The Future of Mountain Forests

PhD Position

Susceptibility of Alpine forest tree species to first- and second-order fire effects

Background

Mountains play an essential role in global geo-chemical cycles, are extraordinary rich in biological and socio-cultural diversity and provide manifold ecosystem services. Climatic changes, which are especially pronounced in mountain regions, will particularly affect mountain forests due to the long life-span of trees, which does not allow for rapid adaptation. Drought stress may substantially limit mountain forest vitality, socio-economic and especially protective functions and interrelate with further risks, such as forest fires. The project "The Future of Mountain Forests" aims at analysing if and how drier conditions (i) influence carbon and water balances from tree to forest level, (ii) change plant stress responses and interactions with microbial communities, and (iii) affect ecosystem services. It will enable a better understanding of mountain forests and their complex processes under current and future conditions, and create knowledge highly relevant to future forest management strategies.

The project is funded in the frame of the doc.funds program of the Austrian Science Funds FWF. It is based on eight PhD theses focusing on closely interlinked aspects at cellular, tree and forest level. The PhD students are supervised in teams and embedded in the Doctoral College "Alpine Biology and Global Change" and the internationally recognised Research Area "Mountain Regions" of the University of Innsbruck. They profit from the interdisciplinary exchange with other PhD students and close cooperation with re-known international scientific partners, availability of highly-instrumented field sites, a comprehensive training program, a search tool for mountain literature, involvement in the "International Mountain Conference" and the associated international summer school as well as alumni programs. PhD students can expect promising career perspectives based on their methodical and organisational skills, embedment in the international scientific community and the expected excellent publication record.

PhD Project

Climate change causes increased risks of wildfires, due to raising temperatures and the increase of drought events. Fires often are not lethal for trees, but rather trigger second-order effects, such as physiological limitations in carbon and water relations or increased susceptibility to pathogens. Knowledge on the susceptibility of European forest species and underlying first- and second order mechanisms is poor, despite fire frequencies and intensities in the Alps, and respective risks for the protective function of mountain forests, increase.

This PhD-thesis aims at short- and long-term fire effects on the hydraulics of Alpine forest species. We expect species-specific impairments of the hydraulic safety in several species, which will impair water relations and reduce their resistance against consecutive drought events. We hypothesise fire-induced impairments to be more pronounced in young trees.

The final research program will be defined together with the PhD student. It will include the analyses of structural (Microscopy, SEM, Micro-CT) and functional (hydraulic measurements, cell damage analysed via electrolyte leakage) effects upon heat treatment (temperature test chamber) of branches and roots harvested at the project study sites. Young trees will be used for fire experiments in the Botanical Garden (analyses of embolism formation, structural impairments during fire and of post fire mortality) and at the treeline for a field experiment on fire damage and germination and rejuvenation after fire. Local heating of stems will enable to quantify hydraulic and structural effects (analyses of wood cores, electric resistivity tomography, ultrasonic acoustic emission technique) also on adult trees. Research activities may also include a monitoring on recent wildfire sites.

Schedule

Year	2023		2024				2025				2026				2027	
Organisation, Recruitment, Methodical training																
Tree hydraulics																
Xylem structure																
Monitoring forest fire site																
Experiments young trees (heat plume effect, etc.)																
Publication																
PhD position																

Supervision

Stefan Mayr (stefan.mayr@uibk.ac.at)

Co-Supervisison: Michael Bahn, Ilse Kranner, Walter Oberhuber, Ursula Peintner

Cooperation

Sean Michaletz, University of British Columbia

The PhD project will finance a research stay at the partner institution.

Details Position

FWF PhD-position 4 years (initial contract 3 months)
30h per week, gross salary € 2.464,80 per month
Start: July 2023 to September 2023

Requirements

- Master Botany, Ecology or similar study
- Interest in plant physiology, climate change, sensor-technology
- Experience with eco-physiological methods and data analyses desirable
- Interest in cooperation with international partner(s)
- Ability to work independently

Application

Please send your application **to MountainForests@uibk.ac.at until 2023-04-11**. Please prepare the following pdf documents (with chapters in the given order):

1. NAME_application.pdf

- Motivation Letter: 1-2 pages; description of why you want to participate in "The Future of Mountain Forests" and the selected PhD project(s); you can apply for up to 3 PhD projects with one application (please give the preferred project)
- Research Outline: 1-2 pages; description of your research approaches and ideas for the PhD project(s)
- CV: 1-2 pages; including publication list

2. NAME_documents.pdf

- BSc-diploma and transcript (translated to English)
- MSc-diploma and transcript (translated to English)
- MSc-thesis abstract (in English)
- Certificate of English skills (level B2 or higher (TOEFL: >87 points, IELTS: >6.5 points)

Further information

https://www.uibk.ac.at/en/projects/mountainforests/
or contact MountainForests@uibk.ac.at