

Photosynthetic Systems in Architecture (PhoSA): a design|build|research approach

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Abstract Green facades are a nature-based solution gaining importance for reducing the urban heat island effect under the conditions of climate change. They are making their way from visionary designs into the architectural mainstream in practise as well as in architecture schools. Many designs however lack the understanding of vegetation as an ecosystem and would neither stand the tests of feasibility and longevity, nor would the authoring students or practitioners be able to quantify the actual effects of the greening. Integration in a human ecosystem of users and caretakers for such green element is often missing as well.

To enable future practitioners from architecture, biology and engineering to integrate green wall systems into their designs and projects, institutes from different faculties at RWTH Aachen University have created a series of teaching modules that rely on a design|build|research approach with RWTH campus as a living lab.

design: 14 students developed 7 designs for a modular Green Kit to be applied at university buildings. A winning proposal was selected by an expert jury and a student jury.

build: the group then over one summer semester developed the proposal towards a prototype that has been implemented with the special challenge of becoming part of a listed building constructed in 1977. Specialised development teams have been formed for different tasks like the structural design and building integration, the vegetation composition, the production of the textile planters, the water and nutrient supply and the creation of a guideline for replication.

research: in the following summer, a student group has monitored the prototype concerning its contribution to heat island and noise reduction. After a reflection on ecosystem services provided by a green façade the Green Kit Observer has been designed to measure different parameters among them heat radiation through infrared cameras, air temperature and noise reflection and comparing them to the data of an adjacent non-greened wall.

While the first iteration had been carried out in consecutive teaching modules, the approach has now been integrated into a new teaching module for architecture and biology students. The interdisciplinary groups have the task to optimise and locally adapt the prototype, to implement it on a new site, to monitor it and to analyse

the harvested data. The initial focus on the benefit of greening has been extended to the sensor-based monitoring of the system for automated maintenance.

The presentation will detail the experience made with the interdisciplinary and integrative teaching approach. It will reflect on the quality and analysis of research data on the benefits of green wall systems collected in cooperation with students and the impact small greening systems can have.