

# Proposed Research Outline

Christophe Rouleau-Desrochers

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## 1 Context

1. In temperate and boreal forests, temperature plays a crucial role in setting the physiological activity boundaries for trees.
2. Growing season extension
3. Trends of spring and autumn phenological events and their drivers
4. Mechanisms that could limit growth despite having a longer growing season: heat waves, drought, spring frosts
5. How these shifts translate into effects on trees/forests are not totally clear
6. Global growing season shifts consequences on forest ecosystems and services
7. I will conduct an experiment using saplings under experimental conditions, high-resolution drone imagery and meta-analysis to test this hypothesis
8. Importance of young trees on forest recruitment and refine projections of carbon sequestration under future climate change.

## Chapter 1: Experiment on drought and spring frosts on tree biomass

1. Year 1 and 2 of award tenure
2. Hypothesis: the timing of spring frosts and drought events will modify trees' growth response
3. Objectives: understand how the timing of spring and drought events affect trees' growth across 10 species.
4. 10 species, 15 replicates/species
5. Treatments: 2 drought, 2 spring frost and 1 control.
6. Micro-dendrometer to get high-resolution data on primary growth response of trees.
7. Phenological observations
8. Shoot elongation for secondary growth response
9. Biomass

## **Chapter: cambial phenology X drone imagery phenological observations**

1. Year 2 and 3 of award tenure
2. Hypothesis: synchrony between growth onset and leaf phenological phases will change accross species and sites.
3. Objectives: Understand how species-specific leaf and wood phenology relate using drone imagery and deep learning methods (Veras et al., 2022)
4. Relevance of using high-resolution drone imagery to monitor forest community imagery (4 sites on the east coast following a latitudinal gradient)
5. Four dominant tree species within these 4 populations
6. Microcores sampling using Trephor weekly for the whole growing season (Dox 2022, Rossi 2006)
7. Soil moisture measurements and temperature sensors

## **Chapter 3: meta-analyses on something or something else or explicitly mention that I will follow-up with Fuelinex...**

1. should figure something out