

Urban legacies: Aquatic stressors and low aquatic biodiversity persist despite implementation of regenerative stormwater conveyance systems

Sep 23, 2019

Author:

Rosemary M. Fanelli, Karen L. Prestegard, and Margaret A. Palmer

Abstract

Urbanization is a global stressor of stream ecosystems. Watershed managers in urban regions often implement infiltration-based stormwater control measures (SCMs) to mitigate the effects of urbanization. Most research on SCM implementation, however, has focused primarily on their effects of sediment and nutrient loading, so little is known about the effect of SCMs on other urban stressors to which aquatic ecosystems are especially sensitive (e.g., flow patterns, temperature, conductivity). We addressed this research gap by studying the hydro-ecological effects of SCM implementation in 11 headwater streams in Maryland, USA. The study included 4 forested streams, 4 urban streams (urban-degraded), and 3 urban streams whose watersheds contain regenerative stormwater conveyances (urban-restored), a type of infiltration-based SCM. We measured baseflow discharge and water quality monthly and monitored stream stage, temperature, and precipitation at high frequencies over a 1-y period. We also quantified aquatic insect assemblage composition during the spring season of the monitoring year. We found that stream conductivity and daily maximum water temperatures increased with increasing impervious cover and that SCM implementation had no effect on these metrics. Dissolved oxygen was lower in the urban-restored streams than in forested streams, whereas dissolved oxygen was slightly higher in urban-degraded streams than in urban-restored streams. Temperature surges during runoff events were highest in the urban-degraded streams and lower in urban-restored streams, indicating mitigation by SCM implementation. All metrics describing aquatic insect abundance and diversity metrics were negatively affected by urbanization, and SCM implementation had no effect on most of these metrics. Multivariate analyses revealed multiple stressors present in the urban streams, but conductivity explained most of the variance in insect assemblage composition across the study sites. Conductivity was strongly correlated with chloride concentrations, suggesting road salt is a source of elevated conductivity. Chloride concentrations exceeded established chronic and acute criteria in several urban streams, including 2 of the 3 urban-restored streams. These results document that the effects of urbanization in streams persist even after SCM implementation occurs. Ultimately, our research underscores the need for restoration designs to address multiple stressors that cause ecosystem degradation in urbanized streams.

Read the article in [University of Chicago Press Journals](#) [1].

Associated SESYNC Researcher(s):

[mpalmer](#) [2]

DOI for citing:

<https://doi.org/10.1086/706072>

Source URL:

<https://www.sesync.org/urban-legacies-aquatic-stressors-and-low-aquatic-biodiversity-persist-despite-implementation-of>

Links

[1] <https://doi.org/10.1086/706072>

[2] <https://www.sesync.org/users/mpalmer>