Effectiveness of landscape-based green infrastructure for stormwater management in suburban catchments

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Abstract

Land cover changes associated with urbanization have negative effects on downstream ecosystems. Contemporary urban development attempts to mitigate these effects by designing stormwater infrastructure to mimic predevelopment hydrology, but their performance is highly variable. This study used in situ monitoring of recently built neighbourhoods to evaluate the catchment-scale effectiveness of landscape decentralized stormwater control measures (SCMs) in the form of street connected vegetated swales for reducing runoff volumes and flow rates relative to curb-and-gutter infrastructure. Effectiveness of the SCMs was quantified by monitoring runoff for 8 months at the outlets of 4 suburban catchments (0.76–5.25 ha) in Maryland, USA. Three "grey" catchments installed curb-and-gutter stormwater conveyances, whereas the fourth "green" catchment built parcel-level vegetated swales. The catchment with decentralized SCMs reduced runoff, runoff ratio, and peak runoff compared with the grey infrastructure catchments. In addition, the green catchment delayed runoff, resulting in longer precipitation–runoff lag times. Runoff ratios across the monitoring period were 0.13 at the green catchment and 0.37, 0.35, and 0.18 at the 3 grey catchments. Runoff only commenced after 6 mm of precipitation at the decentralized SCM catchment, whereas runoff occurred even during the smallest events at the grey catchments. However, as precipitation magnitudes reached 20 mm, the green catchment runoff characteristics were similar to those at the grey catchments, which made up 37% of the total precipitation in only 10 of 72 events. Therefore, volume-based reduction goals for stormwater using decentralized SCMs such as vegetated swales require additional redundant SCMs in a treatment train as source control and/or end-of-pipe detention to capture a larger fraction of runoff and more effectively mimic predevelopment hydrology for the relatively rare but larger precipitation events.

Read the article in *Hydrological Processes* [1].

[2] https://www.sesync.org/users/khondula