

## Upgrading of extensive green roofs with regionally typical native plants for insects

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Since 2015, methods for the establishment of extensive green roofs with regionally typical native plant species from dry sandy grasslands in northwestern Germany have been developed at Osnabrück University of Applied Sciences (Kiehl et al. 2021, Schröder & Kiehl 2021). From 2020 to 2024, the research project „DaLLI – Extensive Green Roofs in Urban Landscapes as Habitat for Insects“ is funded within the Federal Biological Diversity Programme by the Federal Agency for Nature Conservation with funds from the German Ministry of Environment. The aim of the project is to increase the diversity of extensive green roofs using near-natural methods of species introduction (seeding of native plants, transfer of raked material) and the establishment of structural

elements in order to increase their value for insects and other animals. The effectiveness of these measures for flower-visiting insects has been studied in 2021 and 2022 at the research green roof of Osnabrück University of Applied Sciences (established in 2018) and a 1 ha “biodiversity green roof” established in 2019 in Wagenfeld (both in Lower Saxony, Germany). In addition, the development of the vegetation of these green roofs over the years and the effects of maintenance measures are investigated (Schröder et al. 2020).

Both, seeding newly developed seed mixtures with regionally typical native plants and the transfer of seed-containing raked material from original sandy grasslands are suitable for establishing a species-rich green roof vegetation. A high diversity of different (sub-)habitats on a green roof promotes vegetation diversity (Fig. 1)



Figure 1: Dry-grassland species on areas with shallow substrate (foreground) and more mesophytic plant species on substrate mounds (background) result in a diverse flowering aspect at the biodiversity green roof in Wagenfeld (Germany).

This can be realised e.g. by different substrate types and depths as well as by substrate mounds above main walls of the building. Combinations of sunny and dry areas with more shady or moist areas also have positive effects on plant diversity. A green roof maintenance with individually adapted and sequential mowing (depending on biomass production) and, if necessary, emergency irrigation in periods of extreme drought is crucial for maintaining species diversity. Flower-visiting insects

such as wild bees (many of which nest in the soil) do not only need a high supply of pollen and nectar from native plant species, but also suitable nesting sites. To promote the habitat diversity for insects, green roofs can be provided with structural elements such as vegetation-free sand mounds made of unwashed fine sand, sunexposed and partially spot-drilled deadwood of different age from deciduous trees or high-quality nesting aids, e.g. made of reed stalks (Fig. 2)



Figure 2: Nesting structures for insects on a green roof with native plants: deadwood, sand mound and high-quality nesting aid made of reed stalks and spot-drilled dead wood of deciduous trees.

The results of the insect surveys confirm the importance of near-natural green roofs as a habitat for wild bees and other animal groups. In 2021 and 2022, the near-natural green roof in Osnabrück showed a higher number of wild bee species compared to two nearby conventional green roofs. While no relevant nesting structures were present on the conventional roofs, nesting activities were observed for several species on the near-natural green roof. On the biodiversity green roof in Wagenfeld, which was designed with native plants and various structural elements, 36 wild bee species were found in total in 2021 and 2022, including several specialized and/or rare species (Witt 2023). The sand mounds are particularly important for many of the nesting wild bees as well as for digger wasp species.

Guidelines for practitioners include the results of the vegetation development during the first years and provide helpful information on the establishment of biodiversity-promoting green roofs (Schröder et al. 2020). Different types of green-roof construction and greening variants (seed mixtures, transfer of raked material) are presented, as well as recommendations for the maintenance and promotion of habitat diversity. Instructions for the practical implementation of biodiversity-promoting structural elements on green roofs (for sand mounds, deadwood and useful nesting aids) are available on the project website ([www.hs-osnabrueck.de/dalli/](http://www.hs-osnabrueck.de/dalli/)). First results on the costs of biodiversity green roofs and single structural elements (e.g. for contract documents) can be found in Leuters et al. (2023).

### References

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