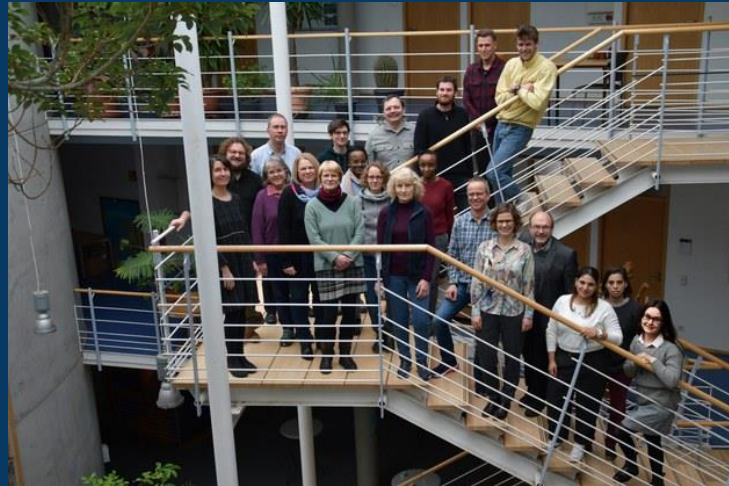


Vorstellung von Bachelor- u. Masterarbeitsthemen am Institut für Bodenkunde und Standortlehre



Prof. Dr. Karsten Kalbitz
Professur für Bodenressourcen
und Landnutzung



Prof. Dr. Natalie Orlowski
Professur für Waldstandorte
und Wasserhaushalt

BSc. topic: Calibration of soil moisture sensors for deadwood

Background:

- BENEATH project
- Carbon and water cycle of a near-natural beech forest in a changing climate
- What is the role of deadwood?

Aim:

- Calibrating soil moisture sensors for accurate use in deadwood
different decay classes

Requirements:

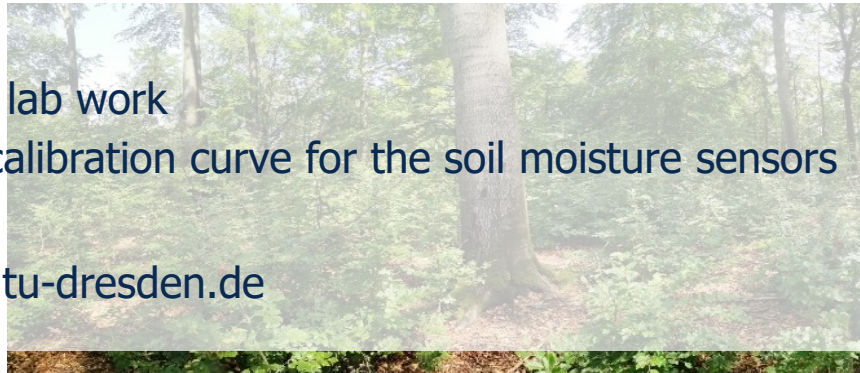
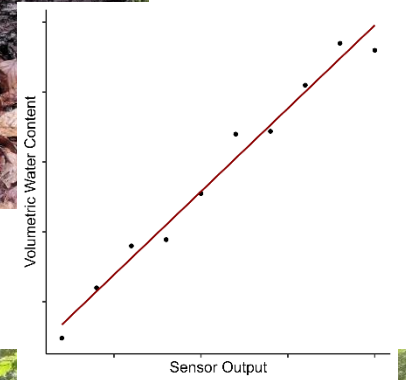
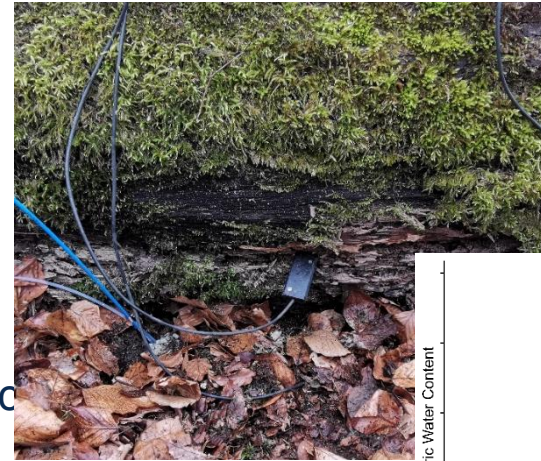
- Enjoy designing and carrying out an experiment in the lab

Tasks:

- Help with necessary lab work
- Determination of a calibration curve for the soil moisture sensors

Contact / Supervisor:

- robin.schaefferling@tu-dresden.de



BSc./MSc. topic: CO₂-Emission after DOC-Irrigation

Background:

Safeguarding the drinking water quality of the Saxon drinking water reservoir Sosa, which is endangered by DOC inputs

Aim:

1. Balancing how much DOC is emitted as CO₂ from DOC-adsorbing soil during artificial irrigation with DOC-rich water
2. Qualify you as young Researcher

Requirements:

Motivation to deal with statistics (you are not left alone)
Having fun with scientific work

Tasks:

- Implement Research Design in the Field
- Measuring CO₂-Emissions from Soil by respiratory hoods
- Data Analysis

Additional information:

- 5 – 10 Fieldtrips to the catchment of the drinking water reservoir Sosa
- Start Fieldwork: Spring 2025
- <https://publikationen.sachsen.de/bdb/artikel/43660/documents/66111>

Contact / Supervisor: erik.nestler@tu-dresden.de



<https://www.google.com/url?sa=i&url=https%3A%2F%2Ftalltimber.s.org%2Ffire-frequency-effects-soil-respiration%2F&psig=AOvVaw1bma>

BSc. /MSc. topic: Reaction of **Soil Microorganisms (C_{mic})** after DOC-Irrigation

Background:

Safeguarding the drinking water quality of the drinking water reservoir Sosa in Saxony, which is endangered by DOC inputs

Aim:

1. determine how much C from DOC is fixed as well as released as CO_2 from soil microorganisms after artificial irrigation with DOC-rich water
2. Qualify you as young Researcher

Requirements:

Motivation to deal with statistics (you are not left alone)
Having fun with scientific work

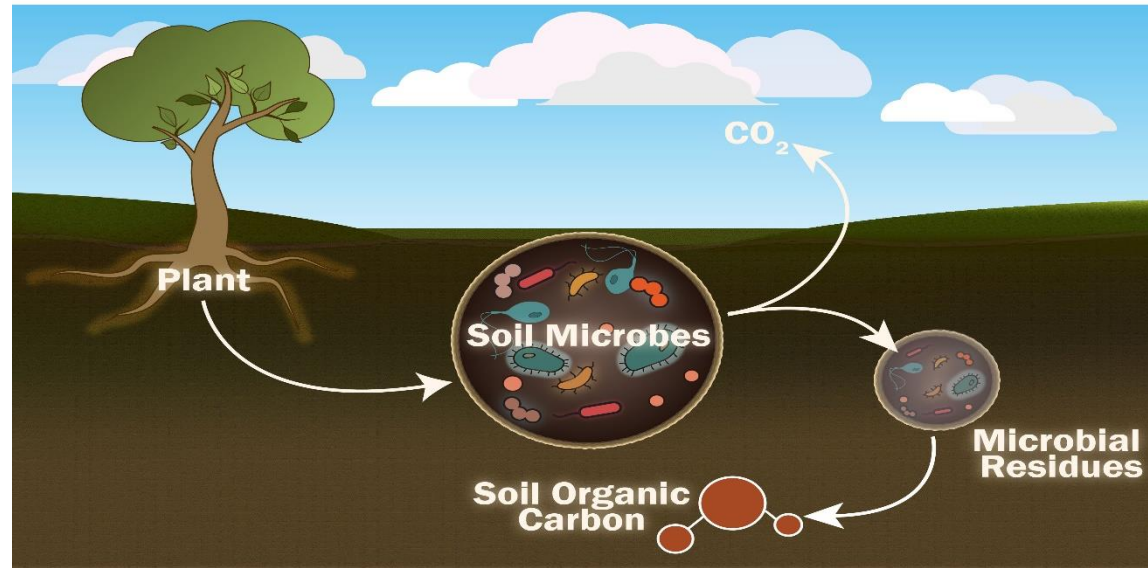
Tasks:

- Experimental setup
- measurement of CO_2 emissions and microbial biomass in the laboratory
- Data analysis

Additional information:

<https://publikationen.sachsen.de/bdb/artikel/43660/documents/66111>

Contact / Supervisor: erik.nestler@tu-dresden.de



<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwvutoday.wvu.edu%2Fstories%2F2022%2F01%2F>

BSc./MSc. topic: Modelling tracer breakthrough curves of various soils

Background: Transport of solutes in soils depends on various specific soil characteristics. These characteristics can be derived by the shape of respective tracer breakthrough curves.

Aim: Develop a *R* script for automated curve fitting using obtained empirical data. Build an *R Shiny* app for teaching purposes.

Requirements:

- Interest in lab & field work
- Proficient *R* skills

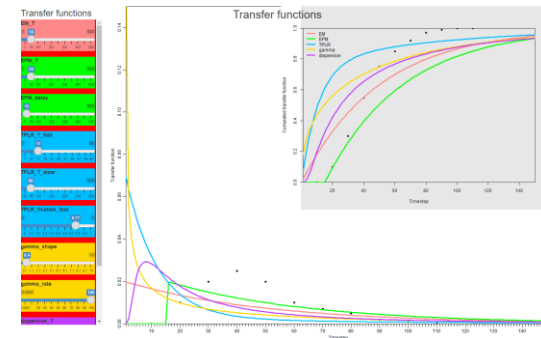
Tasks:

- Soil column sampling, setting up & conducting soil column experiments
- Data analysis and modelling of tracer breakthrough curves using *R*
- Build an *R Shiny* app with adjustable parameters for manually fitting curves to observed data

Contact / Supervisor(s): Prof. Orlowski
(natalie.orlowski@tu-dresden.de); MSc. Tom König



Soil column experiment setup (LfU Bayern)



Different tracer breakthrough curves with adjustable parameters using a *R-Shiny* app.

BSc./MSc. topic: Water use by hybrid Poplars in relation to environmental variables

Background: For quantification of tree water use a combined analysis of soil-plant-atmosphere conditions is necessary. Experimental studies are critical to understand tree water use dynamics in relation to soil-related factors.

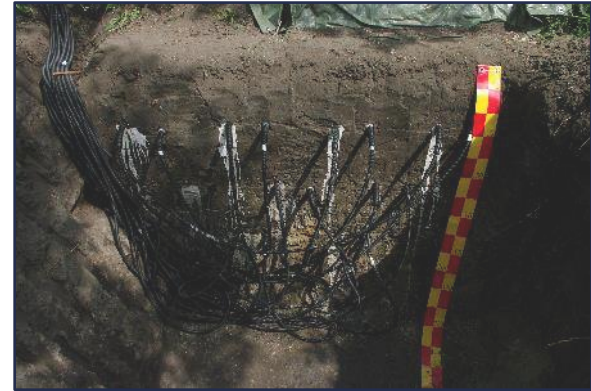
Aim: The aims are (1) to evaluate environmental data collected during four field campaigns (2018-2022), and (2) statistical analysis and relations among meteorological, soil-related and sapflow variables.

Requirements: Good knowledge of R or Python required. Affinity for statistical analysis. The thesis should be written in English language.

Tasks: Literature review and comparison of gap filling methods. Application of an appropriate method for gap filling. Inferring of sapflow from meteorological and soil-related variables.

Additional information: No field or lab work is required. This is a good opportunity to acquire experience handling datasets and applying statistical methods.

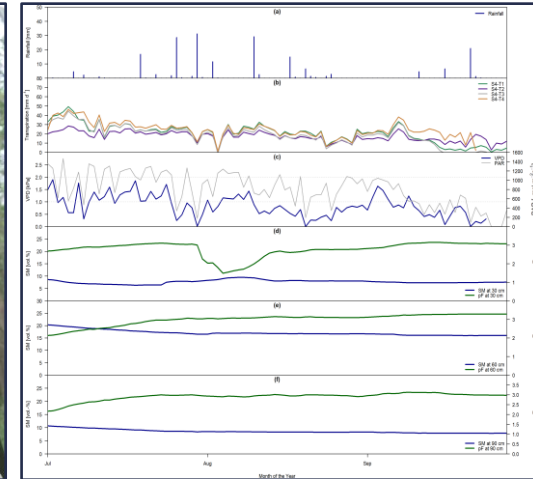
Contact: Gabriela Fontenla Razzetto, gabriela.fontenla_razzetto2@tu-dresden.de



Soil sensors



Sapflow sensors



Data evaluation

BSc./MSc. topic: DIY - Soil Respiration Chamber

Background: Previous methods for measuring soil respiration are often expensive and time-consuming.

Aim: Building of a low-cost soil respiration chamber with Arduino/Raspberry Pi and comparison to commercial system.

Requirements:

- Basic knowledge of programming and electronics
- Independent work

Tasks:

- Building & programming a prototype
- Lab tests

Contact / Supervisor:

patrick.wordell-dietrich@tu-dresden.de



BSc./MSc. topic: Setup and test of an automated precipitation sampler for water stable isotope analysis

Background:

- Many different collector designs exist to obtain water isotope samples of precipitation
- Automated sampling enables the collecting of high-frequency data
- Majority of commercial collectors: costly, not adequate for isotopes

Aim: Development of low-cost precipitation sampler for water isotope sampling

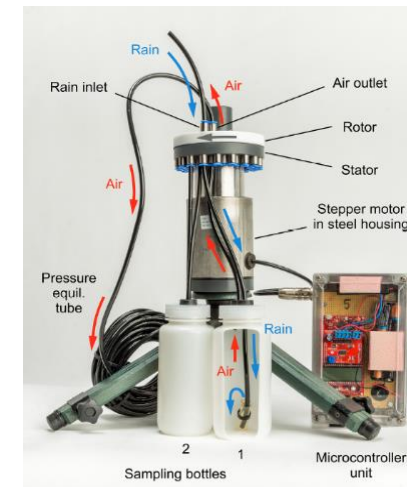
Requirements:

- Interest in lab and field work, “MacGyver” skills
- Statistical data analysis

Tasks:

- Design, setup, and testing of automated precipitation sampler

Contact / Supervisor(s): Prof. Orłowski (natalie.orłowski@tu-dresden.de);
MSc. Jonas Pyschik (Uni Freiburg)



Overview of the automatic sampler principle (photo André Künzelmann, UFZ). Michelsen et al., 2019

BSc./MSc. topic: Setup and test of an automated injection module for the water vapour stable isotope analysis of soil and plant samples

Background: Water stable isotope measurements are a valuable tool for tracing water fluxes through the soil-plant-atmosphere system; high resolution data needed → automated vapour measurements

Aim: Setup (parts lists, hard- & software available) and test automated injection module for water stable isotope measurements of plants/soils

Requirements:

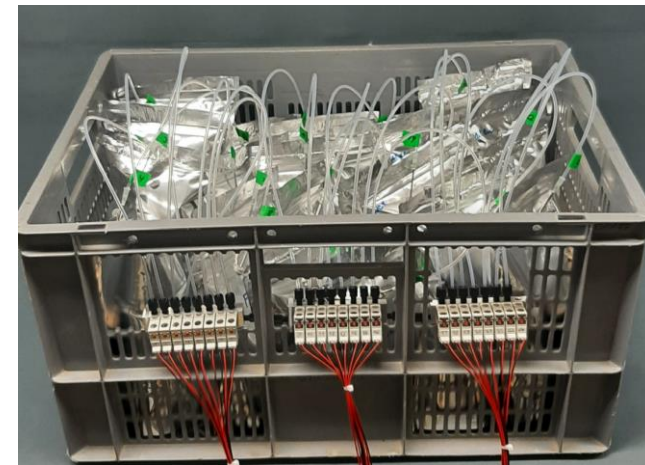
- Interest in lab work, “MacGyver” skills
- Statistical data analysis

Tasks:

- Design, setup, and testing of automated injection module
- Data analysis and potential modulation of the setup

Contact / Supervisor(s): Prof. Orlowski

(natalie.orlowski@tu-dresden.de); MSc. Jonas Pyschik (Uni Freiburg)



Automatic measuring setup (All bags filled with samples, bag ports connected to valves) Pyschik et al., 2024

BSc./MSc. topic: Cavitron-based plant water extractions for water stable isotope analysis

Background: Matching plant water isotopic composition with potential water sources, enable the estimation of their contributions to plant water uptake → water extraction method needed → Flow-rotor centrifuge “Cavitron”: promising new extraction method for plant water isotopes

Aim: Explore potential of this method for its applicability to a variety of different plant species

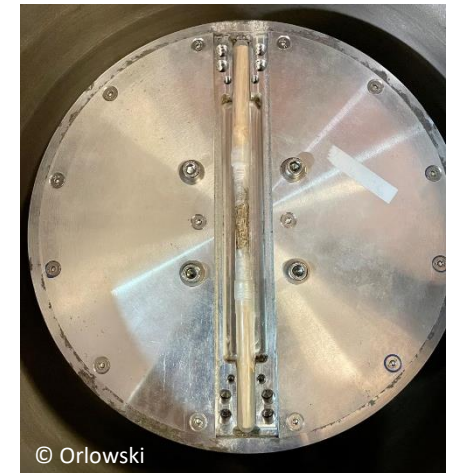
Requirements:

- Interest in lab and field work
- Statistical data analysis

Tasks:

- Plant and precipitation sampling
- Water extraction and isotope analysis
- Statistical data analysis, interpretation & discussion of results

Contact / Supervisor(s): Profs. Orłowski (natalie.orlowski@tu-dresden.de) and Schuldt



© Orłowski

Cavitron twig water extraction

MSc. topic: Investigating groundwater recharge by a novel approach using the LWF Brook90 Model and soil water isotope data

Background: Understanding groundwater recharge is crucial.

Existing hydrological models provide insights into groundwater recharge → but LWF Brook90 model may offer an improved understanding of soil-vegetation interactions

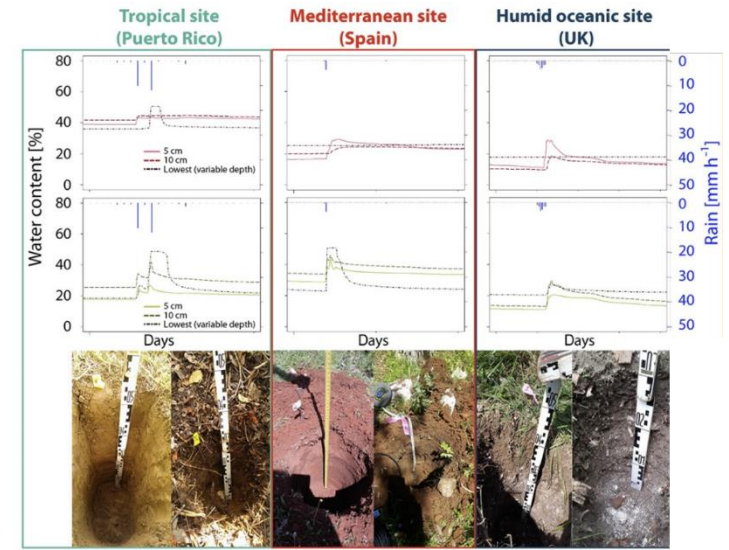
Aim: Model setup for groundwater recharge estimation using water isotopes → analyze interplay of soil moisture dynamics with different climate and land use scenarios

Requirements:

- (Isotope) hydrology knowledge
- Proficiency in data analysis and modelling
- Programming skills (nice-to-have)

Tasks:

- Preparation and analysis of model input data
- Model adaptation and calibration
- Comparative analysis of model outputs with field data (model validation)



Vol. water content and precipitation measurements at different sites

Contact / Supervisor(s): Profs. Orlowski (natalie.orlowski@tu-dresden.de) and Hartmann

MSc. topic: Unravelling the relationship between atmospheric and soil moisture dryness on forest's water status

Background: Forests are suffering from climate extremes, but little knowledge about how these extremes affect tree & forest functioning

Aim: Quantifying & assessing the impact of extreme soil & air dryness on the functioning of trees (at ICOS site Tharandt)

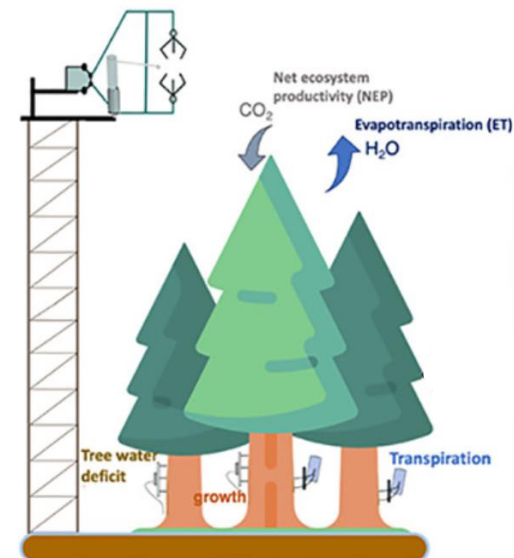
Requirements:

- Able to handle big datasets
- Interest in statistical data analysis
- Programming skills (nice-to-have)

Tasks:

- Literature review
- Analysis of eddy-covariance data, VPD, tree growth and soil moisture data with regard to forest's response to dryness
- Discussion and interpretation of results → climatic anomalies and responses

Contact / Supervisor(s): Profs. Orlowski (natalie.orlowski@tu-dresden.de) & Mauder



Measuring setup for forest water status
(after Shekhar et al., 2024)

MSc. topic: Investigating the usage of drones to map temperature variations within and outside of forest stands

Background: Forest ecosystems are threatened by a warming climate and changes in temperature regimes

Aim: Assess the temperature measurement capabilities of thermal UAV imagery to assess temperatures remotely in different forest stand situations

Requirements:

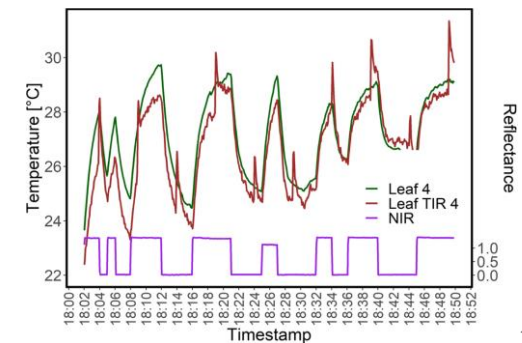
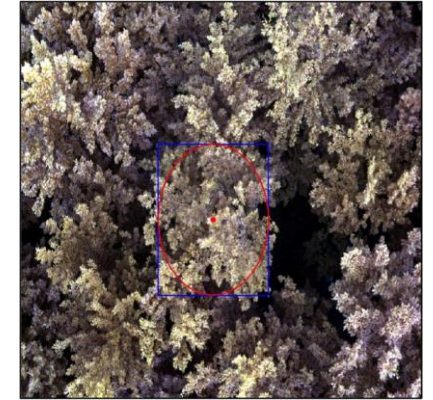
- Interest in digital image processing
- Interest in statistical data analysis
- Programming skills (nice-to-have)

Tasks:

- Acquire, process and analyze thermal image data with a drone
- Process and compare soil temperature measurements to UAV based data
- Data analysis and discussion of usability of UAV data for temperature measurements

Contact / Supervisor(s): Prof. Orlowski
(natalie.orlowski@tu-dresden.de); JProf. Anette Eltner

Krause & Sanders, 2023



MSc. topic: Microplastics analysis and uptake into plants

Background: Terrestrial systems accumulate nano and microplastics (MP) but are understudied; data on fate of MP in soils and plants still scarce

Aim: Examine MP uptake and transfer into different food crops

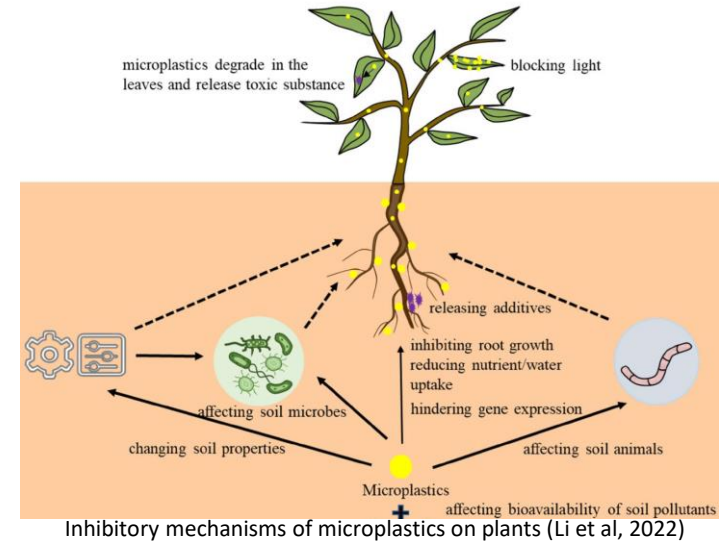
Requirements:

- Interest in: lab and greenhouse work, working with plants, statistical data analysis

Tasks:

- Analysis of sewage sludge and compost from local distributors for MP content
- Setup and conductance of greenhouse experiment (Nossen, LfULG) with different plant species and different sewage sludge and compost applications
- Analyze MP transfer into plants
- Analyze and discuss results

Contact / Supervisor(s): Prof. Orłowski (natalie.orlowski@tu-dresden.de)



Further topics



<https://tu-dresden.de/bu/umwelt/forst/boden/studium/pruefungen>

**Danke für die
Aufmerksamkeit!**

Fragen?

