Dynamic evolution of Natural Capital in urban drainage adaptation planning

urban flood resilience

FACTSHEET

Project area: *Natural Capital and Ecosystem Services assessment*
Intended audience: *Local authorities, developers, government agencies and environmental NGOs.*

Introduction

An adaptation pathways approach for urban drainage infrastructure planning has gained interest from researchers and practitioners to assist in identifying the right time and place for the implementation of different blue-green drainage infrastructure options to adapt urban areas to climate change. This factsheet presents findings on how the assessment of different combinations of blue-green infrastructure options, that make up adaptation pathways, can enhance or impact natural capital and associated ecosystem service profiles, over time. Three adaptation pathways are assessed in a South London Borough to address future flood risk while also delivering a "natural capital uplift" through blue-green interventions.

Background

Although ecosystem services knowledge is already in use in urban planning, especially with regards to the multiple benefits achievable from blue-green infrastructure systems, there is still need for natural capital assessments at relevant scales and contexts to inform planning decisions. This research focuses on a residential area in a South London Borough (Figure 1), where increased urban development has led to the existing drainage network reaching its capacity and extreme storm events have caused local flooding incidents. The case study area has significantly expanded over time, with plans to further introduce more housing units over the next three decades. The local authority is considering the integration of blue-green infrastructure with existing grey infrastructure to reduce the flood risk.

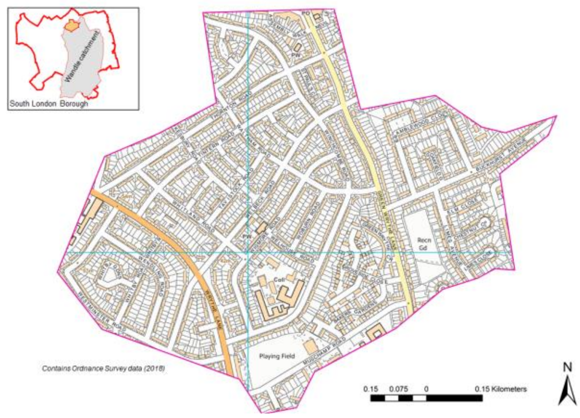

Figure 1: Study area - subcatchment in a South London Borough

The adaptation pathways framework used in this study is discussed in detail by Kapetas and Fenner (2020). Three adaptation pathways involving different combinations of blue-green options are assessed to address future flooding based on climate change projections between 2020-2050: (1) bioretention cells gradually implemented in phases over time, (2) a retention pond implemented immediately in part of the subcatchment while bioretention cells are implemented gradually in phases in the rest of the subcatchment, and (3) a traditional "grey" pipe system expansion implemented immediately with supplementary bioretention cells implemented gradually. In addition, an online survey was issued to expert stakeholders in the study area to capture their views on priority and important ecosystem services.

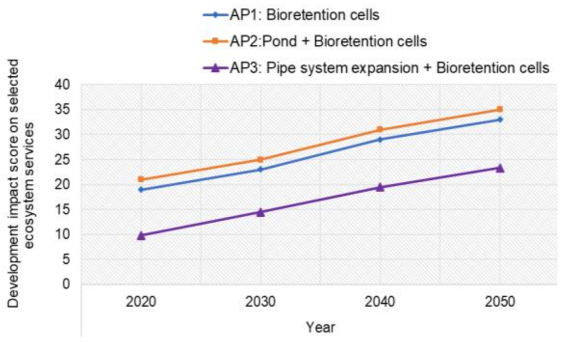

Figure 2: Impact of different blue/green and grey adaptation pathway options on natural capital and ecosystem service delivery overtime.

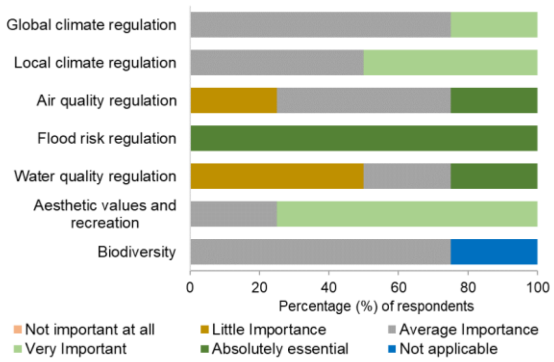

Figure 3: Importance of different ecosystem services in a South London Borough as perceived by expert stakeholders.

Findings and implications

All blue-green adaptation pathways are found to have a positive impact on ecosystem services, such as aesthetic values, local climate regulation and air quality regulation at varying rates. Adaptation Pathway 2 (AP2), i.e. combination of a SuDS (sustainable drainage system) pond and bioretention cells, has the highest overall development impact score on ecosystem services over time while AP3, i.e. a mix of a 'grey' pipe expansion and bioretention cells, has the least development score on ecosystem services (Figure 2). This demonstrates that a mix of blue-green such as AP2 enhance natural capital and increase potential for delivery of ecosystem services. In contrast, combining pipe system upgrade (grey option) with bioretention cells (AP3) has the least positive impact on natural capital.

Alongside this, hydraulic modelling results show that a mix of blue-green pathways such as a SuDS retention pond and bioretention cells can significantly reduce the flood risk in the study area over time. Pipe expansion 'grey option' alone does not provide enough flood control in the long term (Kapetas and Fenner, 2020).

Survey responses from expert stakeholders showed that the most important ecosystem service in the study area is flood risk regulation (Figure 3). Aesthetic values and recreation were indicated as the second very important ecosystem services while other ecosystem services like global climate regulation, local climate regulation, air quality regulation and biodiversity were considered to be of average importance. Water quality regulation was indicated as being of little importance in the study area. These findings confirm the flood risk challenge in the study area and hence the prioritisation of this ecosystem service.

Findings from this study imply that incorporating blue-green options in urban adaptive approaches can mitigate against natural capital loss and contribute to the delivery of multiple benefits to the urban population. Blue-green drainage infrastructure options comprise natural capital assets that provide ecosystem services as they are being implemented. The use of such blue-green adaptation pathways approaches aligns the work of practitioners developing and implementing long-term natural capital plans.

Reference: Kapetas L, Fenner R. 2020. Integrating blue-green and grey infrastructure through an adaptation pathways approach to surface water flooding. *Phil. Trans. R. Soc.* A 378: 20190204. http://dx.doi.org/10.1098/rsta.2019.0204

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