Blue-Green Cities
Delivering and Evaluating Multiple Flood Risk Benefits
Hydrologic and environmental attributes in Grey and Blue-Green Cities
Blue-Green Research Aim

Develop and rigorously evaluate strategies for managing flood risk that deliver multiple benefits as part of urban planning and renewal
Case Study City: Newcastle
Blue-Green Cities are working with Ningbo academics

James Griffiths, David Higgitt, Faith Chan and Odette Paramor
WP1 Communications and Uncertainty

WP2
a. Flood simulation
b. Sediment, morphology and habitats
c. Behavioural responses

WP3 FRM components and interfaces

WP4 Evaluation and synthesis of benefits

WP5 Newcastle demonstration (2015)

EPSRC Studentship (Shaun Maskrey)
Bayesian networks as a tool for involving stakeholders in the participatory modelling and management of flood risk
1. Uncertainty

- Fidelity
- Sensitivity
- Uncertainty
- Validity
- Relevance
- Quantification

 Verification
Water depth map of **Ouseburn catchment** (area = 120km², cell size = 2m, cells = 30million). Storm event = 60 minutes, 100-year return period.
2b. Sediment, morphology, habitats

AIM: assess sediment transport and debris dynamics within Blue-Green urban drainage networks and develop improved approaches to accounting for the risks and benefits associated with Blue-Green infrastructure.
2c. Retrofit SuDS – attitudes/behaviours

The Dings, Bristol (above), @Bristol (top-right), St Nicholas House, Bristol (bottom right)
3. FRM components and interfaces

- Develop tools and methodologies to represent urban FRM and Blue-Green networks within a single urban environment
- “System of systems” approach
- Examining interdependencies with wider urban infrastructure

Hoang & Fenner, 2014 submitted
4. Evaluation and synthesis of benefits

Aim: Develop procedures for the robust evaluation of the multiple functionalities of Blue-Green infrastructure components within FRM strategies

- Blue (flood) and non-flood (Green)
- Evaluate the relative significance of benefits in context specific locations
- Establish preference ratings
- Review current design procedures and make recommendations to the design guidance to enhance the most significant non-flood benefits
Hoang and Fenner (Submitted), modified after Fratini et al. (2012) and CIRIA’s SUDS manual (2007)
Investigate wider system interactions and multiple benefits of Blue-Green infrastructure

3 step-approach

1. Benefit evaluation

2. Benefit significance:
   incremental value added in a location-specific context; can benefits in discreet installation be leveraged by enhanced connectivity? (GIS-based)

3. Benefit preference
5. Demo Study

Identified flood risk (pluvial/fluvial)?

Data availability

Change flood risk management strategies?

Buy-in from all local stakeholders

Is Blue-Green infrastructure viable?

Newcastle

Newcastle City Council
EA
Northumbrian Water
Natural England Universities
Wildlife and Rivers Trusts
Estates
Natural History Society
A LAA is usually an **open arrangement** where participants create a **Joint understanding** of a problem and its **possible solutions** based on rational criticism and coherence through **discussion**. It facilitates the identification of **innovative ideas** for the solution of complex (wicked) problems **outside the constraints of existing formal institutional settings**.

**Solutions** or ideas are afterwards presented in formal inter-organisational decision-making processes.

- **June 12th meeting:** “stock-take” of Newcastle BG initiatives
PhD Studentship
Participatory modelling using Bayesian networks

Location:
Hebden Bridge, West Yorkshire

Objectives:
Ensure local stakeholder knowledge, particularly about social processes, is utilised in flood risk modelling

To achieve this through a participatory approach that harnesses the utility of the Bayesian network technique
Acknowledgement

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- Engineering and Physical Sciences Research Council
- Northern Ireland Rivers Agency
- Environment Agency
- National Science Foundation
- City of Portland Bureau of Environmental Services
- Johnson Creek Watershed Council

bluegreencities.ac.uk
1. Establishment

Organising group (coordinator)
Core Group
Regular meetings
Wider Group (LinkedIn)

2. Functioning

- Legitimacy
- Trust
- Innovation
- Leadership
- Decision makers

Terms of Reference - purpose, structure, rules

3. Sustainability

Aim, vision, context, stakeholders, focus, culture

Active learning, communication, facilitation, characteristics, clear rewards
Clean Water For All (CWFA) 2014
A UK+US collaboration
Climate change and flood risk: understanding and communicating risk and uncertainty

Runoff and flood simulation

Sediment, contaminants, morphology and riparian restoration

Community perceptions: the social dynamic

System interactions and multiple benefits of Blue-Green Infrastructure

Structuring and evaluating community priorities through participatory modelling
Case Study: Johnson Creek, Portland, OR

Johnson Creek State of the Watershed Report 2012
CWFA Research Objectives

• To develop a method for identifying the Relevant Dominant Uncertainties and the capacity for FRM strategies to be effective under different future scenarios.

• To model Johnson Creek (with and without green streets) to understand the impacts of stormwater run-off on sediment and water quality.

• Examine the influence of Green Streets, Blue-Green Infrastructure and river restoration on waterway health and water quality.
CWFA Research Objectives

- To explore the multiple perceived benefits of adopting a ‘Blue-Green’ approach to FRM, considering temporal changes in perceptions and behaviour.

- Participatory modelling; where and when is it appropriate to use Bayesian networks to be used as a tool to support the participatory process?