



Eidg. Forschungsanstalt für Wald,  
Schnee und Landschaft WSL



PHYTOAKMETER



### Master Thesis Opportunity

Within the Forest Entomology Group and as part of the Forest Health & Biotic Interactions Research Unit of the Swiss Federal Research Institute, WSL, we are offering an exciting Master thesis opportunity titled **“The Effect of Within-tree Microclimatic Gradients on Plant Phenology & Plant-herbivore Interactions”**. This project, at the interface of forest canopy ecology, climate change ecology, chemical ecology (metabolomics) and entomology will provide the candidate with trainings in plant and insect phenotyping, insect bioassays and plant metabolomics including sample preparation, processing, and phytochemical analyses. This project is implemented within a part of a large multi-groups project “PhytOakmeter” that aims to determine how rhythmic growth patterns, herbivory, drought, and climatic gradients individually and in interaction affect oak chemistry and oak-herbivore interactions.

**Background:** Interactions between plants and insect herbivores constitute a crucial link between primary production and multi-trophic food webs. Consequently, plant-herbivore interactions are key drivers of community dynamics, numerous ecosystem functions, and nutrient cycling processes. The relationships between plants and insect herbivores are largely mediated by phytochemical traits. Therefore, factors that substantially alter phytochemistry may have wide-reaching ecosystem-level consequences. Due to their size and vertical stratification mature trees possess pronounced vertical gradients in temperature and light conditions. These within-tree microclimatic gradients have been associated with variation in leaf chemistry and herbivory. In addition, climate change is expected to also alter forest microclimate with far reaching ecological consequences. This project is designed to quantify the relationship between within-tree microclimatic variation, phytochemistry and herbivory and to understand to what extent light and temperature gradients contribute to within-tree variation in leaf phenology, chemistry, and herbivory. This project will be mainly performed in controlled environments in climate chambers at the ETH Zurich. We will use Pedunculate oak (*Quercus robur*) clones and grow them in different climate chambers simulating the upper canopy, lower canopy or ground-level light intensity and temperatures mirroring the natural microclimatic conditions measured in canopy forest. By observing the trees throughout the growing season, we will measure growth-related traits (leaf number, flushes SLA leaf specific area), assess trees’ resistance to herbivory by performing herbivore bioassays with caterpillars, and measure leaf defense chemistry. The results of this study will elucidate on the extent which light and temperature gradients of different forest strata contribute to within-tree variation in leaf phenology, chemistry, and herbivory. The data can contribute to the publication of a main sub-project of the Phytoakmeter or be published separately in a scientific journal.

**Requirements:** Strong interest in plant-insect interactions. Precise work and good observation skills. Plant handling & phenotyping and experience working with plant-insect as well as basic skills in statistics with R, are advantageous.

Length of the project: March-August 2024 (the length is adjustable to a possible longer period). Work breakdown: climate chamber & lab work: 70%, office work: 30%

For application or additional information please contact Dr. Moe Bakhtiari (mojtaba.bakhtiari@wsl.ch). More information about Forest Entomology Group:

<https://www.wsl.ch/en/about-wsl/organisation/research-units/forest-health-and-biotic-interactions/forest-entomology/>