LABORATOIRE D'ÉCOLOGIE FONCTIONNELLE VÉGÉTALE

Two-year postdoctoral position: Understanding variation in leaf phenology at the landscape scale using multi-temporal drone imagery

The Laboratory of Plant Functional Ecology (LEFO) is currently looking for a postdoctoral researcher to study inter- and intraspecific variation in leaf phenology (green-up and senescence) at the individual tree level in deciduous tree species, and its environmental controls.

Preliminary research in our lab found that the timing of senescence can vary by two weeks or more within neighboring trees of the same species growing under the same climate but facing different topo-edaphic conditions (soil nutrient and/or water availability). This project seeks to further our understanding about the sources of such variation in leaf phenology by studying it across several thousands of deciduous trees in a 50-ha area of mixed temperate forest in Québec, Canada. Understanding variation in leaf phenology is important because this is one of the largest sources of uncertainty in terrestrial carbon models.

The postdoctoral researcher would have access to a large (hundreds of GB) and diverse dataset consisting of:

1. high-resolution (1.5 cm / pixel) **RGB orthomosaics** from a 50-ha area; imagery was acquired for **30 dates starting in early May 2022**, before green-up, all the way to early November 2022 after all deciduous leaves had fallen)
2. Associated **3D point clouds and digital surface models** for all these dates over the same area
3. **LiDAR** data (acquired by drone in November 2022 under leaf-off conditions; lower-resolution data from 2015 is also available)
4. Full-range (400-2500 nm) **imaging spectroscopy** (1 m / pixel) data for the entire 50-ha and beyond acquired in July 2022; foliar trait maps (e.g. LMA, nutrients, water) will be produced from this dataset in 2023 by a student from the lab

5. Accurate **tree-level crown annotations for >11,000 deciduous trees from 8 species** (7 broadleaf and 1 conifer, *Larix*) over the 50-ha area

All drone imagery and products are perfectly aligned with each other (cm accuracy). Combined with the tree annotations, this makes it possible to study changes in leaf color at the individual tree level over the entire area at high temporal resolutions (every five days when change in color was fastest) over the entire 2022 season. The spectroscopy and trait data could help to evaluate how the phenology might depend on foliar nutrient status. There could be an opportunity in 2023 to add drone thermography data to evaluate water stress (but not in the same year as the rest of the dataset unfortunately). We also have RGB data for seven dates spanning the entire 2021 for the same 50-ha that could also be used.

The postdoctoral researcher would be supervised by Etienne Laliberté at the Institut de recherche en biologie végétale of Université de Montréal. The institute is located within the beautiful Montréal botanical garden, and offers an exciting and stimulating research environment. The postdoctoral research would be expected to participate fully in the lab activities (e.g. lab meetings, journal clubs). Depending on the candidate's skills and interests, there could be opportunities to participate in other research projects from the lab as side-projects.

This position is for up to **two years, full time**. Postdoctoral researchers at UdeM are under a collective agreement (French only), and all details about the work conditions can be found in that document. The applicant is expected to have:

- A PhD (obtained less than five years ago) in forest ecology, remote sensing, or in a other relevant field of research
- **Excellent spatial data science skills** (essential)
- **Excellent writing and data analysis skills** (essential)
- **Solid experience in forest/plant ecology and (ideally) good knowledge of vegetation phenology** and its drivers.

This position is open to Canadian or international applicants. International applicants will require a visa and will be responsible for obtaining it. While French is the official language in Québec and within UdeM, it is possible for postdoctoral researchers to only use English. We value diversity, equity and inclusion and encourage applicants from marginalized groups to apply.

Applicants should send a letter explaining their motivation and relevant skill set, a CV and the names of three references to Etienne Laliberté (etienne.laliberte@umontreal.ca). Any questions about the position should be also addressed to Etienne Laliberté.

The **deadline for sending in applications is January 13, 2023**, but we will consider applications until the position is filled. The **expected start date would be as soon as possible after an offer is made in early 2023**, with some flexibility.