10th Newsletter of the UFZ Green Roof Research

May 04, 2022

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

Europäische Union

Europa fördert Sachsen.
EFRE
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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 Zentrum für Umweltforschung

UNIVERSITÄT LEIPZIG

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Ingenieurbüro Blumberg

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UFZ Green Roof Research

Working group „Climate study and climate modelling of the impact of green roofs on buildings and cities“

In the bachelor thesis by **Willy Stöckel** (University of Leipzig, supervised by Uwe Schlink), investigations were carried out regarding the transfer of heat into the green roof substrate. This is an important addition to the investigations on the green roof surface energy (Fig. 1). The heat conduction in the green roof substrate could be measured at a depth of 5 cm using commercial heat flux plates. However, since heat is stored in the substrate layer above the heat flux plates, the measured values deviate significantly from the ground heat flux at the surface level.

In the work, a method for the reliable extrapolation of the measured values of the soil heat flux to the surface could be proposed. The method is primarily based on the temporal changes of the soil temperature. The composition of the soil heat flux at the surface is visualized in Fig. 2.

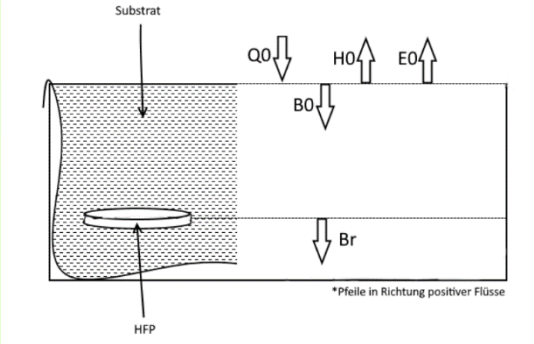

Figure 1 - **Energy balance on the green roof:** The main driving factor is the net radiation (Q0), which is partitioned into the latent heat flux (E0), sensible heat flux (H0) and soil heat flux (B0). The measurement of the soil heat flux in the substrate (Br) can be performed by heat flux plates (HFP) in the substrate only at a reference depth. In general, B0≠ Br, as the layer between the two points stores energy.

Authors: Willy Stöckel (UFZ / University of Leipzig) and Niels Wollschläger (SUSOZ, UFZ)

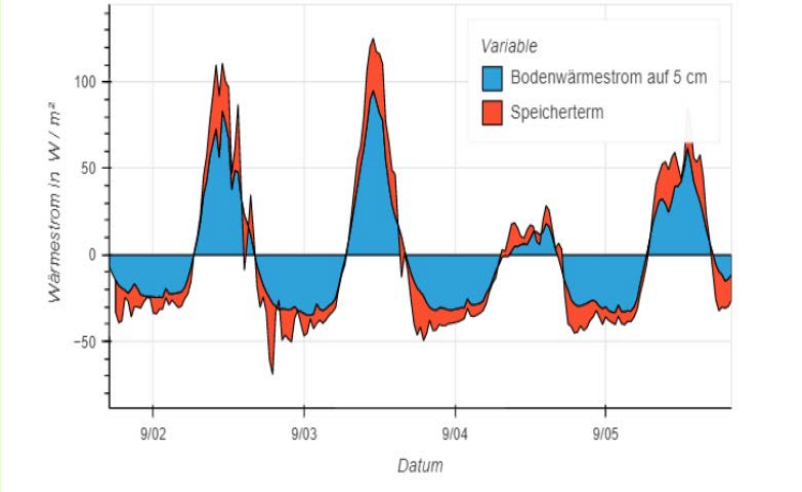

Figure 2 - **Composition of the soil heat flux at the surface**: Time series of the soil heat flux measured at a depth of 5cm (Br) and the determined soil heat flux at the surface B0. The red areas denote the heat storage of the upper substrate layers.

Authors: Willy Stöckel (UFZ / University of Leipzig) and Niels Wollschläger (SUSOZ, UFZ)

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Working Group „Process-related indicators of different green roof variants“

Our master student **Johannes Stüllein** (HTWK Leipzig, Fig. 3) is currently working on the calibration of the runoff measurements of all three green roof variants and the gravel roof as a reference. The aim of this work is to investigate the possibility of using marsh plant roofs as rainwater storage. For this purpose, comparative water balances will be conducted comparing the marsh plant roof with other green roofs (extensive and simple intensive) and a gravel roof in terms of water storage capacity.

Another goal of his work is to explore the limits of the purification capability of a wetland roof for graywater treatment. For this purpose, load tests are carried out on the wetland roof segment, which is fed with real graywater. The cleaning performance of the system at different hydraulic loading rates, as well as at increased phosphorus and ammonium concentrations in the graywater, are being determined.

Figure 3: **Johannes Stüllein** calibrating roof runoff measurements.
Author: Lucie Moeller (UBZ, UFZ)

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Working Group „Green Roofs as a Pollutant Sink“

In her doctoral thesis, which will be supervised by Katrin Mackenzie and Lucie Moeller, **Xiaoyan Chen** (Fig. 4) will continue the work Johannes Heisig who started in his state examination thesis the study on the elimination of surfactants in a wetland roof loaded with real grey water. Johannes has written a very informative thesis that has received full praise from the university assessors (very good: 1.0). Xiaoyan will continue this research. Here, the main pollutant group of surfactants (as a benchmark) will be examined first. Thereafter, a shift of the focus will be made to address interactions of the roof with polar micro-pollutants that are difficult to biodegrade. An increase in the degradation performance of the greywater roof with regard to these problematic components will be sought by increasing retention in the root zone through optimized flow conditions and the use of suitable (controllable) adsorber materials. It is intended to be submitted to Otto von Guericke University Magdeburg.

Figure 4: **Xiaoyan Chen** working on the wetland green roof treating gray water of an one-family-house

(Author: Lucie Moeller)

10th Newsletter of the UFZ Green Roof Research

Working group „Biodiversity“

The state examination thesis of student **Sarah Fischinger** was submitted on schedule in April 2022. It includes comparative floristic studies on Leipzig green roofs of different types and ages. From garage roofs to a solar green roof, vegetation including lower plants was mapped and evaluated on representative subplots. One result of the work is that mosses and lichens appear regularly on all extensively vegetated roofs after a few years. They are intrinsic organisms of these roofs, which have a functional ecological importance.

The same month started **Anastasia Härtel** her bachelor's thesis, which is devoted exclusively to the floristic-vegetation relationships of the roof types on the UFZ Research Green Roof (Figs. 5 and 6). In transects, the diversity and extent of the plants are being documented, with selected individuals of dominant or formative species being repeatedly measured. In combination with key data from databases, plant growth will be modeled using the simulation software "GRASSMIND". Among other things, the question is to what extent plant growth on green roofs can be predicted.

Figure 5 - **Sedum flurry on extensive roof**: Siberian (center) and Caucasus stonecrop (top right) with rotary moss (bottom right) in spring dress. The frequent occurrence of this short-lived moss species indicates favorable nutrient contents of the substrate (photo taken in April 2022).

Author: Peter Otto, University of Leipzig

Figure 6 - **Labiataceae-rock-nettle meadow on intensive roof:** Due to tolerance of spontaneous vegetation on a partial area, the cultivated species there are mainly in competition with grasses, especially with furrow fescue, which covers the substrate like a green felt (photo taken in April 2022).

Author: Peter Otto, University of Leipzig

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Working group „Biodiversity“

The horticultural maintenance work on the UFZ research green roof was completed before the start of the new vegetation period. Very labor-intensive was the removal of spontaneous vegetation on the roof with simple intensive greening. This underlines the importance of maintenance measures on roofs with a higher substrate layer. The emergence of unwanted plants can be fatal if their seeds are already in the humus of the applied substrates. It is important that the organic portion of roof substrates has been dampened for a sufficiently long time. This means the heat death of seeds contained therein and a moderate level of required care.

4th Leipzig Green Roof Academy - Announcement

End of June 2022, the **4th Leipzig Green Roof Academy** will start at the UFZ in cooperation with the Office for Environmental Protection of the City of Leipzig. During the Green Roof Academy, students from various disciplines will learn the basics of green roofs. In a competition, the students then have the opportunity to apply their new knowledge to a real building and develop a green roof concept.

Dates and registration link can be found on the flyer (right) or on the website www.ufz.de/gruendachakademie (in German only).

Deadline for registration is June 10, 2022.

More information on the UFZ Green Roof Research:

https://www.ufz.de/forschungsgruendach

Questions to the UFZ Green Roof Research:

forschungsgruendach@ufz.de

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