

## **Larix laricina Wetland Biophysical Setting**

### Tamarack Wetland Biophysical Setting

#### Interior Alaska

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**Conservation Status Rank:** S3 (vulnerable)

#### **Introduction**

The *Larix laricina* (Tamarack) Wetland Biophysical Setting is represented by open forests dominated by *Larix laricina* and *Picea mariana* (black spruce) occurring on wet lowlands in interior Alaska (Viereck and Little 1972, Heebner 1982, Viereck et al. 1992, Juday 2001, Boggs et al. 2001). Trees are small and stunted and the understory is comprised of species commonly found in *Picea mariana* forested bogs (Viereck et al. 1992; Figure 1). *Larix laricina* as a species is of conservation concern due to both the drastic population reductions caused by infestations of larch sawfly (*Pristiphora erichsonii*) and the geographic and potentially genetic separation of the Alaska population from to the North American population. Published descriptions of the plant associations and successional processes of *Larix laricina* wetlands are limited and thus threats and trend of the greater biophysical setting are not fully understood.



Figure 1. *Larix laricina* Wetland Biophysical Setting at Denali National Park, Alaska.

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#### **Distribution**

*Larix laricina* is a disjunct species restricted to drainages between the Brooks and Alaska Ranges. It is locally abundant along the Tanana River but scattered along the Yukon, Kuskokwim and Koyukuk Rivers (Viereck and Little 2007). The *Larix laricina* Wetland distribution map (Figure 2) was developed from manual digitization of the *Larix laricina* range in Alaska (Viereck and Little 2007). Collection records document the occurrence of *Larix laricina* in wetland habitat (CPNWH 2016).

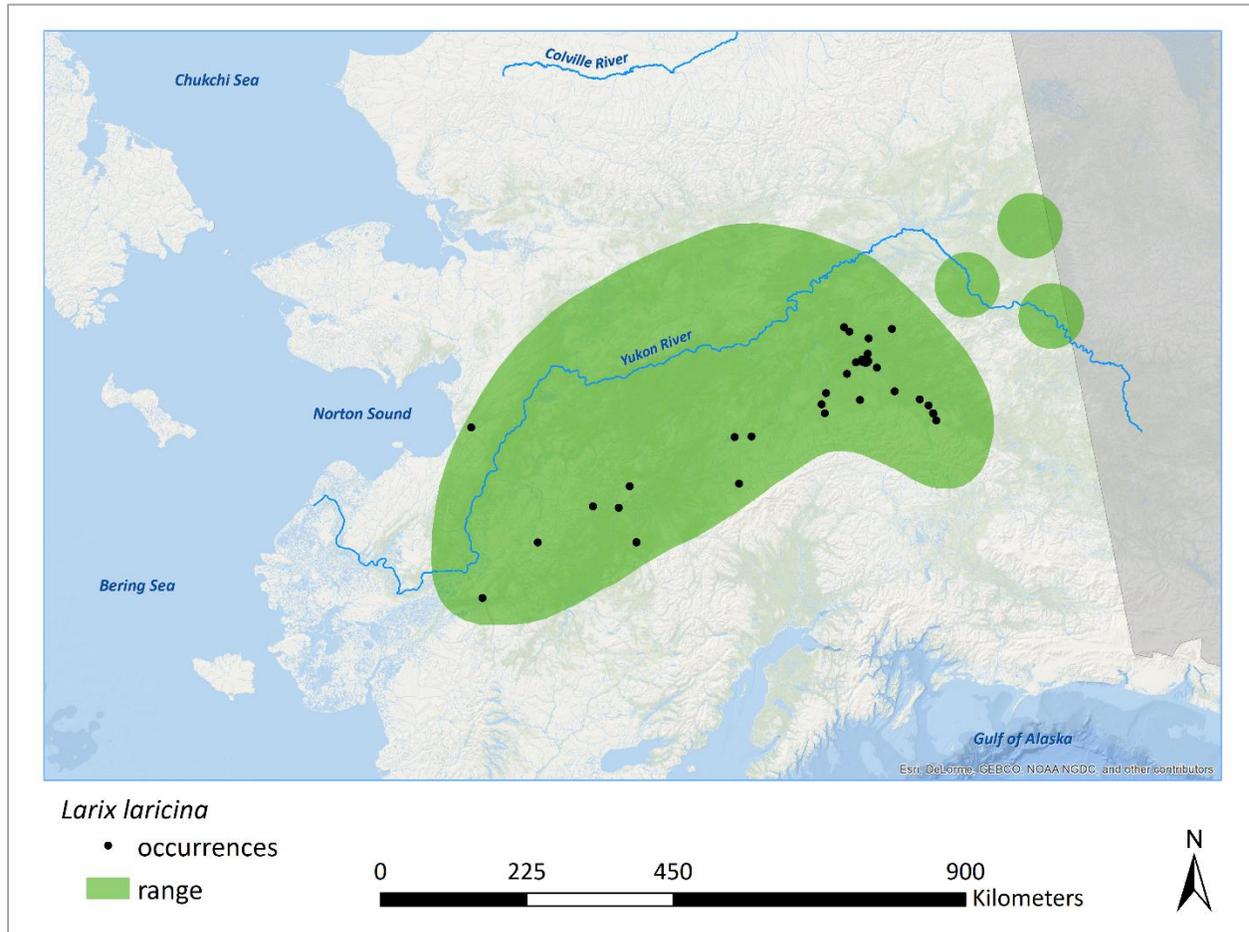


Figure 2. Distribution of the *Larix laricina* Wetland Biophysical Setting. Note only small patches of mature *Larix laricina* forest occur within its range and the occurrences shown in the map are buffered for greater visibility.

### Climate

Interior Alaska has short, warm summers and long, cold winters. The subarctic continental climate is dry and cold (Natural Resources Conservation Service, 2006). Mean annual precipitation ranges from about 15 cm in the northwest lowlands to over 254 cm in the Alaska Range. In summer, afternoon thunderstorms are common in valleys and lower mountain slopes. The mean annual temperature ranges from -13 to -2 °C and freezing temperatures may occur in any month in most of the region.

### Environmental Characteristics

The *Larix laricina* Wetland Biophysical Setting is generally restricted to wet and cold sites underlain by shallow permafrost (Figure 3; Brown et al. 1988, Viereck and Little 2007). Site slopes range from 0 to 6 degrees and elevations range from 198 to 479 m (Heebner 1982, Boggs et al. 2001). This biophysical setting occurs on both nutrient-poor, acidic peatlands (Damman and French 1987, Johnston 1990) and nutrient rich nonacidic peatlands (Juday 2001).

### Vegetation, Succession and Disturbance

On wet sites, *Larix laricina* trees are typically stunted, achieving heights of only 3 m and diameters of 8 cm; sites with better drainage support mature trees 9-18 m tall and 10-25 cm in diameter (Johnston 1990, Viereck and Little 2007). The maximum age for *Larix laricina* is about 180 years. In wetland habitats, the



Figure 3. Stand of *Larix laricina* near Fairbanks, Alaska.

overstory is dominated by *Larix laricina*, with *Picea mariana* and *Betula neoalaskana* present as codominants or minor associates; total canopy cover ranges from 10-30%. Understory shrubs include *Andromeda polifolia*, *Betula nana*, *Chamaedaphne calyculata*, *Ledum palustre* ssp. *decumbens*, *Rubus chamaemorus*, *Vaccinium uliginosum*, and *V. vitis-idaea* (Heebner 1982, Boggs et al. 2001). The herbaceous layer may include *Eriophorum vaginatum*, *Equisetum fluviatile*, *Drosera rotundifolia*, *Carex bigelowii*, *C. rhynchophylla*, *Sparganium angustifolium*, *Menyanthes trifoliata* and *Comarum palustre*. Cover of peat mosses in the *Sphagnum* genus is often high (Heebner 1982, Boggs et al. 2001).

In interior Alaska, the thawing of permafrost under a tree canopy may result in pond formation (Drury 1956). As plants colonize and peat accumulates in the pond, *Larix laricina* communities will develop. *Larix laricina* is a pioneer or early seral species that commonly establishes in the wettest portions of a wetland. It is the first tree to colonize floating

*Sphagnum* mats and may also invade bogs during the sedge mat, or ericaceous shrub stages (Beefink 1951, Brown et al. 1988, Gates 1942). *Larix laricina* is extremely intolerant of shade and is eventually replaced by *Picea mariana*.

Several folivorous insects infest *Larix laricina* stands in interior Alaska. These include the larch sawfly (*Pristiphora erichsonii*), larch casebearer (*Coleophora laricella*), larch bud moth (*Zieraphera* sp.) and eastern larch beetle (*Dendroctonus simplex*; Johnson 1990, Werner 1980, Werner 1986). Repeated larch sawfly infestations from 1993 through 1999 killed most populations of *Larix laricina* across an estimated 651,100 ha area of interior Alaska (U.S. Department of Agriculture 1999). Female sawflies deposit eggs in new shoots near the branch tips. The hatched larvae feed on needles for 3–4 weeks, generally in late June and early July with several consecutive years of heavy defoliation leading to tree death. Outbreaks of the larch casebearer (*Coleophora laricella*) have also caused extensive mortality in some areas (Johnston 1990).

*Larix laricina* is susceptible to damage from flooding and disruptions in groundwater movements. Trees have been killed over large areas where newly-constructed roads or beaver dams impede water movement (Johnston 1990).

### Conservation Status

**Rarity:** This biophysical setting is widespread in interior Alaska, but limited in total area with only 41 occurrences documented. The Alaska population is of conservation concern because it is isolated from the remaining North American population (Figure 2). *Larix laricina* is thought to have entered Alaska along the Mackenzie River corridor and became isolated from the Yukon Territory populations when the climate subsequently cooled (pers. comm. Glenn Juday). At one time, the Alaska population was also considered either a distinct species or as a variety of *Larix laricina* on the basis of narrower cone scale and bracts (Figure 4); however the variability is now generally recognized as within the range of other populations of the species (Johnston 1990, Parker and Dickinson 1990, United States Department of Agriculture, 2015).

**Threats:** Threats include infestations of larch sawfly (*Pristiphora erichsonii*) and eastern larch beetle (*Dendroctonus simplex*) as well as forest fire and climate change. A warming climate will likely affect the range of this biophysical setting in Alaska as wet, interior lowlands



Figure 4. *Larix laricina* cones and needles, near Fairbanks Alaska.

dry and permafrost-supported ecosystems shift north.

**Trend:** *Larix laricina* as a species is of conservation concern because of drastic population reductions caused by infestations of larch sawfly (*Pristiphora erichsonii*) in stands across the northern United States and Canada. In Alaska it is estimated that over 2,800 km<sup>2</sup> of larch forest were impacted since the beginning of the infestation in 1999 (Burnside et al. 2007). In the Nowitna National Wildlife Refuge *Larix laricina* trees that established following the sawfly damage of 1998-2000 are now producing cones (pers. comm. Karin Bodony, USFWS). Short-term declines related to climate warming and drying, which is expected to decrease the fire return interval and potentially compromise permafrost-supported wetland systems are predicted. In the long-term, declines related to future larch sawfly and eastern larch beetle infestations are predicted.

### Species of Conservation Concern

The mammal 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). Additional study is required to evaluate whether this biophysical setting supports other mammal or bird species of conservation concern. Please visit the Alaska Center for Conservation Science website for species descriptions (ACCS 2016).

Table 1. Mammal species of conservation concern within the *Larix laricina* Wetland Biophysical Setting.

Common Name	Scientific Name	Global Rank	State Rank	Habitat Description
<b>Mammals</b>				
Alaska tiny shrew	<i>Sorex yukonicus</i>	GU	S3	The tiny shrew is a habitat generalist that will use <i>Larix laricina</i> wetland habitat when present.

Table 2. Plant species of conservation concern within the *Larix laricina* Wetland Biophysical Setting.

Scientific Name	Global Rank	State Rank	Habitat Description
<i>Circuta bulbifera</i>	G5	S3	Uncommon in wet sedge meadows and pond margins.
<i>Sphagnum balticum</i>	G2G4	S4	Abundant in hollows and floating mats in raised bogs and poor fens.
<i>Splachnum luteum</i>	G3	S4	Grows on dung in fens and bogs across the boreal forest.
<i>Splachnum rubrum</i>	G3	S2	Grows on dung in fens and bogs across the boreal forest.
<i>Warnstorfia pseudostraminea</i>	G3	S3	Found in mineral-poor and acid habitats (disturbed), slightly sloping poor fens, ditches, periodically water-filled depressions.

### **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 *Larix laricina* Wetland Biophysical Setting.

Name	Global Rank	State Rank	Concept Source
<i>Larix laricina</i> / <i>Chamaedaphne calyculata</i> / <i>Sphagnum</i> spp.	G3	S3	Boggs et al. 2001
<i>Picea mariana</i> - <i>Larix laricina</i> / <i>Andromeda polifolia</i> - <i>Eriophorum vaginatum</i> / <i>Sphagnum</i> spp.	G3	S3	Heebner 1982
<i>Picea mariana</i> - <i>Larix laricina</i> / <i>Empetrum nigrum</i> / <i>Sphagnum</i> spp.	G3	S3	Heebner 1982
<i>Picea mariana</i> - <i>Larix laricina</i> / <i>Ledum palustre</i> ssp. <i>decumbens</i> - <i>Vaccinium uliginosum</i> / <i>Hylocomium splendens</i>	G3	S3	Heebner 1982
<i>Picea mariana</i> - <i>Larix laricina</i> / <i>Ledum palustre</i> ssp. <i>decumbens</i> / <i>Sphagnum</i> spp.	G3	S3	Heebner 1982

### **Classification Concept Source**

The classification concept for this biophysical setting is based on Heebner (1982) and the *Picea mariana*-*Larix laricina* forest community described by Viereck and others (1992).

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