

## ***Callitropsis nootkatensis* Wetland Biophysical Setting**

### Yellow Cedar Wetland Biophysical Setting

#### Southern Alaska

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**Conservation Status Rank:** S4 (apparently secure)

#### ***Introduction***

The *Callitropsis nootkatensis* (yellow cedar) Wetland Biophysical Setting is a forested type dominated by *Callitropsis nootkatensis* occurring on poorly-drained, coastal sites in a temperate rainforest environment (Figure 1). Drainage is considered intermediate between forested peatlands and well-drained hemlock forests. *Callitropsis nootkatensis* is an ecologically, culturally and economically important tree species in the Pacific Northwest. This slow-growing, long-lived tree has few natural insect and disease agents and can achieve ages of more than 1,000 years (Harris 1990). In the climatically milder parts of its range, *Callitropsis nootkatensis* is a species of conservation concern due to drastic population reductions related to root injury under conditions of decreased snowpack (Hennon et al. 2006). Low snow cover may also impact *Callitropsis nootkatensis* populations by increasing the availability of first and second year growth to grazing deer (White et al. 2009).



Figure 1. Mixed conifer association including *Callitropsis nootkatensis* and with *Lysichiton americanus* in the understory in Glacier Bay National Park and Preserve.

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## Distribution

*Callitropsis nootkatensis* occurs in coastal mountain ranges from southern Alaska to the Siskiyou mountains in northern California (Figure 2). In the northern portion of its range, *Callitropsis nootkatensis* grows from sea level to near timberline but is limited to high elevations in its southern range (Harris 1990). The *Callitropsis nootkatensis* wetland biophysical setting distribution map was developed from the intersection of the U.S. Forest Service yellow cedar range draft map (Hennon et al. 2016) with forested wetland classes delineated by the National Wetlands Inventory (USFWS 2016).

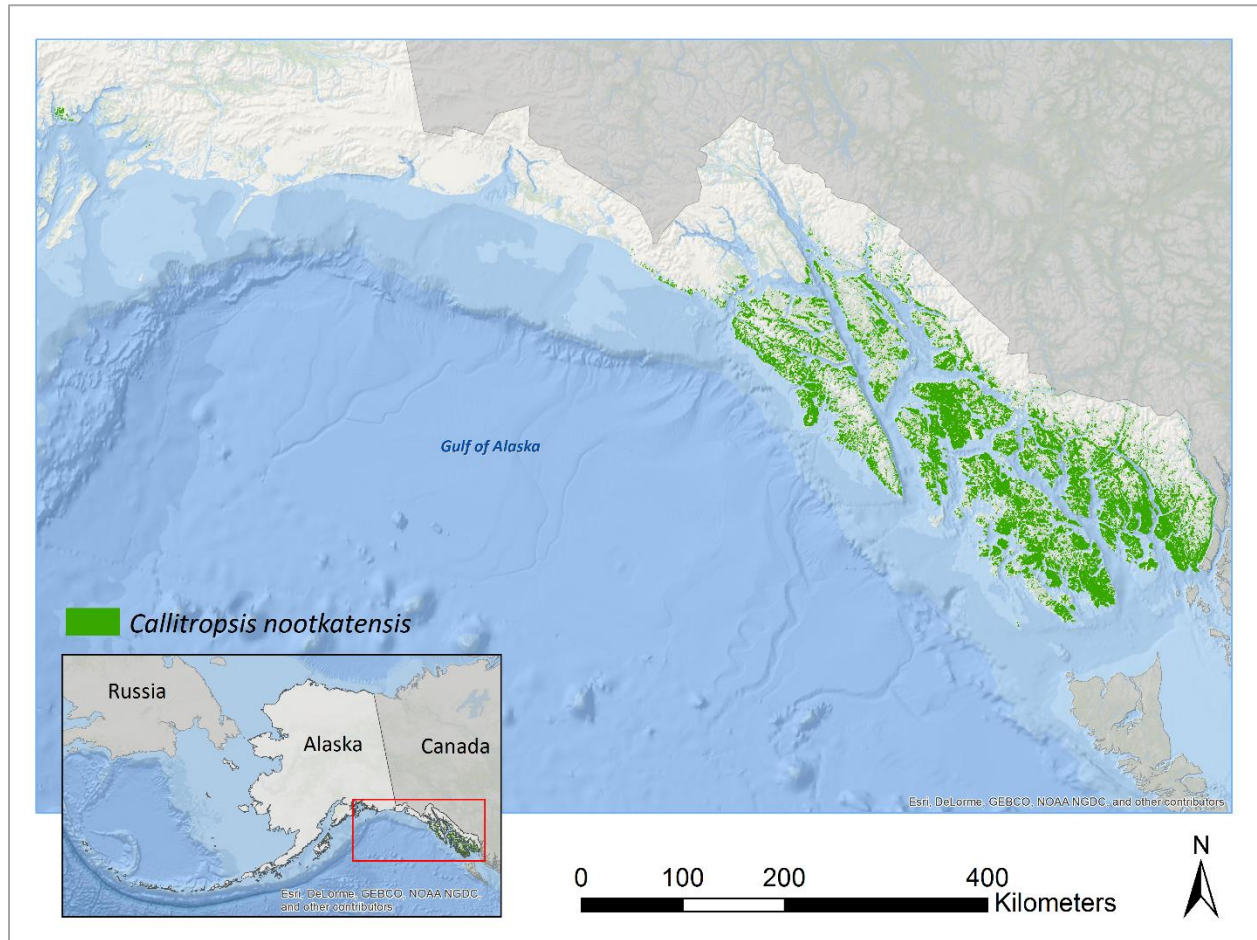


Figure 2. Distribution of the *Callitropsis nootkatensis* Wetland Biophysical Setting in southeast Alaska (Hennon et al. 2016). Note that the areas of occupancy in this map are buffered for greater visibility.

## Climate

Southern Alaska has a cool, wet maritime climate and is generally free of permafrost (Gallant et al. 1995, Nowacki et al. 2001). Mean annual precipitation ranges from 135 to 390 cm with 80 to 600 cm falling as snow. Average summer temperatures range from 7 to 18 °C; average winter temperatures are between -3 and 3°C.

## Environmental Characteristics

This biophysical setting generally occupies poorly-drained and low-elevation sites. The setting occurs on gently sloping and flat lowlands, and glacial kames, kettles, drumlins and outburst floodplains (Cauoette et al. 2006). Soil supporting *Callitropsis nootkatensis* wetlands are either classified as histosols or have a

histic epipedon. On sites with high water tables, *Callitropsis nootkatensis* is adapted to root shallowly and concentrate fine root growth near the soil surface; this strategy allows roots to respire and avoid hypoxia under saturated conditions (Hennon et al. 2016). Most commonly, drainage is retarded by compacted till or volcanic ash, which forms an impermeable layer. However, high water inputs may also contribute to wet soil conditions. On deep soils formed in colluviums or alluvium, excessive water received from neighboring slopes saturates the soil. Soils are usually stable. Sites with hummocky topography tend to accumulate deep, poorly-drained, organic-rich soils in the topographic lows leaving better drained soils on the topographic highs.

### **Vegetation**

Poorly drained sites in coastal temperate rainforests typically support *Callitropsis nootkatensis* in association with other conifers. Tree species include *Callitropsis nootkatensis* and sometimes *Tsuga mertensiana* (mountain hemlock), *Tsuga heterophylla* (western hemlock), *Pinus contorta* (lodgepole pine) and occasionally *Picea sitchensis* (Sitka spruce). In the southern portion of its range, *Thuja plicata* (red cedar) may also be present. The overstory is open with less than 45% cover. Snags are common and often represent 25% or more of the basal area. Poor soil drainage and low nutrient availability usually limit tree heights to 10 to 21 m, yet cedars in these associations often exceed 1,000 years in age. The understory is usually comprised of a dense shrub layer combined with dwarf conifers. Shrubs include *Menziesia ferruginea*, *Oplopanax horridus* and *Vaccinium* species. Understory wetland indicator species include *Gaultheria shallon*, *Lysichiton americanus* or both. These open forests have higher species richness compared to more productive sites with greater canopy closure, as greater sunlight penetration to the understory results in more niches for herbaceous plants and shrubs (Cauoette et al. 2014).

### **Climate Change, Succession and Disturbance**

Mortality of *Callitropsis nootkatensis* is widespread, totaling approximately 2,000 km<sup>2</sup> in the forests of Southeast Alaska (Figure 3). Affected stands are typically composed of long dead, recently dead, dying and some surviving trees, which suggests that the decline is long term and continuing. Tree death is expressed in a narrow, low-elevation band from sea level to 152 m (Hennon et al. 2012). *Callitropsis nootkatensis* roots are shallower and less cold tolerant than those of other associated conifers and are therefore more vulnerable to injury from superficial soil freezing. It is suspected that the persistence of snow beyond the last hard spring freeze protects *Callitropsis nootkatensis* from root injury. Thus, lower snowpack explains the broad spatial distribution of *Callitropsis nootkatensis* decline and heightened mortality in the warmer areas of its range (Hennon et al. 2008). The successional trajectory in these areas of decline is not well understood. Other conifer species already present as understory trees appear to be favored where the *Callitropsis nootkatensis* overstory has died. This secondary growth may remain even-aged for up to 300 years before gradually changing to an uneven-aged condition. Research of forest inventory plots in relationship to landscape factors in southeast Alaska suggests that *Callitropsis nootkatensis* is moving upslope with warming climatic conditions (Cauoette et al. 2015).



Figure 3. *Callitropsis nootkatensis* decline on a hillslope just above sea level on Chichagof Island, Southeast Alaska. Photo by P. Hennon.

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Stand-scale disturbances include blowdowns, floods, tidal waves and clearing. Blowdown is less common in relatively open *Callitropsis nootkatensis* stands than in other forest types with higher canopy closure. The response of vegetation relates to the scale and severity of the disturbance. In general, disturbances that impact the forest canopy but spare the understory and soil initiate secondary successional processes that are characterized by a short period of shrub dominance characterized by *Vaccinium* species, *Gaultheria shallon* and/or *Menziesia ferruginea*, followed by reestablishment by conifers that are either present in the understory prior to the disturbance or germinated after the disturbance.

### **Conservation Status**

**Rarity:** Just under 500 occurrences of *Callitropsis nootkatensis* wetlands occupying 7,785 km<sup>2</sup> are estimated to occur in Southeast Alaska.

**Threats:** Climate change, particularly that effecting the duration of snowpack relative to late-season cold events is suspected to drive *Callitropsis nootkatensis* population declines in Alaska (Hennon et al. 2008). Timber harvest, especially activity targeting low and accessible locations, represents an additional threat.

**Trend:** Widespread mortality of *Callitropsis nootkatensis* totaling more than 2,000 km<sup>2</sup> of its approximate 10,000 km<sup>2</sup> range in Alaska has been documented by Hennon and others (2016). In the short-term, 29% of the range is projected to decline, with declines reaching 38% in the long-term (Hennon et al. 2016).

### Species of Conservation Concern

The animal and plant species listed below are designated critically imperiled or vulnerable either globally (G1-G3) or within Alaska (S1-S3) and are known or suspected to occur in this biophysical setting (Table 1, Table 2). Please visit the Alaska Center for Conservation Science website for species descriptions (ACCS 2016).

Table 1. Amphibian, mammal and bird species within the *Callitropsis nootkatensis* Wetland Biophysical Setting.

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
<b>Amphibians</b>				
Columbia spotted frog	<i>Rana luteiventris</i>	G4	S2	Known from isolated ponds in the Taku, Stikine and Unuk River corridors, could occur in ponds associated with <i>Callitropsis nootkatensis</i> wetlands.
Northwestern salamander	<i>Ambystoma gracile</i>	G5	S3	Known to occur in south of Ketchikan on Mary Island and northwest Chichagof Island near Pelican, likely found in <i>Callitropsis nootkatensis</i> wetlands in these areas.
Western toad	<i>Anaxyrus boreas</i>	G4	S3S4	Known to occur in southeast Alaska's island and mainland coastal rainforest habitat; and likely found in <i>Callitropsis nootkatensis</i> wetlands.
<b>Mammals</b>				
Alexander Archipelago wolf	<i>Canis lupis</i> ssp. <i>ligoni</i>	G4T3	S3	Found in coastal spruce-hemlock forests with preference for areas where prey are most abundant. This coastal wolf subspecies likely uses <i>Callitropsis nootkatensis</i> forested wetlands in search of prey.
California myotis	<i>Myotis californicus</i>	G5	S2	Suspected to occur in limited areas of <i>Callitropsis nootkatensis</i> forested wetlands.
Keen's myotis	<i>Myotis keenii</i>	G2G3	S1S2	In Southeast Alaska this species occurs primarily in coniferous forests with females preferring old-growth forests and cedar trees in riparian areas for day roosts.
Long-tailed vole	<i>Microtus longicaudus</i>	G5	S3	Prefers various habitats and likely occurs in <i>Callitropsis nootkatensis</i> forested wetlands.
Prince of Wales flying squirrel	<i>Glaucomys sabrinus</i> ssp. <i>griseifrons</i>	G5T2	S2	This Prince of Wales island endemic is dependent on old-growth Sitka spruce-western hemlock forest and is likely present in <i>Callitropsis nootkatensis</i> forested wetlands.
Wrangell Island red-backed vole	<i>Myodes gapperi</i> ssp. <i>wrangeli</i>	G5T3	S3	Endemic known from three islands in southeast Alaska, prefers mesic forested habitats and likely occurs in <i>Callitropsis nootkatensis</i> wetlands.
<b>Birds</b>				

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
Cedar Waxwing	<i>Bombycilla cedrorum</i>	G5	S3B	Prefers coniferous wetland edge with peatland habitat.
Great Blue Heron	<i>Ardea herodias</i>	G5	S2S3	Suspected to nest in tall trees of wetlands near tidal and freshwater.
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	G3G4	S2S3	Nest in old-growth hemlock and Sitka spruce on moss-covered trunks, or on ground near sea-facing talus slopes or cliffs.
Northern Pygmy Owl	<i>Glaucidium gnoma</i>	G5	S3	Habitat consist of forests or open woodlands in foothills and mountains, including adjacent meadows while foraging (AOU 1983).
Queen Charlotte Goshawk	<i>Accipiter gentilis laingi</i>	G5T2	S2	Nest in either Sitka-spruce or western hemlock. Typically hunt in continuous forests.

Table 2. Plant species of conservation concern within the *Callitropsis nootkatensis* Wetland Biophysical Setting.

Scientific Name	Global Rank	State Rank	Habitat Description
<i>Cardamine angulata</i>	G5T3	S3	Wetland plant likely found in association with <i>Callitropsis nootkatensis</i> .
<i>Cardamine pensylvanica</i>	G5T3	S3	Wetland plant likely found in association with <i>Callitropsis nootkatensis</i> .
<i>Luzula comosa</i>	G4G5	S1	Meadows, open woods and coniferous forests.
<i>Lycopodiella inundata</i>	G5	S3	Wet meadows and bogs.
<i>Platanthera orbiculata</i>	G5	S3S4	Occurs in wet coniferous and deciduous forest and forested fens.
<i>Polystichum setigerum</i>	G3	S3	Mixed conifer forests.

### Plant Associations of Conservation Concern

The plant associations listed below are designated critically imperiled or vulnerable either globally (G1-G3) or within Alaska (S1-S3) and are known or suspected to occur in this biophysical setting (Table 3).

Table 3. Plant associations of conservation concern within the *Callitropsis nootkatensis* Wetland Biophysical Setting.

Name	Global Rank	State Rank	Concept Source
Mixed conifer/ <i>Gaultheria shallon</i>	G3	S3	DeMeo et al. 1992
Mixed conifer/ <i>Gaultheria shallon</i> / <i>Lysichiton americanum</i>	G3	S3	DeMeo et al. 1992
Mixed conifer/ <i>Lysichiton americanus</i> - <i>Athyrium filix-femina</i>	G3	S3	Martin et al. 1995
Mixed conifer/ <i>Vaccinium</i> spp.- <i>Gaultheria shallon</i>	G3	S3	DeMeo et al. 1992
Mixed conifer/ <i>Vaccinium</i> spp.- <i>Gaultheria shallon</i> / <i>Fauria crista-galli</i>	G3	S3	DeMeo et al. 1992

### Classification Concept Source

The classification concept for this biophysical setting is derived from DeMeo and others (1992), Martin (1989), and Pawuk and Kissinger (1989).

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