2025 Drought Impacts to Forests Gleaned through the Acadian Phenocam Network

Lynsay Spafford UNB

Central Woodland Conference
May 2, 2026

Acadian Phenocam Network Team

Lynsay Spafford
UNB

Loïc D'Orangeville
ULaval

Anthony Taylor
UNB

Andrew MacDougall
StFX

Lisa Kellman
StFX

James Steenberg
DNR
Dalhousie (Adjunct)

Background

- Longer warmer leafing periods
- Earlier leaf out
- Later fall colours

Leaf phenology = timing of leaf life cycle events

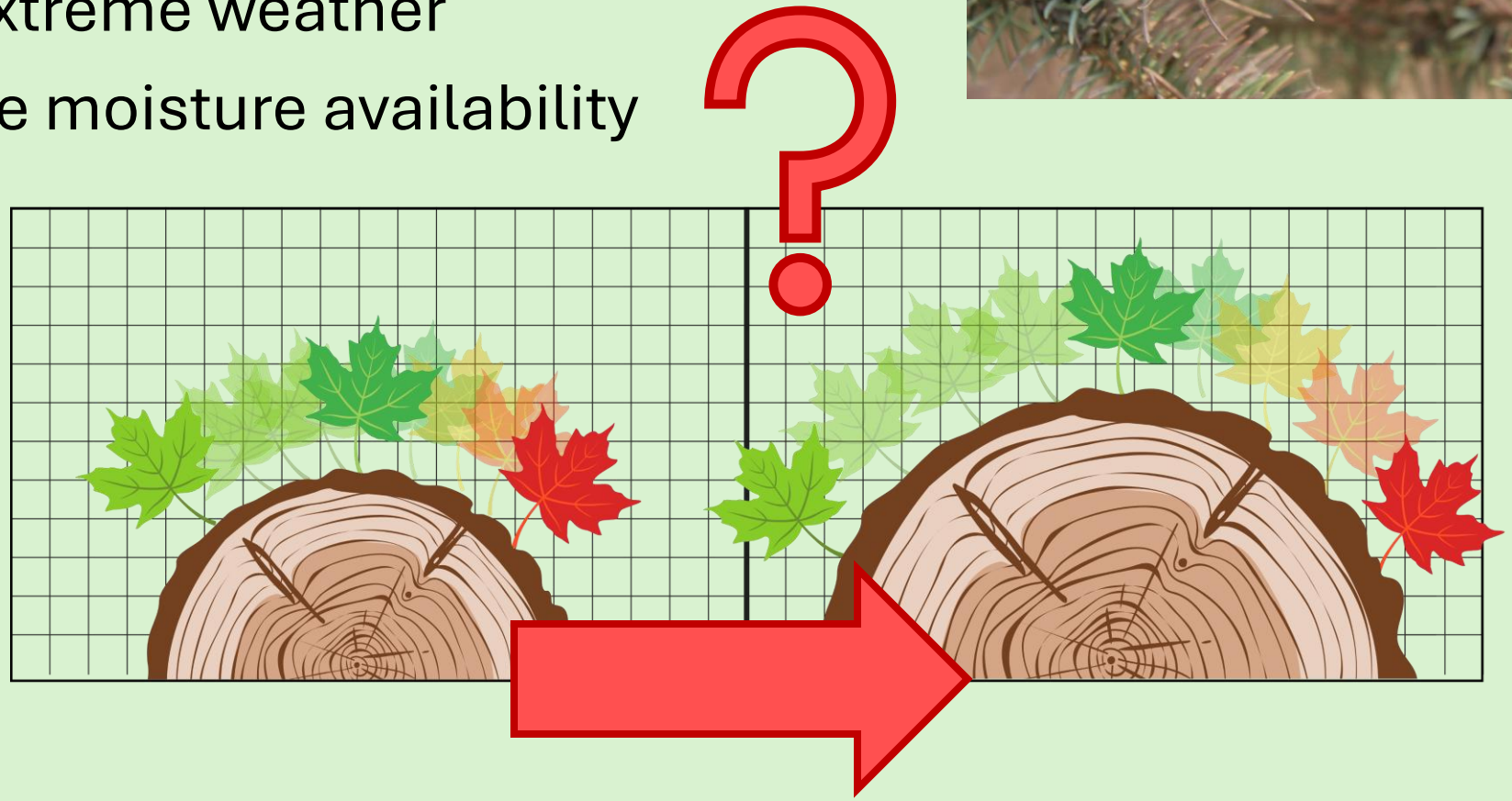
May 30, 1868

May 30, 2005

Miller-Rushing et al., 2006

Background

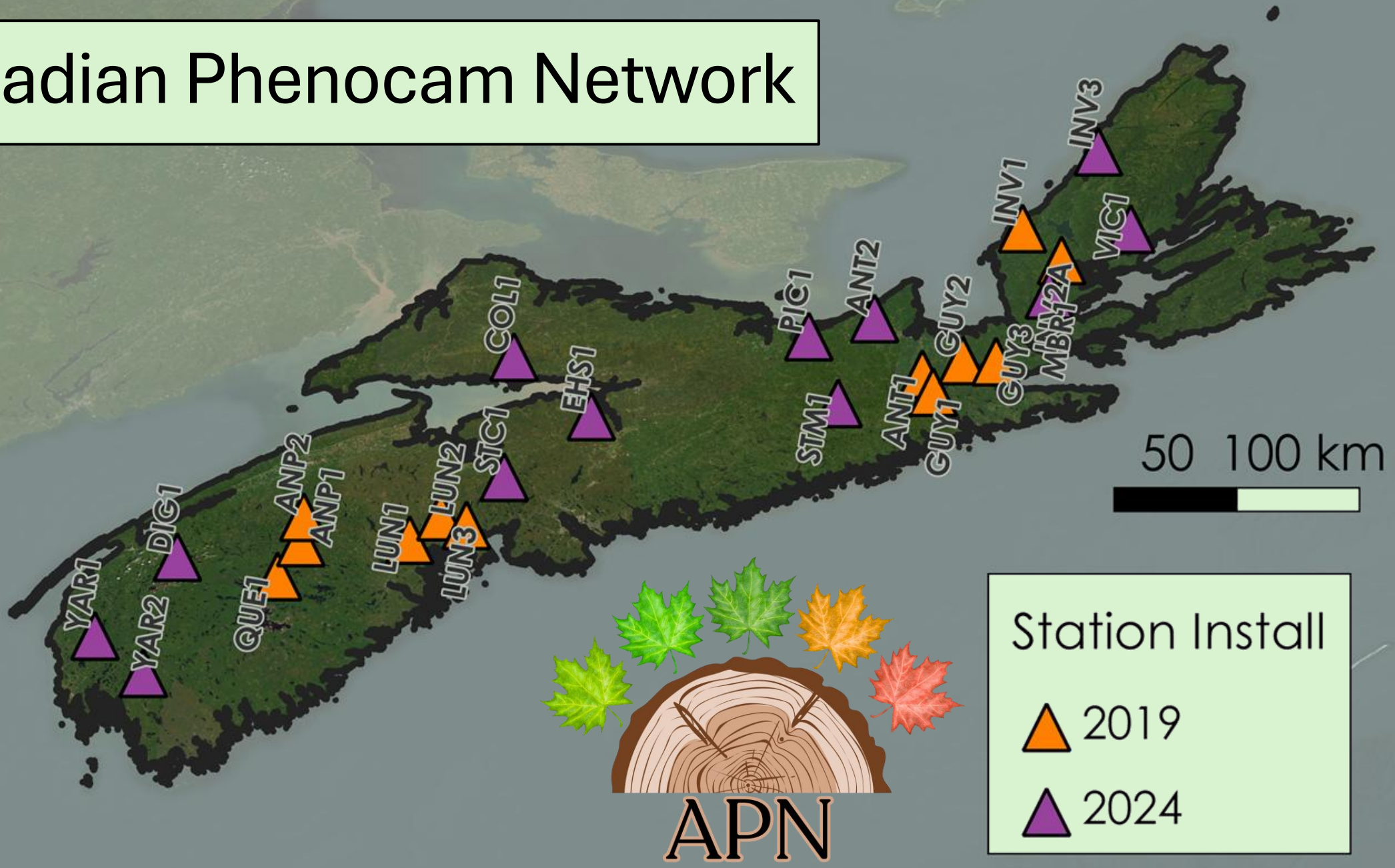
- Could lead to increased growth though also increased stress
- More extreme weather
- Variable moisture availability



Goals of the Acadian Phenocam Network

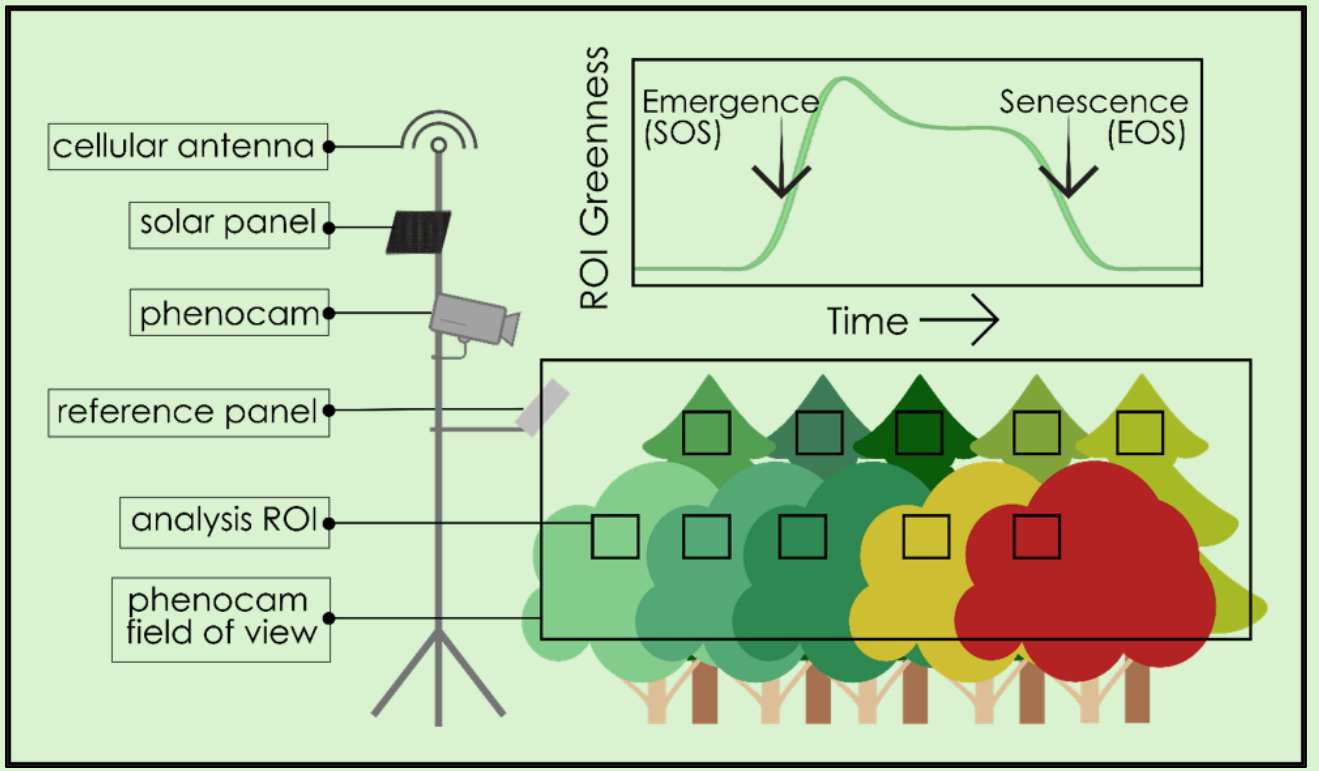
1. Establish a long-term network across Nova Scotia tracking how weather patterns affect leaf phenology and radial growth.
2. Set up a resource for woodlot owners and other forest stakeholders to get frequent species status updates.
3. Use our observations to calibrate models which can help to anticipate phenology and growth patterns in future decades.

Acadian Phenocam Network



Infrastructure: Phenocams

- Time-lapse images 6X per day
- Near-remote sensing

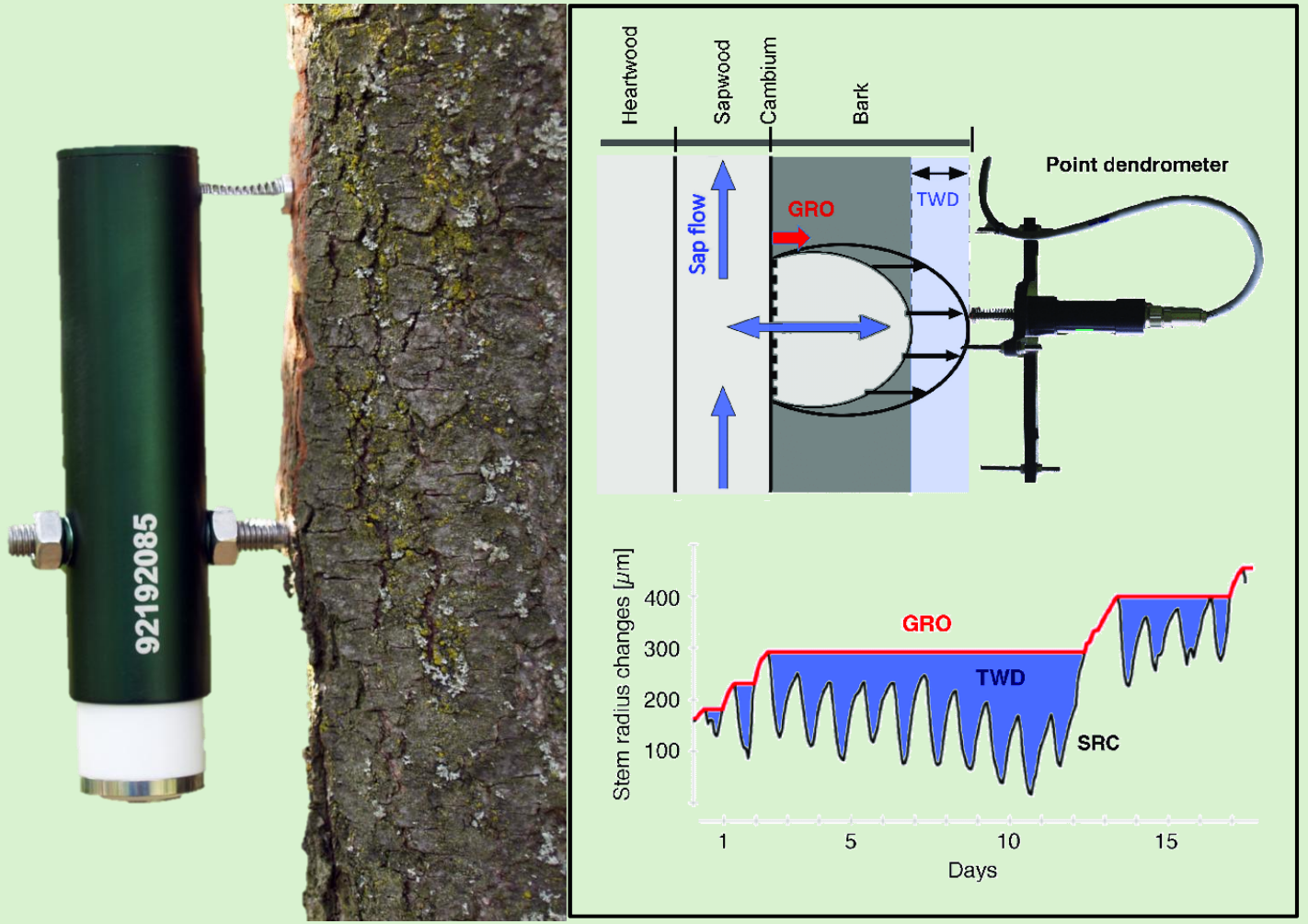


Spafford et al., 2023b

04/27/2025 01:00 PM 59°F 15°C
SPYPOINT FLEX-M

Infrastructure: Dendrometers

- Tree radii every 15 min
- Daytime shrinkage
- Nighttime expansion



Zweifel et al., 2021

Currently monitoring 12 Acadian Forest Species

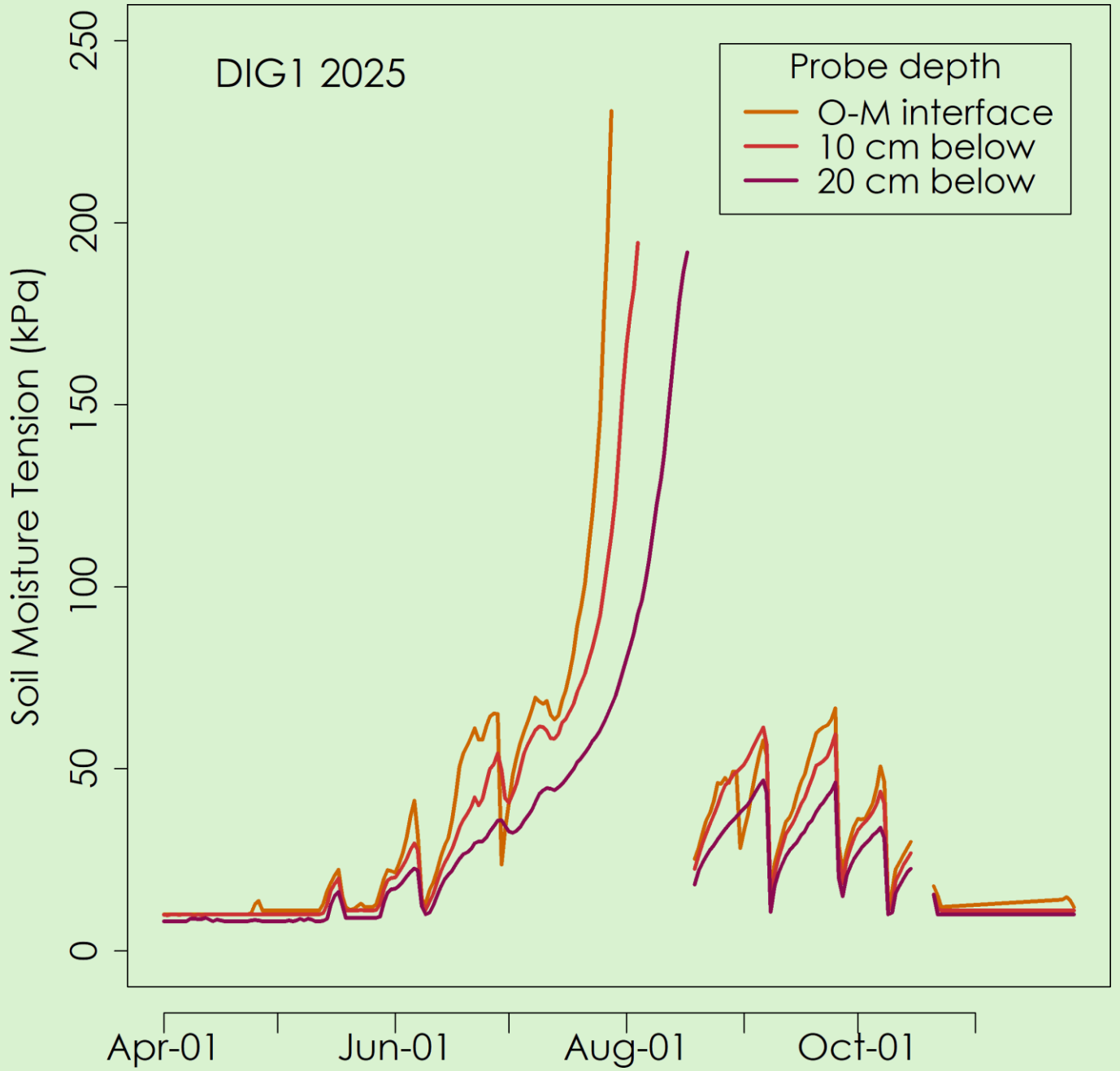
sugar maple	*red maple*	*paper birch*	*yellow birch*	*red oak*	*largetooth aspen*

red spruce	*white spruce*	*black spruce*	*white pine*	*balsam fir*	*eastern larch*

2025 Severe Drought

- Optimal: < 30 kPa
- Dry: 50-100 kPa
- Very dry: > 100 kPa

→ *Exceeded 200 kPa*

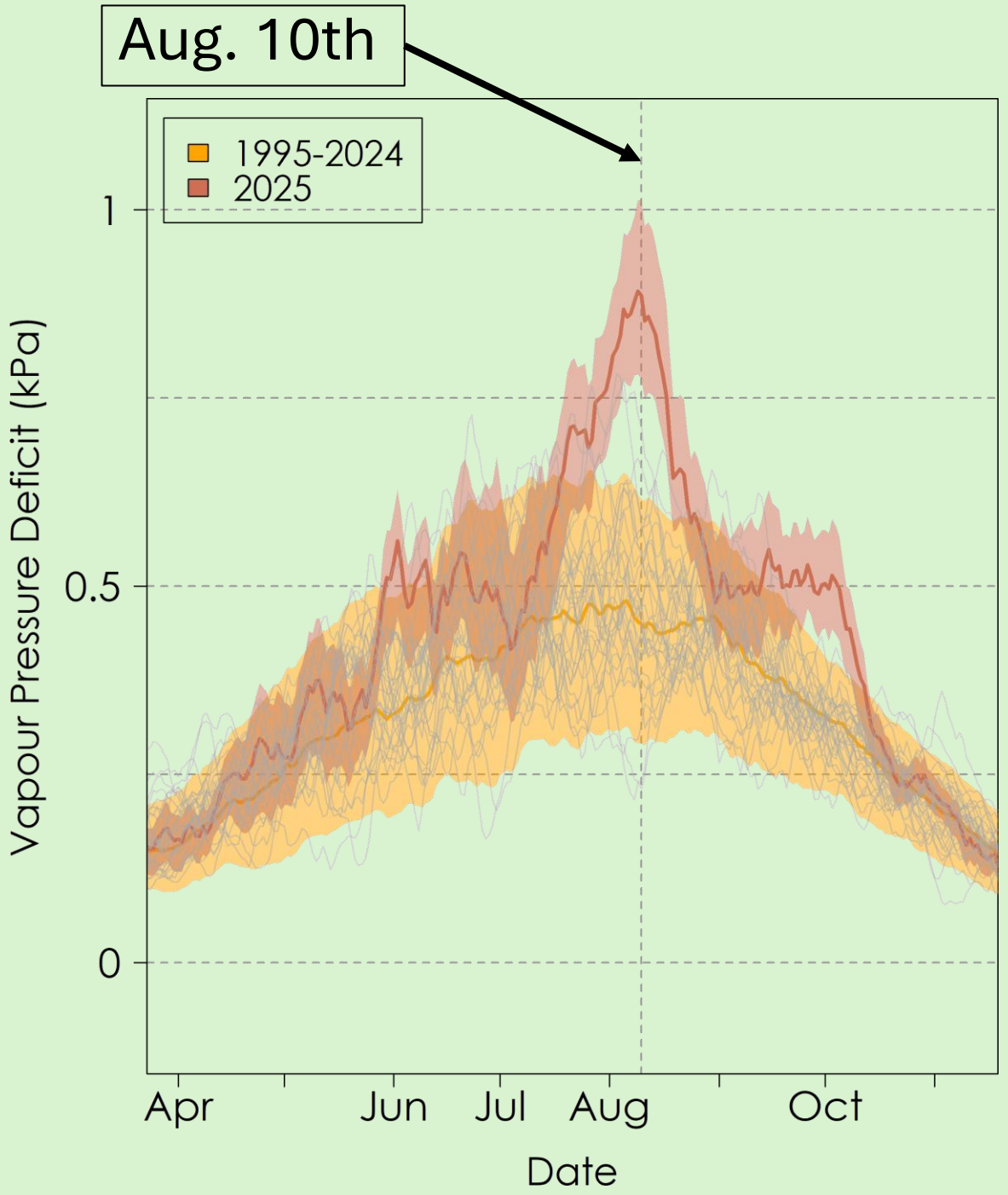


2025 Severe Drought

- Vapour pressure deficit (VPD) = critical control of growth
- VPD peaked on August 10th across sites

Nationwide study:
+0.1 kPa in VPD over time
→**10%** less radial growth

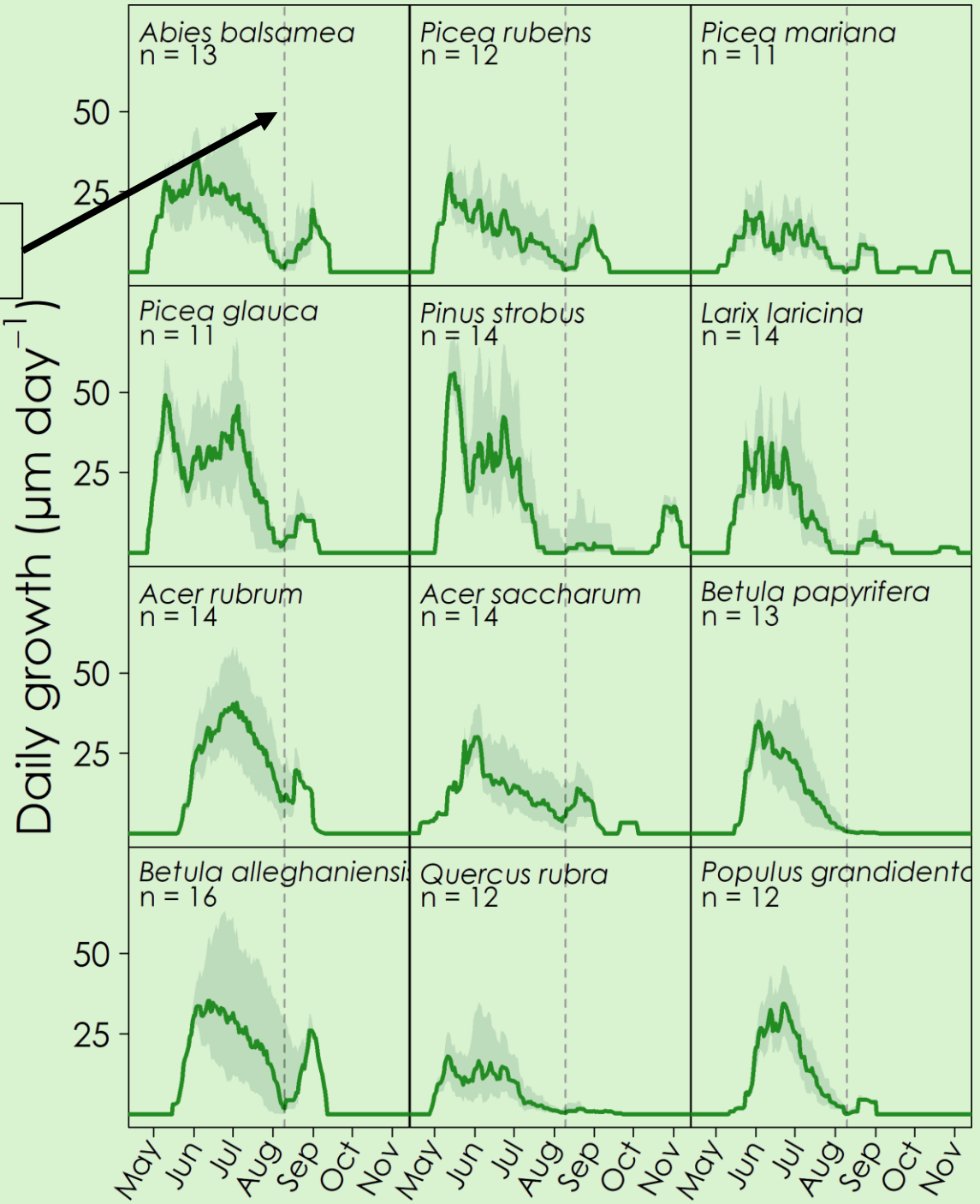
Mirabel et al., 2023



Measured Growth Responses

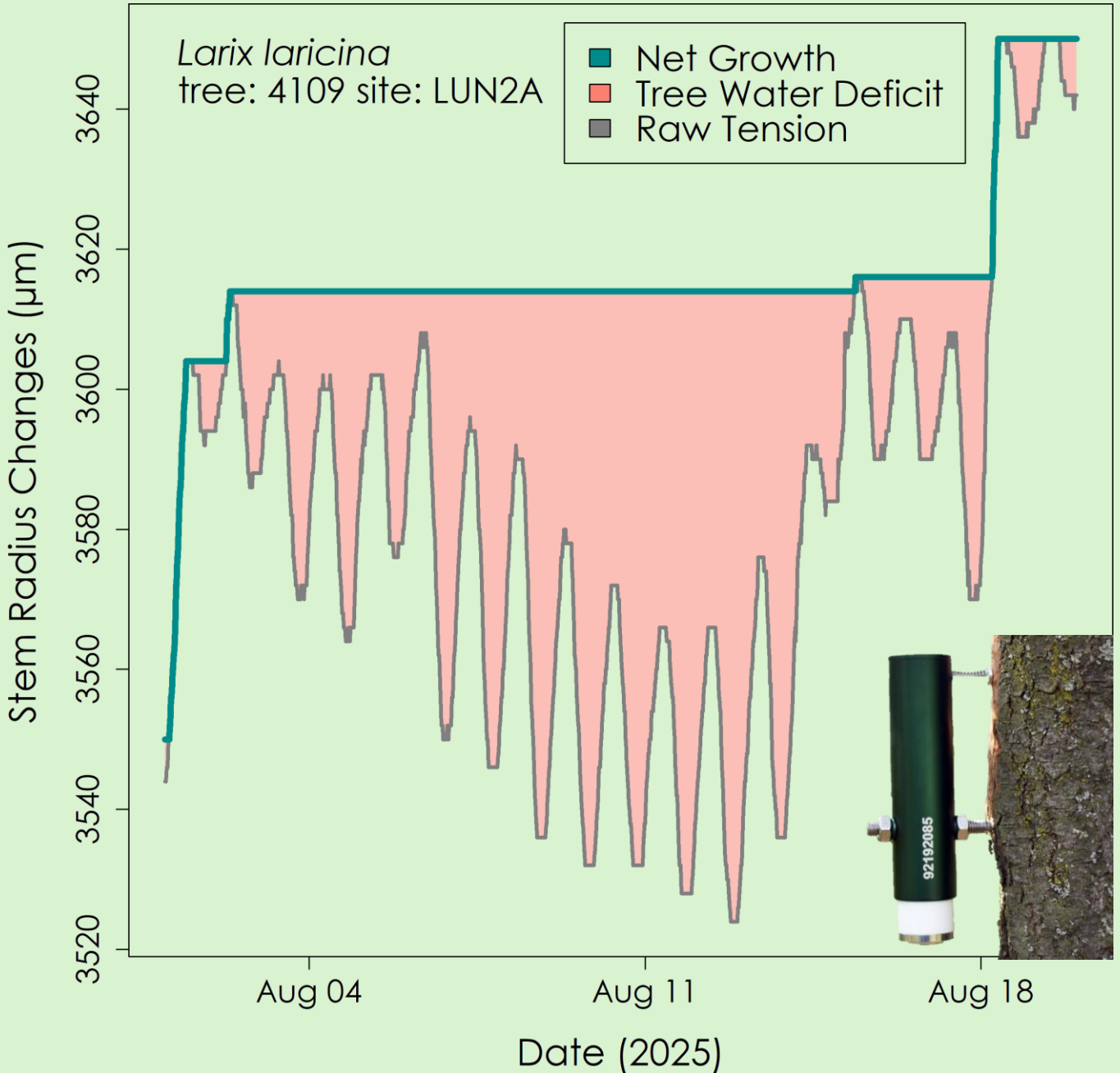
- Interrupted growth:
  - Balsam fir
  - Spruces
  - White pine
  - Larch
  - Red and sugar maple
  - Yellow birch
  - Larch

Aug. 10th



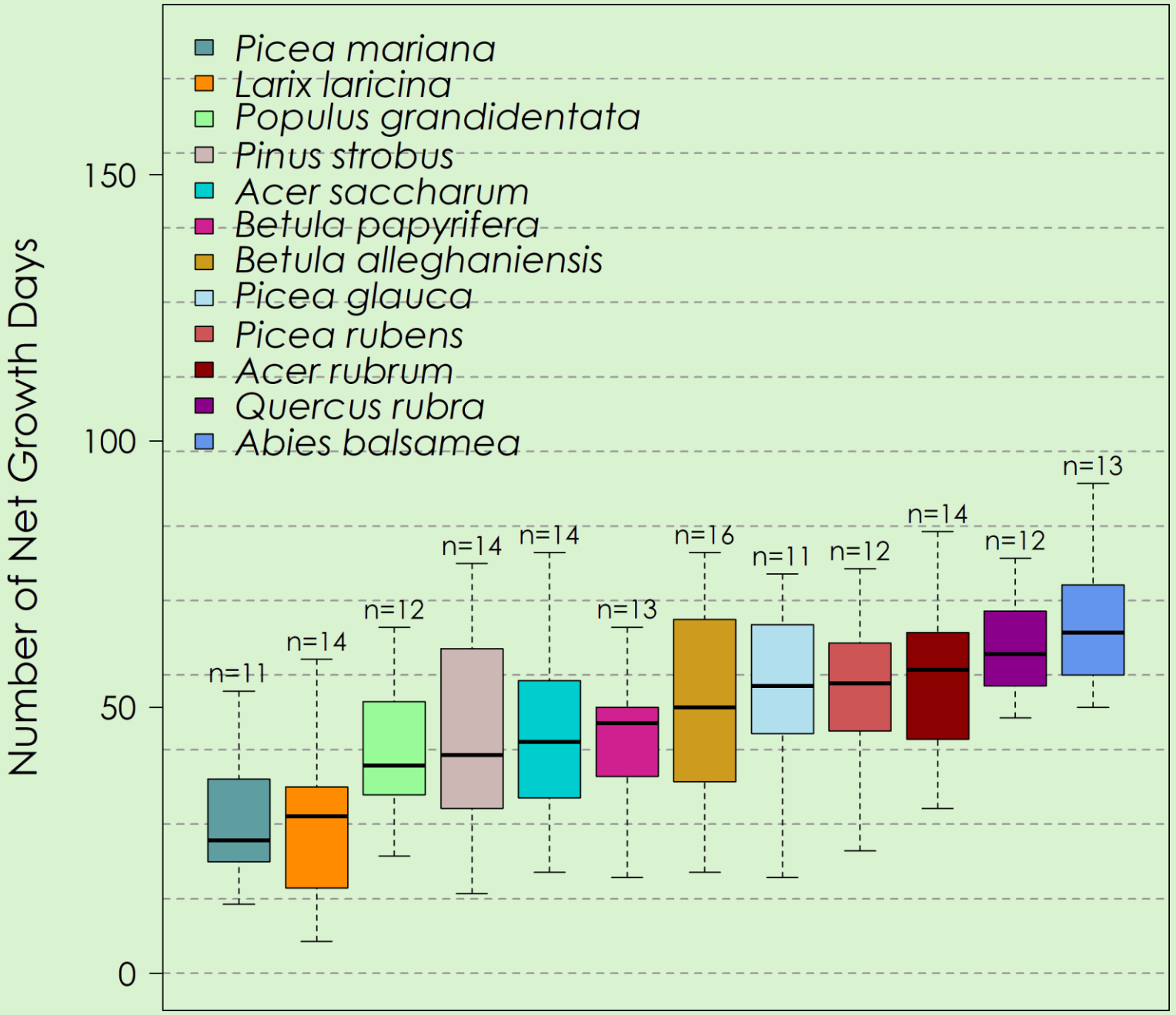
Example: larch in Lunenberg county

- 12-day no-growth streak in August
- Accumulating nighttime water deficit



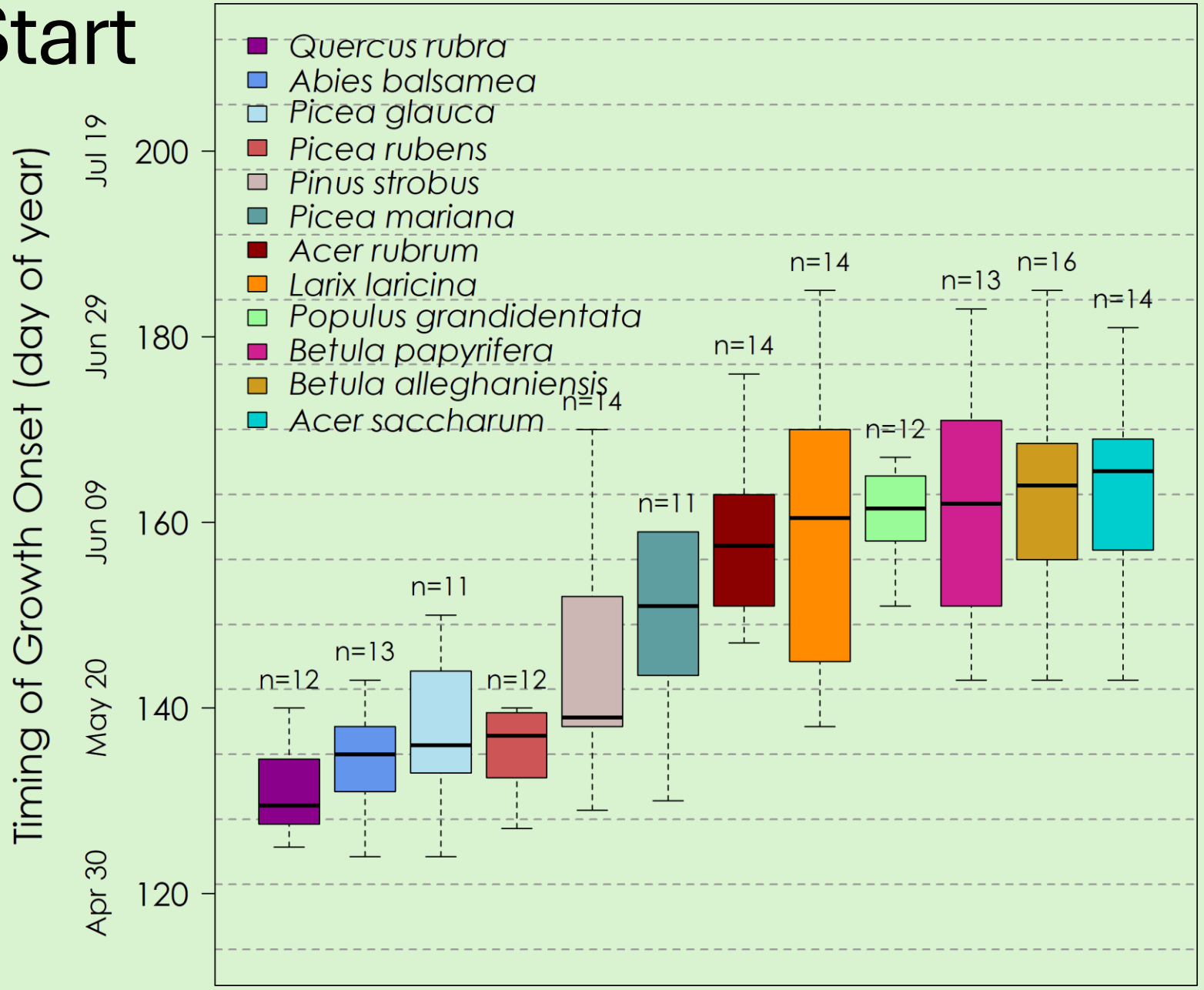
Number of Days with Net Growth

- Balsam fir and red oak had the most days with net growth



Timing of Growth Start

- Balsam fir and red oak were also the first to start growing in May
- Starting earlier led to peak growth coinciding with more water availability
- Consistent with a previous study across eastern NA



D'Orangeville et al., 2022

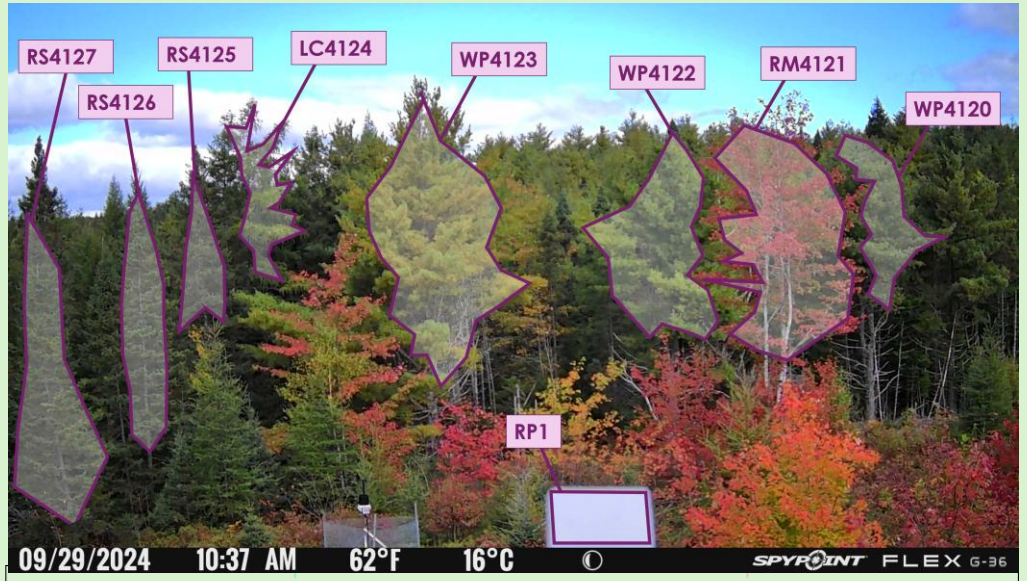
Summary

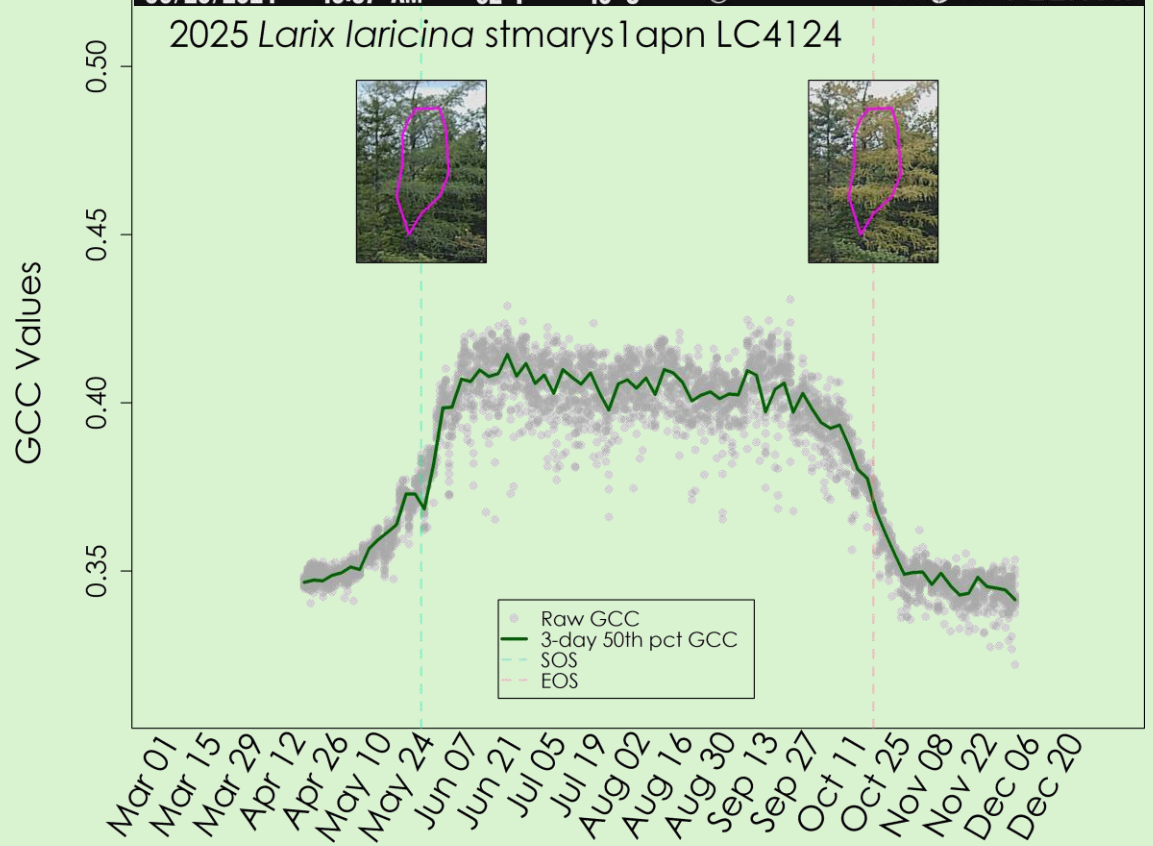
- The 2025 drought was sufficient to interrupt radial growth for most species
- Ring-porous and most conifer species which started growing earlier had more net growth days
- The later growth of diffuse-porous species (birch, maple, aspen, etc.) was suboptimal under drier conditions

Photo credit: Malcolm MacDonald

Ongoing Work

- Capture legacy effects within 2026 & future growth patterns
- Soil analysis results
- Collaboration to develop radial growth models – US & Switzerland





Stay Tuned!

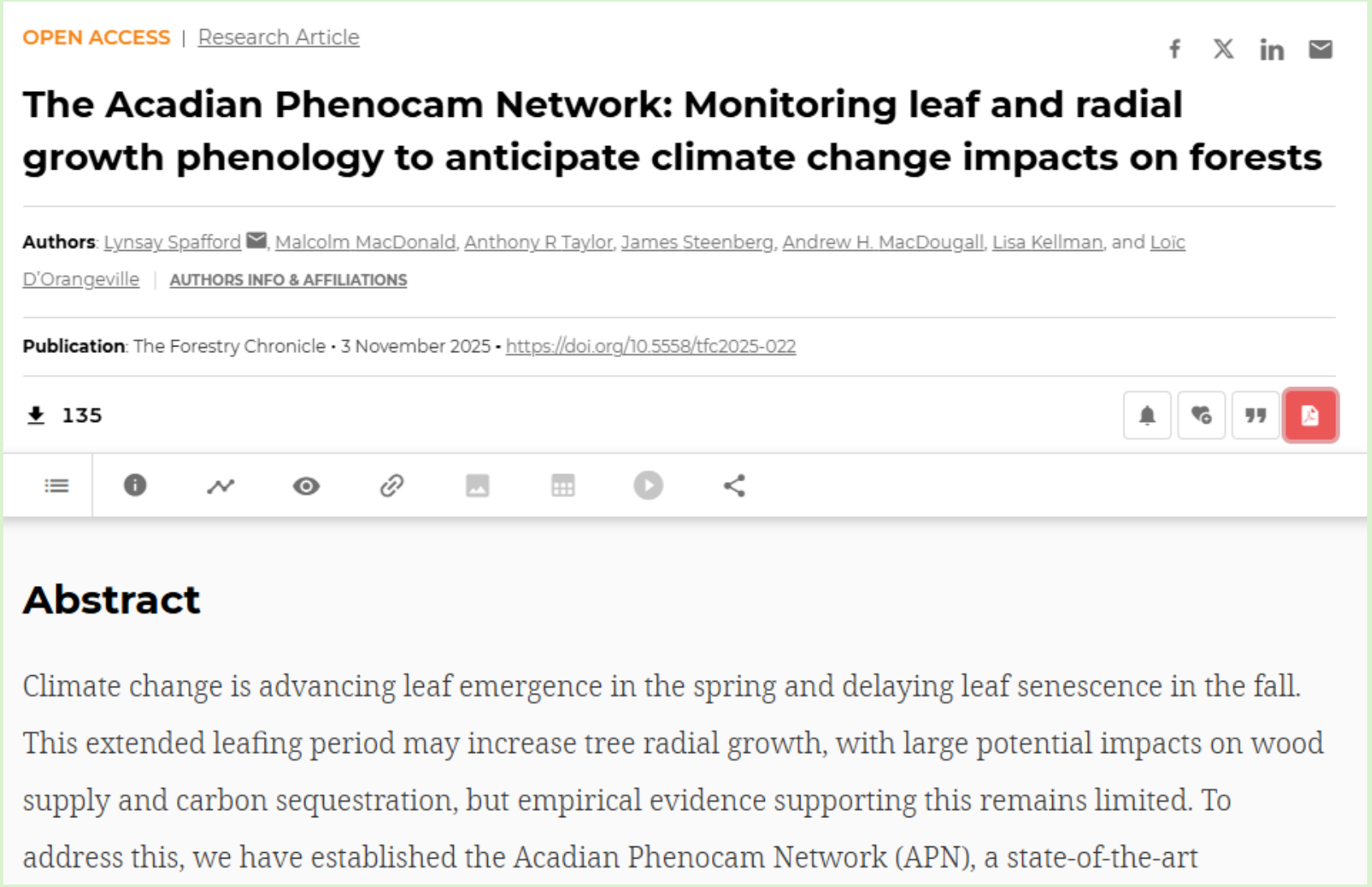
Building a website with more info
on our long-term network including
status updates and reports:

acadianphenonet.ca

APN

Read more about the APN

→ Open-access publication in the 100th anniversary edition of the Forestry Chronicle



OPEN ACCESS | Research Article

The Acadian Phenocam Network: Monitoring leaf and radial growth phenology to anticipate climate change impacts on forests

Authors: Lynsay Spafford, Malcolm MacDonald, Anthony R Taylor, James Steenberg, Andrew H. MacDougall, Lisa Kellman, and Loïc D'Orangeville | AUTHORS INFO & AFFILIATIONS

Publication: The Forestry Chronicle · 3 November 2025 · https://doi.org/10.5558/tfc2025-022

135

Abstract

Climate change is advancing leaf emergence in the spring and delaying leaf senescence in the fall. This extended leafing period may increase tree radial growth, with large potential impacts on wood supply and carbon sequestration, but empirical evidence supporting this remains limited. To address this, we have established the Acadian Phenocam Network (APN), a state-of-the-art

References

- D'Orangeville, L., Itter, M., Kneeshaw, D., Munger, J. W., Richardson, A. D., Dyer, J. M., & Pederson, N. (2022). Peak radial growth of diffuse-porous species occurs during periods of lower water availability than for ring-porous and coniferous trees. *Tree Physiology*, *42*(2), 304-316.
- Miller-Rushing, A. J., Primack, R. B., Primack, D., & Mukunda, S. (2006). Photographs and herbarium specimens as tools to document phenological changes in response to global warming. *American Journal of Botany*, *93*(11), 1667-1674.
- Mirabel, A., Girardin, M. P., Metsaranta, J., Way, D., & Reich, P. B. (2023). Increasing atmospheric dryness reduces boreal forest tree growth. *Nature Communications*, *14*(1), 6901.
- Spafford, L., MacDonald, M., Taylor, A. R., Steenberg, J., MacDougall, A. H., Kellman, L., & D'Orangeville, L. (2025). The Acadian Phenocam Network: Monitoring leaf and radial growth phenology to anticipate climate change impacts on forests. *The Forestry Chronicle*, *101*(2), 266-281.
- Spafford, L., MacDougall, A. H., Vitasse, Y., Filippa, G., Richardson, A., Steenberg, J., & Lever, J. J. (2023a). Leaf phenology as an indicator of ecological integrity. *Ecosphere*, 14(5), e4487.
- Spafford, L., MacDougall, A., & Steenberg, J. (2023b). Climate-driven shifts in leaf senescence are greater for boreal species than temperate species in the Acadian Forest region in contrast to leaf emergence shifts. *Ecology and Evolution*, 13(8), e10362.
- Zweifel, R., Etzold, S., Basler, D., Bischoff, R., Braun, S., Buchmann, N., & Eugster, W. (2021). TreeNet–the biological drought and growth indicator network. *Frontiers in Forests and Global Change*, 4, 776905.