Con) and Average Percentage Canopy Cover (Cov) of Sitka National Historical Park Landcover Classes (continued)**

Habit	Scientific Name	Red Alder / Salmonberry Riparian Forest (4 plots)		Red Alder / Sitka Spruce / Salmonberry Forest (5 plots)		Sitka Spruce – Western Hemlock / Red Alder / Salmonberry Forest (1 plot)		Sitka Spruce – Western Hemlock / Devil's Club Forest (3 plots)		Western Hemlock – Sitka Spruce / Blueberry Species Forest (1 plot)		Western Hemlock – (Sitka Spruce) / Depauperate Forest (3 plots)		Western Hemlock / Blueberry Species Forest (1 plot)		Nootka Alkaligrass Tidal Flat (1 plot)		Tufted Hairgrass – Pacific Silverweed Halophytic Wet Meadow (2 plots)		American Dunegrass – Large Umbel Coastal Meadow (1 plot)		Rockweed Intertidal (1 plot)		Developed (4 plots)		
		Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	Con	Cov	
Nonvascular (continued)																										
	<i>Polytrichastrum alpinum</i>	50	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Polytrichum</i> sp.	-	-	-	-	100	2	33	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Rhizomnium glabrescens</i>	50	4	40	2	-	-	100	28	100	50	100	31	100	50	-	-	-	-	-	-	-	-	-	25	1
	<i>Rhytidiadelphus loreus</i>	75	11	60	6	100	2	67	10	100	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	<i>Rhytidiadelphus squarrosus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5	-	-	-	-

## Appendix B: Plant Species List and Frequency of Occurrence in Sitka National Historical Park Landcover Plots

The occurrences of both vascular and non-vascular plant taxa across 27 landcover plots are listed.

Habit	Scientific Name	Common Name	Symbol	Occurrence
Tree				
	<i>Alnus rubra</i>	red alder	ALRU2	14
	<i>Callitropsis nootkatensis</i>	Alaska cedar	CANO9	1
	<i>Picea sitchensis</i>	Sitka spruce	PISI	19
	<i>Pinus contorta</i>	lodgepole pine	PICO	1
	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	black cottonwood	POBAT	1
	<i>Sorbus aucuparia</i>	European mountain ash	SOAU	11
	<i>Tsuga heterophylla</i>	western hemlock	TSHE	18
Shrub				
	<i>Alnus viridis</i> ssp. <i>sinuata</i>	Sitka alder	ALVIS	5
	<i>Menziesia ferruginea</i>	rusty menziesia	MEFE	6
	<i>Oplopanax horridus</i>	devil's club	OPHO	7
	<i>Ribes bracteosum</i>	stink currant	RIBR	3
	<i>Ribes glandulosum</i>	skunk currant	RIGL	1
	<i>Ribes laxiflorum</i>	trailing black currant	RILA3	4
	<i>Rosa rugosa</i>	rugosa rose	RORU	2
	<i>Rubus parviflorus</i>	thimbleberry	RUPA	1
	<i>Rubus spectabilis</i>	salmonberry	RUSP	19
	<i>Salix sitchensis</i>	Sitka willow	SASI2	1
	<i>Sambucus racemosa</i>	red elderberry	SARA2	10
	<i>Vaccinium ovalifolium</i>	oval-leaf blueberry	VAOV	8
	<i>Vaccinium parvifolium</i>	red huckleberry	VAPA	13
Graminoid				
	<i>Agrostis exarata</i>	spike bentgrass	AGEX	2
	<i>Calamagrostis canadensis</i> var. <i>langsдорffii</i>	bluejoint	CACAL3	1
	<i>Carex gmelinii</i>	Gmelin's sedge	CAGM	1
	<i>Carex lyngbyei</i>	Lyngbye's sedge	CALY3	2
	<i>Carex macrochaeta</i>	longawn sedge	CAMA11	1
	<i>Dactylis glomerata</i>	orchardgrass	DAGL	1
	<i>Deschampsia cespitosa</i>	tufted hairgrass	DECE	2
	<i>Festuca rubra</i>	red fescue	FERU2	1
	<i>Festuca rubra</i> ssp. <i>aucta</i>	red fescue	FERUA	2
	<i>Festuca rubra</i> ssp. <i>pruinosa</i>	red fescue	FERUP5	1
	<i>Hordeum brachyantherum</i>	meadow barley	HOB2	3
	<i>Juncus haenkei</i>	Haenke's rush	JUHA2	1
	<i>Leymus mollis</i>	American dunegrass	LEMO8	5
	<i>Lolium perenne</i>	perennial ryegrass	LOPE	1
	<i>Luzula divaricata</i>	forked woodrush	LUDI	6
	<i>Poa annua</i>	annual bluegrass	POAN	8
	<i>Poa pratensis</i>	Kentucky bluegrass	POPR	2
	<i>Poa pratensis</i> ssp. <i>irrigata</i>	spreading bluegrass	POPRI2	2

## Appendix B: Plant Species List and Frequency of Occurrence in Sitka National Historical Park Landcover Plots (continued)

Habit	Scientific Name	Common Name	Symbol	Occurrence
Graminoid (continued)				
	<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky bluegrass	POPRP2	1
	<i>Puccinellia nutkaensis</i>	nootka alkaligrass	PUNU	2
	<i>Triglochin maritima</i>	seaside arrowgrass	TRMA20	1
	<i>Trisetum canescens</i>	tall trisetum	TRCA21	6
Forb				
	<i>Achillea millefolium</i>	common yarrow	ACMI2	3
	<i>Angelica lucida</i>	seacoast angelica	ANLU	2
	<i>Argentina egedii</i>	Pacific silverweed	AREG	3
	<i>Aruncus dioicus</i>	bride's feathers	ARDI8	1
	<i>Atriplex alaskensis</i>	Alaska orache	ATAL	3
	<i>Cardamine oligosperma</i>	little western bittercress	CAOL	2
	<i>Cardamine oligosperma</i> var. <i>kamtschatica</i>	umbel bittercress	CAOLK	1
	<i>Centaurea montana</i>	perennial cornflower	CEMO	1
	<i>Cerastium fontanum</i>	common mouse-ear chickweed	CEFO2	3
	<i>Chamerion angustifolium</i>	fireweed	CHAN9	3
	<i>Claytonia sibirica</i>	Siberian springbeauty	CLSI2	2
	<i>Cochlearia groenlandica</i>	Danish scurvygrass	COGR6	1
	<i>Conioselinum chinense</i>	Chinese hemlockparsley	COCH2	7
	<i>Coptis aspleniifolia</i>	fernleaf goldthread	COAS	1
	<i>Cornus canadensis</i>	bunchberry dogwood	COCA13	2
	<i>Digitalis purpurea</i>	purple foxglove	DIPU	3
	<i>Epilobium ciliatum</i> ssp. <i>glandulosum</i>	fringed willowherb	EPCIG	2
	<i>Fragaria chiloensis</i>	beach strawberry	FRCH	1
	<i>Fritillaria camschatcensis</i>	Kamchatka fritillary	FRCA5	2
	<i>Galium aparine</i>	stickywilly	GAAP2	1
	<i>Geum macrophyllum</i>	largeleaf avens	GEMA4	5
	<i>Geum macrophyllum</i> var. <i>macrophyllum</i>	largeleaf avens	GEMAM	1
	<i>Glaux maritima</i>	sea milkwort	GLMA	2
	<i>Heracleum maximum</i>	common cowparsnip	HEMA80	9
	<i>Honckenya peploides</i>	seaside sandplant	HOPE	3
	<i>Leucanthemum vulgare</i>	oxeye daisy	LEVU	1
	<i>Ligusticum scoticum</i>	Scottish licorice-root	LISC3	3
	<i>Lysichiton americanus</i>	American skunkcabbage	LYAM3	2
	<i>Maianthemum dilatatum</i>	false lily of the valley	MADI	19
	<i>Moneses uniflora</i>	single delight	MOUN2	6
	<i>Myosotis asiatica</i>	Asian forget-me-not	MYAS2	3
	<i>Oenanthe sarmentosa</i>	water parsely	OESA	1
	<i>Osmorhiza depauperata</i>	bluntseed sweetroot	OSDE	1
	<i>Osmorhiza purpurea</i>	purple sweetroot	OSPU	1
	<i>Plantago macrocarpa</i>	seashore plantain	PLMA	1
	<i>Plantago major</i>	common plantain	PLMA2	1
	<i>Plantago maritima</i>	goose tongue	PLMA3	1

## Appendix B: Plant Species List and Frequency of Occurrence in Sitka National Historical Park Landcover Plots (continued)

Habit	Scientific Name	Common Name	Symbol	Occurrence
<b>Forb (continued)</b>				
	<i>Plantago maritima</i> var. <i>juncooides</i>	goose tongue	PLMAJ	1
	<i>Prenanthes alata</i>	western rattlesnakeroot	PRAL	5
	<i>Ranunculus repens</i>	creeping buttercup	RARE3	9
	<i>Ranunculus uncinatus</i>	woodland buttercup	RAUN	1
	<i>Rubus pedatus</i>	strawberryleaf raspberry	RUPE	5
	<i>Sagina maxima</i> ssp. <i>crassicaulis</i>	stickystem pearlwort	SAMAC	1
	<i>Spergularia canadensis</i>	Canadian sandspurry	SPCA3	2
	<i>Stellaria crispa</i>	curled starwort	STCR2	2
	<i>Streptopus amplexifolius</i>	claspleaf twistedstalk	STAM2	12
	<i>Streptopus amplexifolius</i> var. <i>amplexifolius</i>	claspleaf twistedstalk	STAMA2	1
	<i>Streptopus amplexifolius</i> var. <i>chalazatus</i>	tubercle twistedstalk	STAMC	1
	<i>Streptopus lanceolatus</i> var. <i>roseus</i>	twistedstalk	STLAR	3
	<i>Taraxacum officinale</i>	common dandelion	TAOF	8
	<i>Tiarella trifoliata</i>	threeleaf foamflower	TITR	14
	<i>Trifolium repens</i>	white clover	TRRE3	5
	<i>Vicia nigricans</i> ssp. <i>gigantea</i>	giant vetch	VINIG	3
	<i>Viola glabella</i>	pioneer violet	VIGL	4
	<i>Zostera marina</i>	seawrack	ZOMA	1
<b>Fern</b>				
	<i>Athyrium filix-femina</i>	common ladyfern	ATFI	16
	<i>Cryptogramma acrostichoides</i>	American rockbrake	CRAC3	1
	<i>Dryopteris expansa</i>	spreading woodfern	DREX2	16
	<i>Gymnocarpium dryopteris</i>	western oakfern	GYDR	6
	<i>Polypodium glycyrrhiza</i>	licorice fern	POGL8	2
<b>Nonvascular</b>				
	<i>Climacium dendroides</i>	tree climacium moss	CLDE70	1
	<i>Eurhynchium oregonum</i>	Oregon eurhynchium moss	EUOR2	5
	<i>Eurhynchium praelongum</i>	eurhynchium moss	EUPR7	2
	<i>Fucus distichus</i>	rockweed	2AM	3
<b>Nonvascular (continued)</b>				
	<i>Hylocomium splendens</i>	splendid feathermoss	HYSP70	9
	<i>Plagiomnium insigne</i>	plagiominium moss	PLIN11	6
	<i>Plagiothecium undulatum</i>	undulate plagiothecium moss	PLUN4	5
	<i>Pleurozium schreberi</i>	Schreber's big red stem moss	PLSC70	2
	<i>Polytrichastrum alpinum</i>	alpine polytrichastrum moss	POAL24	2
	<i>Rhizomnium glabrescens</i>	rhizomnium moss	RHGL70	13
	<i>Rhytidiadelphus loreus</i>	goose neck moss	RHLO70	9
	<i>Rhytidiadelphus squarrosus</i>	square goose neck moss	RHSQ70	1
<b>Total</b>				<b>478</b>

## Appendix C: Summary of Site Characters for Sitka National Historical Park Landcover Plots

Plot Name	Latitude (decimal degrees, NAD83)	Longitude (decimal degrees, NAD83)	Elevation (m)	Slope (percent)	Aspect (degrees from true north)	Landcover Class	Ecological Unit (Kriekhaus et al. 1993)	Hydrologic Regime
SITK01	57.04687776	-135.3194379	1.4	0	N/A	Rockweed Intertidal	Beach	Brackish-Very Wet
SITK02	57.047430547	-135.3172846	7.4	5	340	Western Hemlock - (Sitka Spruce) / Depauperate Forest	Moraine	Mesic
SITK03	57.051723422	-135.3185861	1.7	28	230	Red Alder / Salmonberry Riparian Forest	Floodplain	Mesic-Wet
SITK04	57.051644381	-135.319106	5.0	2	80	Western Hemlock / Blueberry Species Forest	Lowland	Mesic-Wet
SITK05	57.050963268	-135.3199636	11.5	0	N/A	Western Hemlock - (Sitka Spruce) / Depauperate Forest	Lowland	Mesic
SITK06	57.049701456	-135.3170012	8.9	3	230	Red Alder / Salmonberry Riparian Forest	Floodplain	Mesic
SITK07	57.051015906	-135.3171692	4.3	0	N/A	Sitka Spruce - Western Hemlock / Devil's Club Forest	Stream Terrace	Mesic
SITK08	57.051958535	-135.3182527	7.7	34	215	Red Alder / Sitka Spruce / Salmonberry Forest	Floodplain	Mesic
SITK09	57.044892088	-135.3133799	2.5	1	142	Nootka Alkaligrass Tidal Flat	Beach	Brackish-Very Wet
SITK10	57.045027874	-135.3136238	2.9	4	122	American Dunegrass - Large Umbel Coastal Meadow	Beach	Brackish-Mesic
SITK11	57.04512829	-135.3136562	3.4	0	N/A	Red Alder / Sitka Spruce / Salmonberry Forest	Uplifted Beach	Mesic
SITK12	57.045477815	-135.3142669	7.3	0	N/A	Sitka Spruce - Western Hemlock / Red Alder / Salmonberry Forest	Uplifted Beach Meadow	Mesic
SITK13	57.046043426	-135.3130644	7.1	0	N/A	Developed	Uplifted Beach	Mesic

## Appendix C: Summary of Site Characters for Sitka National Historical Park Landcover Plots (continued)

Plot Name	Latitude (decimal degrees, NAD83)	Longitude (decimal degrees, NAD83)	Elevation (m)	Slope (percent)	Aspect (degrees from true north)	Landcover Class	Ecological Unit (Kriekhaus et al. 1993)	Hydrologic Regime
SITK14	57.046121294	-135.3149833	7.4	1	120	Western Hemlock - Sitka Spruce / Blueberry Species Forest	Uplifted Beach	Mesic
SITK15	57.047539596	-135.3161291	1.3	18	40	Red Alder / Salmonberry Riparian Forest	Floodplain	Mesic
SITK16	57.047707317	-135.3187251	2.7	12	255	Red Alder / Sitka Spruce / Salmonberry Forest	Uplifted Beach	Mesic
SITK17	57.047070377	-135.3153224	2.2	0	N/A	Tufted Hairgrass - Pacific Silverweed Halophytic Wet Meadow	Estuary	Brackish-Mesic
SITK18	57.047843104	-135.3145655	2.9	4	120	Sitka Spruce - Western Hemlock / Red Alder / Salmonberry Forest	Stream Terrace	Mesic
SITK19	57.04776532	-135.3140853	4.9	2	100	Tufted Hairgrass - Pacific Silverweed Halophytic Wet Meadow	Estuary	Brackish-Wet
SITK20	57.047110526	-135.3109615	3.3	8	160	Red Alder / Sitka Spruce / Salmonberry Forest	Uplifted Beach	Mesic
SITK21	57.048444003	-135.3132638	16.0	0	N/A	Red Alder / Salmonberry Riparian Forest	Stream Terrace	Mesic
SITK22	57.049167193	-135.3146834	8.2	2	135	Sitka Spruce - Western Hemlock / Devil's Club Forest	Floodplain	Mesic
SITK23	57.047396936	-135.3170785	5.2	2	45	Western Hemlock - (Sitka Spruce) / Depauperate Forest	Stream Terrace	Mesic
SITK24	57.051023701	-135.3309035	3.8	0	N/A	Developed	Lowland	Mesic
SITK25	57.051345063	-135.331315	4.9	2	140	Developed	Lowland	Mesic
SITK26	57.048358005	-135.3204043	3.0	12	180	Sitka Spruce - Western Hemlock / Red Alder / Salmonberry Forest	Uplifted Beach	Mesic
SITK27	57.048467472	-135.3195866	2.9	4	200	Developed	Lowland	Mesic







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NPS 314/121575, May 2013

**National Park Service**  
**U.S. Department of the Interior**



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**Natural Resource Stewardship and Science**

1201 Oakridge Drive, Suite 150  
Fort Collins, CO 80525

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