

# Adapting cities: Applying research in adaptation policy and practice

Kit England

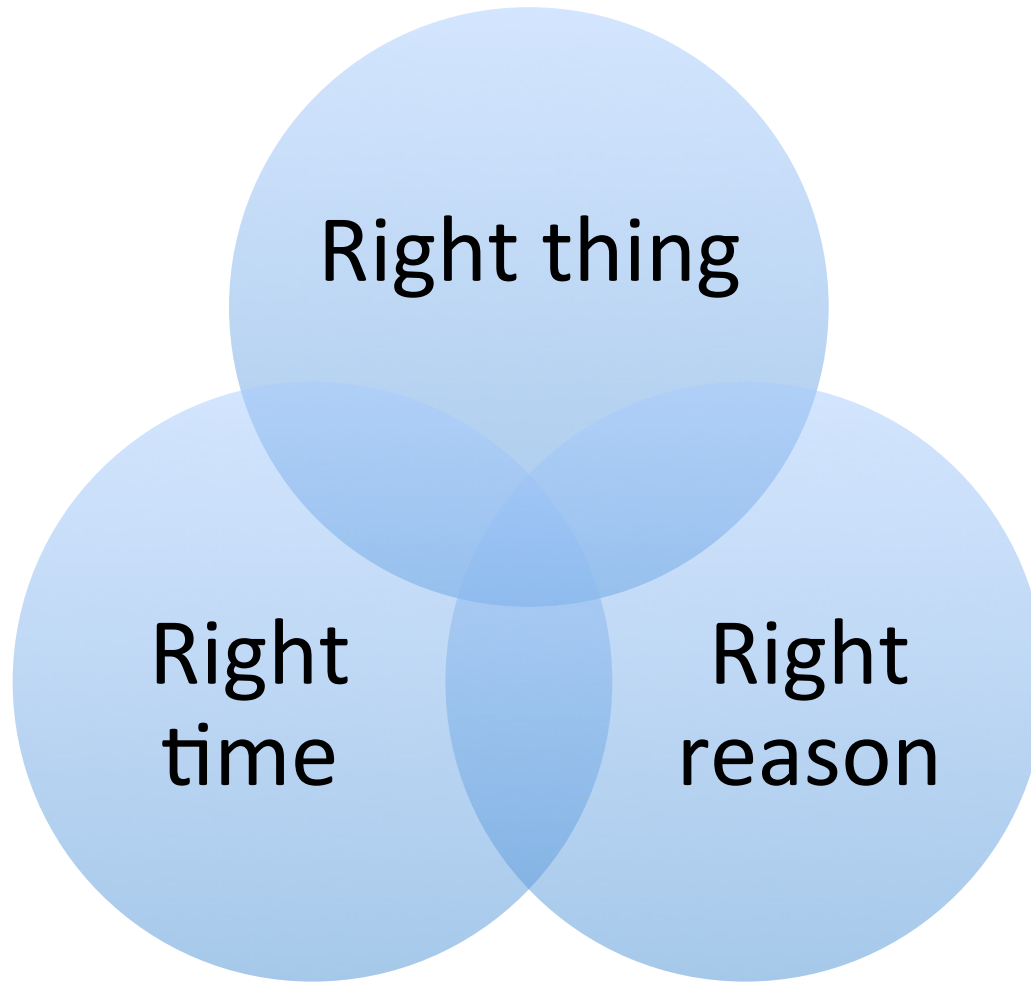
Chair, Core Cities working group on adaptation

## Core Cities

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Challenge, Progress and Opportunity

# Where we can be most effective?



# The challenges for cities

- **The magnitude of impacts and their consequences in cities.** Cities are hubs of economic growth, with more than half the world's population and most of its built assets and economic activities;
- **The potential for greater cascade and convergence risks,** due to the increased interaction of complex economic, social and environmental systems
- **Many emerging risks concentrated in urban areas, posing unique challenges and opportunities-** including urban heat island, increasing night-time temperatures/ heating and cooling requirements; the lack of permeability increasing surface water flood risk, whilst river and coastal are at increased fluvial and tidal risk



## Cities on the front line of a changing climate

Urban centres account for more than half of the world's population, most of its economic activity and the majority of energy-related emissions. The role of cities in reducing emissions and protecting their inhabitants is therefore central to effective climate policies.



Cities account for 37–49% of global GHG emissions



Urban infrastructure accounts for over 70% of global energy use



Over 64% of the world population to live in cities by 2050, significantly increasing energy use for infrastructure



New infrastructure and land-use policies could reduce GHG emissions by 20–50% by 2050

### IMPACTS

Climate change is expected to affect numerous aspects of urban life.



Adaptation is possible if complex, but cheaper in the long run than doing nothing. How cities adapt to the effects of climate change will vary enormously.

### Sea-Level Rise

Two-thirds of cities with populations above 5 million are located in the Low Elevation Coastal Zone. Rising sea levels and storm surge flooding could have widespread effects on populations, property, and ecosystems, presenting threats to commerce, business and livelihoods.



**ADAPTATIONS**  
Responses include: (A) improving early warning systems, (B) strengthening coastal infrastructure, a significant degree of rezoning (including relocation of critical services), (C) and evacuation and crisis response management.

### Food Insecurity

All aspects of food security are potentially affected by climate change, including access to food, food utilisation and price stability. Climate change is likely to cause food production in some regions (including the ocean due to warming and acidification) to decline.



**ADAPTATIONS**  
Local responses include support for urban and peri-urban agriculture, (D) green roofs, local markets and enhanced social (food) safety nets. (E) Develop alternative food sources, including inland aquaculture, to replace ocean-based resources under threat.

### Extreme Weather Events

Changes in extreme rainfall could cause the amount of sewage released to the environment from combined sewerage overflow spills and flooding to increase by 40% in some cities. Inland flooding is often made worse by uncontrolled city development.



**ADAPTATIONS**  
Responses include strengthening infrastructure, (F) localised migration, wastewater, stormwater and runoff infrastructure and management, and better emergency measures including (G) stockpiling fuel, water and food.

### Increased Temperatures

The mean temperature rise in some cities could be over 4°C by 2100, with peak seasonal temperatures even higher. More hot days will exacerbate urban heat island effects, resulting in more heat-related health problems and, possibly, air pollution.



**ADAPTATIONS**  
Development of urban planning heat management strategies, (H) including green zones, wind corridors, green roofs and water features. (I) Building codes will need to be improved, and the infrastructure used by vulnerable parts of the population will need to be made more resilient.

### Freshwater Availability

Risks to freshwater resources, such as drought, can cause shortages of drinking water, electricity outages, water-related diseases (through use of contaminated water), higher food prices and increased food insecurity from reduced agricultural supplies.



**ADAPTATIONS**  
Options include (J) encouraging water recycling and grey water use, improving runoff management and developing new/alternative water sources, (K) storage facilities and autonomously powered water management and treatment infrastructure.

Mitigation efforts can have positive impacts for generations to come



#### Energy Supply

Reductions in greenhouse gas (GHG) emissions can be achieved by the use of low-carbon technologies including renewables, nuclear, and carbon capture and storage. Switching from coal to gas can be a bridging solution.



#### Transport

Emissions can be reduced by avoiding journeys, shifting to low-carbon transport systems, enhancing vehicle and engine efficiency, and reducing the carbon intensity of fuels by substituting oil-based products with natural gas, bio-methane or biofuels, or with electricity or hydrogen produced from low GHG sources.



#### Buildings

Retrofitting existing buildings can reduce heating energy requirements by 50–75% in single-family housing and 50–90% in multi-family housing at costs of about US Dollar 100 to 400 per square metre. In contrast, substantial new construction in fast-growing regions presents a great mitigation opportunity as emissions can be virtually eliminated for new builds.



#### Energy Demand

Increasing the efficiency of buildings, appliances and distribution networks will reduce energy demand. Changes in the awareness and behaviour of residents can also reduce demand. Projections suggest demand may be reduced by up to 20% in the short term and 50% by 2050.



#### Low Carbon Cities

Options for rapidly developing cities focus on shaping their urban and infrastructure development trajectories. For mature cities, options lie in urban regeneration (compact, mixed-use development that shortens journeys, promotes transit/walking/cycling, and adaptive reuse of buildings) and rehabilitation and/or conversion to energy-efficient building designs.



#### Policy Instruments

Approaches include co-locating high residential with high employment densities, achieving high land-use mixes, investing in public transit. The best plans for advancing sustainable urbanisation and low carbon development, especially in fast-growing parts of the world requires political will and institutional capacity.



# How Europe is addressing this

- European Commission embedding adaptation. Recognises a number of factors needed to mainstream, including political commitment, coherent policy, new research, pilots of new approaches and implementation
- **Political commitment** - 'Mayors Adapt' a political commitment scheme for Local Authorities. Cohesion funding to LEPs prioritising this, along with Life +/North Sea Operational Programme
- **Coherent policy** - Adaptation and Green Infrastructure strategies
- research themes in Horizon 2020 – two key programmes: Climate Action, and Secure Societies
- To move work to the mainstream we need cities and academics to coalesce around European and local priorities around ALL these topics

# UK Government approach

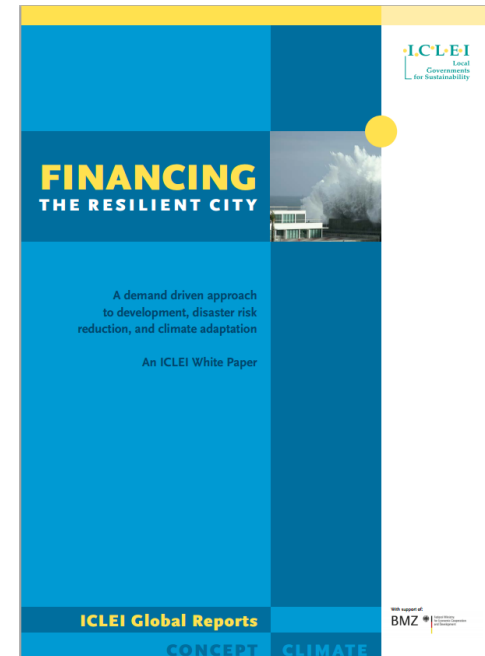
- **National Adaptation Programme** – statutorily required by the Climate Change Act 2008 – informed by the National Climate Change Risk Assessment
- Supported by ClimateUK regional partnerships and Environment Agency ‘Climate Ready’ support service
- A voluntary approach– delivered in the context Localism.
- Core Cities committed to accelerate work on adaptation in their local areas Covered a range of areas, including Built Environment, Infrastructure, Health and Wellbeing and Businesses and Services. **[SPEC OUT]**
- Effectiveness of this approach to be evaluated by Committee on Climate Change
- **Core Cities now leading from the front** – looking at Government barriers to more effective adaptation, and trying to push forward adaptation in their area

# The challenge for UK cities

- Local Authorities identified by Adaptation Sub-Committee as key deliverers/enablers
- However, Local Government undergoing massive austerity, and an aging population
- EA research highlights a general decline in profile, importance, and resources due to reducing spend, focus on statutory duties, and a need to support the local economy
- A number of 'best practice' schemes delivered, but needs to scale
- A recognition of adaptation as both a marathon and a sprint -

# The big idea(s)

- If Cities are to adapt, the finance required dwarfs what Local Authorities and Government hold or can borrow.
- Globally cities need to build the business case to unlock private capital alongside existing finance.
- Cities moving towards this, particularly green bonds, but also crowd sourcing.
- Also need to change the language – adaptation not working, instead need to quantify the benefits much more robustly (GVA, Jobs, public health)



# Implications for academia

- Need an ongoing partnership with academia to effectively build the business case **FOR** cities, and **IN** cities
- Develop evidence, assess hazards and vulnerability, understand city issues and priorities, and potential solutions
- Each of these will be different in different cities, but there are some common threads
- There are research priorities for cities, but also some primary research gaps

# Research priorities

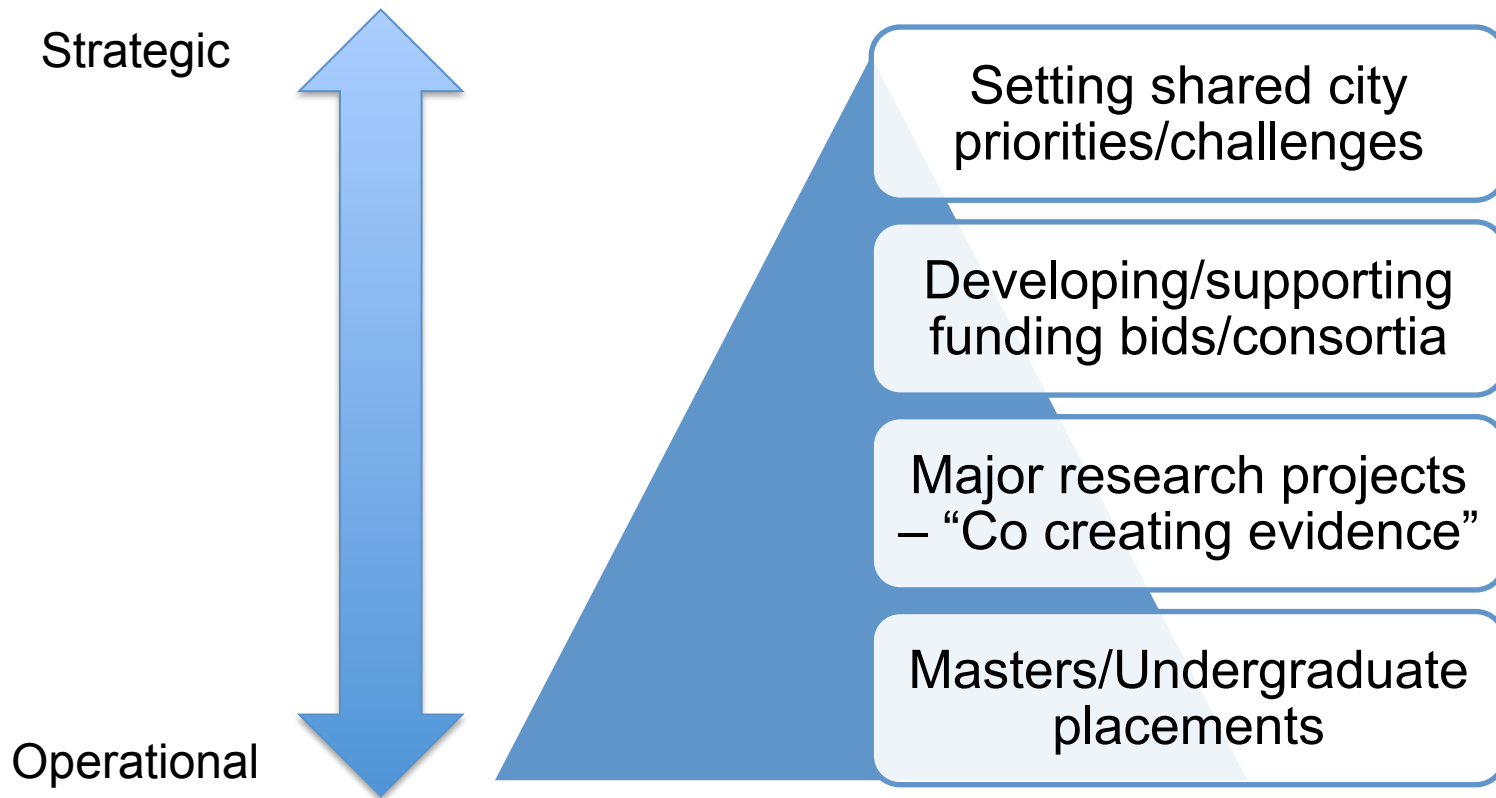
- **How do we change the language?** What is the most effective way to 'sell' adaptation? Is it more about the economic case – jobs created, resilience of supply chains, GVA from adaptation measures – if so we have to get there.
- **Finance** – Building the legal, financial and policy capacity of Cities to access private finance
- **Creating local evidence bases** - Development and application of tools and techniques around exposure, vulnerability and adaptive capacity which can create resilient individuals, institutions and systems in cities



# Other research gaps

- **Behaviours** – What is the contribution of individuals – how can their actions address hazards, how do
- **The role of Government** - What is the role of Government in facilitating adaptation given the scale? What are the barriers in UK and international policy holding local adaptation back?
- **Weatherising climate projections** – Developing standard ways to adapt existing evaluation/appraisal techniques for projects to account for climate change
- **International impacts on cities** – e.g. migration
- **Food** - Risks to food security and strategies to address this
- **The urban-rural network** - cities don't exist in isolation, what are effects on the surrounding areas, how do they impact

# Types of city/academic collaboration



# Key questions

- How can we take forward this agenda?
- What are the levers in our control to address this?



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# Birmingham – Smart Adapting Cities

“Metanoia”



## **Birmingham City Council**

**Leader-** leading global green city;

### **Planning-**

150,000 population;  
80,000 new homes;

### **Green**

### **Commission**

-Green Vision;

- Carbon Roadmap -60% carbon reductions;
- Natural Capital

**Nick Grayson**

Climate Change & Sustainability Manager,



**Birmingham City Council**

# Birmingham – Smart Adapting Cities

**"We the mayors and governors of the world's leading cities. ask you to recognise that the future of our globe will be won or lost in the cities of the world."**

Copenhagen Climate  
Change communiqué,  
December 2009



**STERN 1% GDP  
GLOBAL 2006**

## UK Statistics 2012

% UK classified as urban?

% of UK population living as urban ?

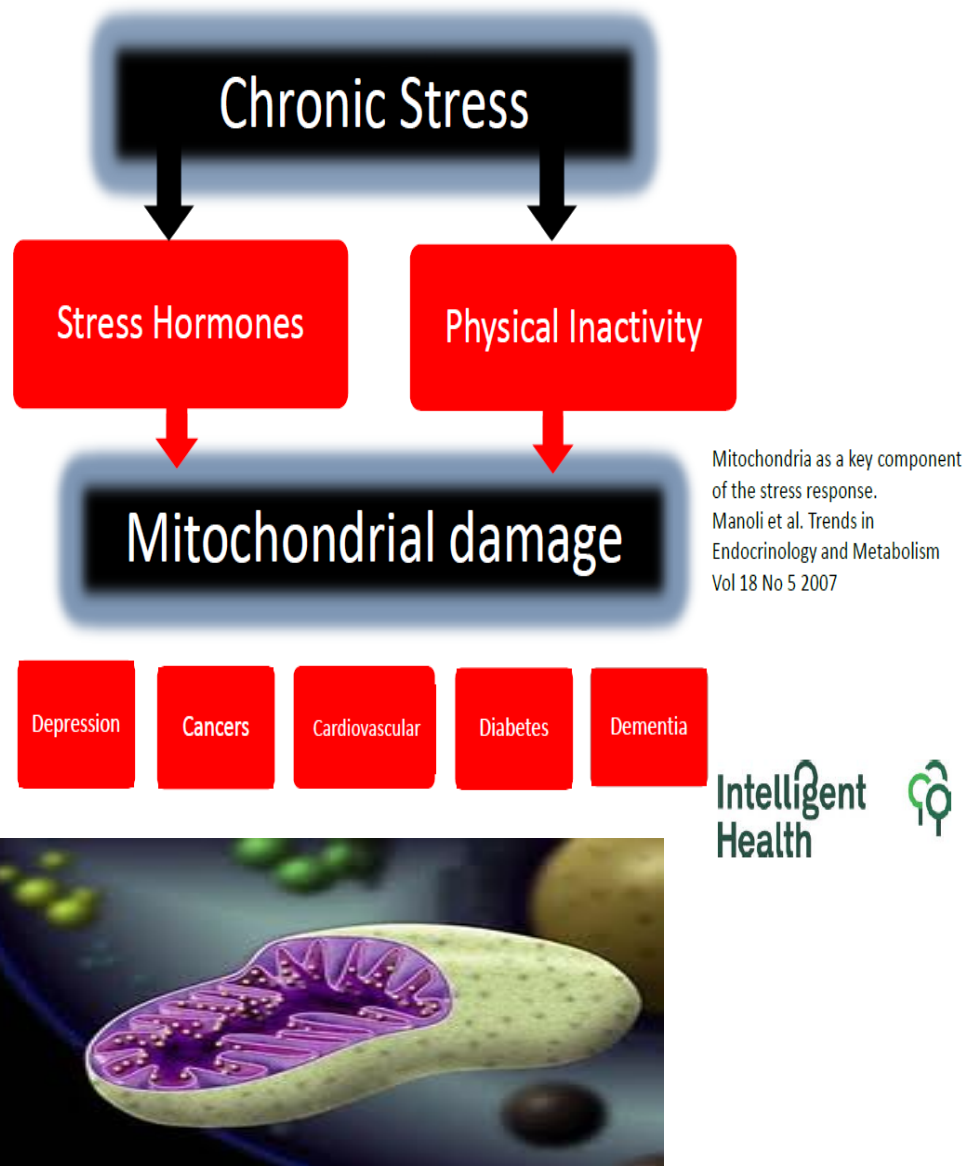
% urban areas not built form?

% total of England built on?

% GHG & natural resources – global cities?



# Birmingham – Smart Adapting Cities



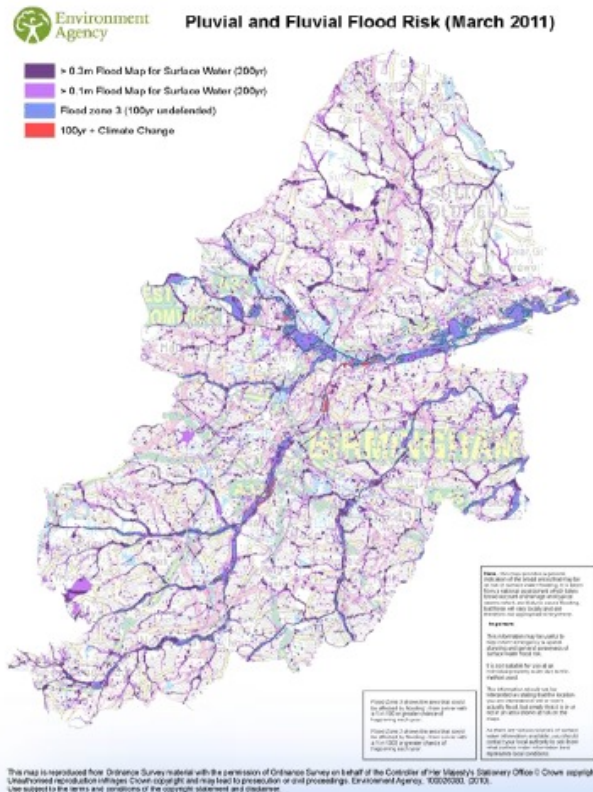
Non-communicable diseases represent a new frontier in the fight to improve global health. Worldwide, the increase in such diseases means that they are now responsible for more deaths than all other causes combined.

Secretary General United Nations 2011

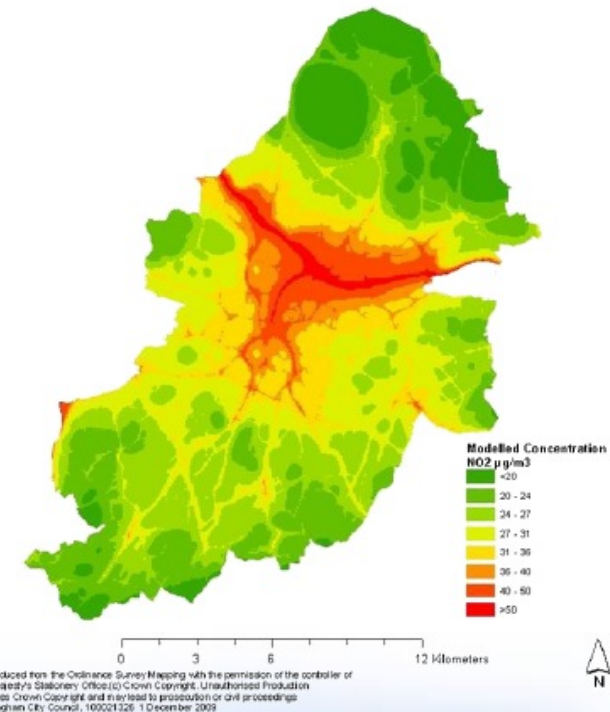
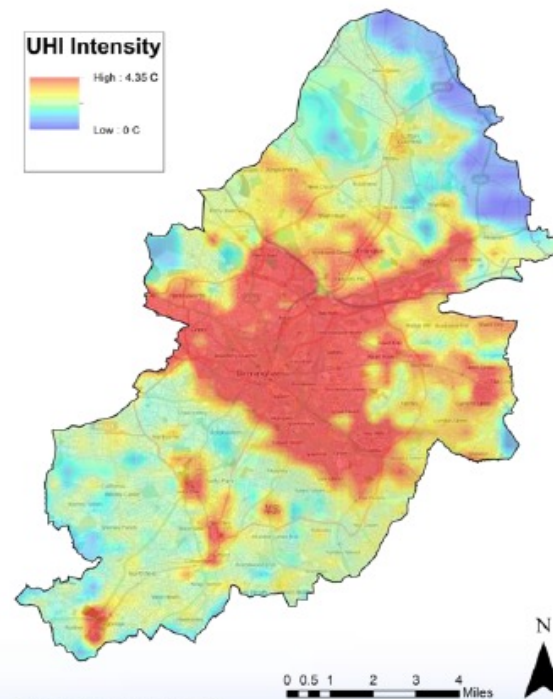
# BUCCANEER – Birmingham Urban Climate Change Adaptation Neighborhood Estimates of Environmental Risk

## Assessing the risks to Birmingham

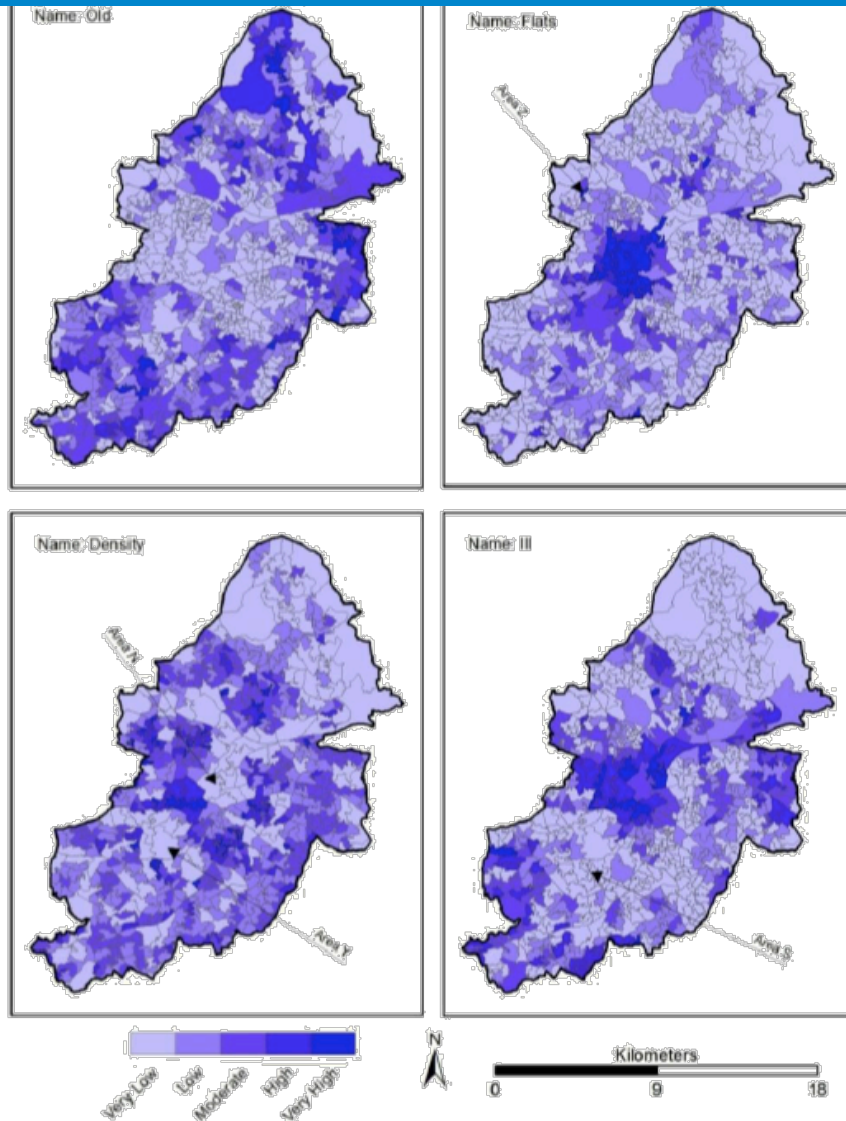
Modelled Annual Mean Nitrogen Dioxide Concentrations 2008



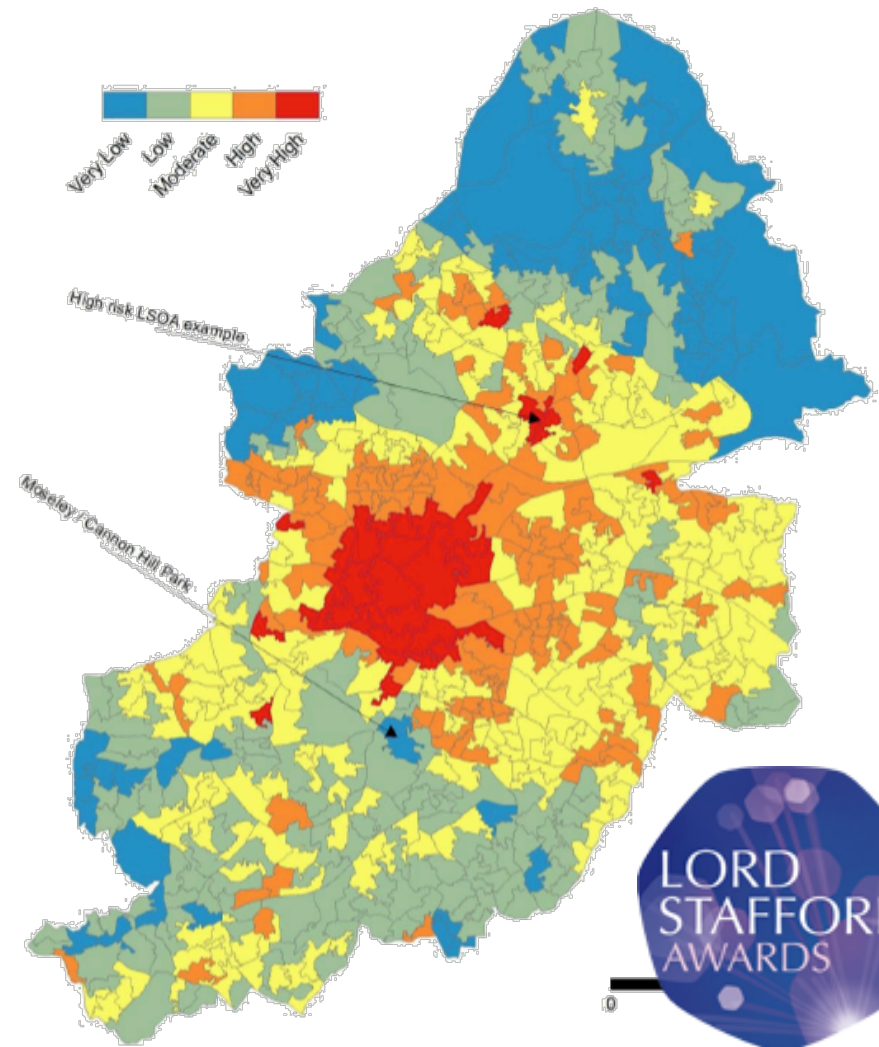
**Birmingham's Estimated  
Heatwave Urban Heat Island  
(18th July 2006, 01:00)**



# Birmingham – Smart Adapting Cities



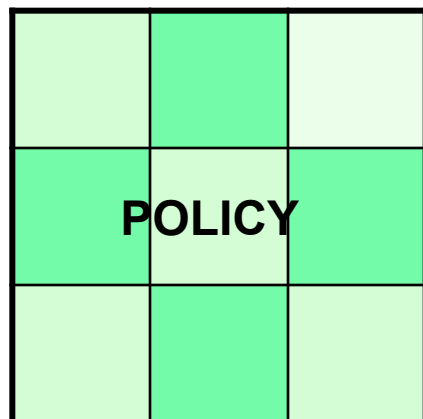
## BUCCANEER PROJECT



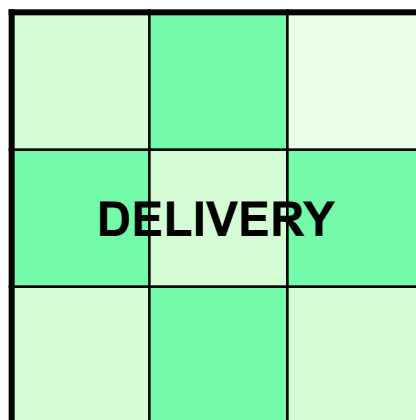
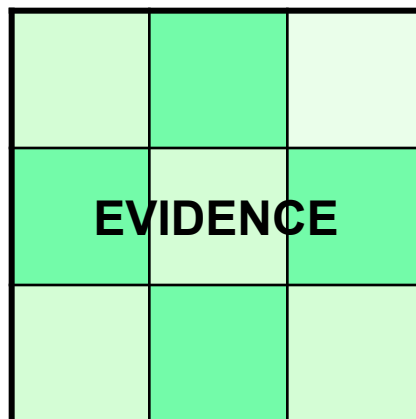


# Birmingham – Smart Adapting Cities

The 9 piece  
jigsaw



Green  
Infrastructure &  
Adaptation  
Delivery Group



## Key Partners

Climate Risk

Water

Green Infrastructure

Health & Well Being

Biodiversity

The LEP & Business

Community + Resilience

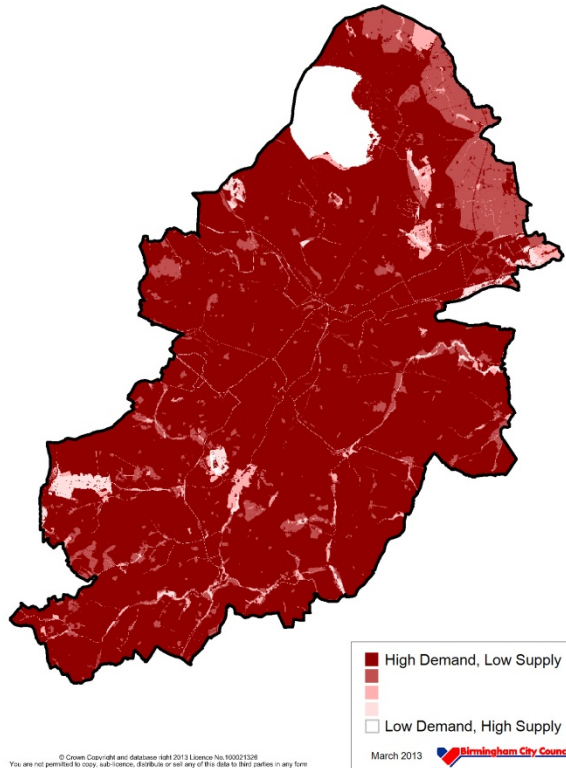
Planning

Transport & Infrastructure

Principle	Outcome
An Adapted City	Retain City’s top ranking for adaptation
	<ul style="list-style-type: none"> <li>•Ensure all future growth is adapted</li> <li>•Trees for cooling and thermal insulation</li> <li>•Green roofs, walls and street canyon research</li> </ul>
The City’s Blue Network	Adopt water sensitive urban design
	<ul style="list-style-type: none"> <li>•Integrated SuDS, flood and water management solutions</li> <li>•Blueprint for enhance walking and cycling offer</li> <li>•Blue Corridor/ network policy with Canal Rivers Trust</li> </ul>
A Healthy City	Adopt Natural Health Improvement Zones (NHIZ)
	<ul style="list-style-type: none"> <li>•Integrate the delivery of health and green living spaces</li> <li>•Continue to extend the ‘Be Active’ offer</li> <li>•Public Health as key partners in Planning</li> </ul>
The City’s Productive Landscapes	Embrace urban forestry and urban food growing
	<ul style="list-style-type: none"> <li>•Continue to promote allotments</li> <li>•Facilitate community food growing and orchards</li> <li>•Promote the multiple benefits of urban forestry</li> </ul>
The City’s Greenways	Change gear- to a walking and cycling City
	<ul style="list-style-type: none"> <li>•Create walkable/ cyclable neighbourhoods</li> <li>•Citywide signed routes linked to public transport</li> <li>•Link healthcare activities and prevention programmes</li> </ul>
The City’s Ecosystem	Birmingham as a Biophilic City
	<ul style="list-style-type: none"> <li>• City to adopt an ecosystem services approach</li> <li>•Partners to lead on District Nature Improvement Area plans</li> <li>•Birmingham to join global Biophilic Cities Network</li> </ul>
The City’s Green Living Spaces	Birmingham an international City of Green Living Spaces
	<ul style="list-style-type: none"> <li>•Adopt the 7 principles across Planning Framework</li> <li>•Green Infrastructure and Adaptation Delivery Group</li> </ul>

# Birmingham – Smart Adapting Cities

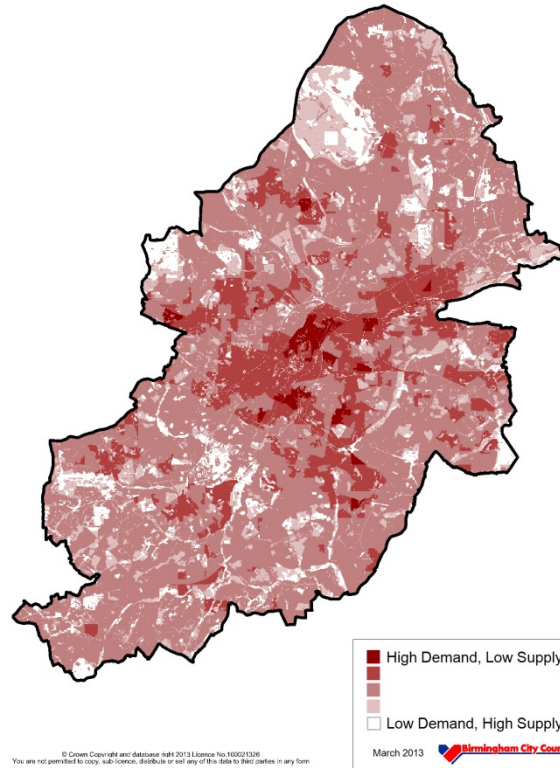
Biodiversity Services Supply and Demand map



•Biodiversity

•Education

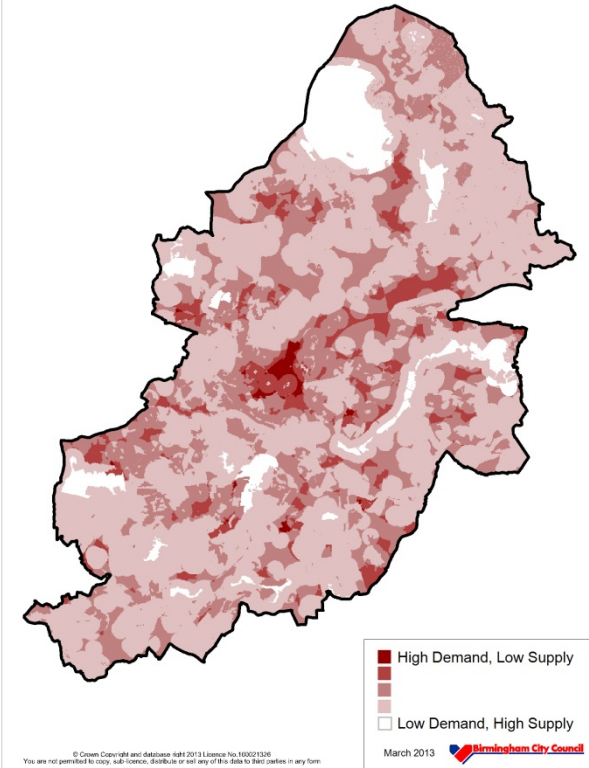
Local Climate Services Supply and Demand map



\* Local Climate

\* Aesthetics & mobility

Recreation Services Supply and Demand map



\* Recreation

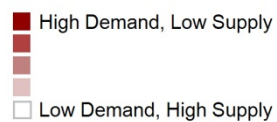
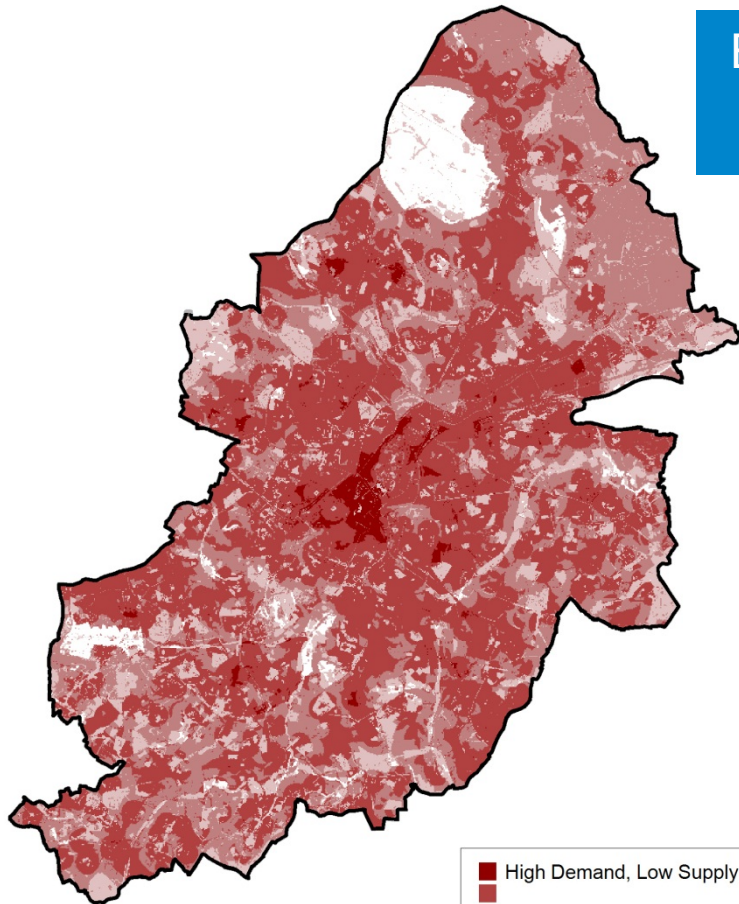
\* Flood risk



# Birmingham – Smart Adapting Cities

The Multi-layered Challenge map for Birmingham

Birmingham –  
a global first

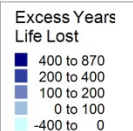
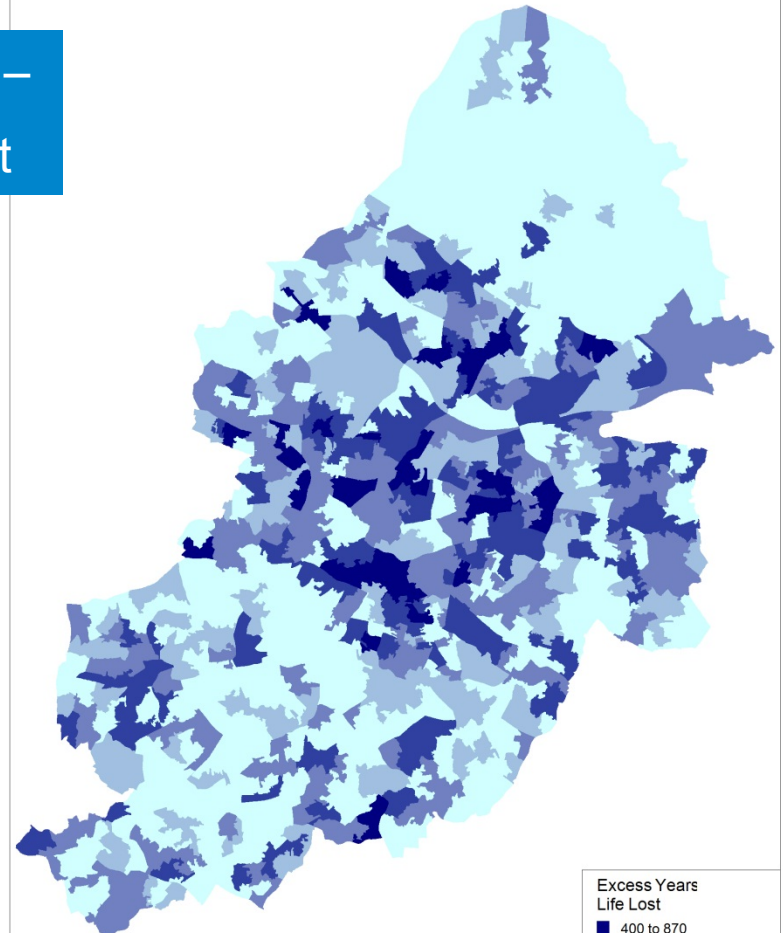


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March 2013



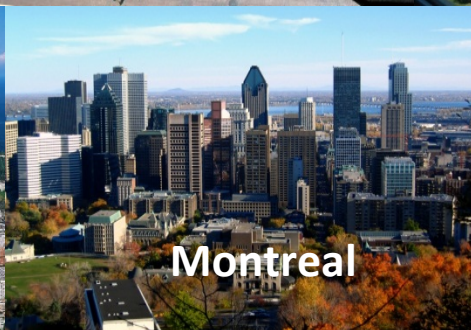
Excess Years Life Lost at LSOA





# Birmingham: The UK's First Biophilic City

**BiophilicCities** - Cities that achieve a deep affinity with nature





# Birmingham – Smart Adapting Cities

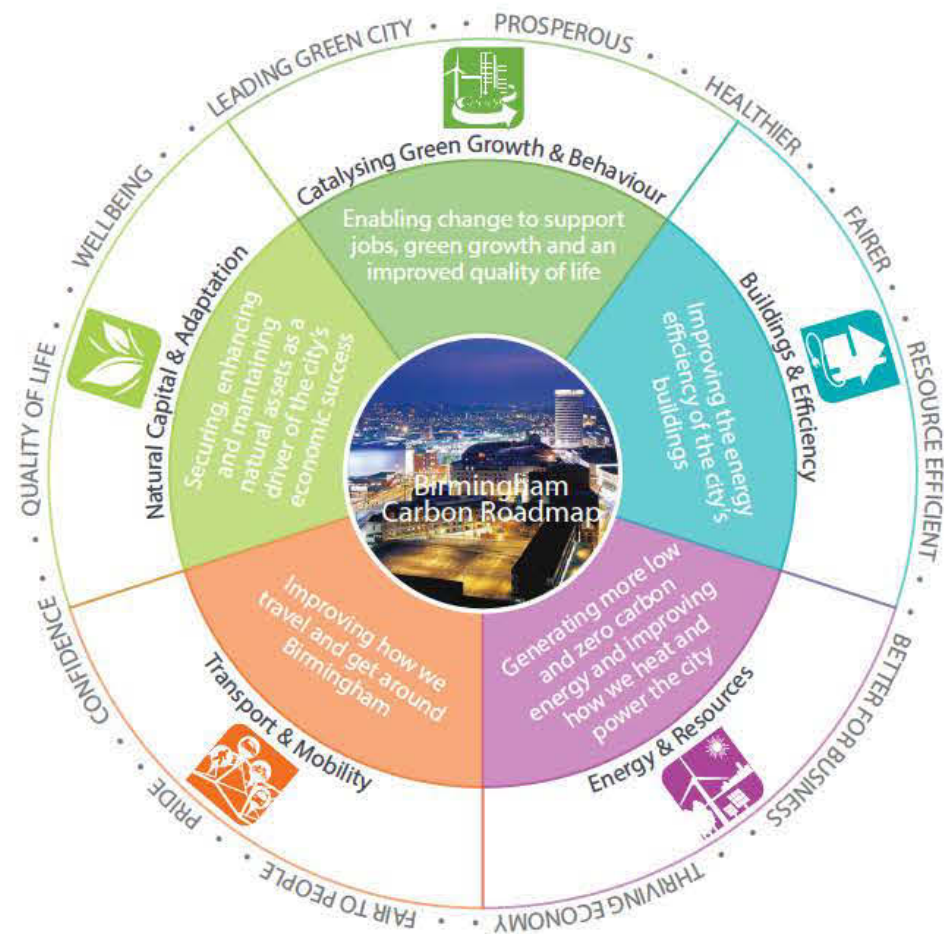


## BIRMINGHAM'S GREEN COMMISSION CARBON ROADMAP

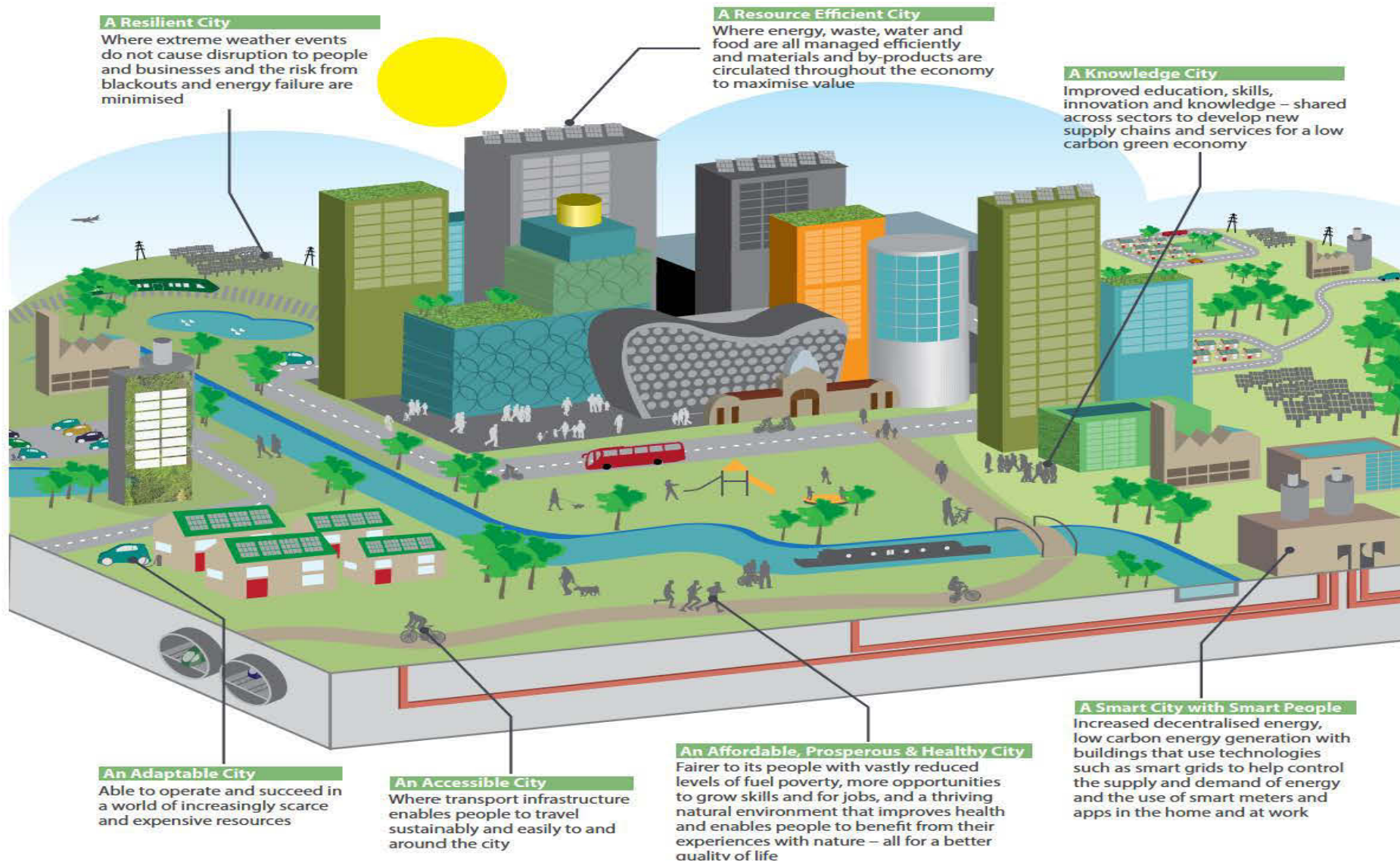
LEADING GREEN CITY  
BETTER FOR BUSINESS  
PROSPEROUS, HEALTHIER, FAIRER



November 2013



# Birmingham – UK Urban Demonstrator



# Birmingham – Smart Adapting Cities

[www.birminghamclimate.com](http://www.birminghamclimate.com)

[http://www.birminghamclimate.com/ie\\_index2.html](http://www.birminghamclimate.com/ie_index2.html)

[http://www.local.gov.uk/health/-/journal\\_content/56/10180/3510483/ARTICLE](http://www.local.gov.uk/health/-/journal_content/56/10180/3510483/ARTICLE)

<http://greencity.birmingham.gov.uk/>

<http://www.birmingham.gov.uk/greencommission>

<http://www.birmingham.gov.uk/greenlivingspaces>

<http://liveablecities.org.uk/>

<http://www.theguardian.com/cities/2014/apr/03/birmingham-san-francisco-oslo-global-green-biophilic-cities-club>

<http://biophiliccities.org/>

<http://www.landscapeinstitute.co.uk/PDF/Contribute/>

[PublicHealthandLandscape\\_CreatingHealthyPlaces\\_FINAL.pdf](#)

[PublicHealthandLandscape\\_CreatingHealthyPlaces\\_FINAL.pdf](#)



THE UNIVERSITY  
OF BIRMINGHAM



Business Council for  
Sustainable Development  
United Kingdom





# Case Study: Newcastle City Council





# About the City

- Population of 282,000
- Climate change and severe weather presenting increasing risks – mainly from more extreme rainfall
- Reducing revenue spend from £270m to £170m by 2016 – this will continue to fall
- Economic impacts of Climate Change for NE identified 7:1 cost benefit ratio for acting
- Work programme on adaptation set out – mainly our own activities/operations, but a city element too

- Insert pics from 28<sup>th</sup> June, and Newcastle Uni research story

# Flooding impacts – 28<sup>th</sup> June 2012

- **Domestic Properties** - 1,200 flooded, including 500 flooded internally;
- **Businesses** - Damage to premises, and loss of profits from inability to fulfil orders;
- **Highways** - £9.2m damage, disruption across the network, and knock-on effects on the availability and frequency of bus services;
- **Metro** - Widespread disruption, including a landslide onto the tracks, closed stations, and services cancelled or delayed;
- **Railways** - Closure of East Coast Mainline due to a landslip; delays on local rail networks;
- **Electricity** - lost to 23,000 homes across the North due to lightning;
- **Tourism** - Closure of the Hoppings funfair, compounding three days' closure because of torrential downpours
- **Council Operations** – Closed and damaged buildings, including nurseries, schools, colleges, warehouses and Customer Service Centres;

# BlueGreenCities



- Bringing together a number of different work packages – people's behaviours, sediment modelling, flood forecasting, to test policy options for addressing flood risk using green/blue infrastructure
- Newcastle being used as demonstration city
- Economic valuation of multiple benefits of Blue/Green states – e.g. air quality, flood risk

# Weather network

- Deploying sensors to lampposts across the City
- Linked to weather stations in Schools and other weather feeds (e.g. Twitter)
- Will create a local dataset to inform better modelling on exposure, and on forecasting.
- Also serve to correlate impacts and local data/thresholds





# iBuild

# Adapting Newcastle

- [LEANNE'S QUESTION

# Heat vulnerability assessment

- Downscaling

# CAFCAS (Climate Adaptation Financing for Coastal Areas)

- De-risking private investment in resilient infrastructure
- Generating investment summaries and testing viability with private finance (sovereign wealth, private equity) to remove barriers
- Newcastle considering highways infrastructure
- Also low carbon and equality angle too



# Civic Retrofit

- Building in adaptation into £17m low carbon office accommodation retrofit
- A 'moment of change' that we seized upon
- Employing data from PROMETHEUS, and route first trodden by 'Design for Future Climate'
- Using future DSY to evaluate options for addressing overheating using low-carbon solutions, and quantify costs