M.Sc. project
« Historical impact of climate on the defoliation of black spruce by the spruce budworm »

Context
The spruce budworm (SBW, *Choristoneura fumiferana*) is the most important defoliating insect of coniferous stands in North America. In 2017, this insect affected an area of 7 million hectares, more than 12% of Quebec's boreal forest.

Black spruce, one of the most abundant and economically important species in the boreal forest, is relatively resistant to SBW outbreaks. However, studies have shown that a warming climate, creating greater synchronicity between the emergence of black spruce buds and SBW larvae, would increase the susceptibility of this species to future outbreaks.

Objectives and Methodology
This project aims to determine the interaction between climate and defoliation caused by SBW on the growth of forest stands in the 20th century throughout Quebec. We will use existing dendrochronological (tree ring measurements) databases for black spruce and the other SBW-affected species, white spruce and balsam fir, to model their growth as a function of climate in the presence or absence of an outbreak ([https://doi.org/10.3389/fpls.2018.01905](https://doi.org/10.3389/fpls.2018.01905)). Hierarchical models will allow dendrochronological series to be combined with other sources of information on outbreaks (e.g. aerial surveys since 1968) and produce more accurate maps of the historical progression of SBW activity. Access to Compute Canada supercomputers will allow the application of complex models to large datasets.

Keywords: sustainable forest management, climate change, forest ecology, dendrochronology, natural disturbances.

Location: The student will be based at the Forest Research Institute (IRF; [https://www.ugat.ca/programmes/irf/](https://www.ugat.ca/programmes/irf/)) at the Rouyn-Noranda or Amos campus of the Université du Québec en Abitibi-Témiscamingue, and will be co-supervised by Philippe Marchand ([https://bit.ly/2DFyGl6](https://bit.ly/2DFyGl6)) and Miguel Montoro Girona ([https://bit.ly/34LfttX](https://bit.ly/34LfttX)). The IRF is dynamic, multicultural and international and provides a quality environment for students to develop their research, with 12 professors and more than 60 graduate students working on very diverse topics such as forest dynamics, silviculture, genetics, biodiversity, ecophysiology and sustainable forest management. IRF students also benefit...
from professional development resources and opportunities (scholarships, participation in conferences, workshops) offered by the Centre for Forest Research (www.cef-cfr.ca). In addition, the student will be a member of the Chair in Sustainable Forest Management (http://chaireafd.uqat.ca/). As part of this project, the student will also have the option of completing an international internship funded with our collaborators in the United States (Harvard University) or the Netherlands (Wageningen University).

**Funding:** $18,000 annual scholarship for 2 years.

**Preferred qualifications:** Undergraduate degree in biology, ecology, environmental science or forestry with an interest in statistics, GIS and modelling, OR degree in mathematics, statistics, geomatics or informatics, with an interest in their environmental applications in a context of climate change.

**Preferred start date:** Summer or Fall 2020

**Project collaborators:** Yves Bergeron (UQAT), Mathieu Bouchard (MFFP), Louis De Grandpré (SCF), Matthew Duveneck (Harvard), Élise Filotas (TÉLUQ), Anouschka Hof (Wageningen), Hubert Morin (UQAC), Pierre Therrien (MFFP).

Are you ready to begin your Master's on this fascinating topic? Send your CV, a cover letter, a transcript and contact information for two references to Philippe Marchand (philippe.marchand@uqat.ca) and Miguel Montoro Girona (miguel.montoro@uqat.ca). Review of applications will start on January 20, 2020 and continue until the position is filled. A professional adventure in the great boreal forest of Abitibi awaits you!

**Links:**

- City of Amos: https://amos.quebec/
- Aiguebelle Park: https://www.sepaq.com/pq/aig/
- Abitibi-Témiscamingue Tourism: https://www.abitibi-temiscamingue-tourism.org/