



# Refined Distribution Map and Identification of Healthy Larch (*Larix laricina*) Stands in Alaska: Year 2 results

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## INTRODUCTION

Larch sawfly (*Pristiphora erichsonii*) is an invasive defoliator in Alaska. Based on aerial survey data, it is estimated that 600,000-700,000 acres of larch forest in Alaska have been impacted by a larch sawfly infestation that began in 1993 and continues to a lesser degree to the present time (Figure 1). The mortality of larch affected by the larch sawfly has been documented to reach 80%, with mortality being concentrated in the larger trees. As a result, concern has been expressed that the extent of the larch mortality may necessitate genetic conservation measures.

Further information, however, is needed before an informed decision can be made regarding the true nature of the larch sawfly infestation on larch in Alaska. First, inaccuracies exist in the mapped distribution of larch in Alaska, as demonstrated by the fact that the larch sawfly infestation has been documented well outside the mapped distribution of larch (Figure 1). Second, the entire range of larch has not been surveyed for larch sawfly infestation because of the large acreages covered during annual aerial pest detection surveys and the necessity of traveling between settlements for plane refueling. As a result, larch sawfly infestation, and associated mortality, has not been assessed over large expanses of the general distribution of larch in Alaska (>50,340,000 acres). Third, healthy stands of larch have been observed by aerial pest detection surveys crews, but the extent of these stands has not been documented. The current FHM Evaluation Monitoring project was undertaken to more accurately assess the impacts of past larch sawfly infestation on the Interior Alaska larch resource.



## OBJECTIVES

- Refine the distribution map of larch in Alaska;
- Map the location of healthy larch stands across the distribution of the species ;
- Map the larch sawfly infestation in areas not previously covered during annual aerial pest detection surveys;
- Provide information necessary for making the determination whether to proceed with a genetic conservation program for larch.

## METHODS

In Alaska, larch (aka "tamarack") grow primarily in a mixed forest type with black spruce (*Picea mariana*). As a result, it's difficult to accurately discriminate and separately type-map live larch (also damage types) during the Alaska Aerial Detection Survey conducted during July and August each year. Over two years, we conducted aerial surveys in the fall when larch foliage changes color, and is easily distinguishable from black spruce which (Photo 1). In year 1 (Sept. 2006), this special "healthy larch" survey was concentrated primarily across the eastern portion of the reported range of larch in Interior Alaska. In Sept. 2007, additional areas along the western distribution area were covered before weather conditions halted the survey (Figure 1). During this 2-year healthy larch survey, in addition to larch presence/absence noted along the survey grid, we also noted relative densities (i.e. low, medium, high) of healthy larch stands using a Digitally-Assisted Sketch Mapping (DASM) system, linked to a wireless GPS unit and tablet computer using a standard georeferenced map base (e.g., USGS quads) for attributing the polygon data. We also attributed relative age of the healthy larch stands for the larch polygons acquired by the DASM system.

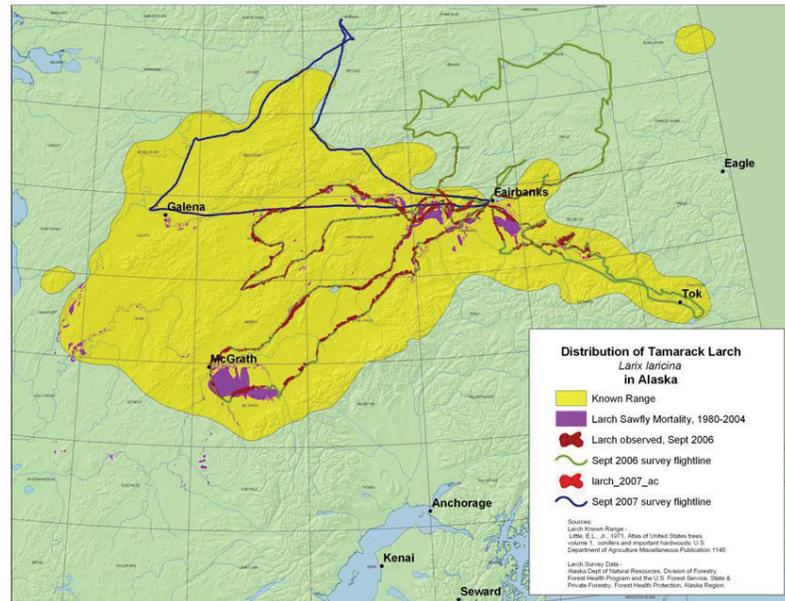


Figure 1. Recognized distribution of larch in Alaska, areas of larch sawfly mortality as a result of larch sawfly infestation, and areas of healthy larch stands mapped during September 2006 and September 2007.

## YEAR 1 RESULTS

During 18-22 September 2006, aerial surveys were conducted over the eastern portion of interior Alaska, both inside and outside the recognized range of larch (Viereck, L.A. and E.L. Little, Jr. 2007, Alaska Trees & Shrubs, 2nd ed. Univ. of Alaska Press, 359 p.) (Figure 1); 2,572 miles were flown, encompassing a 6,067,738 acre survey area containing larch stands. The land area with healthy larch stands totaled 673,685 acres (11.1% of area surveyed). Outside the mapped range of larch, 10,651 acres of healthy larch areas were identified (Figure 1). The density of healthy larch stands within the currently recognized distribution of the species was modeled using the results of the September 2006 aerial surveys in conjunction with slope and elevation data (Figure 2). So late in the season (just prior to snowfall), it was not possible to distinguish, and accurately map, where larch sawfly infestation had occurred during the previous summer.

## YEAR 2 RESULTS (2007)

During 17-20 September 2007, an additional 817 miles were flown, encompassing 2,039,185 acres to add to the healthy larch survey database. The 2007 survey covered a good portion of the NW portion of Interior Alaska, both inside and outside the recognized distribution range. Approach of inclement weather prevented additional mapping of the SW and far western larch extent, however (Fig 1).



Photo 1: Aerial view of a larch stand during fall colors in interior Alaska.

## CONCLUSIONS

- The project aided in refining the known distribution map of larch in Alaska;
- Past forest damage detection data (aerially mapped larch sawfly damage), and larch type mapping during routine summer surveys, provides some measure of accuracy for locating healthy larch stands. However, future assessments of the larch resource, and extent of its distribution in Interior Alaska will require association with additional ground plot verifications.
- The results of this special larch aerial surveys indicate that substantial areas of healthy larch stands exist in interior Alaska. Therefore, a genetic conservation plan for larch in Alaska is likely not necessary at this time.
- Questions remain regarding the regeneration potential of the existing healthy larch stands because the existing trees may be too small (young) to produce cones.
- The modeling of healthy large stands may allow for additional refinement of the recognized distribution map of larch in interior Alaska, in conjunction with other verifiable aerial and ground plot monitoring data.

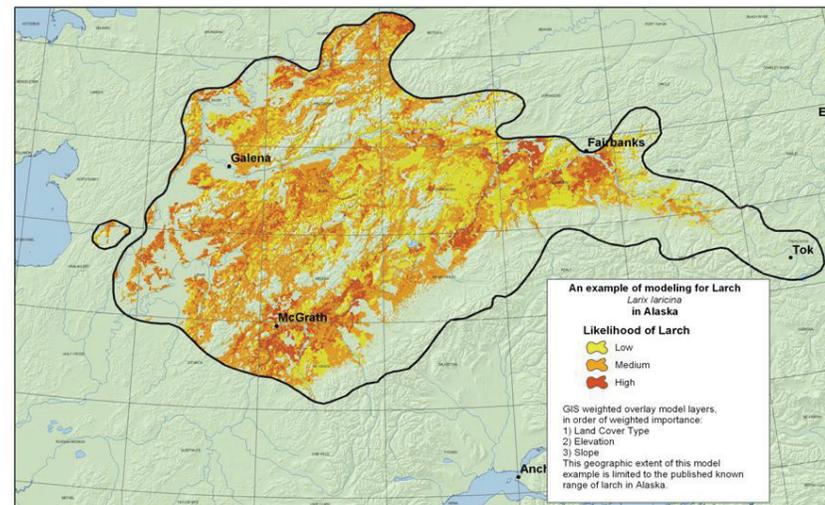


Figure 2. Modeled density of healthy larch stands in interior Alaska based on September 2006 aerial survey results.



Adult larch sawfly



Mature sawfly larva



Sawfly larva damage



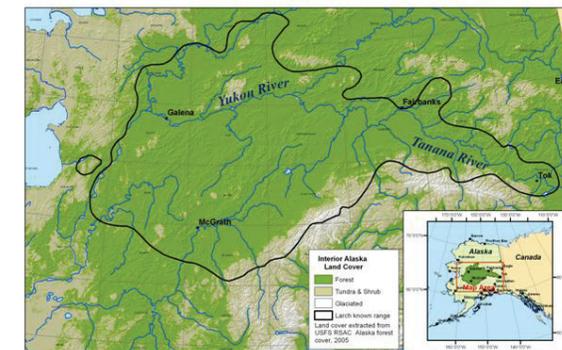
Healthy larch needles

**Tamarack Larch**, or Tamarack or American Larch (*Larix laricina*) is a species of larch native to northern North America, mainly in Canada, from eastern Yukon and Inuvik, Northwest Territories east to Newfoundland, and also south into the northeastern United States from Minnesota to West Virginia, there is also a disjunct population in central Alaska. The name Tamarack is the Algonquian Native American name for the species.

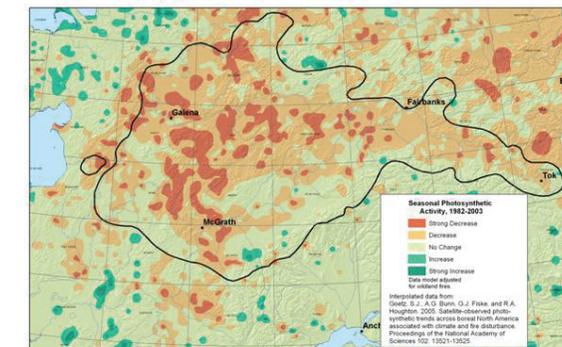
The central Alaskan population, separated from the eastern Yukon populations by a gap of about 700 km, is treated as a distinct variety.

In Alaska, larch is a small indigenous tree of lowland muskeg habitats. Fossil records from the Wisconsin glaciation indicate that Alaska larch survived in Alaska as a small disjunctive population on the Yukon River flats. The range of Alaska larch expanded little during the Holocene and the species is now distributed only in the lower Yukon and Tanana River drainages. Alaska larch is highly shade intolerant, and on upland habitats, it fails to compete with trees of similar stature. As a juvenile, Alaska larch is the fastest growing indigenous conifer in Northern Alaska. Because of its small size and limited range, however, Alaska larch has little commercial value except for firewood and novelty items.

The larch sawfly (*Pristiphora erichsonii*) (Hymenoptera: *Tenthredinidae*) was first recorded in North America in 1880. It is believed to be of European origin and was first recorded from Alaska in 1965. Outbreaks of the larch sawfly became apparent in Alaska in 1993 when 12,000 acres of tamarack defoliation was observed in interior Alaska. By 1996, this outbreak encompassed more than 600,000 acres and still continues. Heavily defoliated trees commonly re-foliate after a few weeks. Repeated defoliation, however, can result in trees with thinned foliage, branch mortality, and a significant growth loss. Larch growing on poor sites that have been defoliated for consecutive years may die. Tamarack mortality has been observed over extensive areas of interior Alaska.



The interior region of Alaska has a highly continental climate, with the warmest summers in the state, as well as the lowest record winter temperatures. Mean annual temperatures average slightly below freezing, with the January average of -18F (-28C), and June average of 70F (21C). In general, the interior ecosystem is spruce-dominated: black spruce and sphagnum moss on poorly drained permafrost with a thin active layer (muskeg) and white spruce on the better drained uplands. Disturbed areas have a fireweed - willow - birch/aspens/valder - spruce succession. Permafrost is discontinuous and easily disturbed by fire or human activity. Tree line is on the order of 1000 meters elevation or lower, sloping downward toward the west and north.



There is evidence that interior Alaska forests may be in decline following an initial growth spurt associated with climate change. The reasons for this decline are not certain, but related work points to increased drying as a likely cause. The observed warming and drying are consistent with climate model predictions for the region.



Larch sawfly defoliation in interior Alaska

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