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Aarhus University
Stakladen, Building 1423
Frederik Nielsens Vej 2
8000 Aarhus C

10.00 – 18.00

19th DWF Water Research Conference – 30 January 2025



DWF 19th water research conference, 2025

A screening framework for the selection of areas to implement multipurpose urban constructed wetlands for the production of biobased construction materials

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Introduction:

In the quest to make cities resilient in the face of wicked problems, including climate change, water infrastructure is essential in mitigating climatic challenges while providing aesthetic, social and mental benefits. Leading literature on NbS highlights the need to explore the multifunctionality of NbS with a systems approach. In extension of the above, this study hypothesizes the prospect of an urban autopoiesis where constructed wetlands are made to amplify the production of biomass for construction application (thatched roofs, facades, light inner walls etc.) all the while the cultivation wetland sites simultaneously have recreative, biodiverse and social benefits in the city. With said overlapping affordances, such an application would potentially decrease the demand for conventional material consumption. However, the known benefits of constructed wetlands for urban water management are well-established i.e. recharge of groundwater aquifers, flood mitigation (protective buffers), trapping of sediments and other substances. Moreover, the wetlands can also support in the absorption of carbon dioxide, heat storage and release, absorption of solar radiation and respective support to food chains. But the prospect of increasing biomass production from constructed wetlands in urban spaces to alleviate the construction sector's material consumption could influence the currently known benefits of constructed wetlands for water management and for other related impacts. In this context this study aims to investigate the feasibility of further exploring multipurpose urban constructed wetlands to be used at the same time as water management infrastructure and for cultivation purposes, serving as a biomass provider for nature-based construction materials for the building sector.

Methods and data:

The screening process to check the suitability of locations to implement the urban constructed wetlands, was based on the following steps: quantitative estimation of the local demand for biobased construction materials and determining the potential spaces available for implementing urban wetlands. The used to support the latter steps consisted of gathering the spatial distribution of attributes included in the screening process, add this database as layers of a GIS tool, and aggregating the information of all criteria used in order to filter and classify the case study area in terms of the potential places with better conditions for implementing constructed wetlands. Four criteria were used in the screening project: topography, land use type, solar radiation and flood risk (bluespot analysis). Software SCALGO and QGIS were used to map for the aforementioned criteria that would highlight the "generalizable" conditions from both a technical water management perspective as well as architectural, social and geographical ones. As case study, the municipality of Frederiksberg was chosen because it is a highly densified urban area, in which the benefits of urban constructed wetlands can be supportive in all the potential benefits.

Results:

The case study results indicate that the established benefits are mostly intact or amplified. In contrast, a few of the benefits are challenged more or less severely depending on specific site conditions, but this cannot be generalized but instead assessed case by case considering the local conditions and characteristics, which is why the main contribution of this study is not really the specific results of the case study but the proposed screening framework. The proposed framework shows to be a valuable pathway to facilitate the screening process for the location of suitable areas in the urban environment for the implementation of constructed wetlands. The combination of different GIS tools available to give a streamlined process to area selection will facilitate future prospective studies and make implementing the concept by municipalities easier.

Discussion and take-home message:

On account of the results obtained, there are grounds to continue the further exploration of urban wetlands application for construction material cultivation. At the same time, other complex systemic challenges will need to be considered and further investigated. Future steps include testing this approach in other case studies to check the reliability of results in different contexts and creating a multicriteria GIS tool to facilitate the use of the proposed screening approach for urban wetlands location selection.

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