23rd Newsletter of the UFZ Green Roof Research

UFZ RESEARCH GREEN ROOF

04th August 2025

Plants and insects on the single-intensive green roof
of the UFZ Research Green Roof
(Photo: Maya Ziehlke, UFZ)

Research green roof
at the Helmholtz Centre for Environmental Research – UFZ

Europäische Union

Europa fördert Sachsen.
EFRE
Europäischer Fonds für regionale Entwicklung

This construction measure is co-financed by tax funds on the basis of the budget passed by the members of the Saxon state parliament.

Research partners:

UFZ HELMHOLTZ Centre for Environmental Research

UNIVERSITÄT LEIPZIG

iDiv

Practice partners:

Ingenieurbüro Blumberg

ZinCo

Stadt Leipzig
Amt für Umweltschutz

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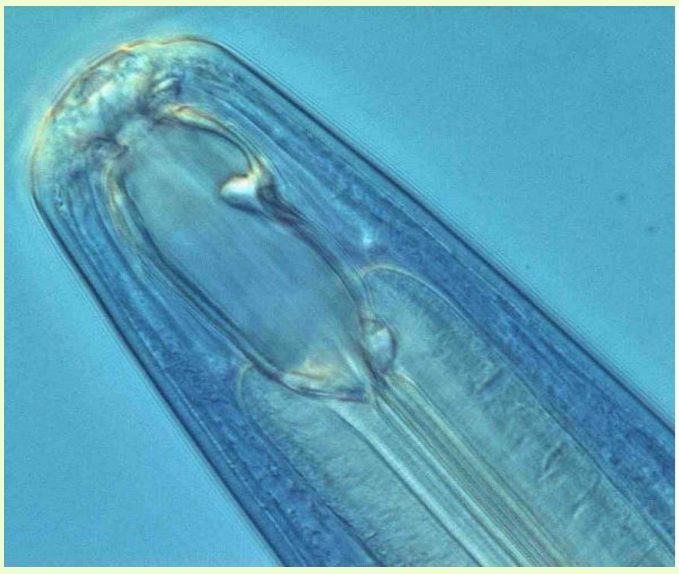
What actually lives in the substrate of green roofs?

Green roofs hold a special fascination for people – including me. My name is **Dr. Peter Dietrich**, and I'm a research associate at Martin Luther University Halle-Wittenberg and the German Centre for Integrative Biodiversity Research (iDiv). When I read the UFZ green roof working group's call for new colleagues, I was immediately excited. I'm an interaction ecologist by training, and I particularly research the interplay between plants and microorganisms/microfauna. Since little research has been done on the composition and diversity of soil organisms on green roofs, I saw this as the ideal opportunity to get into green roof research. The UFZ Research Green Roof offers excellent conditions for this: It enables the investigation of a wide variety of green roof types and management methods. For example, **the effects of extensive and intensive green roofs, irrigation, or weeding on soil organisms can be systematically recorded**.

I'm particularly interested in **nematodes**. Ever heard of them? They are tiny, worm-like creatures that occur in the soil in their millions. Nematodes are considered excellent bioindicators and provide valuable information about the health of ecosystems. For example, a high number of small, fast-growing species can indicate severe disturbances such as frequent droughts, while larger, slower-growing species usually disappear under such conditions. Nematode indices provide important information about environmental conditions, soil functioning, pollutant loads, and whether a system is dominated by bacteria or fungi. Despite their great bioindicative potential, research into nematodes on green roofs is still in its infancy – and I, together with my doctoral student **Justus Aisu**, would like to change that.



In the picture you can see the head of a predatory nematode on the left and Dr. Peter Dietrich (above) and Justus Aisu on the right.
© Justus Aisu

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I am also supported by three dedicated and motivated students who are investigating other exciting topics as part of their final theses. For this purpose, they examined and sampled 20 different green roofs in Halle and Leipzig (including the UFZ Research Green Roof). They briefly introduce themselves and their projects below:

Hello, I'm **Daliah Dittmar**, a 6th-semester biology student at Martin Luther University Halle-Wittenberg. I'm currently writing my bachelor's thesis at the Institute of Geobotany, and when I'm not busy exploring green roofs, I enjoy gardening on my balcony.

In times of climate change and biodiversity loss, green roofs have long been more than just design elements in our cities. They contribute to reducing the urban heat island effect, improve water balance and air quality, and provide valuable refuges for plants and animals. But in addition to visible plants, invisible agents also play a crucial role in the functioning of these extreme locations: soil fungi. Arbuscular mycorrhizal fungi (AMF), in particular, form a symbiotic partnership with plants that improves their nutrient and water uptake and increases their resilience to stress. But even independent of this symbiosis, they make a valuable contribution by improving soil structure, which increases the soil's water retention capacity, and by promoting microbial diversity through their hyphal network and their influence on the plants' exudate profiles.

As part of my work, **I am investigating the influence of green roof management and age on the abundance of arbuscular mycorrhizal fungi in plant roots**, a topic that has received surprisingly little attention to date. It is already known that many commercially available substrates are initially poor in mycorrhizal propagules, and the establishment of such networks is further complicated by the horizontal and vertical isolation of green roofs. Furthermore, it has been shown that not all roof plants utilize mycorrhiza equally. While grasses and herbs often show high colonization rates, the commonly used Sedum species are less strongly or not at all mycorrhizal.

Comparatively little is known to date about the influence of green roof age, building height, and the management of these areas. In this way, I hope to close a research gap in the field of mycorrhizal ecology on green roofs and thus open up new perspectives for further investigations.

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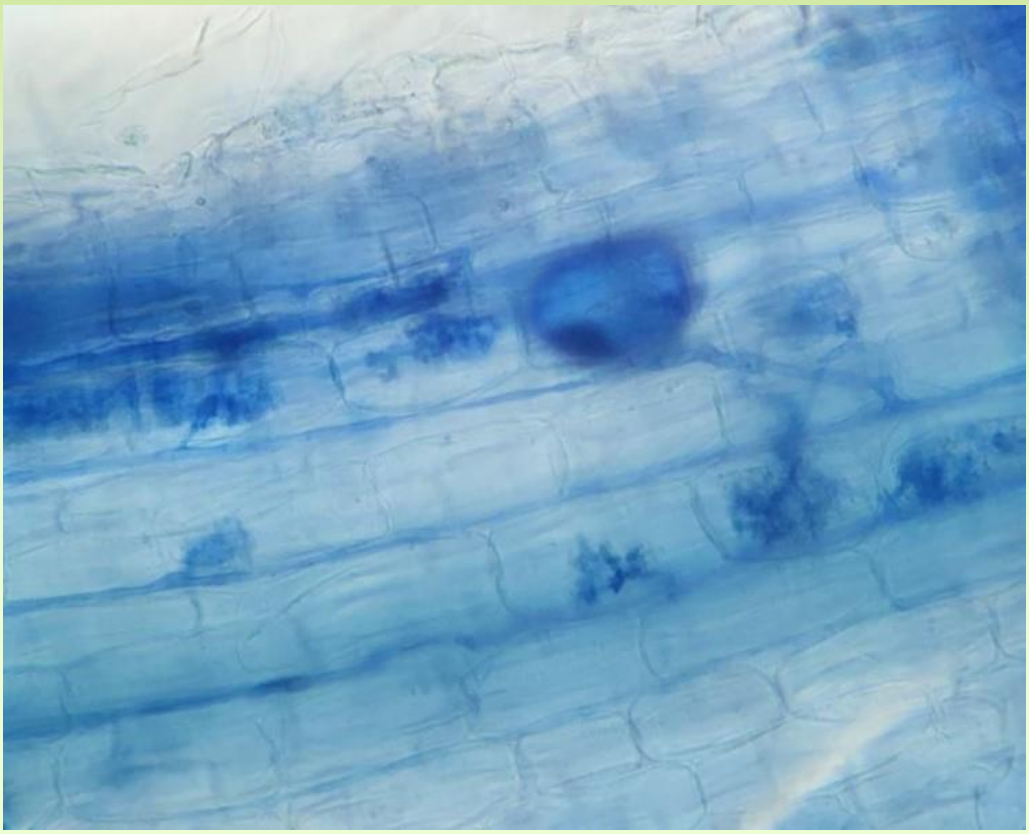

The picture shows the cells of a ribwort plantain root (light blue square structures) as well as various structures of the mycorrhizal fungus: the dark blue thread-like structures are hyphae, the large dark blue sphere is a vesicle and the small dark blue trees are the arbuscules (important for the exchange of substances between fungus and plant).
© Anna Glowinski

My name is **Vincent Munzer**, and I'm also studying biology at the MLU Halle-Wittenberg. Since my undergraduate studies, I've been interested in plants and their interaction with the environment. I've been particularly fascinated by plant diversity.

Biodiversity is a cornerstone of our ecosystems and ensures their existence and functioning. While a green roof isn't an ecosystem in the traditional sense, it can still be considered a system whose functions (e.g., water retention, cooling, habitat for birds and insects, etc.) can be positively influenced by plant diversity. Green roofs are often installed but then neglected by the building owners and left to develop. This can lead to succession processes, i.e., a gradual change in the species composition and structure of the vegetation over time, and thus also to an increase in plant diversity due to "weeds."

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In my master's thesis, I want to determine how diverse green roofs in Leipzig and Halle are in terms of their vegetation. I plan to examine roofs of varying ages, from two years to over 30 years. I want to find out whether the natural process of succession also occurs on green roofs, and whether they can thus become a small hotspot of diversity in cities. In addition to the age of the roofs, factors such as management and maintenance, as well as substrate characteristics, also play a role, which I will also test. I want to find out what influence these factors have on the vegetation and which management is beneficial for high plant diversity.

The picture shows Vincent Munzer (left) and Daliah Dittmar sampling a green roof.
© Pia Helene Dubyk

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While Peter, Daliah, and Vincent have already provided exciting insights into their research on nematodes, mycorrhizal fungi, and plant diversity, I would like to delve a little deeper. The substrate of green roofs harbors an often hidden world of microbes, such as soil fungi (outside of roots), which are important for ecosystem stability, nutrient cycles, and plant health.

My name is **Pia Helene Dubyk**. Like the other two, I am studying biology at the MLU Halle-Wittenberg and am writing my **bachelor's thesis on the diversity and community composition of soil fungi on green roofs in and around Leipzig-Halle**. I am particularly interested in those fungi that we cannot see directly, for example, that do not form fruiting bodies, but nevertheless contribute significantly to soil structures, nutrient cycles, or symbiotic processes.

To detect these "invisible" fungi in the substrate of green roofs, I use modern molecular biological methods – nanopore sequencing. This technique makes it possible to fully capture the fungal communities of a substrate based on their DNA – including species that are difficult or impossible to detect using conventional methods such as microscopy or cultivation.

In the picture you can see Pia Helene Dubyk working at the microscope.
© Pia Helene Dubyk

My goal is to discover which fungal communities colonize green roofs, how diverse these communities are, and how substrate type, age, and roof management influence their composition. I find the question of whether functional and stable fungal communities can establish themselves on green roofs despite the sometimes extreme conditions particularly fascinating. Since there are only a few studies on this topic to date, I hope to contribute to closing this research gap with my work.

Together with the others, we aim to create the most comprehensive picture possible of urban green roofs through our research. As has already become clear: These anthropogenic ecosystems are often forgotten or ignored - even though they could be valuable biodiversity hotspots in cities. This makes it all the more important to examine and understand these systems in more detail.