

Project area:
Intended readership:

Communications and Uncertainty
Local authorities, practitioners, academics, interest groups

Blue-Green infrastructure and sustainable drainage systems (SuDS) are increasingly recognised as vital components of urban flood risk management systems. However, scientific uncertainty regarding their hydrologic performance and lack of confidence concerning their public and political acceptability create concerns and challenges that limit widespread adoption. We explore the biophysical and socio-political uncertainties that can act as barriers to the implementation of Blue-Green infrastructure in Portland, Oregon, and suggest how these may be addressed and overcome.



Green streets installation in Portland, Oregon

Relevant Dominant Uncertainties (RDUs) in urban water and flood risk management

Implementation of Blue-Green strategies for urban flood risk management are currently limited due to scientific uncertainties in hydrological and biophysical processes that impact on service delivery, maintenance requirements and asset performance. **These uncertainties are generally perceived to be greater for Blue-Green compared to the equivalent grey infrastructure.** Decision makers and planners also question the appetites of beneficiary communities and their elected representatives for increasing a city or neighbourhoods' reliance on Blue-Green infrastructure, and there is often little confidence that all stakeholders will value, understand, and be willing to pay for the additional benefits (to society, the environment and the economy) of using Blue-Green in combination with grey infrastructure.

Two types of **Relevant Dominant Uncertainty (RDU)** are identified: scientific RDUs related to physical processes (RDU_p) that affect future infrastructure performance and service provision, and; socio-political RDUs stemming from lack of confidence in the social structures, public preferences and political backing for wider implementation of Blue-Green infrastructure (RDU_s).

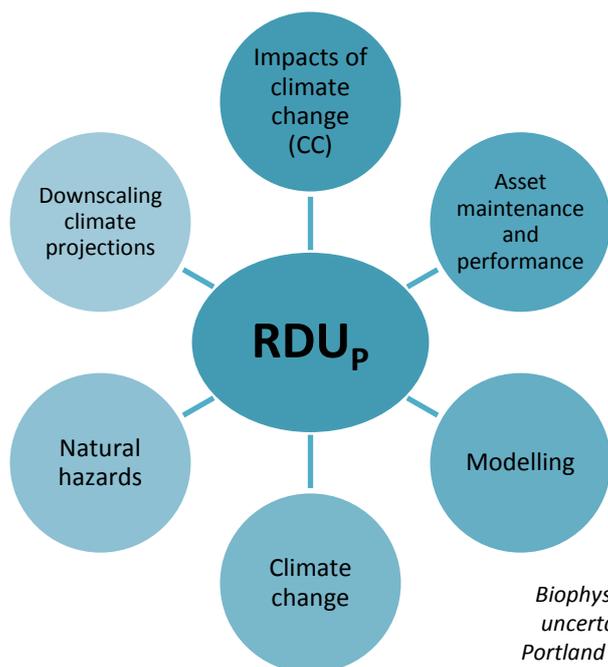
Case study: uncertainties surrounding Blue-Green infrastructure in Portland, Oregon

We investigated the potential barriers to the implementation of Blue-Green infrastructure in Portland, Oregon, through a series of semi-structured interviews with institutional stakeholders from different governmental departments. We drew out uncertainties and classified them as RDU_p or RDU_s . We identified **concerns**, **challenges** and **uncertainties** that a) represent more general project management issues that affect all City infrastructure management, and b) issues specific to Blue-Green infrastructure. We then classified concerns and challenges as *addressable* and *non-addressable*, and looked at which uncertainties could be *reduced* vs. those that are *irreducible*.

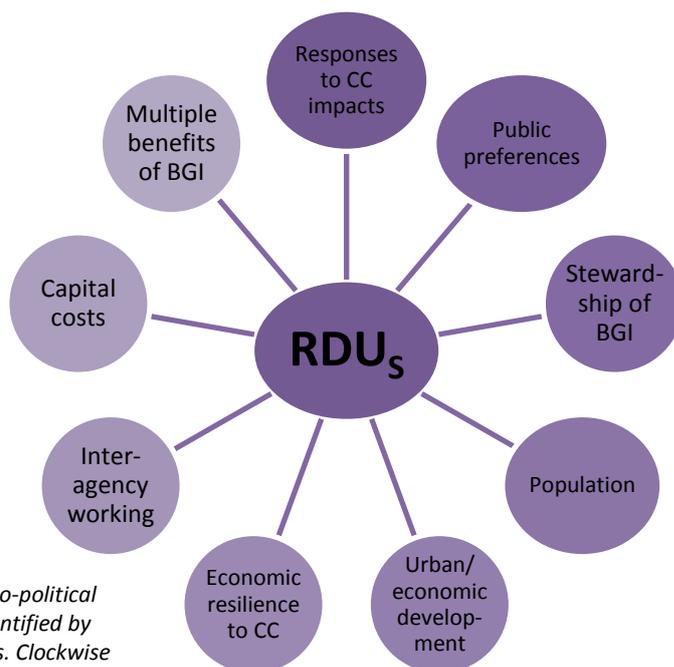


Biophysical and socio-political RDUs

We identified 15 RDUs; 6 biophysical (RDU_p) and 9 socio-political (RDU_s). **The socio-political RDUs, notably public preferences, stewardship and equitable delivery of Blue-Green infrastructure assets, appear to have a greater impact on decision making in Portland than their hydrological and biophysical counterparts.**



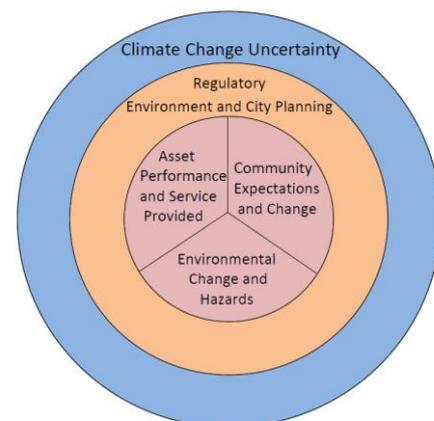
Biophysical and socio-political uncertainties as identified by Portland stakeholders. Clockwise from top: most to least recognised



In Portland, asset performance and service provision, community expectations and change, and environmental change and hazards, are key concerns for the implementation of Blue-Green infrastructure. This is bounded by the challenges associated with city planning in general and imposed by the regulatory environment, with future uncertainties in climate change an overarching factor.

Addressing socio-political uncertainties

A key different between RDU_s and RDU_p is that **people can influence social-political uncertainties**, especially at the local level. Through interventions such as education, open discussion and social learning opportunities, people can change the dominant understandings that create the culture of the future. Informing residents of the benefits of Blue-Green infrastructure can make them more inclined to support Blue-Green projects and take ownership of local initiatives.



Factors that influence the adoption of Blue-Green infrastructure in Portland

Decision making under uncertainty in Portland

Portland has successfully championed a series of Blue-Green city-wide strategies that demonstrate decision making in spite of the hydrological/biophysical and socio-political uncertainties. For instance, over 32,200 new street trees, 867 green street planters and 398 ecoroofs have been built as part of the 'Grey to Green' initiative that ran for five years. Portland's Bureau of Environmental Services continues to champion Blue-Green schemes and reduce RDU_p by further monitoring and detailed modelling of infrastructure assets, and address RDU_s by greater community engagement and outreach.

Other sources of information:

Thorne, C., E. Lawson, C. Ozawa, S. Hamlin, and L. Smith (2015) [Overcoming uncertainty and barriers to adoption of Blue-Green infrastructure for urban flood risk management](#), *Journal of Flood Risk Management*, DOI: 10.1111/jfr3.12218.

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