

TITLE: Assessing mortality and regeneration of larch* (*Larix laricina*) after a 1999-2004 landscape level outbreak of the larch sawfly (*Pristiphora erichsonii*) in Alaska

[* Other names: Alaska larch, eastern larch, hackmatack, tamarack, *Larix alaskensis* W. F. Wight, *L. laricina* var. *alaskensis* (W. F. Wight) Raup; ref: Viereck, L.A. and E.L. Little, Jr., 2007, Alaska Trees and Shrubs, 2nd ed., Univ. of AK Press]

LOCATION: Interior Alaska

DURATION: Year 2 of 2-year project **FUNDING SOURCE:** Base

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PROJECT OBJECTIVES: The primary objective of this project is to assess the causes(s) of mortality associated with a landscape-level infestation of the larch sawfly that occurred in Alaska between 1999 and 2004. Since the majority of the larch stands in Alaska's interior are remote, with no easy or cost-effective access, this assessment will require some analysis of previously acquired data layers (primarily insect and vegetation cover) to be able to select a subset of targeted stands for ground survey and sampling. We will also provide base forest health information that can be used to determine the ability of these stands to regenerate. Using the collected data we hope to be able to determine the primary source of mortality from the recent sawfly outbreak; we will also measure various stand parameters in the targeted stands that should provide clues to regeneration success (or lack of regeneration) in the heaviest defoliated areas during the 1999-2004 outbreak. This project will build on information gained from a previously funded, and completed, evaluation monitoring project (WC FHM 05-02; see 2007 project report) that refined the extent and distribution of Alaska's native larch and identified stands that survived the massive larch sawfly outbreak first observed from Aerial Detection Monitoring in 1999.

From the Aerial Detection Surveys, using AKDNR's (AK Dept. of Natural Resources, Div. of Forestry) 1980-2007 forest damage database, larch modeling and other archived and GIS'd AKDNR data, we will determine the stands that will be ground surveyed. Over the 2 years proposed for this project, we will survey 4 to 6 representative larch stands across the known distribution area of larch in interior Alaska.

Year one (2008):

We will:

1. Visit at least two "accessible" but ideally 4 larch stands along the interior Alaska road system near Fairbanks, establish permanent plot transects, and measure a variety of larch stand characteristics (age, diameter, and stocking estimates), size class distribution, and past and current disturbance (insect mortality, fire).
2. Record, among other metrics, stand composition, larch size class and distribution within stands, age cohorts, presence/absence of cones, larch regeneration estimates, percent insect mortality (larch beetle), other mortality, wildfire evidence, etc.
3. Compile a forest health risk matrix in spreadsheet form as well as a narrative report describing our results from the combined aerial and ground detection monitoring assessments that will aid the selection of stands for year 2 sampling.
4. Review recent Alaska and Canada literature on growth and reproduction factors for Alaska larch.

Year two (2009):

We will:

1. Visit and establish 2-4 permanent plot transects in 4-6 stands, more remote (roadless) areas across the known interior Alaska larch distribution,
2. Summarize our collective data from 2008 and 2009, including appropriate output maps.
3. Compare this information with the only existing “post sawfly outbreak” ground plot data available, collected by USFS/FHP on the Innoko River (SW Interior Alaska) between 2000 and 2007.

JUSTIFICATION: Fully 80% of the larch areas observed and mapped during the 1999-2004 sawfly outbreak in Interior Alaska sustained significant mortality, with mortality appearing to be concentrated in larger trees. Larch is a shade-intolerant early successional species that requires a significant component of mature, cone bearing trees for sustainability from significant stand disturbances. Many stands sustained close to 100% mortality three to four years after this outbreak was first documented and aerially mapped. Without a cost-effective way to conduct aerial survey ground checks of aerial survey observations within most of the areas larch is located in the Interior (e.g., slack water swampy areas assoc. with black spruce), insect mortality causal agents are difficult to assess or distinguish from other potential mortality (disease, abiotic agents, etc.).

Also, questions still remain concerning regeneration potential of most stands with healthy larch because the existing trees may be too small (young) to produce cones. Also, the lack of road access to fully 95% of Alaska’s larch areas, cost, and logistical considerations for gathering ground plot data in these remote areas has resulted in very little historical, even recent larch stand information, being available across the species’ range.

This proposed project addresses the following evaluation monitoring project selection criteria: (1) The project was initially identified from FHM Aerial Detection Survey monitoring data; (2) The proposed project is significant in geographic scale in that the requested funding will assess impacts on the state-wide distribution of larch in Alaska which is in the interior, north of the foothills of the Alaska Range; (3) Biological impacts of the recent extensive larch sawfly outbreak (99-04) and catastrophic 2004 & 2005 fire season in interior Alaska can be assessed over the entire state-wide distribution of larch utilizing previously acquired geospatial data in a GIS from several sources; and (4) This project can be successfully completed, using a combination of archived and GIS’d resource data to select representative areas for plot sampling and reserving significant funding for contractual items (small plane charter costs & travel time) to reach the more remote areas of the larch distribution in Interior Alaska.

DESCRIPTION:

a. Background: Larch sawfly is an invasive defoliator in Alaska. Based on aerial survey data, this insect has impacted an estimated 600,000-700,000 acres of larch stands in Alaska as recently as a 6-year period between 1999 and 2004. As stated above, mortality of larch within the sawfly-defoliated stands has been documented by aerial surveys to reach 80% or more in the majority of affected larch stands. Experienced aerial surveyors have estimated 100% mortality on some sites, likely a result of several consecutive years of defoliation on the poorest larch sites. Based on recent surveys that assessed the extent of healthy larch stands remaining after the late 1990s outbreak, and the available peer-reviewed literature, questions remain regarding the regeneration potential (e.g., cone production) in the existing post-outbreak stands as well as the biotic (insects and disease) and abiotic impacts and causes of past and current larch mortality. With this project we hope to identify key risk factors associated with repeated sawfly defoliation and mortality impacts from that defoliation.

b. Methods: Over the 2 year project period, we will conduct site visits to 8-10 representative stands across the previously described distribution area of larch in Interior Alaska to assess larch regeneration, age, size class distribution, and cause of the mortality resulting from the late 1990s larch sawfly outbreak, including an assessment and measurement of potential abiotic risk factors (e.g., past fire presence/absence, soil and nutrient characteristics as evidenced by understory vegetation and other easily measured data). Using previously archived resource information, GIS modeling of existing databases, and existing recent ground plot information (e.g., 2000-2007 Innoko River USFS/FHP larch plot data) **, we will develop a set of risk factors to assess regeneration potential and forest insect hazard to larch in Alaska. A peer-reviewed publication of significant findings may be warranted, however, that would likely entail a future request for continuation funding beyond the proposed 2-year period of this proposed evaluation monitoring project.

*[** Archived GIS data exists from the USFS/FHP & AKDNR FHM Aerial Detection/Detection Monitoring surveys (1980-2007), Alaska wildfire dataset (1950-2007), USGS AK LandFire vegetation plot dataset (2006-2007 for Interior AK), and results from a healthy larch distribution survey completed during 2006 and 2007. USFS/FIA ground plot data, although somewhat dated, is also available. Alaska larch ground plot data is virtually non-existent in the peer reviewed literature. However, permanent plots established by USFS/FHP Region 10 in 1999 along the Innoko River (western extent of Interior Alaska larch distribution) are available (1999, with re-measurements between 2000 and 2007), and will be used to compare and contrast with the ground plots proposed for this Evaluation Monitoring project. University of Alaska research project reports and a few graduate theses are also available for more information on risk factors associated with regeneration, stocking and survivability of larch, commonly associated with black spruce, *Picea mariana*, over its present range in Alaska.]*

c. Products: This list is based on a 2-year project (year 1 and projected year 2 deliverables are noted below):

- (1) Annotated map of historical ADS larch damage mapping (1980-2007) relative to known larch distribution in Alaska (Dec2008);
- (2) Poster presented at Jan/Feb 2009 FHM Work Group meeting;
- (3) USFS/FHP & AKDNR (AK Dept. of Natural Resources, Div. of Forestry) biological evaluation, including summary of permanent ground plot larch stocking and mortality data from plots established since 2000 (Dec2009);
- (4) Annotated larch sawfly and larch beetle risk map for Alaska larch (Dec2009);
- (5) Potential for a peer-reviewed manuscript at the conclusion of this project.

d. Proposed Schedule of Activities: 2008 – Based on an AKDNR analysis of GIS-archived data and a preliminary larch extent model, target at least 2 stands along the road system near Fairbanks for biological evaluation and data collection to expand the area of permanent ground plots, and add to the existing ground data (e.g., USFS/FHP Innoko River plots); (2) Conduct a minimum of 2 days of aerial survey during July-September to map the southwestern extent of larch in interior Alaska with the objective of selecting potential areas for remote site evaluations during 2009. The key objective here is to target potential areas for remote site evaluations during 2009. However, completion of this new project is not dependent on completing additional healthy larch surveys.....

2009 – Conduct site visits in the remote areas selected during 2008 flights (a minimum of 2 sites) to refine estimates of the risk factors previously measured; (2) Summarize results from the ground

data collected, including information from the Innoko River permanent plots and enter into a Forest Health Monitoring database. Aerial and ground survey results will also be summarized in the annual USFS/AKDNR Forest Health Protection report for each year of this project.

COSTS/BUDGET: see last page



e. Progress/Accomplishments Year 1 (2008) & Plan of Work (Year 2)

Year 1 Results (2008)

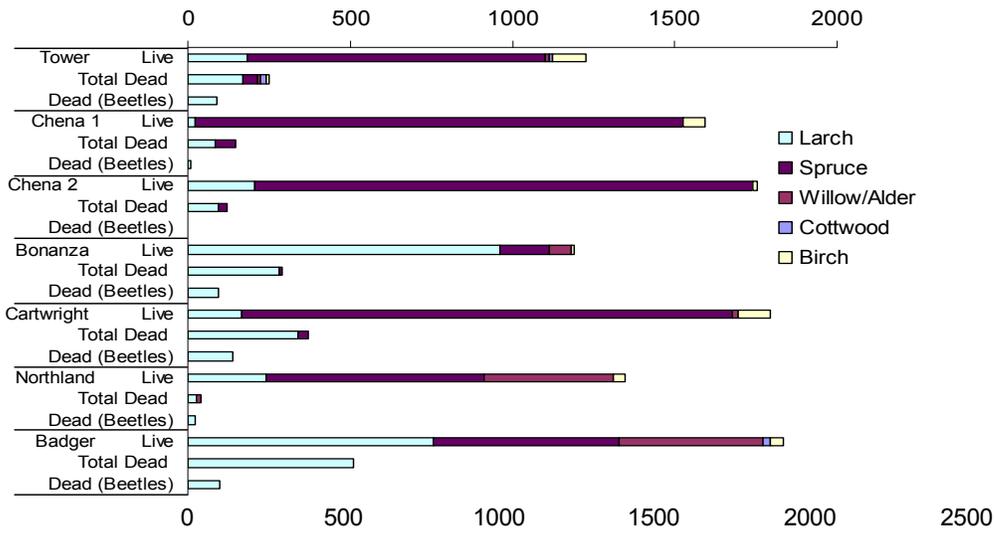
Between July 14-25 and August 25-29, 2008, larch stand exams were conducted along the road system in and around Fairbanks (approx. 360 miles north of Anchorage and the Alaska Range in Interior Alaska). Stand exams and larch mortality and regeneration assessments were completed and basal tree sections were collected for stand age and growth estimates.

- The seven sites where data was taken in Year 1 (2008) were quite distinct both in species composition and numbers of dead trees.
- Insect mortality agents (e.g., larch beetle) may not be as important as previously thought in stands impacted by insect defoliators (e.g., larch sawfly) (*figure 1.a.*)
- Regeneration was quite variable across sites (figure 1.b.). Larch regeneration after landscape level insect disturbance (e.g., larch sawfly infestation) was quite good on three of the seven sites sampled in 2008. Spruce regeneration was successful on all sites.
- Results from this project will help land and resource managers more accurately assess potential stand mortality associated with larch sawfly outbreaks across the extent of larch in Interior Alaska.



PRELIMINARY CONCLUSIONS

A



B

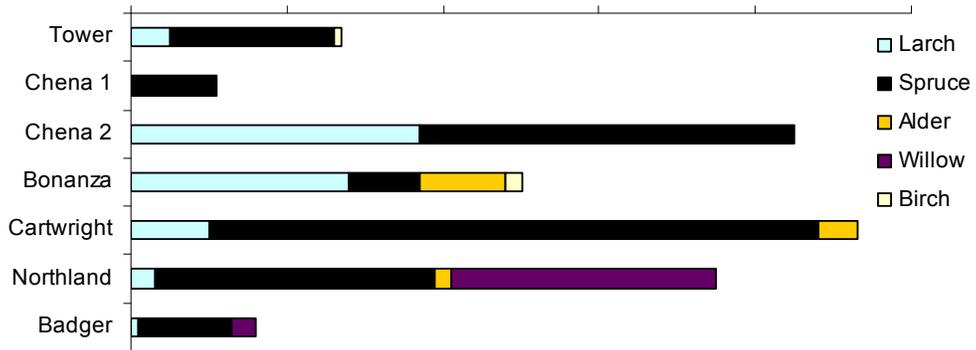


Figure 1. a. Tree species composition (live, total dead, and beetle kill) per acre for seven larch sites, b. Regeneration at each site per acre.

REMAINING PROJECT WORK

- Summarize the July & August, 2008 larch stand data and present a poster at the 2009 FHM Work Group meeting;

FY08 project funds were received by AKDOF in its Consolidated grant from USFS/FHP R10, awarded, and obligated in our FY09 forest health program budget, starting July 1, 2008. Eligible project expenses will be allocated to the project for calendar 2009 work, should this project be approved for Year 2 funding. If funded for FY09, we will:

1. Visit and establish permanent plot transects in 6-8 additional stands, more remote (roadless) areas across the known interior Alaska larch distribution,
2. Summarize our collective data from 2008 and 2009, including appropriate output maps.
3. Compare this information with the only existing “post sawfly outbreak” ground plot data available, collected by USFS/FHP on the Innoko River (SW Interior Alaska) between 2000 and 2007.
4. Present a poster of the project results at the national 2010 Forest Health Monitoring Working Group Meeting.

Please refer to the original grant proposal for more specific outputs we hope to accomplish with this FHM Evaluation Monitoring funding. The AKDOF appreciates the opportunity to apply for this supplemental funding which has enabled our Forest Health Protection Program to operate more effectively to accomplish our forest health mission in Alaska.

ACKNOWLEDGMENTS

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COSTS: (Note: Plane charter/fuel costs will be saved in year 1 and some of these costs will be saved in year 2 to select potential access sites for ground plots; also some limited ground checks will be attempted both years by combining this additional time and expense with the annual ADS/Detection Monitoring survey in July).

YEAR -2008	Item	Requested FHM EM Funding	Other-Source Funding	Source
Administration	Salary	\$2,500	\$1,000 (tech salary)	
	Overhead	\$0	\$500	Base FHP
	Travel	\$1,500	\$2,000	
Procurements	Contracting	\$4,000		
	GIS Services	\$1,000	\$3,500	AKDNR
	Equipment	\$0	\$1,000	
	Supplies	\$0	\$500	
Total		\$9,000	\$9,000	

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR - 2009				
Administration	Salary	\$4,500	\$2,000 (tech salary)	
	Overhead		\$1,000	Base FHP
	Travel	\$2,500	\$2,000	
Procurements	Contracting	\$8,000		
	GIS Services		\$10,000	AKDNR
	Equipment	\$0		
	Supplies	\$0		
Total		\$15,000	\$15,000	