PhD position – Modeling wind–tree interactions

Contact

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Context

Windstorms are among the most damaging natural hazards, accounting for over 40% of wood biomass loss in European forests. Yet wind is not always detrimental: it plays a key role in tree development. Wind-induced loads are sensed by trees, leading to adaptive growth that improves their resistance to future winds. Despite this, current models of forest resistance rarely account for such mechanical adaptation.

Objectives

This PhD project aims to develop and validate a model to estimate wind loads on individual branches, linking wind speed to induced loads while incorporating tree morphology, forest structure, spatial distribution, and sheltering effects from neighboring trees. The ultimate goal is a computationally efficient model to predict tree and forest development. The project combines **field experiments**, **theoretical modelling of fluid–structure interactions**, and **numerical development in Python** to create a predictive tool that improves upon current empirical approaches.

Requirements

Candidates should hold a Master's degree in **fluid dynamics**, **applied mathematics**, **soft matter physics**, or **biophysics**, with an outstanding academic record. A strong interest in interdisciplinary research is particularly valued.

Starting date

Ideally **1 October 2025**, but flexible.

Funding

This position is funded by **PEPR FORESTT**, project **WIND-SWEEP (2025–2029)**.

Job location

The PhD will be based at **IRPHE (Institut de Recherche sur les Phénomènes Hors Équilibre)** in Marseille, France, a leading French laboratory in fluid mechanics with a strong interdisciplinary tradition. The candidate will join **Christophe Eloy's group** and will be co-supervised by **Thiéry Constant (UMR SILVA, INRAE Nancy).** The candidate will spend extended periods in Nancy to participate in field experiments and meet with the other members of WIND-SWEEP project.

How to apply

Candidates are invited to contact Christophe Eloy by email as soon as possible with:

1. A detailed CV
2. Contact information for at least two academic references
3. Full transcripts of their Master's degree(s)
4. A motivation letter describing their past activities and research interests