



PhD Position

TITLE: Under Pressure: How climate extremes and genetic variation shape resilience in trembling aspen

Background:

Climate change is altering temperature regimes, precipitation patterns, and the frequency and intensity of extreme climatic events in boreal forests. These changes may have important consequences for tree growth, phenology, and ecosystem functioning. Trembling aspen (*Populus tremuloides*) is a key component of North American boreal forests, contributing substantially to biodiversity, carbon cycling, and ecosystem services. However, its growth and survival may be affected by increasing water limitation, climate variability, and recurrent insect outbreaks. Recent research suggests that the effects of drought on aspen growth are complex. Episodic drought events do not necessarily represent dominant controls of long-term growth when considered alongside other environmental drivers, whereas sustained water imbalance may have more persistent effects on tree performance. At the same time, the capacity of aspen to recover from drought and biotic disturbances may vary among genotypes and between male and female trees.

Objectives and expected contributions

The PhD project will determine how climatic variability, environmental stress and biotic disturbances shape the growth, phenology and resilience of trembling aspen across boreal forests. Our main goal will be to distinguish the effects of episodic climatic extremes from those of background climate variability and sustained changes in water availability. We also want to determine whether these contrasting forms of environmental stress lead to different trajectories of tree performance and recovery. The project will directly address three questions:

- (1) How do climatic extremes, interannual climate variability and sustained water imbalance differ in their effects on aspen growth, phenology and resilience?
- (2) How do climate and disturbance responses of individual trees scale up to regional successional pathways?, and
- (3) What is the relative contribution of genetic and environmental controls to aspen performance?

By examining variation among genotypes and between male and female trees, we will assess the extent to which resilience is an intrinsic property of aspen populations versus a response to local environmental conditions.

The project results should improve our understanding of how boreal vegetation may reorganize under increasing climatic variability and extremes, while identifying the role of genetic variation in maintaining tree resilience. The findings will be highly relevant to forest monitoring, adaptive management and the conservation of genetic diversity under both current and future climates.

Candidate profile

We are seeking a highly motivated PhD candidate with a strong interest in forest ecology, dendrochronology, climate–growth relationships, plant ecophysiology, or ecological modelling. Experience or interest in the following areas would be an asset:

- Dendrochronology and tree-ring analysis
- Forest ecology and climate–growth relationships
- Plant responses to drought and other environmental stresses
- Statistical modelling in R

The candidate will have the opportunity to work at the interface of climate change, forest ecology, tree resilience, and genetics, using long-term datasets to address questions of direct relevance to the future of boreal forests.



Financial support: \$24,000/year

Start date: Winter or Summer 2027

This project is a cooperation between UQAT and Swedish University of Agricultural Sciences (SLU).

To apply:

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