

QuickNotes

Science summaries from fRI Research

Introducing: Modeling Eastern Spread Risk of Mountain Pine Beetle Using Host Genetic Ancestry

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Cumulative mountain pine beetle attack data collected by Alberta Agriculture and Forestry over the past decade suggests that eastern spread of mountain pine beetle beyond the currently defined lodgepole x jack pine hybrid zone has been limited; even though pure jack pine stands are within the known flight distances of mountain pine beetle. These observations imply that mountain pine beetle populations in lodgepole and hybrid pine may serve as a source population, while pure jack pine may not be able to support the population growth needed for continued eastern spread. However, there is mounting evidence that indicates jack pine is an equivalent host for mountain pine beetle in comparison to lodgepole pine, suggesting eastern-spread is highly probable in the future, and is not influenced by host genetic ancestry. Empirical evidence to support either of these hypotheses are currently lacking. Because it is difficult to visually distinguish lodgepole x jack pine hybrids, and measuring host traits associated with MPB success at a landscape scale is not feasible, these hypotheses can best be tested using a landscape genetic approach.

Objectives

This project will use a landscape genetic approach to: (1) develop an updated predictive surface of pine ancestry for Alberta, (2) Ground-truth the predicted ancestry by sampling in regions of prediction uncertainty, and (3) Develop a spatial model that examines the relationship between MPB incidence data and pine-host genetic ancestry.

Federal-Provincial MPB Research Partnership

Mountain Pine Beetle remains a severe threat to Alberta's pine forests despite the province making positive progress in controlling its spread within the province and reducing the risk to the rest of Canada.

Natural Resources Canada and Alberta Agriculture and Forestry have provided funding to a suite of projects with the goals of limiting the spread of Mountain Pine Beetle and mitigating damages where it has already invaded.



Natural Resources Canada
Ressources naturelles Canada

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Alberta
Agriculture and Forestry

Expected Outcomes

This work will allow us to address two complementary hypotheses; (a) jack pine represents a sink habitat for mountain pine beetle, and (b) pine genetic ancestry does not influence eastern MPB range expansion. In addition to addressing these important knowledge gaps, the project will also develop a ground-truthed predictive ancestry for pine in Alberta.

Implications for Land Management

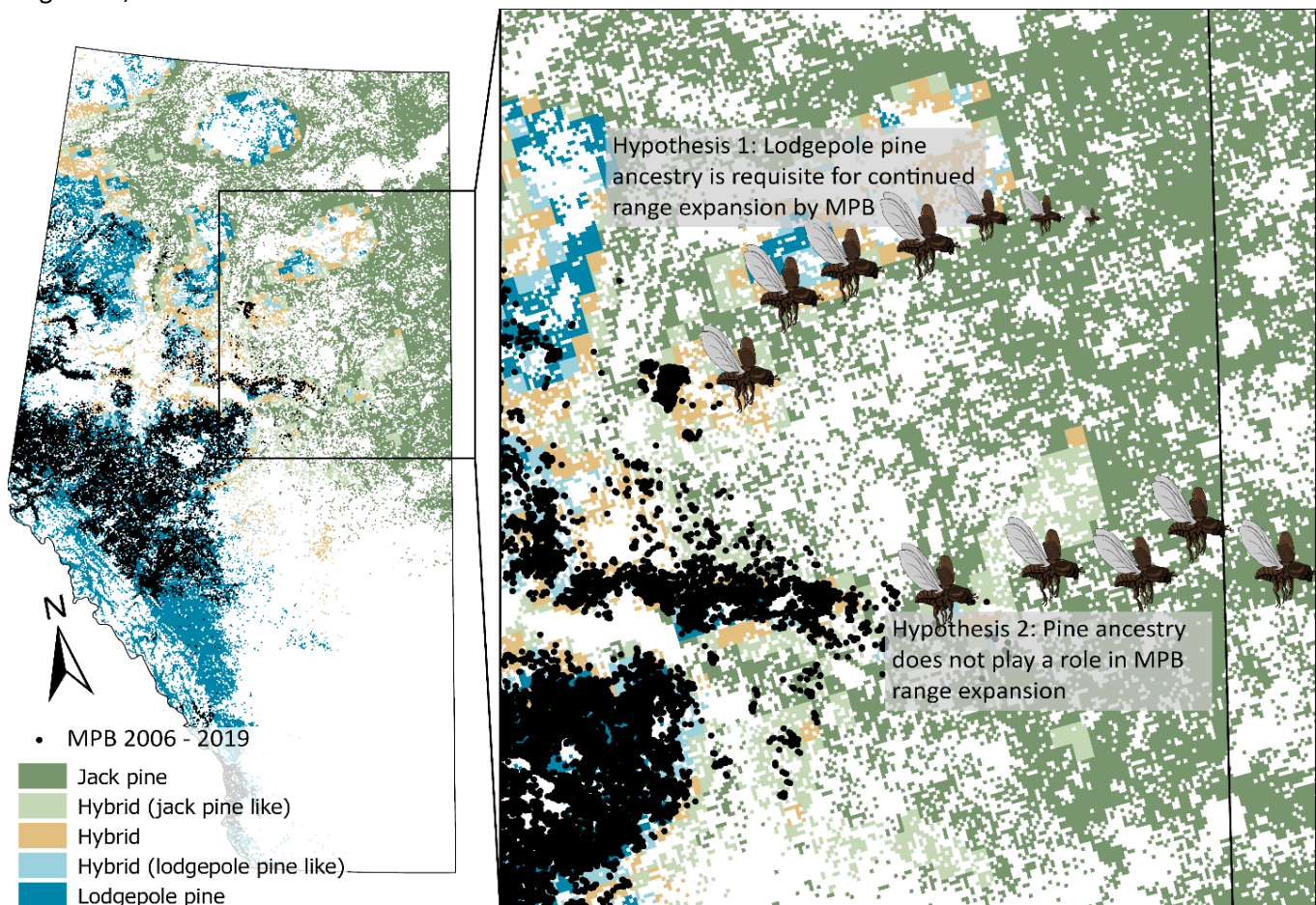
The proposed research will fill a key knowledge gap that will provide baseline data for quantifying eastern spread-risk in the province of Alberta, and would provide an important model parameter to fine-tune the relative MPB risk for Alberta Agriculture and Forestry, the National Forest Pest Strategy, as well as forest industries in Alberta, Saskatchewan Ministry of the Environment, and Northwest Territories Environment and Natural Resources.

Expected Social, Economic, and Ecological Value

MPB expansion into Alberta has cost the province over \$568M in management. This research will provide important economic benefit by answering whether proximity to lodgepole pine is required to sustain an outbreak, potentially allowing for significant cost savings to management and control operations.

Expected Completion Date

August 31, 2023



The complex spatial distribution of lodgepole pine introgression into jack pine may be an important determinant of MPB eastern spread-risk. We will use existing data, and ground truthing to test the hypotheses illustrated in this figure. Map data: MPB data (Alberta Agriculture and Forestry), Canadian ranges of pine species are from Burns et al. (2019), modified based on Yemshanov et al. (2012).