nature reviews earth & environment

Review Article | Published: 24 October 2024

Concepts and evolution of urban hydrology

Tim D. Fletcher, Matthew J. Burns, Kathryn L. Russell, Perrine Hamel, Sophie Duchesne, Frédéric Cherqui & Allison H. Roy

Nature Reviews Earth & Environment (2024) | Cite this article

Abstract

Urbanization and climate change are exacerbating the flood risk and ecosystem degradation in urban catchments, with traditional stormwater management systems often overwhelmed. In this Review, we discuss changes in urban hydrology and approaches to stormwater management. Roughly 90% of rainfall on impervious surfaces and drainage infrastructure becomes run-off, enhancing rainfall export away from cities and leading to local water scarcity and downstream flooding and pollution. Projected increases in urban populations (68% in cities by 2050) and rainfall intensity (~12% in the 10-year and 50-year recurrence interval intensity, under 1.5 °C warming) will exacerbate these issues. Transforming stormwater systems is thus urgently needed, to mitigate flood risk and also to address community desires for environmental protection and enhanced water security. Opportunities include rain gardens and other nature-based stormwater control measures (which restore natural flows and offer other ecosystem services), smart sensor monitoring networks and real-time management (which sustain natural flow regimes, mitigate flood risk and protect ecosystem services) and stormwater harvesting (to avoid local water scarcity). Community acceptance of stormwater harvesting is as high as 96% and stormwater is a substantial resource, with volumes often exceeding demand in some parts of the world. Delivering additional transformations globally requires research into strategies to incentivize engagement and investment, and policies to guide governance of decentralized networks.