Magnitude and Causes of Black Spruce Forests Dieback Affected by Spruce Budworm in Eastern Quebec, Canada

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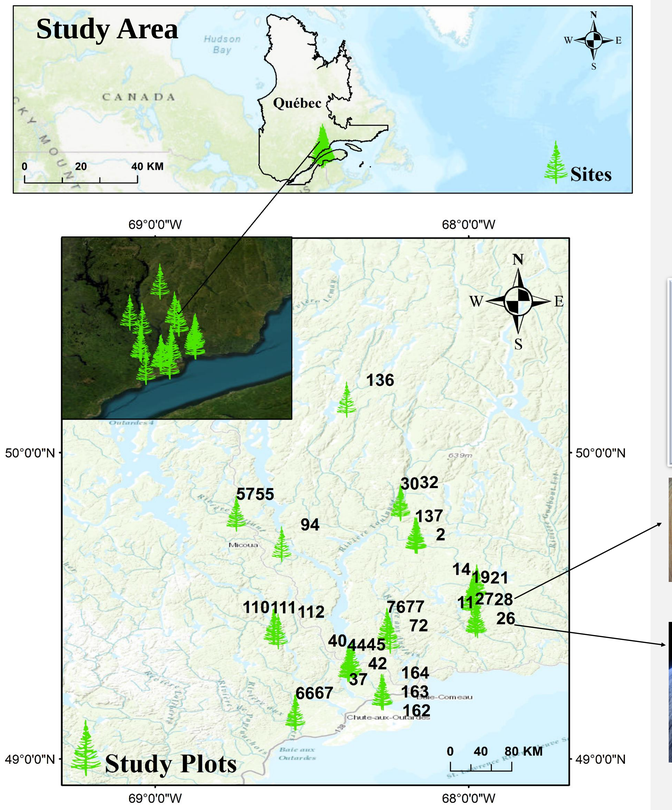
Problematic

- Since 2006, an ongoing spruce budworm outbreak has resulted in substantial dieback of secondary host species, notably black spruce forests, in eastern Quebec.
- This critical situation within the Northshore boreal forest is further exacerbated by the potential acceleration caused by climate change.

Objectives

1. Examine the landscape level dieback dynamics associated with spruce budworm defoliation.
2. Estimate the impact of climatic stress, plot characteristics and defoliation on tree growth.
3. Assess the changes in hydraulic traits of trees during the defoliation period.

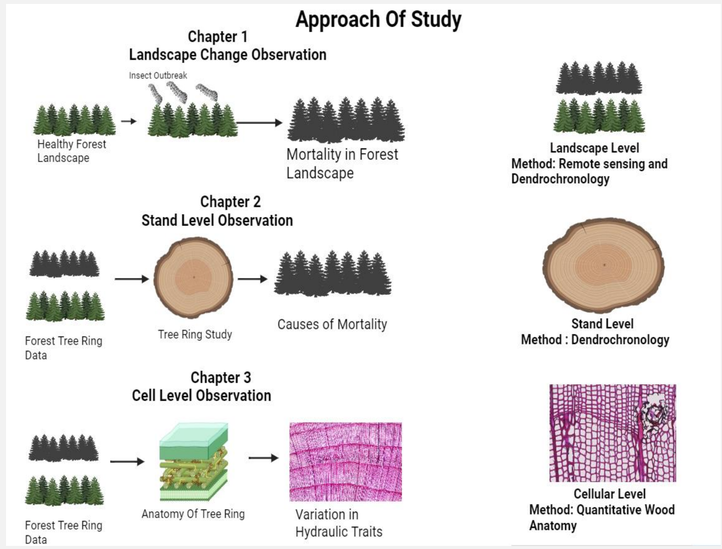
Methodology



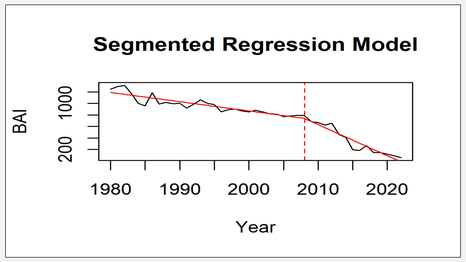
- 34 Study Plots.
- Inventory on all the sites.

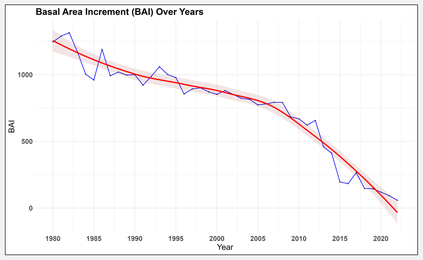
- 10 Trees Per Site.
- Two Tree Ring Cores Per Tree.

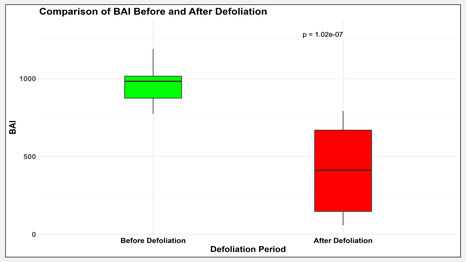
- Vegetation indices Values Per Site.
- Insights into extent of defoliation.

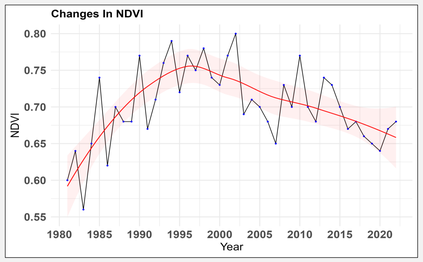


Preliminary Results









- Growth change was detected after 2008.
- Sharp decline in basal area increment was detected after 2012.
- Mean value of annual basal area increment decline significantly after defoliation starts.
- Diverse trend of NDVI.

Next Steps

- Analyze vegetation indices with tree ring growth pattern along landscape to uncover relation of forest health with growth dynamics
- Utilize Generalized Adaptative Mixed modeling to identify cause of dieback.

Importance and applications

- Identify the factors contributing to the diminished growth causing mortality of black spruce across the landscape.
- Improve prediction of forest dynamics in spruce budworm outbreak scenario
- Guide forest management to minimize the risk of defoliation and climate change

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References

- Deslauriers, A., Caron, L., & Rossi, S. (2015). Carbon allocation during defoliation: Testing a defense-growth trade-off in balsam fir. *Frontiers in Plant Science*, *6*(MAY), 1–13. https://doi.org/10.3389/fpls.2015.00338
- Girardin, M. P., Bouriaud, O., Hogg, E. H., Kurz, W., Zimmermann, N. E., Metsaranta, J. M., ... & Bhatti, J. (2016). No growth stimulation of Canada's boreal forest under half-century of combined warming and CO2 fertilization. *Proceedings of the National Academy of Sciences*, *113*(52), E8406-E8414.
- Mašek, J., Tumajer, J., Lange, J., Kaczka, R., Fišer, P., & Treml, V. (2023). Variability in Tree-ring Width and NDVI Responses to Climate at a Landscape Level. *Ecosystems*. https://doi.org/10.1007/s10021-023-0082
- Ministere des Foréts, de la F. et des P. (2019). *Aires infestées par la tordeuse des bourgeons de l'épinette au Québec en 2019*. www.mffp.gouv.qc.ca/forets/fimaq/insectes/fimaq-insectes- portrait- releves.jsp.