# 25th Newsletter of the UFZ Green Roof Research



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Experimental setup for pollinator monitoring on the extensively
greened roof segment of the UFZ Research Green Roof
(Photo: Lucie Moeller)

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## RoofPoll: Integrating a Novel "All-in-One" Monitoring Approach for Pollinators on Green Roofs

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Living in increasingly urbanized environments often leads to a growing disconnection from natural ecosystems and their ecological functioning. Nevertheless, urban areas can provide viable habitats for a wide range of species, offering resources for feeding, reproduction, and shelter. Based on these observations, we addressed three key questions: **which species persist permanently in urban environments, which use them only temporarily, and how these populations can be monitored effectively?**

One innovative response to these questions is RoofPoll, a project developed through collaboration across multiple departments. Our interdisciplinary team (Dr. Hanna Honchar, Simon Wogram, Murray Hamilton, Dr. Christophe Dominik, and Dr. Oliver Schweiger: Community Ecology Department, Ralf Trabitzsch - Environmental Informatics, and Dr. Lucie Moeller - Systemic Environmental Biotechnology) combines expertise from community ecology with a focus on pollinator ecology, technology, artificial intelligence, and biodiversity research. By integrating ecological research with technological and data-driven approaches, the team aims to improve our understanding of pollinators in urban environments and to support their persistence under rapidly changing conditions.

We recognize that green roofs represent an important nature-based solution to counteract the negative impacts of urbanization. By expanding green space in cities dominated by concrete and asphalt, **green roofs can function as small habitat islands for insects**. Even when plant diversity is limited, they may still provide food, shelter, and resting places for pollinators moving through urban landscapes.

Pollinators such as bees, butterflies, and hoverflies play a crucial role in maintaining healthy ecosystems and supporting food production. However, across Europe and beyond, pollinator populations are declining at an alarming rate. Habitat loss, climate change, pollution, and urbanization all contribute to this trend. Recognizing the urgency, the European Union has called for stronger action to restore pollinator habitats and to monitor pollinator populations more effectively.

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## RoofPoll "All-in-One" Monitoring System

Our goal was to go beyond traditional monitoring approaches, which often rely on transect walks, net sampling, and manual field observations. While these methods remain essential, they are time-intensive and limited in their spatial and temporal coverage. Emerging technologies now offer new opportunities for continuous, non-invasive monitoring, capturing ecological dynamics in far greater detail.

*With RoofPoll, we explore how modern technology can help us better understand pollinators living in cities and particularly on green roofs.*

**The RoofPoll "All-in-One" Monitoring System:**

At the heart of the project is our innovative "all-in-one" monitoring system, designed to observe pollinators and their environment continuously (Figure 1). This compact unit integrates:

• A camera to capture images of visiting insects

• Weather sensors to record temperature, humidity, wind, and rainfall

• A small computer that detects and classifies pollinators on the images directly on site

All components are housed in a single, weather-protected box that can operate autonomously, day after day.



Figure 1: Camera trap and compute module integrated into the RoofPoll monitoring system (schematic view) © Dr. Hanna Honchar

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## RoofPoll: Artificial flower board

By combining these tools, we can **monitor pollinator activity, diversity, behavior, floral preferences, and seasonal patterns in real time**. To extend observations beyond natural flowering periods, we also introduce an **artificial flower board** (Figure 2), allowing consistent data collection throughout the entire pollination season.



Figure 2: Artificial flower board: A specially designed artificial flower board attracts insects when natural flowers are scarce. © Dr. Hanna Honchar

As insects land on or pass by the monitoring unit, the camera records them automatically. Rather than storing thousands of unprocessed images, the system uses deep learning algorithms to analyze observations directly on site.

**The software can**:

• **Detect insects in images,**

• **Group them into taxonomical hierarchical classes** (for example Hymenoptera → *Apis* → *mellifera* (honey bee)),

• **Record when and under which weather conditions they appear**.

The resulting information is stored in structured data files, making it easier for researchers to analyze long-term patterns — such as seasonal activity, changes in diversity, or the appearance of potentially invasive species.

Importantly, **this approach is non-lethal and minimally disruptive**. Insects are observed as they behave naturally, without being captured or harmed.

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## RoofPoll: The pilot testing

**Early results and data output**: The first monitoring units have already been installed and tested, both on a extensive green roof segment of the UFZ Research Green Roof (see photo on the first page) and at ground level nearby – to compare and investigate the entire pollinators community. Early results show that **the system operates reliably and can collect rich ecological data over extended periods with minimal human intervention**, for example species ID, and insects' activity: Peak Date, Peak Count, First Observation, Last Observation, Duration (days), daily activity.



Figure 3: Insects at the flower board: Pollinators and other insects visiting the artificial flowers, captured automatically by the camera. © Dr. Hanna Honchar

In the coming months, the team will continue refining the technology, improving detection accuracy, and expanding the range of data collected, including sound recordings. A second major monitoring phase is planned for the next field season, alongside the development of user-friendly web platform to explore and visualize the data.

By combining ecology, engineering, and artificial intelligence, RoofPoll demonstrates how smart technology can support monitoring and nature conservation, even in densely built urban environments. Automated monitoring will not replace human expertise, but it can greatly extend our ability to observe, understand, and ultimately protect pollinators.