



Blue-Green Cities for Urban Flood Resilience



www.urbanfloodresilience.ac.uk

UK Flood Risk

Flooding is the UK's most serious natural hazard

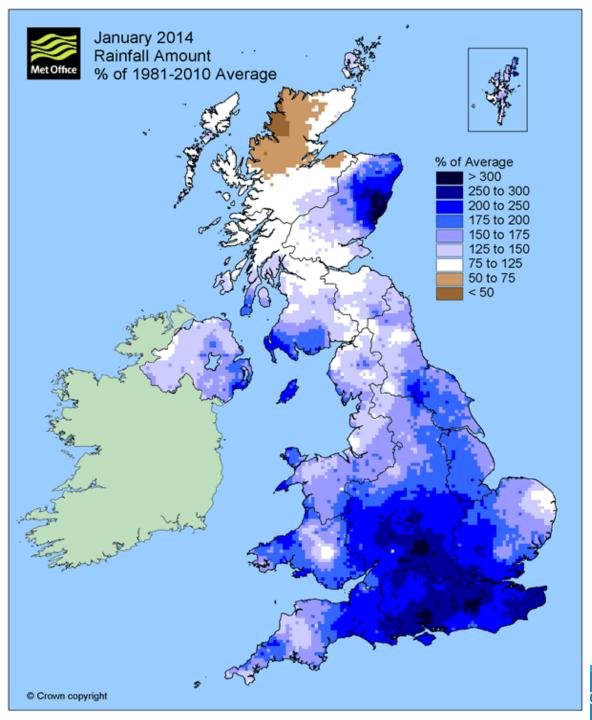
Over 5 million properties (1 in 6) and large proportions of the UK's key infrastructure are at risk

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)



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January 2014 Rainfall Anomaly

ood Resilience @BlueGreenCities

"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."

Commission of Inquiry into flood resilience of the future titled 'Living with water', March 2015. All Party Group for Excellence in the Built Environment, House of Commons, London, p. 32.

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Traditional drainage (grey infrastructure)













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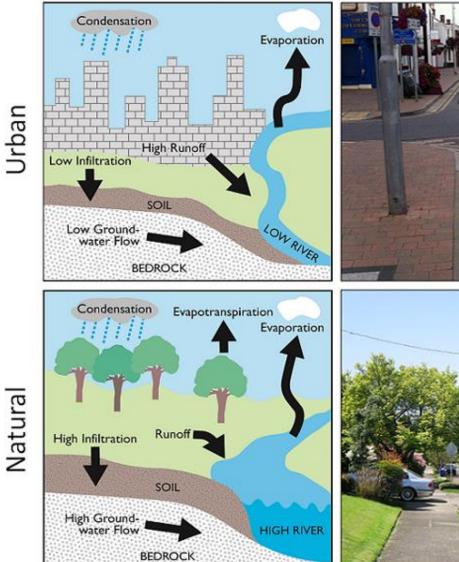
London without the Thames Barrier during the December 2013 tidal surge (Environment Agency simulation)

Source: http://www.bbc.co.uk/news/m agazine-26133660

Water Cycle

Streetscape

GREEN

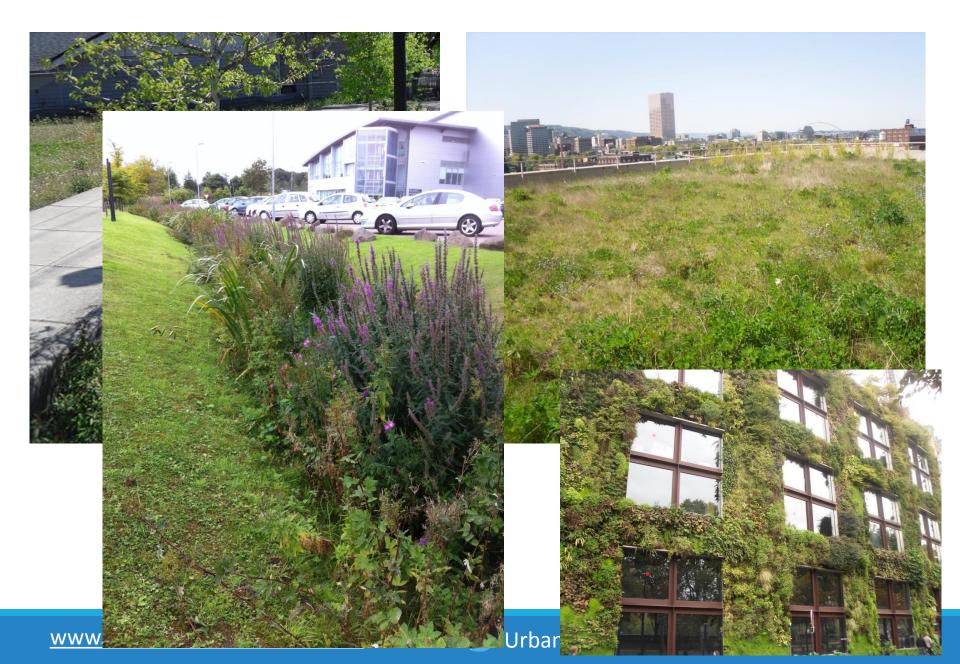


BLUE-

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



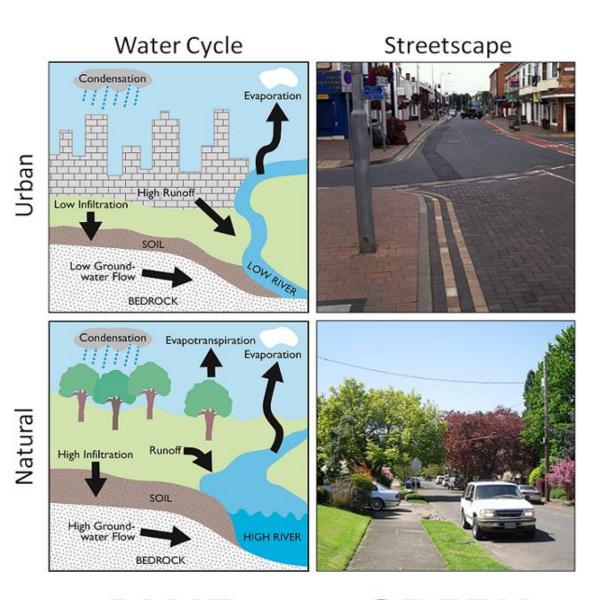
(less blue-green) Blue-Green infrastructure







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Blue-Green infrastructure can have a **significant** impact on local surface water flood risk but it is **very** challenging to significantly impact on low probability high consequence floods at river catchment scale using such techniques.

= Blue-Green + Grey

BLUE- GREEN

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Resilient Blue-Green Cities



Image: https://www.contradodigital.com/wp-content/uploads/2014/06/Blue-Green-City.jpg

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Benthemplein Water Plaza, Rotterdam

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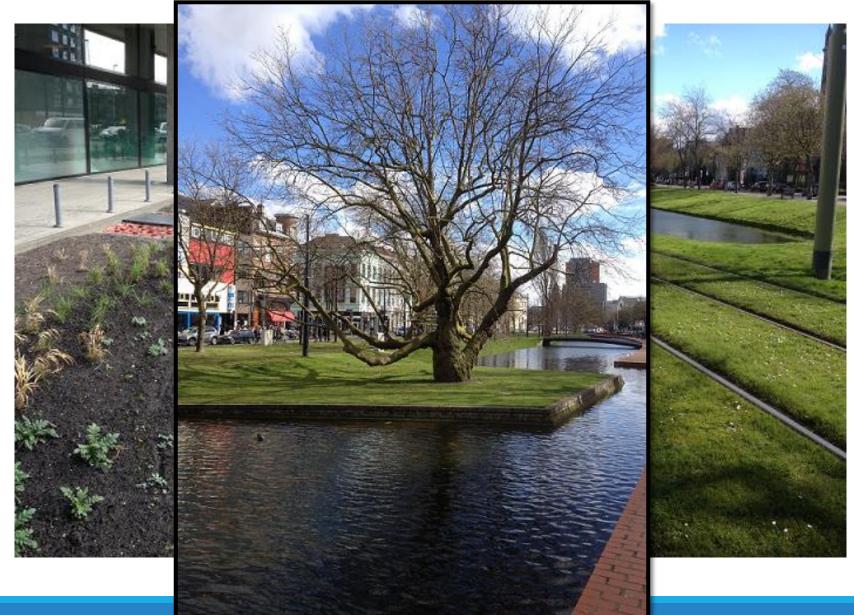


Benthemplein Water Plaza, Rotterdam



Images: http://www.urbanisten.nl/wp/?p ortfolio=waterplein-benthemplein

Rotterdam, the Netherlands



www.urbanfloodres

erean nood Acomende @BlueGreenCities

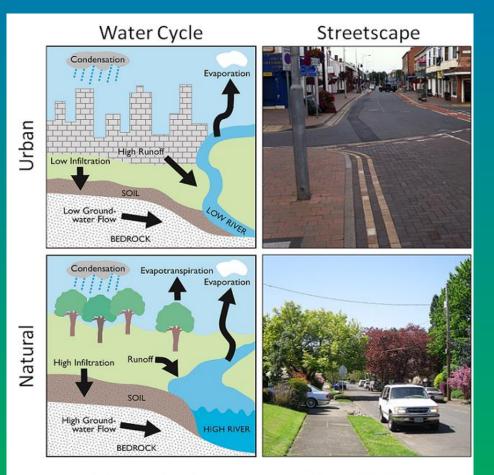
Drijvend Paviljoen (floating pavilion), Rotterdam

Resilient Blue-Green Cities

- Blue-Green + Grey = multiple benefits
 - Day-to-day accrual of non-flood benefits
 - Multifunctional infrastructure to meet strategic objectives of different departments/organisations
 - Healthier, happier and resilient communities
 - Extend lifetime of existing grey assets
 - Increases breadth of stakeholders involved

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Delivering and Evaluating Multiple Flood Risk Benefits in Blue-Green Cities (2013-2016)

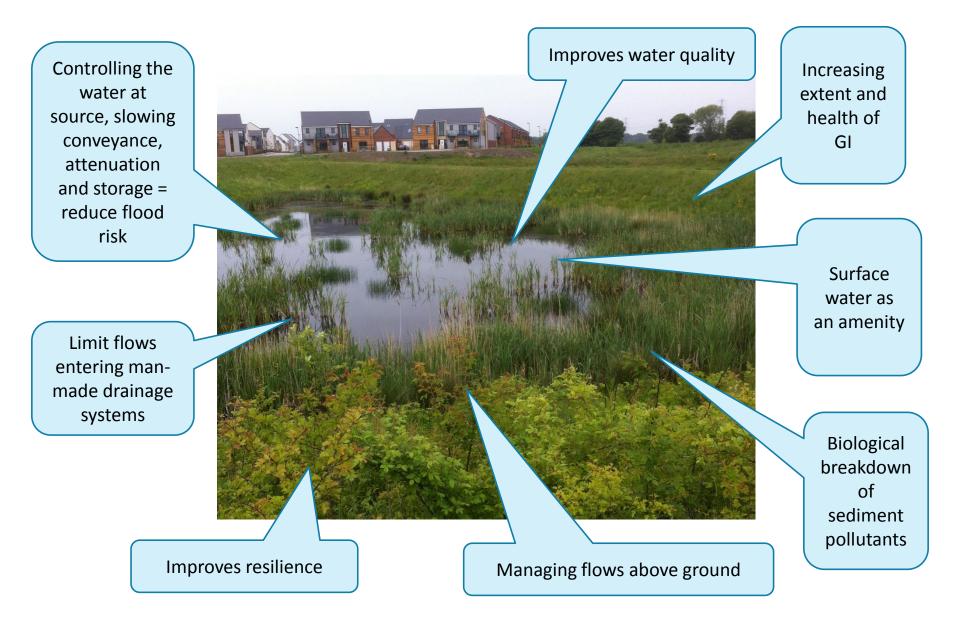


BLUE- GREEN



Developed new strategies for managing urban flood risk as part of wider, integrated urban planning in which the multiple benefits of Blue-Green Cities are rigorously evaluated and understood (www.bluegreencities.ac.uk)

Water and sediment management benefits



Environmental benefits: habitat and biodiversity



Environmental benefits

- Improve air quality
- CO₂ sequestration
- Reduction of the urban heat island effect
- Reduction in noise

Social and cultural benefits

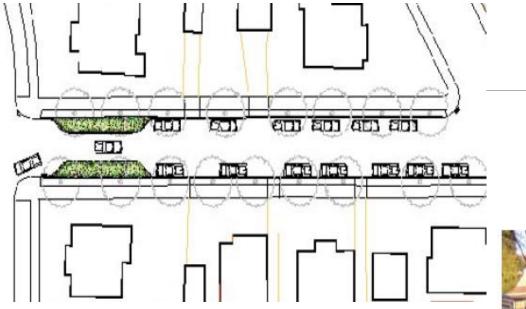


- ➢ Recreation
- Aesthetics
- > Amenity

- > Wellbeing and liveability (stress relief, restorative benefits)
- Encourages community cohesion, social interaction
- Physical and mental health

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Green streets - traffic calming





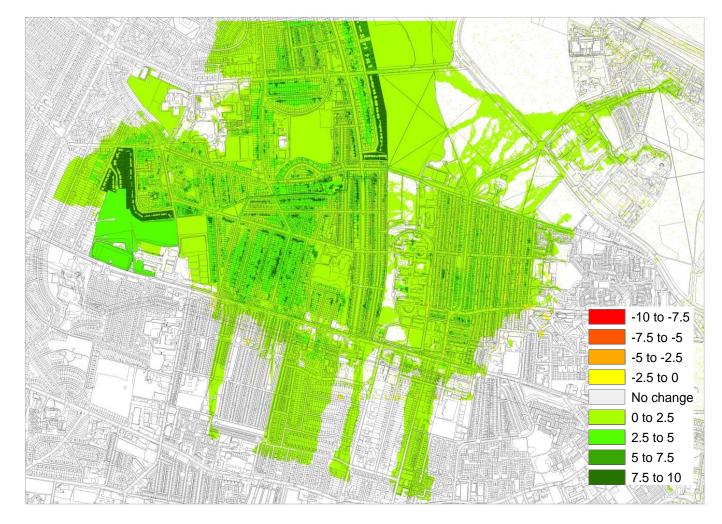




Evaluating the multiple benefits of Blue-Green infrastructure

ArcGIS toolkit for multiple benefit evaluation

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

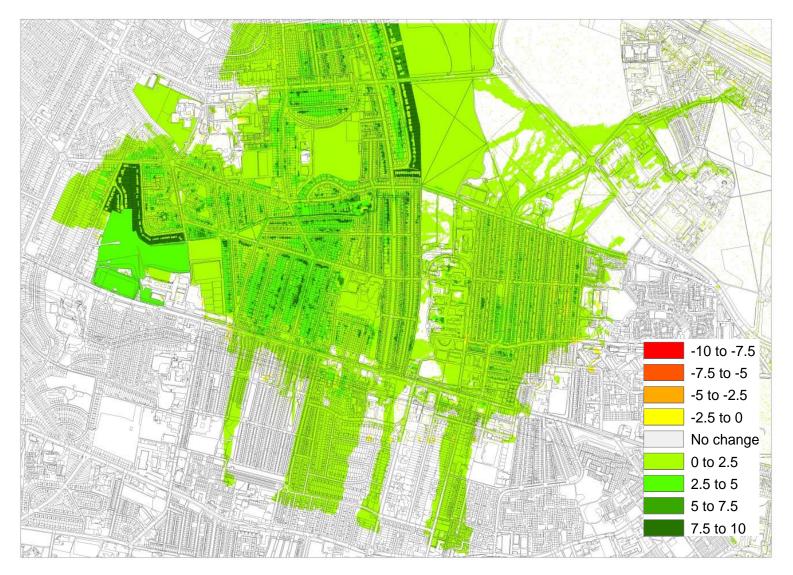


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Blue-Green Scenario: urban greening and permeable paving, Newcastle



Multiple benefits

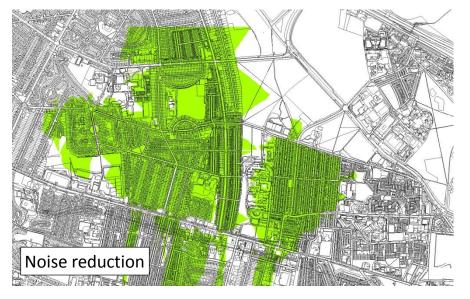


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Single benefits









Concluding remarks

- Blue-Green (+ Grey) = manage flood risk and provides multiple environmental, social and economic benefits
 - Healthier, happier and resilient communities
 - Day-to-day accrual of non-flood benefits
- Multifunctional infrastructure to meet strategic objectives of different departments/organisations
- Extend lifetime of existing grey assets

<u>Acknowledgement</u>

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