Phenology and frost hardiness in sugar maple populations

C.Mura[1], A. Deslauriers[1], S. Delagrange[2], G. Charrier[3], P. Raymond[4], S. Rossi[1]

[1] Université du Québec à Chicoutimi (UQAC), Chicoutimi (QC), Canada; [2] Université du Québec en Outaouais (UQO), Ripon (QC), Canada; [3] Institut National de la Recherche Agronomique (INRA), Clermont-Ferrand, France; [4] Ministère des Forêts, de la Faune et des Parcs (MFFP), Québec (QC), Canada.

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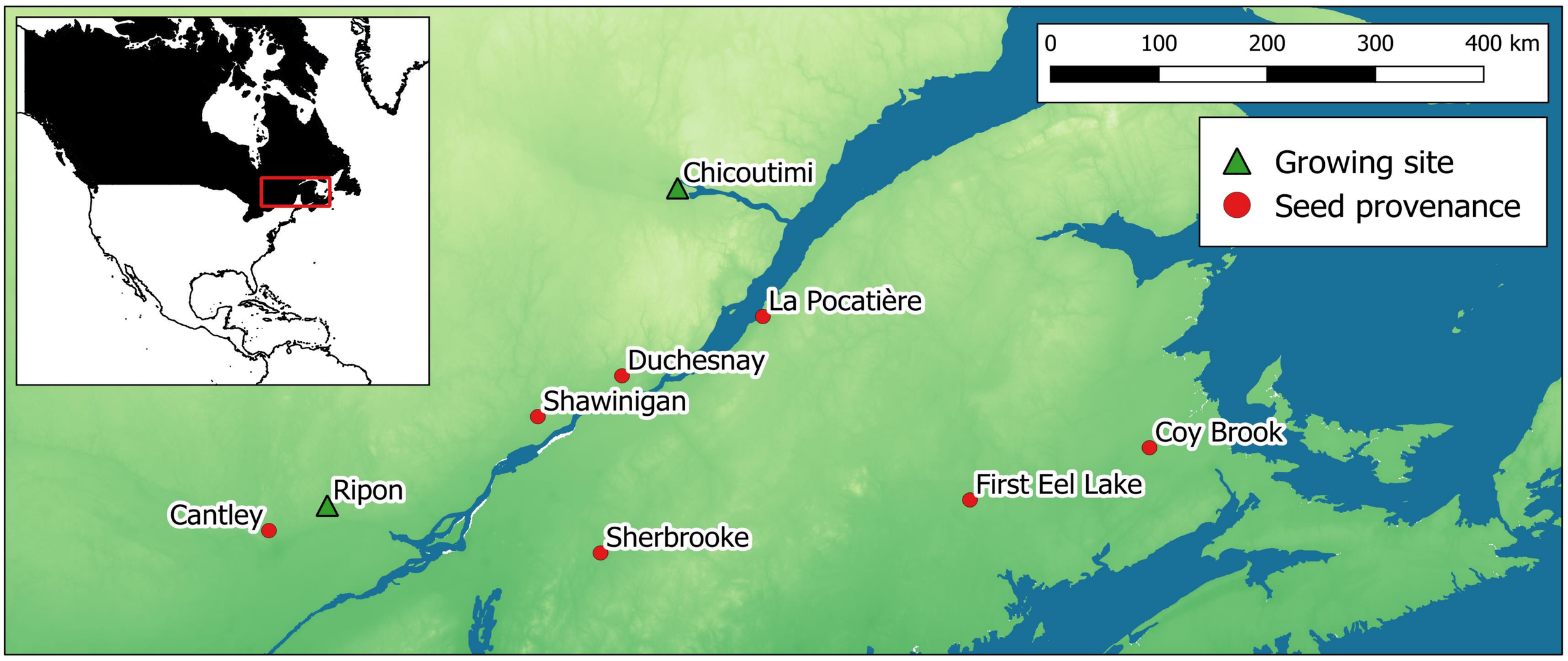
CONTEXT

- Trees regulate their frost hardiness through a series of physiological processes responding to environmental cues.
- As global climate change intensifies, warming temperatures may create a mismatch between the phenology of locally-adapted tree populations and their surrounding environmental conditions, leading to increased risk of frost damages.
- More information on how these traits change in tree populations is necessary to inform forest management choices.

RESEARCH QUESTION

How do phenology and frost hardiness change in sugar maple (*Acer saccharum*) provenances (red dots) growing in two different sites (green triangles)?



METHODS

PHENOLOGY:

Chilling/forcing Experiments
(Will be performed in 2022/23)

FROST HARDINESS:

LT50 (T inducing 50% cell damage) measured by
REL (Relative Electrolyte Leakage)

DYNAMIC MODEL OF FROST DAMAGES

Parametrization of an existing model (Leinonen, 1996; Charrier et al., 2018) for sugar maple

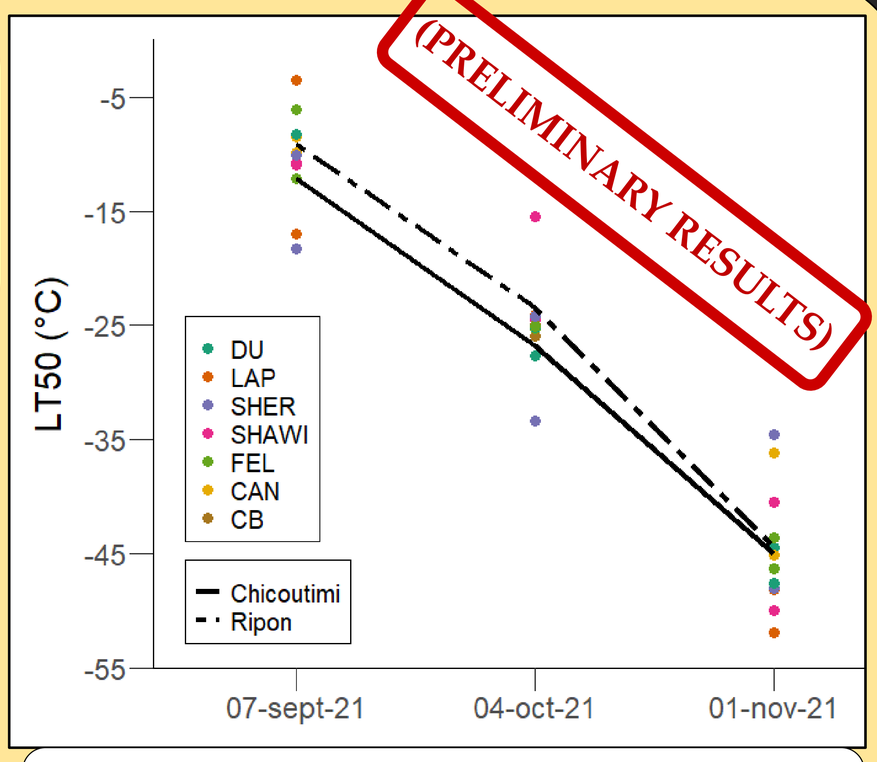


Figure: preliminary results from frost hardiness analyses. Points are the LT50 values for each provenance, lines link the mean LT50 values for all provenances of one site.

Charrier, G., Chuine, I., Bonhomme, M., & Améglio, T. (2018). Assessing frost damages using dynamic models in walnut trees: Exposure rather than vulnerability controls frost risks: Frost risks in walnut trees. *Plant, Cell & Environment*, *41*(5), 1008–1021. https://doi.org/10.1111/pce.12935

Leinonen, I. (1996). A Simulation Model for the Annual Frost Hardiness and Freeze Damage of Scots Pine. *Annals of Botany*, *78*(6), 687–693. https://doi.org/10.1006/anbo.1996.0178

EXPECTED RESULTS

- Northern provenances reach higher levels of frost hardiness
- Once chilling requirements are fulfilled, northern provenances are more responsive to spring temperatures
- Northern provenances are more susceptible to spring frosts because of an early flushing, but less susceptible to winter and autumn frosts because of higher frost hardiness.

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