Watering the Garden

A half day online conference exploring the latest landscape led approaches to managing water in large scale developments and new communities

urban flood resilience

EBBSFLEET GARDEN CITY

Ebbsfleet DEVELOPMENT CORPORATION

THE ENVIRONMENTAL DESIGN STUDIO

ARUP

GILLESPIES

SPACEHUB

cba

University of Nottingham UK | CHINA | MALAYSIA

Newcastle University

UNIVERSITY OF CAMBRIDGE

UNIVERSITY OF EXETER

09.45	Online log in
10.00	**Welcome** Simon Harrison (Ebbsfleet Development Corporation)
10.05	**Urban Flood Resilience** Emily O'Donnell (University of Nottingham)
10.15	**Integrating water management in new communities** Justin Abbot (Arup)
10.35	**Masterplanning with water** Tom Smith (Spacehub) Stephen Birkinshaw (Newcastle University)
11.05	**Integrating water into street design** Sheena Bell (Gillespies) Richard Fenner (University of Cambridge)
11.35	**Break**
11.50	**Water in parks and open spaces** Adrienne Soudain (Chris Blandford Associates) Emily O'Donnell (University of Nottingham)
12.20	**Managing water at the building level** Ed Barsley (The Environmental Design Studio (TEDS)) Sangaralingam Ahilan (University of Exeter)
12.50	**Closing summary** Simon Harrison

Urban Flood Resilience

Emily O'Donnell

University of Nottingham
UK | CHINA | MALAYSIA

EPSRC
Pioneering research and skills

urban flood resilience

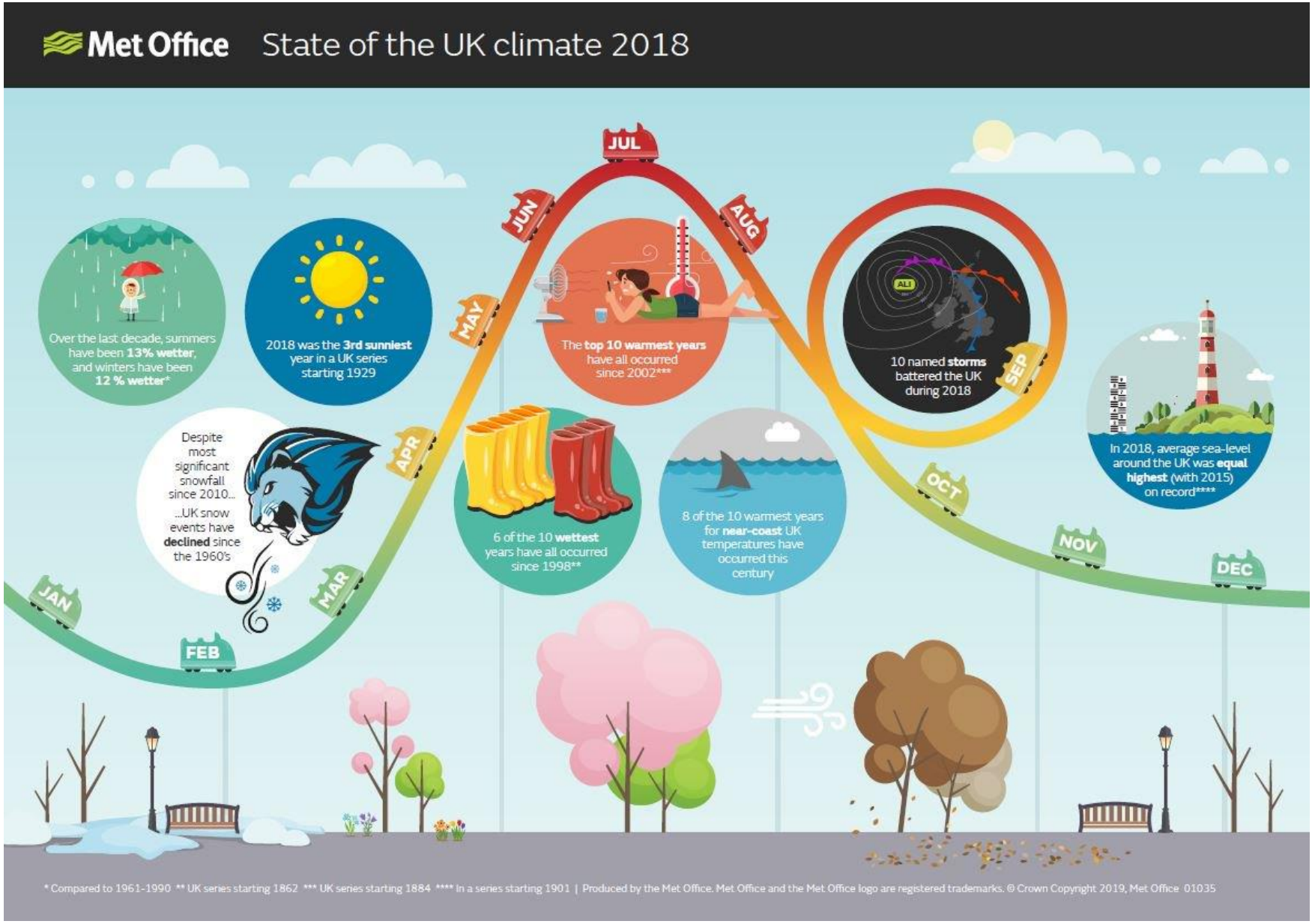
UK Water Challenges

- Flooding
- Water shortages
- Watercourse health
- Re-connecting people with water
- Supporting growth
- Supporting liveable urban places

Flood risk

February 2020

- UK annual expected flood damages exceed £1Bn
- 5.2 million properties (1 in 6) and large proportions of UK's key infrastructure are at risk (Environment Agency, 2018)
- 3.2 million at risk from surface water flooding
- Increasing urbanisation = elevated flood risk to people, property and critical infrastructure systems, stress on already overburdened drainage infrastructure
- Social justice issue



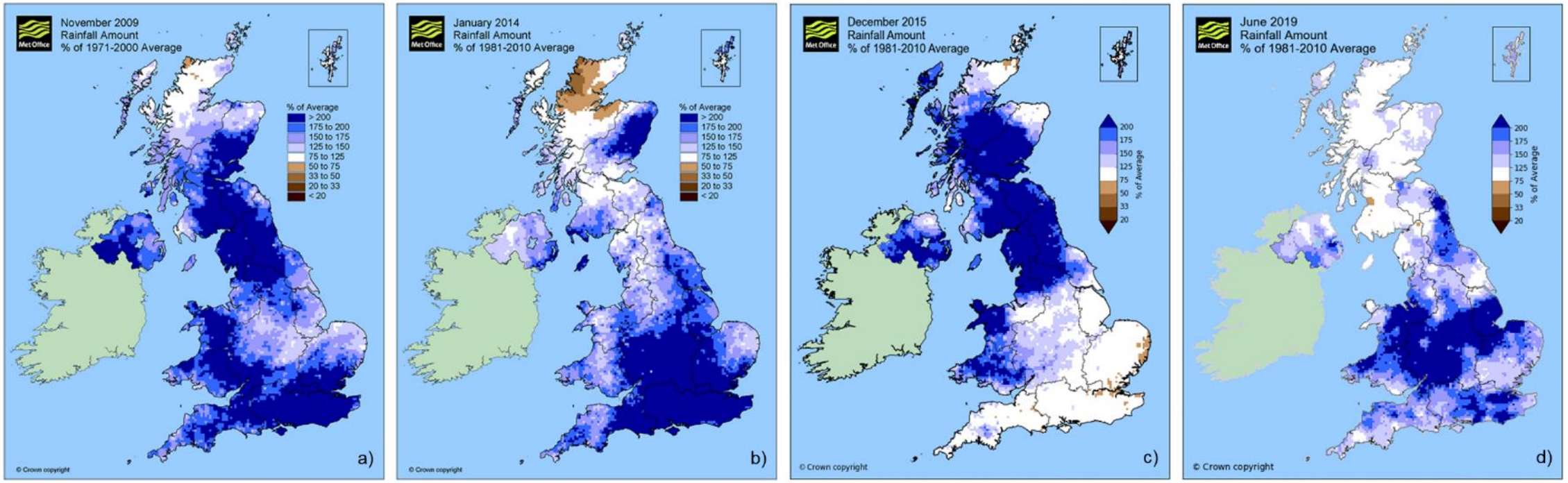
Future projections

- wetter winters
- drier summers
- increased likelihood of more extreme storm events and intense rainfall leading to flash flooding

Committee on Climate Change, July 2019, *Progress in preparing for Climate Change: 2019 Report to Parliament*

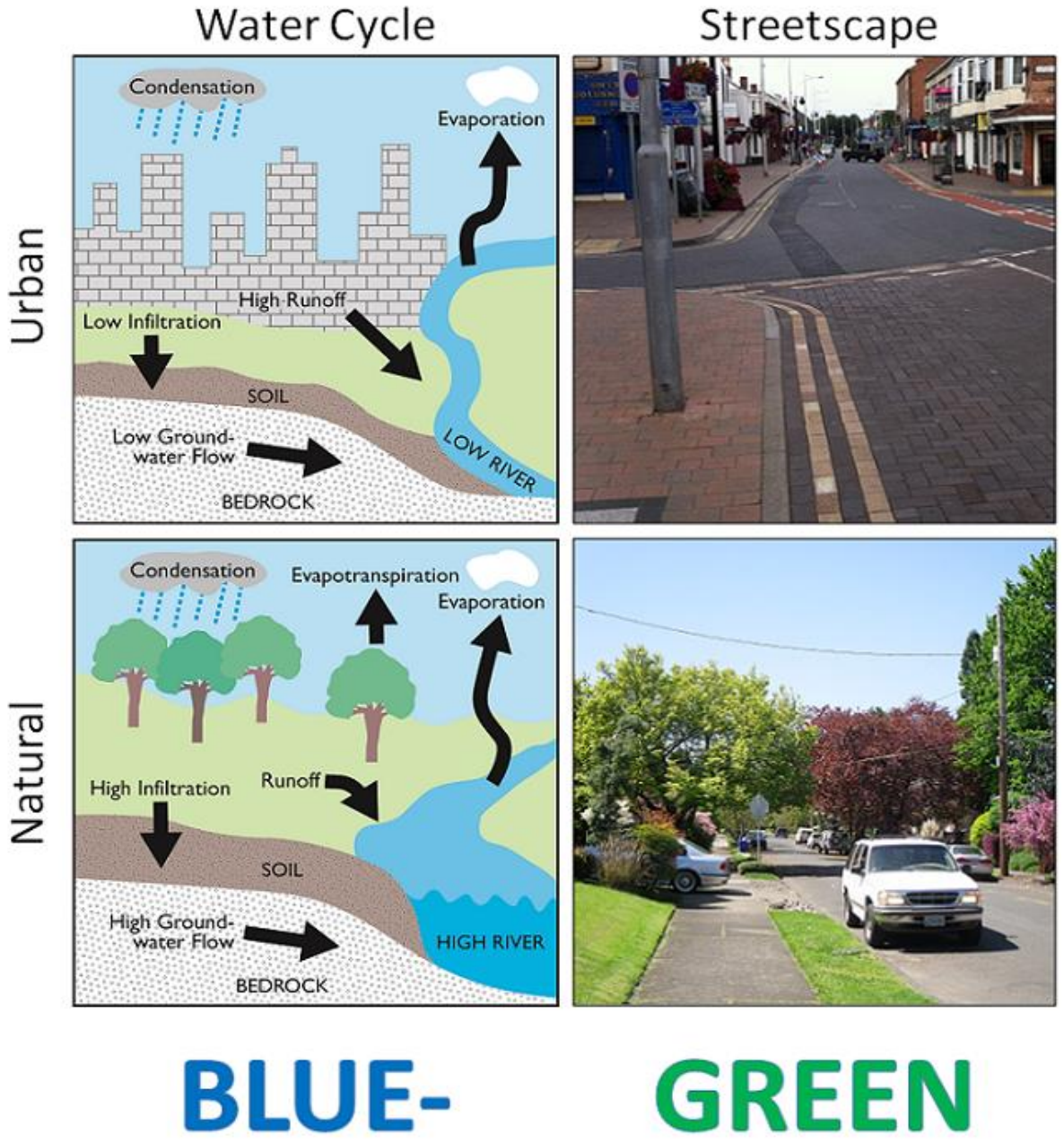
Trends in UK rainfall

November 2009 | January 2014 | December 2015 | June 2019



UK rainfall anomaly maps illustrating months that experienced two to three times the long-term average. Source: Met Office, 2019. Note that the long-term average in a) refers to the period 1971-2000, and in b-d) refers to the period 1981-2010.

O'Donnell. E. and Thorne, C., (2020), Drivers of future urban flood risk, Philosophical Transactions of the Royal Society



Blue-Green Cities

Working with nature to manage water and deliver a range of other benefits to society, the economy and the environment

Prioritising multifunctional landscape and Blue-Green space connectivity

www.bluegreencities.ac.uk

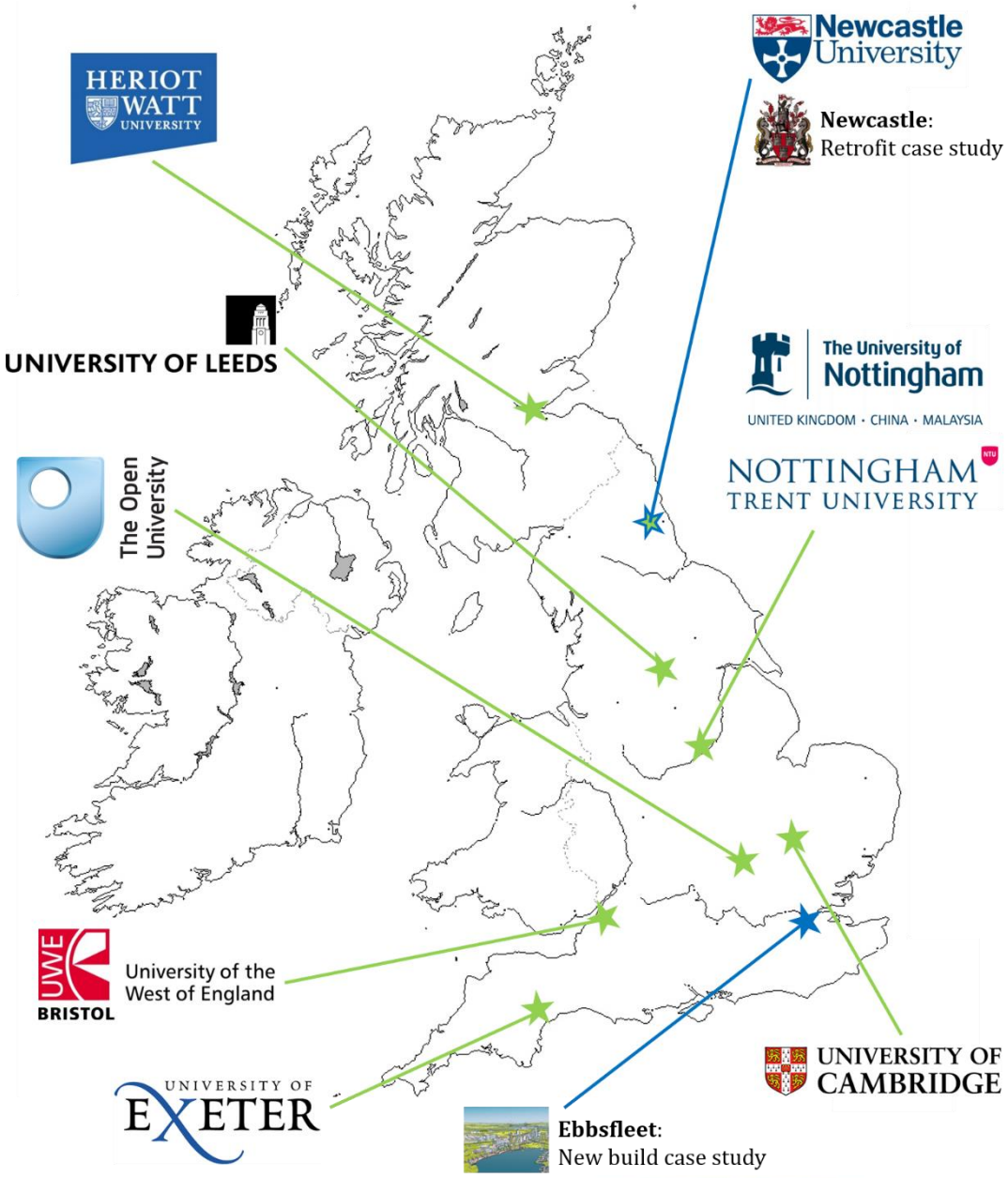
(research project running from 2013-2016)

Achieving Urban Flood Resilience in an Uncertain Future (2016-2021)

Make *urban flood resilience* achievable nationally, by making transformative change possible through adoption of the whole systems approach to urban flood and water management

Urban flood resilience: a city's capacity to maintain future flood risk at tolerable levels by preventing death and injuries, minimising damage and disruption during floods, and recovering quickly afterwards, while managing water quality and ecosystems, and ensuring social equity, and economic, environmental and cultural vitality

Research Consortium

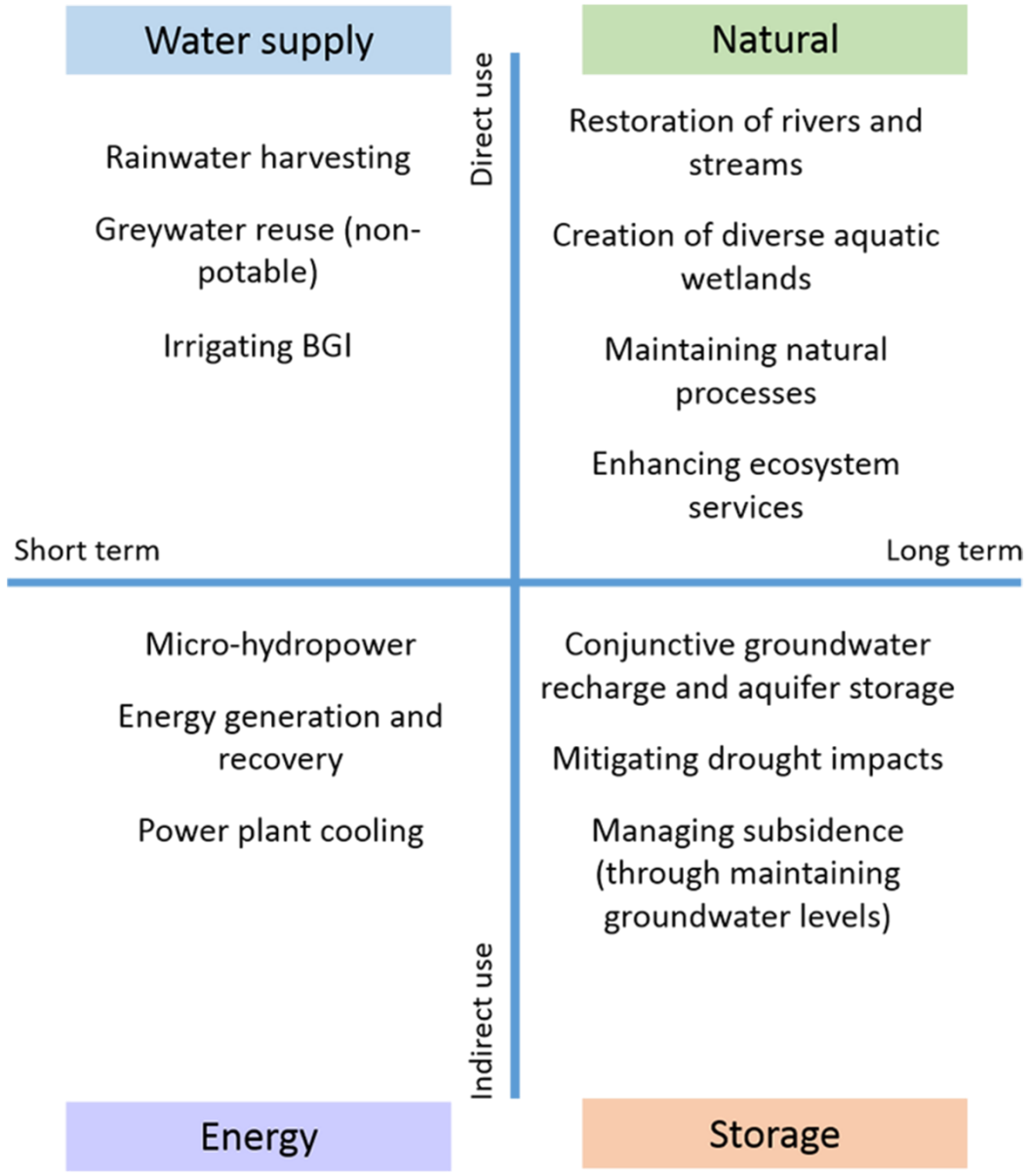


Urban Flood Resilience Research Themes

- **Engineering Design** of integrated Blue-Green and Grey **(BG+G)** surface water treatment trains that support resilient management of both water quantity and quality

- **Planning** that puts urban flood risk management at the heart of urban planning and focuses on interfaces between planners, developers, engineers and communities

- **Development** of flood and water management assets that function interoperably with other urban systems: transport, energy, land-use and natural systems



Changing the Water Narrative:

Stormwater is not just a nuisance but presents *opportunities* to make cities resilient, attractive, competitive and liveable

O'Donnell, E. et al. (2020), *The blue-green path to urban flood resilience*, Blue-Green Systems

Community engagement around Blue-Green infrastructure

Five fundamental principles to guide more effective BGI engagement and encourage a greater sense of ownership and appreciation:

1. People
2. Design
3. Power
4. Procedure
5. Engagement

O'Donnell, E. et al. (2020), *The blue-green path to urban flood resilience*, Blue-Green Systems

Urban Flood Resilience project resources

Websites and blog:

www.urbanfloodresilience.ac.uk

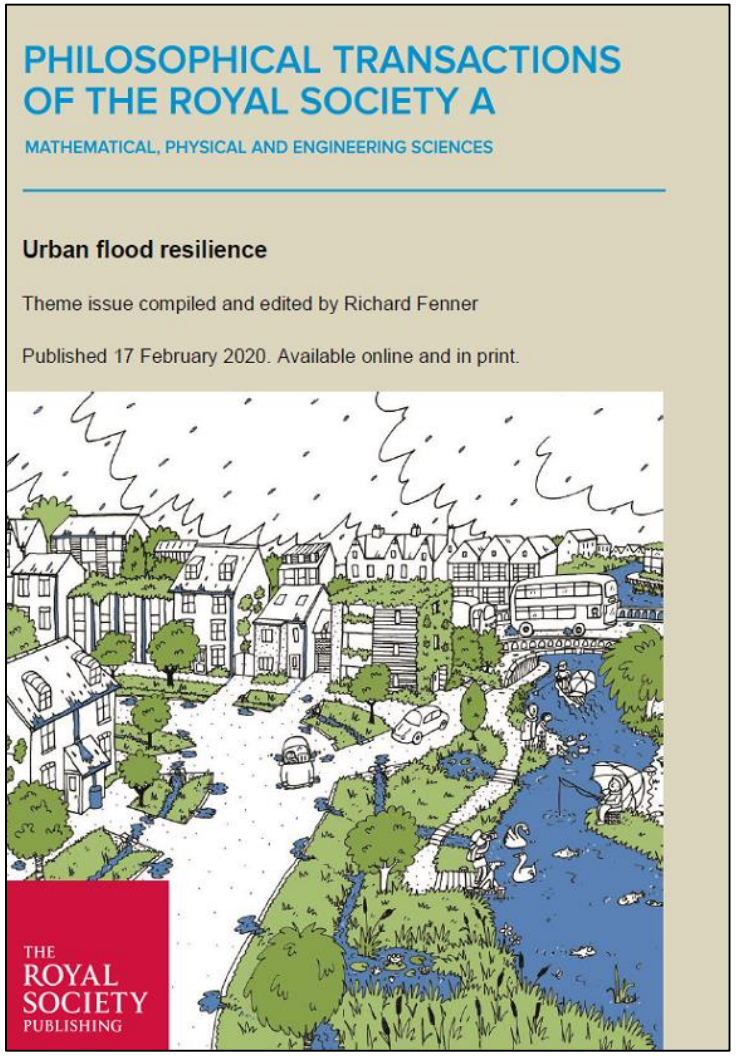
www.bluegreencities.ac.uk

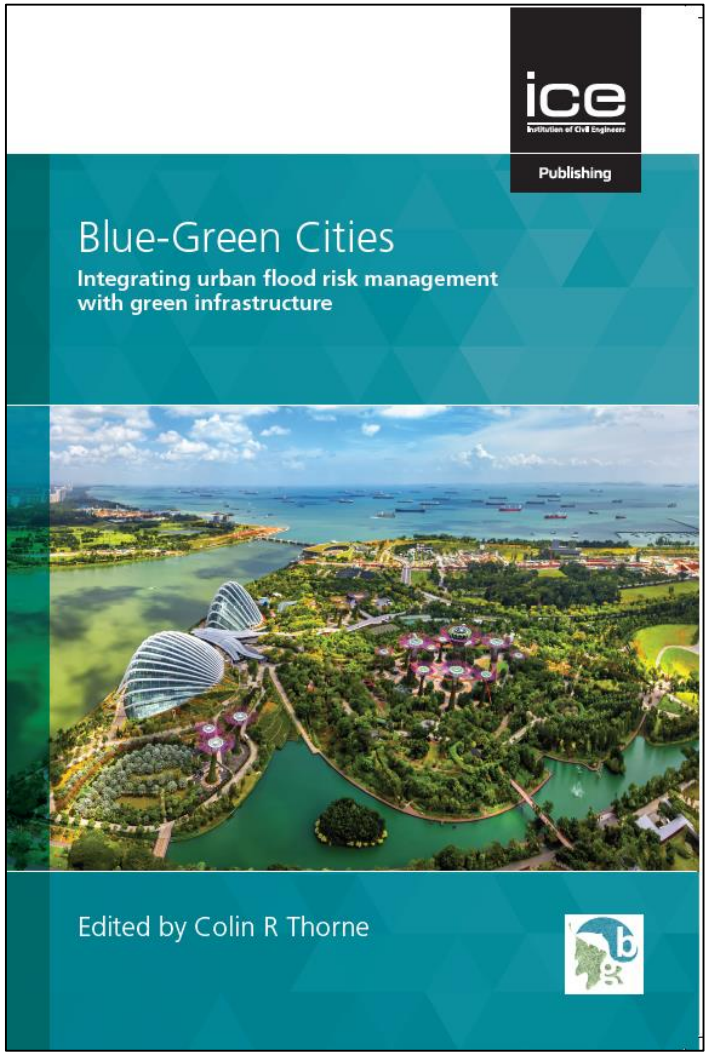
https://blogs.nottingham.ac.uk/blue-greencities/

Special issue and book

https://royalsocietypublishing.org/toc/rsta/2020/378/2168

https://www.icebookshop.com/Products/Blue-Green-Cities-Integrating-urban-flood-risk-man.aspx





Urban Flood Resilience project resources: factsheets

urban flood resilience

Interoperability

Towards a system approach for urban flood risk management

FACTSHEET

Project area: *Design for exceedance, system of systems*
Intended audience: *Researchers, practitioners, general public*

Introduction

Urban areas contain multiple infrastructure systems (e.g. roads, land use, energy) and in each system stormwater management options exist (e.g. permeable roads, retention ponds, dams). Yet, the ability of these systems to interact – or interoperate – with each other to enhance the overall capacity of the system to manage stormwater is not well understood. Actively managing these interactions could increase the functionality of flood risk management designs and produce gains in efficiency while reducing costs. This factsheet presents the concept of interoperability as a means to develop a general framework to guide application of more "whole system" urban flood risk management.

The urban challenge: a system of systems

An urban environment can be considered a "system of systems" [1] (Fig. 1), where limited space, competing demands, and strong interdependencies between infrastructure systems imply that multifunctional and flexible adaptation measures are fundamental to making urban communities more resilient to the adverse impacts of flooding as well as climate change and urbanisation [2,3].

Many options exist for flood risk management (FRM) (Fig. 1). For example, multifunctional Blue and Green designs, which aim to use natural processes to manage excessive water (e.g. increasing infiltration and storage) and water quality, while also providing additional environmental and health benefits (e.g. reducing air pollution).

Yet, despite the growing number of multifunctional options for FRM, it remains difficult to fully integrate them into urban infrastructure systems and to understand how connecting Blue-Green infrastructure with other urban systems (e.g. transport or land use) can expand the capacity of the overall system towards achieving urban flood resilience [4]. For example, the way Blue-Green infrastructure can protect against flooding is often restricted by the availability of space and the timescale of events, and dependent on other systems (e.g. roads for runoff) [2]. Therefore, an important aspect of the transformation to greater urban flood resilience, is to adopt a holistic approach to FRM. But, despite widespread recognition of this need, it is challenging to implement a systems approach in practice [5]. To this end, interoperable systems of Blue-Green and Grey infrastructure for FRM with other urban infrastructure systems present a possible practical solution (Fig. 1).

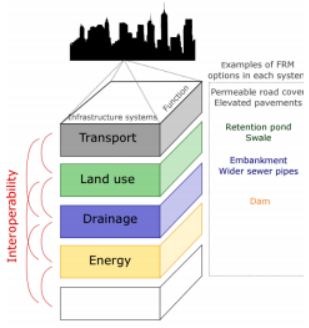


Figure 1: *The city consists of multiple infrastructure systems, having multiple functions. In each system, options exist for flood risk management (FRM), creating possibilities of interoperability between systems to enhance to overall system capacity to deal with excess stormwater.*

urban flood resilience

Implicit Association Tests

Revealing what the public really think about sustainable drainage

FACTSHEET

Project area: *Citizens interactions with blue-green infrastructure*
Intended audience: *Researchers, practitioners, general public*

Introduction

The implicit association test (IAT) is a social-science method used to infer the non-conscious associations held by a person towards a target concept. IATs are being used in this study to explore residents' implicit preferences towards sustainable urban drainage (SuDS) (the target concept), to investigate the basis of these beliefs, and explore whether they differ significantly from those reported by the same participants in questionnaires and surveys.

Why do we need an implicit measure of preference?

There is increasing evidence that self-reporting measures, such as surveys or questionnaires, are open to being rendered invalid by participants that give certain answers because they are socially accepted beliefs. New methods that lie outside of our conscious control can reveal implicit attitudes (Figure 1) that participants may choose to hide (either purposefully or inadvertently) in self-report measures.

Implicit attitudes are argued to be more durable that those we self-report, although they can be altered by personal experience, as well as exposure to media on an event or issue.

Explicit vs. Implicit Attitudes

EXPLICIT:	IMPLICIT:
• Deliberate	• Automatic
• Conscious	• Non-conscious
• Introspective	• Associative
• "Slow" / "Cold"	• "Fast" / "Hot"
• *Self-report*	• *Response time*

Figure 1: The key differences between explicit (self-reported) and implicit attitudes

What is the implicit association test?

The implicit association test (IAT) is a method that provides us with an indication of the associations participants hold between different concepts. For example, an IAT that wishes to look at attitudes towards women may present participants with a series of images of men and women, which are interspersed with a series of pleasant and unpleasant words. Participants are timed to record how quickly they make pairings between these images and words. The test argues that an implicit preference is shown if the participants finds it easier (i.e. takes less time) to make certain associations (such as those between pleasant words and images of females).

The IAT is usually completed on a computer, tablet or phone, and can take as little as a few minutes. They can provide a 'score' immediately, which can be shared with the participant.

Figure 2: Example stimulus image of a public green space containing sustainable urban drainage features (pond).

http://www.urbanfloodresilience.ac.uk/publications/factsheets.aspx

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