Geophysical Research Abstracts
Vol. 20, EGU2018-17987-1, 2018
EGU General Assembly 2018

An evaluation of global bioretention cell design guidelines

Mantas Bacys (1), Usman Khan (2), Jit Sharma (2), and Thomas Ruby Bentzen (1)
(1) Aalborg Universitet, Aalborg, Denmark, (2) York University, Toronto, Canada

Increasing urbanisation has resulted in an increase in impermeable surfaces such as rooftops, parking lots and roads in urban areas. These surfaces restrict the natural flow of water by altering several processes of the water cycle resulting in an increased risk of flooding and reduced water quality. Bioretention cells (BRCs) have received worldwide recognition in recent years due to their ability to tackle these negative environmental impacts and promote more sustainable development in urban areas.
Recent research has shown that these cells can also be used for flood mitigation during extreme events in addition to water quality improvement. This can reduce the costs and need of conventional stormwater pipe systems, reduce water quantity and increase water quality. Thus, there is a need to assess whether current BRC design guidelines are suitable for management of extreme weather events, and if these designs account for the future climate change effects on the precipitation patterns. The first step in tackling this task is the assessment of global BRC design guidelines. This will show how different jurisdictions have adjusted BRC design criteria for their respective regions (based on soil type, climate, level of urbanisation, etc.) and how these adjustments benefit the overall performance of the BRC.
Guidelines for 24 BRCs were collected and evaluated from across the world. They were assessed based on the sizing criteria and subsurface considerations (e.g. soil media composition and thickness). The guidelines were compared based on 5 categories: climate, precipitation, temperature, population and population density (as a measure of urbanisation). The most common design guidelines were modelled using GIFMod, a physically-based numerical model, to assess their performance when dealing with extreme events. From this, the most sensitive design parameters were identified and optimised for improved BRC performance.
Based on the preliminary investigation it is apparent that the global BRC sizing guidelines are rather generic and do not necessarily account for region specific characteristics (e.g. soil type, climatic conditions or urbanisation). For example, ponding depth is typically recommended to be 30 cm in most jurisdictions irrespective of the climate type. Similarly, a drawdown time of 24 hours is most frequently cited in the guidelines irrespective of the type of media. Finally, little to no emphasis has been placed on the impact of climate change on precipitation on the design criteria.
The similarity of global BRC guidelines demonstrates the need for on-going modelling and experimental research to properly design region and climate-specific guidelines. Results from GIFMod will demonstrate the impact of these variables on BRC design, and critically demonstrate how BRC performance can be optimised using region specific, rather than generic design guidelines.