**PhD position in Plant and Forest Biology (2026-2029)**

Post-Graduate School: SIReNa : Sciences et Ingénieries des Ressources Naturelles (Université de Lorraine)

*http://doctorat.univ-lorraine.fr/fr/les-ecoles-doctorales/sirena/presentation/*

PhD specialty: Biology and Ecology of Forests and Agrosystems

Laboratory: SILVA Laboratory (Université de Lorraine-AgroParisTech-INRAE)
PHARE Team (Tree PHysiology in Response to the Environment)
https://silva.nancy.hub.inrae.fr/ and https://silva.nancy.hub.inrae.fr/equipes-de-recherche/phare/

**PhD project's title: Characterization of key players involved in establishing poplar tolerance to successive abiotic stresses**

Supervisor : Pr Marie-Noëlle VAULTIER (Université de Lorraine) - PHARE Team (SILVA Lab)

Key words: climatic changes, abiotic stress, multi-stress (high temperatures, drought, ozone), signaling, stress tolerance, acclimation, poplar, plant, physiology

Context :
Current challenges facing the forestry sector revolve around trees' ability to survive and adapt to a changing environment (drought, air pollution, high temperatures, etc.), which generally generates oxidative stress that ultimately leads to reduced tree productivity as well as mortality, particularly among young trees after planting. In 2025, Groover *et al*. (1) highlighted certain critical research questions and strategies to mitigate the effects of climate change on forests. For example, when a tree is exposed to a stressor for the first time (e.g., water stress), will it subsequently be more tolerant to a second stressor or a combination of two stressors? **Investigating the cellular and molecular parameters involved in trees' tolerance mechanisms is therefore essential.**

In this thesis, we will examine how stresses are perceived and signaled in the short term, and how this affects the response to the same stress applied subsequently or to a second stress, whether applied subsequently or in combination. Indeed, rapid responses and their signaling appear to play a role in the response to stress combinations by coordinating the response to different stresses affecting the plant simultaneously, thereby enhancing acclimation and the plants' ability to withstand changing environmental conditions (2,3).

The role of stomatal conductance regulation, the complex detoxification system, and soluble sugars are key parameters that have already been studied in relation to the stress response in trees. It is interesting to note that the lipid response to stress may confer a greater ability to defend against environmental stresses. Laboratory studies have highlighted the involvement of lipids in poplars in response to stress (4). In some plants, lipid changes have been associated with increased heat tolerance, induced by prior drought (5). However, very few such studies have been conducted on trees to date.

Objective :
The main objective of this thesis is therefore to characterize the role of certain key leaf components in the development of poplar tolerance to successive and combined abiotic stresses (drought, high temperature, ozone). The thesis project will be structured around several major questions:
i) Which molecules (hormones, lipids, sugars) involved in stress signaling enable an early and effective plant response?
iii) What role do these molecules play in poplar tolerance to successive stresses?

The research will focus on **poplar**, a model tree for molecular studies, to enable a detailed analysis of the mechanisms involved. To unravel the mechanisms underlying the development of tolerance in poplars, we will examine successive stressors, mimicking what can be observed under natural conditions.

Bibliographic references :
1) Groover *et al*. (2025) *New Phytol* 245:1817-1832
2) Lämke and Bäurle (2017) *Genome Biol* 18(1):124
3) Kollist *et al.* (2019) *Trends Plant Sci* 24(1):25-37
4) de Freitas Pereira *et al*. (2023) *Plant J* 116 :1784-1803
5) Zhang *et al*. (2019) *Plant Cell Environ* 42 :947-958

## Thesis start date: November 1rst, 2026

Place of work :

Laboratory UMR 1434 SILVA (Université de lorraine-AgroParisTech-INRAE)

PHARE Team (PHysiologie de l'Arbre en Réponse à l'Environnement) : *https://silva.nancy.hub.inrae.fr/equipes-de-recherche/phare*

The doctoral research will be conducted at the SILVA lab (UMR 1434, University of Lorraine- AgroParisTech-INRAE), primarily at the Faculty of Science and Technology campus (54506 Vandoeuvre-lès-Nancy), although experiments may also take place at the INRAE Grand-Est Nancy site (54280 Champenoux). Buses to INRAE run from downtown Nancy.

Required skills :
The research project to be conducted by the doctoral student will incorporate molecular, cellular, and ecophysiological approaches. The candidate must have expertise in plant science, biochemistry, and molecular biology, and, if possible, in ecophysiological measurements.

The successful candidate must:
- demonstrate a high degree of independence and take the lead in this thesis project
- be proactive and motivated, with a willingness to work hard
- possess strong organizational skills and scientific rigor
- enjoy working in the field (experiments in phytotron chambers) as well as in the laboratory
- be comfortable in analyzing data and using R software for statistical analysis
- have strong writing skills (in both French and English for French people and in English for Foreign people)
- be fluent in spoken and written English
- have good interpersonal skills that will allow the candidate to integrate easily into the research team

Information/application :

***To apply: Send your application to M-N Vaultier and be sure to apply via ADUM (https://www.adum.fr/)***
- a resume
- a cover letter describing your research experience (including the topic of your Master's 2 internship)
- your transcripts from Master's 2 and Master's 1
- a letter of recommendation from a reference (and/or contact information for at least two references)

Contact for more information and to apply : Pr Marie-Noëlle VAULTIER (Professor, Université de Lorraine)
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## Application deadline : 10 June 2026 (midnight)