Delivering and evaluating multiple benefits in Blue-Green Cities

Dr Emily O’Donnell
University of Nottingham

24th November 2016
Blue-Green Infrastructure Conference, Belfast
UK Flood Risk

Flooding is the UK’s most serious natural hazard

Over 5 million properties (1 in 6) and large proportions of the UK’s key infrastructure are at risk

Floods are expensive: the summer floods in 2007 cost the economy £3.2 billion (2014 floods >£1 bn)

May get worse with climate change (predicted wetter winters, more intense rainfall)
January 2014 Rainfall Anomaly

% of 1981-2010 Average

- > 300
- 250 to 300
- 200 to 250
- 175 to 200
- 150 to 175
- 125 to 150
- 75 to 125
- 50 to 75
- < 50

© Crown copyright
UK rainfall, 1-29 December 2015

% of 1981-2010 average

- More than 300
- 250-299
- 200-249
- 175-199
- 150-174
- 125-149
- 75-124
- Less than 75

Note: Values compared to average for full month

Source: Met Office

December 2015 Rainfall Anomaly
“what is required is a fundamental change in how we view flood management, from flood defence where we protect ourselves to one of resilience, living with and making space for water and the opportunity to get “more from less” by seeing all forms of water as providing multiple benefits.”

A Grey Future: bigger pipes, more pipes, huge pipes
London without the Thames Barrier during the December 2013 tidal surge (Environment Agency simulation)

Source: http://www.bbc.co.uk/news/magazine-26133660
Blue-Green Cities

- Working with nature to manage water and deliver a range of other benefits to society, the economy and the environment
- Multifunctional landscape
- Blue-Green space connectivity
Blue-Green infrastructure
(less blue-green) Blue-Green infrastructure
Blue-Green Cities Research Aim

Develop and rigorously evaluate strategies for managing flood risk that deliver multiple benefits as part of urban planning and renewal.
Blue-Green Cities Research Approach

- Model Existing Flood Risk Management
- Model Citizens’ Behaviours
- Evaluate Multiple Flood Risk Benefits
- Stakeholder and Community Communications
- Options for Hard/Soft Measures
- Demonstration Case Study
Barriers to Blue-Green infrastructure

- Competing priorities
- ‘Novelty’
- Lack of knowledge
- Funding and costs
- Ineffective communication
- Issues with partnership working
- Adoption of assets
- Legislation, regulations
- Culture, public perception
- Identifying multiple benefits

See Thorne et al., 2015
The Newcastle Learning and Action Alliance

Hypothetically ‘Blue-Greening’ the urban core
Newcastle helps lead the way in blue-green cities move to combat flood risk

15:30, 19 FEB 2016  |  BY TONY HENDERSON

More water storage and greening spaces in Newcastle are the basis for the city conference pledge at the Life Science Centre

Enter your e-mail for our daily newsletter

Source:
http://www.chroniclelive.co.uk/news/north-east-news/newcastle-helps-lead-way-blue-10914312

Blue and green could rival black and white as key colours in the Newcastle of the future.
Development of a flood inundation model: CityCAT

Water depth map of Ouseburn catchment
(120 km², 2 m cell size, 30 million cells, 60 min storm event, 100-yr return period)

Glenis and Kilsby, unpublished data (Newcastle University)
Flooding and sediment

Southwell (East Midlands)
2013 – after the floods
Water and sediment transport modelling

River flood routing simulations 100 yr event, 1 hr duration, with sustainable drainage pond

Sediment deposition in sustainable drainage pond (100 yr event, 1 hr)

See Ahilan et al., 2016
Sediment dynamics within a sustainable drainage treatment train

Water quality improvement, detention (and treatment) of heavy metal pollutants

See Allen et al., 2015
Natural flood risk management and river restoration

See Janes et al., 2016
Community behaviours and preferences

- Local People are the local experts - with useful knowledge
- People value Blue-Green assets - if they understand them
- People will help maintain the Blue-Green assets they value
- People need to feel *ownership* to make BG solutions work
- People must be engaged prior to and throughout implementation

See Everett et al., 2015
Evaluating the multiple benefits of Blue-Green infrastructure

ArcGIS toolkit for multiple benefit evaluation

- Air pollution
- Access to greenspace
- Carbon sequestration
- Noise
- Habitat connectivity
- Flood

Morgan and Fenner, in review
Achieving Urban Flood Resilience in an Uncertain Future
To conduct research necessary to make urban flood resilience achievable nationally, by making transformative change possible through adoption of the whole systems approach to urban flood and water management.
Achieving urban flood resilience in an uncertain future

Investigate how planning and organisation of existing and new urban water systems (including flood risk management, waste/stormwater management and water security) can be transformed to:

- ensure satisfactory service delivery (flood, normal and drought conditions);
- enhance and extend the useful lives of ageing grey assets by supplementing and integrating them with multi-functional Blue-Green infrastructure.
The Blue-Green Cities Research Consortium has been supported by:

- Engineering and Physical Sciences Research Council
- Northern Ireland Rivers Agency
- Environment Agency
- Northumbrian Water
- Newcastle City Council