

# Integrating xylogenesis in carbon balance projections for boreal forests

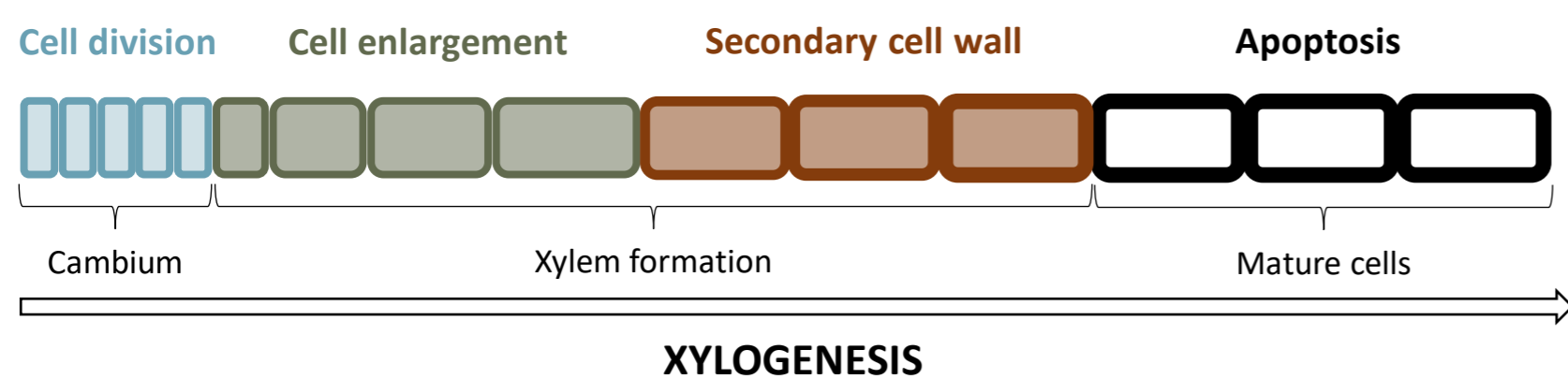
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## 1. Introduction

The boreal forest is a global **carbon (C) sink** that contributes to **climate regulation**. In order to improve projections of the C balance of this forest, it is necessary to **explain** and **model** the influence of **environmental variability** on the **radial growth** of trees. This growth depends mainly on wood formation, i.e. **xylogenesis**.



To understand these complex relationships, it is necessary to use **ecophysiological models** that simulate **photosynthesis, phenology** and **C allocation** simultaneously.

## 2. Objectives & assumptions

Describe the direct controls on boreal xylogenesis

Assess the hydric/thermal limits on xylogenesis

➔ Climatic extremes (summer drought, frost) have a measurable impact on C sequestration through wood formation

Analyze the impact of soil type on xylogenesis

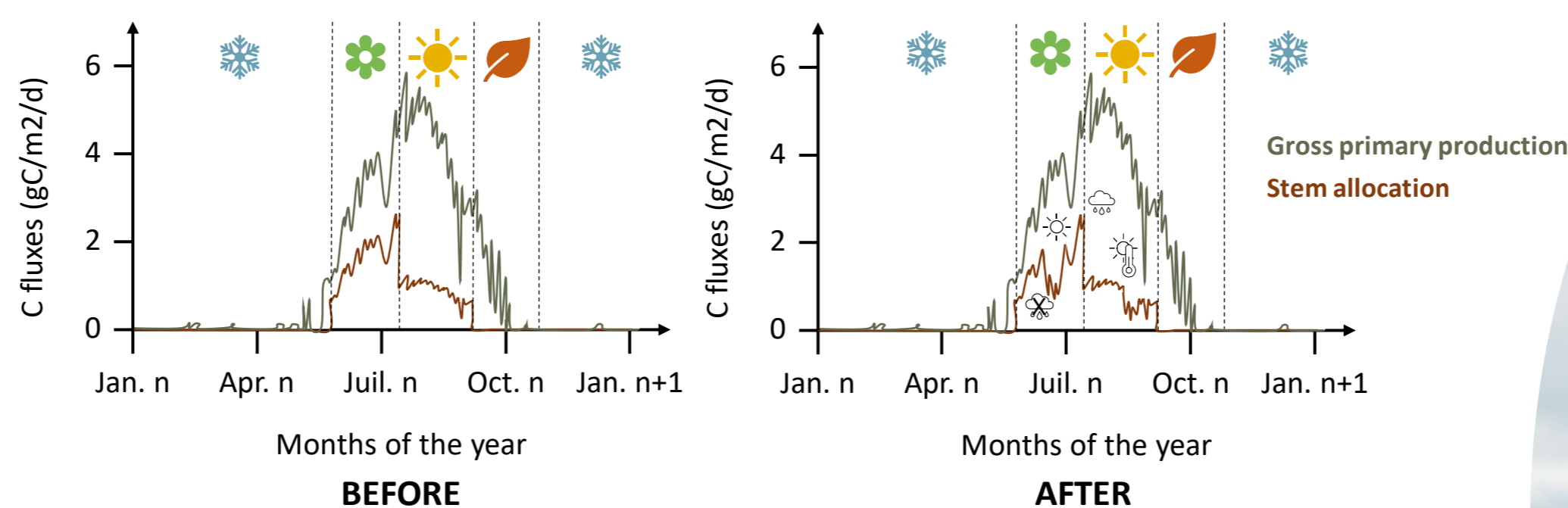
➔ Sites with fast-draining soils already show an increased sensitivity to low water availability

Dissociate the limitations of xylogenesis and photosynthesis + Improve the representation of the C balance

➔ Only the simulation of the constraints of photosynthesis and woody growth together allows us to model the fluxes and balances of C well

## 4. Perspectives

Improve **stand-scale C flux** projections in **MAIDEN**. Integrate the new model into **land surface models** to improve representations of **C fluxes** between the **boreal forest** and the **atmosphere**.



## References

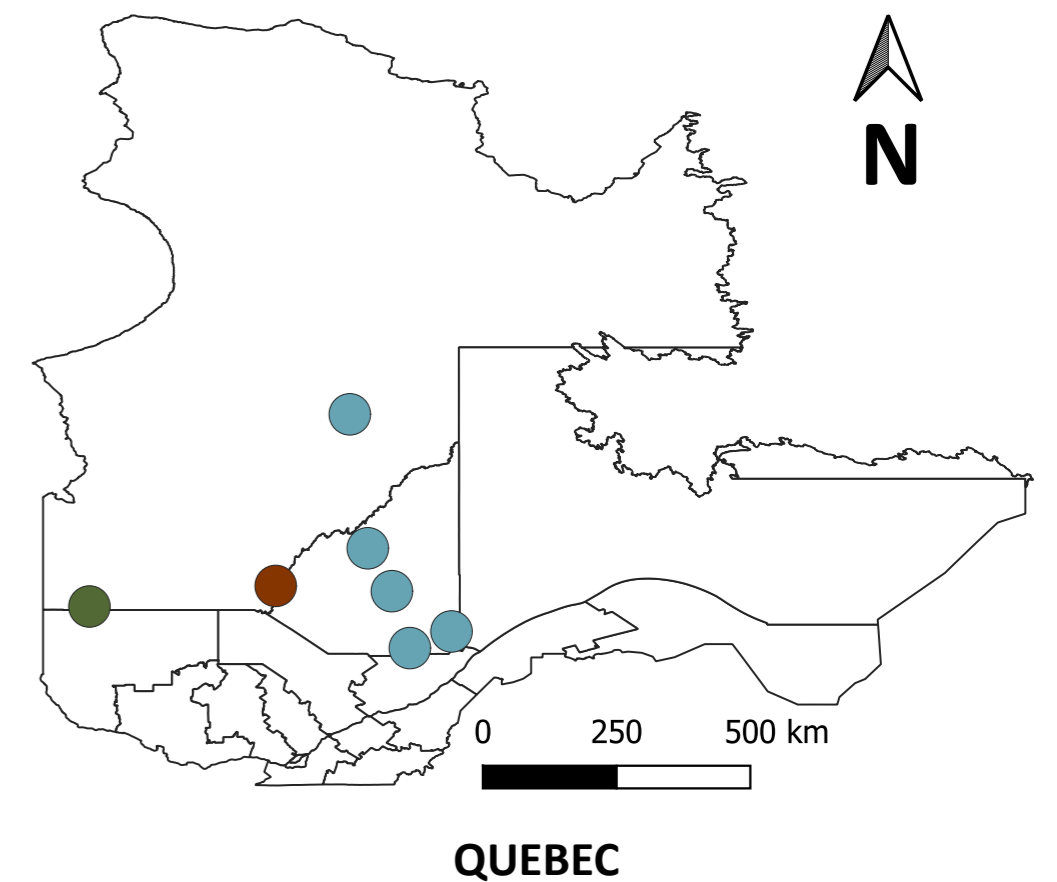
- Fatchi, S., Leuzinger, S., and Körner, C. (2014). Moving beyond photosynthesis: From carbon source to sink-driven vegetation modeling. *New Phytologist* **201**: 1086–1095.
- Friend, A.D., Patrick, A.H.E., Tim, F., Rathgeber, C.B.K., Richardson, A.D., and Turton, R.H. (2019). On the need to consider wood formation processes in global vegetation models and a suggested approach. *Annals of Forest Science* **76**: 49.
- Gennaretti, F., Gea-Izquierdo, G., Boucher, E., Berninger, F., Arseneault, D., and Guiot, J. (2017). Ecophysiological modeling of photosynthesis and carbon allocation to the tree stem in the boreal forest. *Biogeosciences* **14**: 4851–4866.

## 3. Materials & method

### Data

Two **xylogenesis** monitorings and one **ecosystem flux** monitoring will be used. Each monitoring is accompanied by daily **meteorological data**.

- Microcores on latitudinal gradient (2002-2021)
- Microcores on edaphic gradient (2021-2022)
- Flux tower (2010-2015)
- Regions



### Preparation



### Statistical analysis in two models

1. Phenology and average xylogenesis at the site
2. Influence of environmental variables on growth

### Ecophysiological modeling: MAIDEN

