



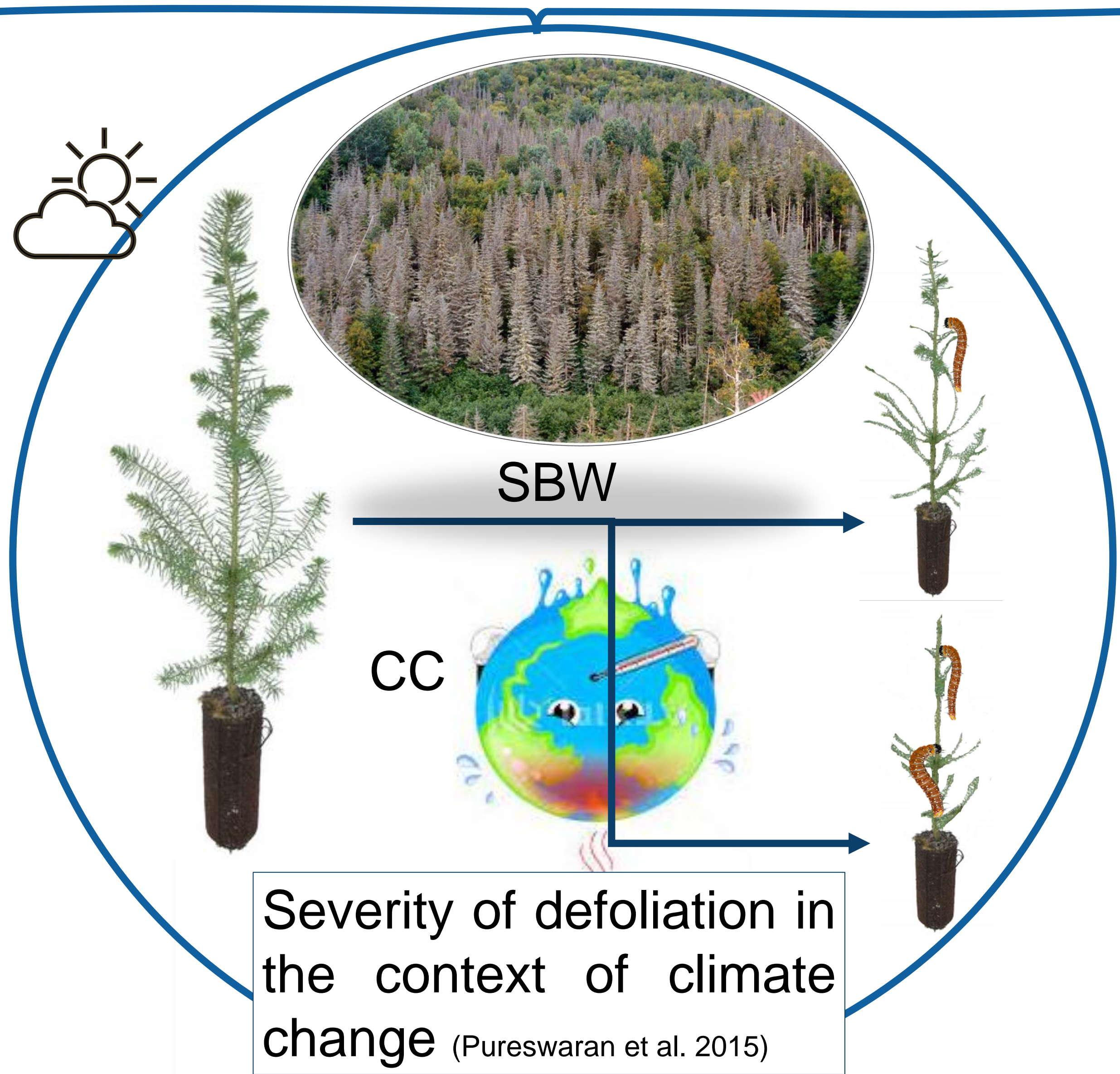
The mystery of tree-rings regarding climate and insect outbreak interactions: A methodological challenge

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Context

- Boreal and northern temperate zone of Quebec
- Natural disturbances
- Insect outbreak
- Spruce budworm (SBW)
- Defoliation
- Black spruce (*Picea mariana*)



Objectives

- Evaluate the influence of climatic parameters on the severity and the spread of the SBW outbreak
- Analyze the SBW outbreak in black spruce during the last century to better understand the effect of defoliation and climate change



Methodology

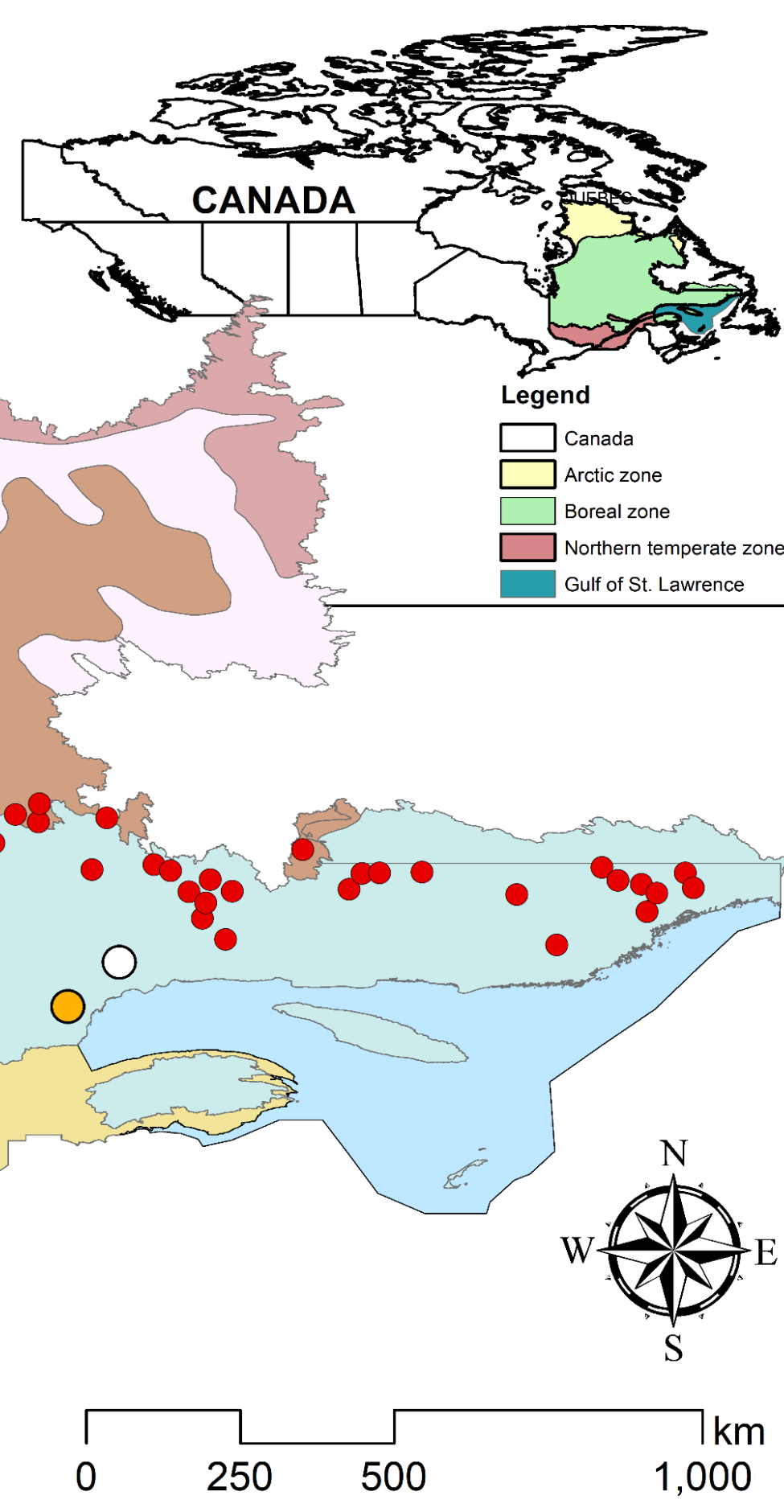
Study area

The location of study sites in Quebec

Legend

- Northern limit project (2003)
- 51-52 project (2003)
- Morin project (2017)
- Mixed projects
- Jardon project (2003)
- North shore project (2006)
- MRNQ Abitibi project (1998)
- Primitive forests projects (2009)
- Navarro project (2003)
- Levasseur project (2000)
- 281 MRNF project (1999)
- Fantin project (2003)
- UQAT project (1999)

- Vegetation subzone**
- Arctic tundra
 - Forest tundra
 - Taiga
 - Continuous boreal forest
 - Mixed forest
 - Deciduous forest5
 - Golfe du Saint-Laurent



Dendroecological data

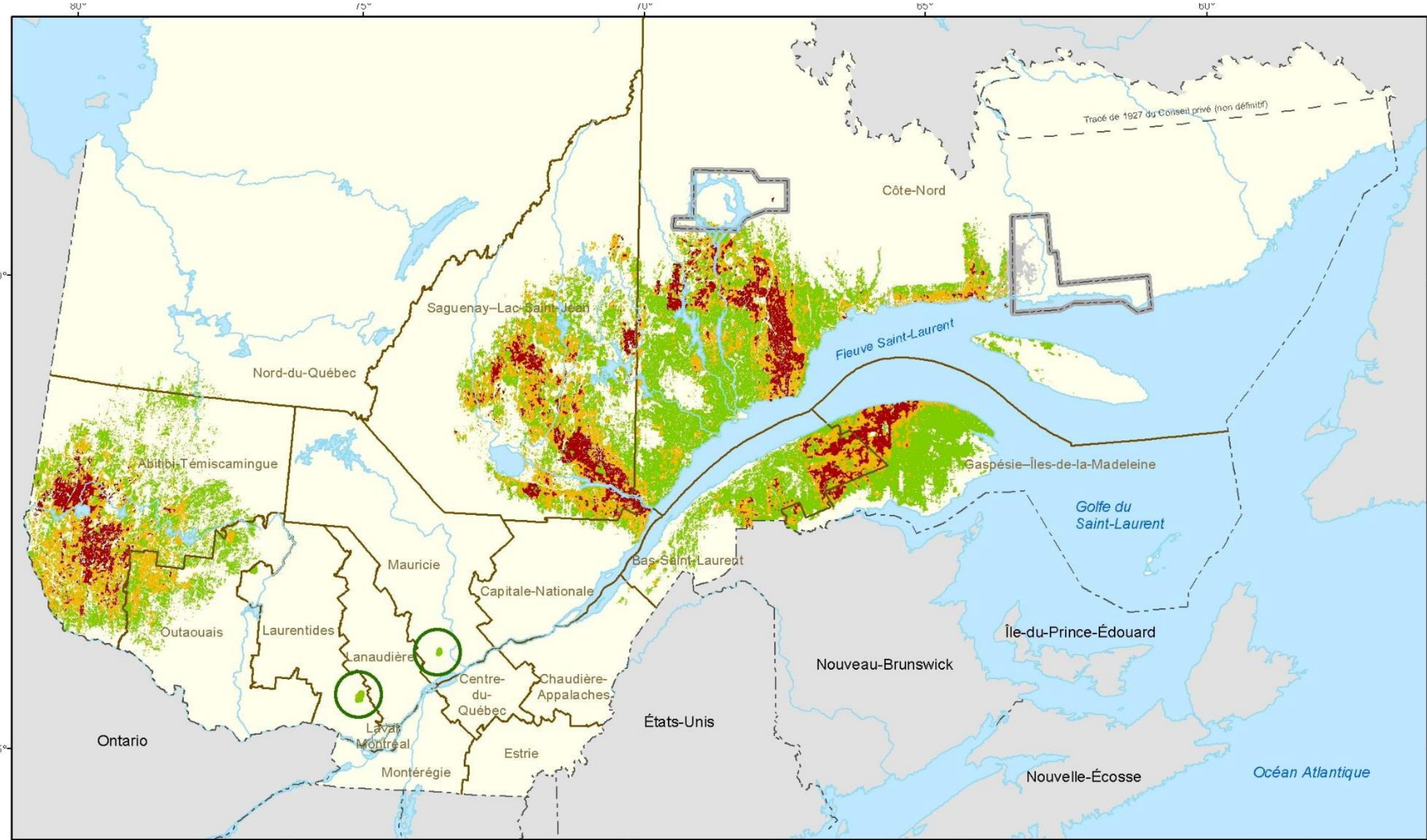
- Biggest data base of black spruce in Quebec for the last century
- Cross dated 5500 black spruce trees (age ≥ 100 years)

The mystery : narrow tree rings caused by an insect (H)



Defoliation survey (MFFP)

The defoliation map (2020) of Quebec produced by MFFP

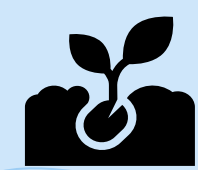


Climatic datasets

- Interpolation using BioSIM

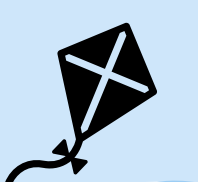
Modeling

- Interaction effect of SBW and climatic parameters on the defoliation of black spruce



Novelty

- Spatial & temporal range, data, & approaches



Contribution

- Provides a new parameter to predict the dynamism of SBW impact over periods
- Contribute to obtain a general trend in the range and severity of future outbreak periods, which is crucial for managing boreal forests under climate change.



References

- Lavoie, J.; Montoro Girona, M.; Morin, H. Vulnerability of Conifer Regeneration to Spruce Budworm Outbreaks in the Eastern Canadian Boreal Forest. *Forests* 2019, 10, 850.
- Navarro, L.; Morin, H.; Bergeron, Y.; Girona, M.M. Changes in spatiotemporal patterns of 20th century spruce budworm outbreaks in eastern Canadian boreal forests. *Front. Plant Sci.* 2018, 9, 1905–1920.
- Pureswaran, D. S.; Grandpré, L. De; Paré, D.; Taylor, A.; Barrette, M.; Morin, H.; Régnière, J.; Kneeshaw, D. D. Climate-induced changes in host tree-insect phenology may drive ecological state-shift in boreal forest. *Ecology* 2015, 96(6), 1480–1491.

