22nd Newsletter of the **UFZ Green Roof Research**



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Tree trench in Kasseler Straße, Gohlis district, Leipzig (Photo: Katy Bernhard, UFZ)

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





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:





UNIVERSITÄT LEIPZIG



Practice partners:







Stadt Leipzig Amt für Umweltschutz

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Tree trenches – innovative blue-green infrastructure

Water-sensitive urban development is the new trend in the (re)construction of urban structures to adapt to climate change. The aim is to manage rainwater locally. This requires new technologies and infrastructures that clean and store water in a decentralised manner. This is where traditional green roofs with retention areas come into play. In addition, efforts are also being made to develop innovative systems directly in the street area that at least partially relieve the burden on the sewer system under such highly sealed surfaces.

One such innovative technology is the tree trench. Here, a tree location is coupled with a water management system with the aim of collecting street water when it rains and making it available to the tree. The tree in turn provides shade and cools the surrounding area through the evapotranspiration of the collected water. As with any new technology, the functions of the tree trenches must first be tested. For this reason, as part of the Leipzig BlueGreen project, three tree infiltration systems of different designs were installed in the Gohlis district of Leipzig in 2020. This measure was financed by the City of Leipzig's Mobility and Civil Engineering Department. These are the first tree tree trenches in a street space in Germany.

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Leipziger The research project "Leipziger BlauGrün" (funded by the Federal Ministry of Education and Research, fund number: 033W110A-K) focuses on the development of resource-efficient urban districts. The Helmholtz Centre for Environmental Research (UFZ), in collaboration with the City of Leipzig, municipal companies, the University of Applied Sciences (HTWK), the University of Leipzig, and commercial enterprises, is developing a concept for climate-adapted water and energy management using the example of new and existing urban districts. The City of Leipzig is thus one of the model municipalities supported in the Resource-Efficient Urban Districts - RES:Z initiative of the Federal Ministry of Education and Research. More information can be found on the website <u>www.ufz.de/leipzigerblaugruen</u>.

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Tree trenches in Kasseler Straße

The tree trenches in Kasseler Straße differ in their construction: two tree trenches contain a 30 cm high water reservoir filled with gravel in the lower area (see picture below), which is sealed at the bottom with clay in one tree trench and with bentonite in another. Above the water reservoir is a zone with a possibility for seepage. Overflows protect these two tree trenches from flooding. Above the water reservoir is a layer of tree substrate and topsoil. A small-leaved lime tree (*Tilia cordata* MILL.) was planted in the centre of each tree trench. A loamy capillary column was installed under the tree to enable the tree to be supplied with water from the water reservoir. The surface was covered with vegetation mats with a mixture of perennials. The third construction variant is simpler - without a water reservoir, without a capillary column and without overflow into the sewerage system. Here, the road runoff is to seep away directly.

The tree trenches replace gullies and when it rains, the water from one half of the road width and from the footpath runs into the tree trench instead of into the sewage system. The infiltration through the tree substrate cleans the street water. The catchment areas of the tree trenches in Gohlis are between 215 and 300 m². On the road side, holes in the kerbstones ensure the inflow of street water, on the footpath side there are no kerbstones and the water runs directly into the tree trench.



Scheme of a tree trench with water reservoir (1), capillary column (2), tree substrate (3), topsoil (4) and overflow pipe (5).

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Monitoring of the tree trenches in Kasseler Straße

To test the functionality of the tree trenches, UFZ equipped these infrastructures with measuring technology. Conventional tree discs, installed at the same time as the tree drainage systems, serve as a reference. The following parameters are recorded:

- The water levels in the water reservoirs are continuously measured using level sensors.
- The moisture content of the substrates is continuously measured at five locations under and next to the trees.
- Tree vitality is photographically documented and evaluated using a method specifically developed for this site (Sippel et al., 2023).
- The water quality in the water reservoirs is regularly analyzed for common water parameters.
- The substrates are tested for micropollutants.

Experience from four years of operation

Previous results show a leak in the bentonite layer in one of the tree trenches equipped with water storage. In the simple tree trench, the substructure was compacted too much, making it difficult for the collected rainwater to seep away. These defects can be prevented by having the construction work supervised by a site manager, for example.

There are also other aspects that need to be optimised from the point of view of the City of Leipzig: the street-side inlets clog very quickly and if they are not cleaned regularly, their functionality is severely restricted. This can be overcame, for example, by leaving gaps between the individual kerbs. In addition, the pit-like construction causes discomfort for some residents. They see it as a potential source of accidents, but also fear that it could be used as a potential rubbish tip or bicycle parking area. This can be prevented by planting appropriate undergrowth such as foxglove, veronica and cushion barberry.