The performance of plant species in removing nutrients from stormwater in biofiltration systems in Cape Town

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Abstract

In 2009, the City of Cape Town (CoCT) adopted a stormwater policy which mandates that new and existing developments should reduce the concentration of phosphorus and suspended solids in stormwater runoff by 45% and 80%, respectively, but offered no explicit guidance about how these water quality targets might be achieved. This study aims to contribute to the limited knowledge that exists about the performance of local plant species to treat stormwater. A large nursery-based study was conducted to investigate the performance of 9 locally-occurring plant species to remove orthophosphate (PO_4^{-3}), ammonia (NH_3) and nitrate (NO_3^-) found in urban stormwater. Synthetic stormwater was applied to each species as well as a control consisting only of soil (Malmesbury shale). The discharge was collected from a drainage pipe at the base of each of the 150 containers. The results show that all species (excluding *Ficinia*) reduced the average concentrations of PO_4^{-3} by 81% and NH_3 by 90%. By contrast, NO_3^- was reduced by an average of 69% (excluding by *Elegia* and *Phragmites*) with 8 of the 9 species removing significantly more than the control. The species that performed well for all three nutrients include *Agapanthus* and turf grasses, *Stenotaphrum* and *Pennisetum*. The results of the study highlight three important factors in the design of biofilters: that a substantial proportion of nutrients can be captured or absorbed by plants; that the soil medium is an important factor in the removal of PO_4^{-3} and NH_3; and that plant choice is essential in the removal of NO_3^-. Future research should test plant species in both the laboratory and field settings, and should include additional contaminants such as household detergents, heavy metals and bacteria.

Keywords: Biofilter, sustainable drainage systems (SuDS), stormwater treatment, nutrient removal