

PhD Candidate
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Improving spruce budworm management: detecting defoliation, assisting population sampling, and impact assessment

A recent spruce budworm (*Choristoneura fumiferana*) outbreak is causing extensive damage to balsam fir-spruce forests in Québec, Canada. Current methods of monitoring and estimating outbreak impacts should adapt remote sensing technology for improving estimates of damage and forest protection planning.

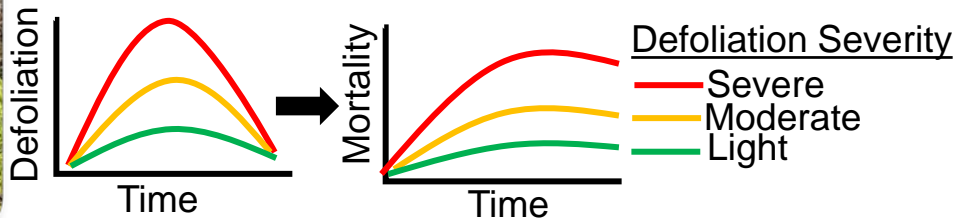
Research Objectives / Thesis Chapters

The **1st objective** will identify stand, site, and environmental factors that influence the defoliation patterns observed during the first 10 years (2012-2021) of the current outbreak.

My **2nd objective** uses multi-sensor (Landsat-8 and Sentinel-2) multi-spectral satellite imagery to classify within-stand annual defoliation over multiple years.

The **3rd objective** tests remotely sensed classified annual defoliation as a dataset for informing potential sampling locations for budworm populations.

The **4th objective** focuses on using detailed tree defoliation with tree-ring growth and mortality measurements from 2014-2021 to develop species-specific models for improving tree-list growth and yield projections.



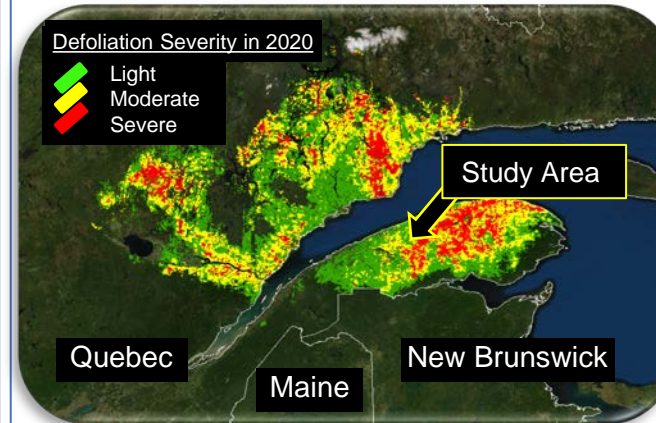
Data & Methods & Progress

Study area is located in Gaspé, Québec, where 99 sample plots were established in 2014 and annually remeasured for tree defoliation and corresponding growth response.

Obj. 1 - Generalized linear mixed effects modelling will be conducted to test for significant factors influencing annual defoliation patterns.

Objs. 2 & 3 - Calibration and validation of classified annual defoliation from change detection imagery will be based on sample plot branch defoliation measurements and evaluated statistically using confusion matrices.

Obj. 4 – New defoliation growth reduction modifiers will be tested against existing models for improving Open Stand Model (OSM) tree-list projections.



Management Outcomes

Within-stand classified defoliation using satellite remote sensing should assist aerial surveys in monitoring outbreaks.

Testing tree defoliation growth responses may offer a new understanding of the defoliation host-tree response relationship.

Supervisor: Dr. David A. MacLean (Emeritus Professor @ ForEM)

Committee members: Dr. Chris Hennigar (ERDNC), Dr. Rob Johns (CFS), Dr. Yun Zhang (Professor @ GGE)

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