

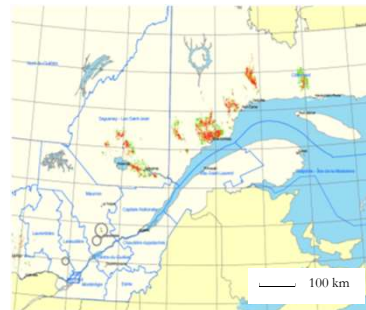
# Insectivorous birds as indicators of future defoliation by the spruce budworm

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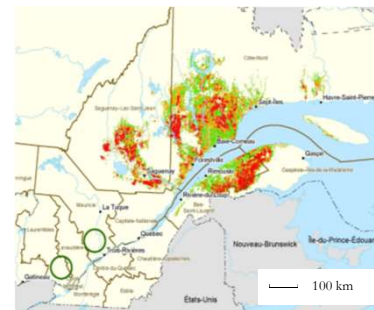
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## Context

- A new Spruce budworm (SBW) has rapidly expanded from 2006, especially in the North Shore area.
- The outbreak is now at New Brunswick's doorstep.
- It could cause 4 to 7 billion dollars in wood fibre losses over 40 years.
- A new forest protection strategy based on early intervention has had promising results but depends on our ability to identify regions that are likely to be defoliated while SBW are low.
- However, current methods of early detection are so far relatively inefficient.



Annual defoliation in 2010:  
765 740 ha defoliated



Annual defoliation in 2016:  
7 018 287 ha defoliated

## Goal of the project

Development of an analytical tool to predict the probability of conifer defoliation by SB using bird species known to respond to increases in SBW populations.

- Use changes in birds density to develop models to better identify stands at risk of defoliation and the time lag between changes in birds densities and defoliation.
- Development of a predictive management model to guide early intervention.

## Bird species foraging on SBW



Tennessee warbler (*Liothlypis peregrina*)



Bay-breasted warbler (*Setophaga castanea*)



Cape May warbler (*Setophaga tigrina*)



Evening grosbeak (*Coccothraustes vespertina*)

Numerical response to the SBW outbreak with increases in density up to tenfold over 4 or 5 years.

- Budworm warblers, and possibly the Evening grosbeak may help us identify incipient outbreak patches even before defoliation is visible from aerial inventories or hyperspectral remote sensing imagery.
- Enormous opportunity to use natural trophic dynamics to guide early intervention management strategies.

## Data



- Census of bird species between 2006 and 2016
- > 2200 point counts
- Habitat characteristics for each point
- Annual defoliation maps

## The approach

- Exploration of the relationships between changes in bird densities and SWB density controlling for forest spatial characteristics at a local and regional scale.
- Modelling using GLMM and model selection procedures using AIC: how do bird densities explain defoliation patterns?
- Identification of the time lag between birds density changes and subsequent or past defoliation.
- Development of a predictive model based on birds dynamics to identify the stands with higher defoliation risk.