Tyndall°Centre™
for Climate Change Research

# How can cities grow whilst reducing emissions and vulnerability?

Comparative Genetics of Cities, 21st May 2010

***Richard Dawson***
***EPSRC Research Fellow***

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# Sustainable urban transformations

*Transformation of urban systems will require:*

- **Much improved understanding of the mechanisms of interaction in urban function, via:**
  - Land use
  - Transport
  - Resource flows (energy, water, nutrients)
  - Building form and function
  - Urban climate
  - Information networks

- **Recognition of the time scales of change and the legacy of past decisions (planning, infrastructure, buildings)**

- **Development of collective understanding of urban function and collaborative platforms for exploration of transition strategies**

- **Motivation and leadership**

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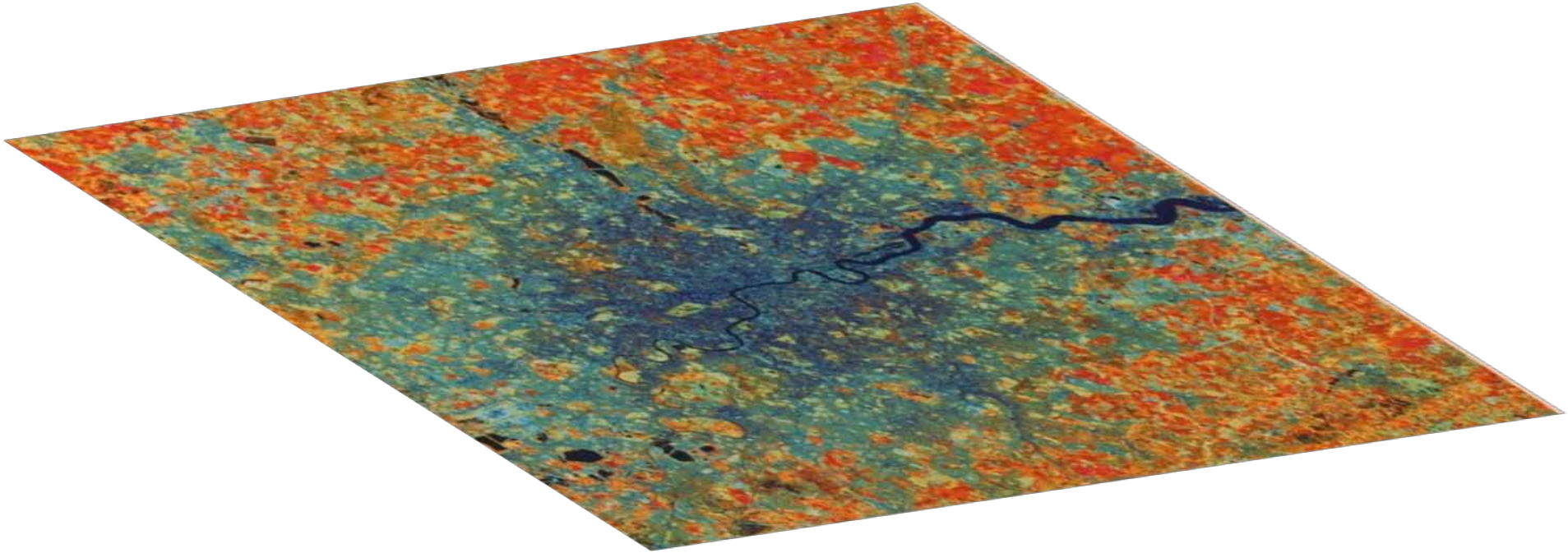
**Urban Integrated Assessment Facility**



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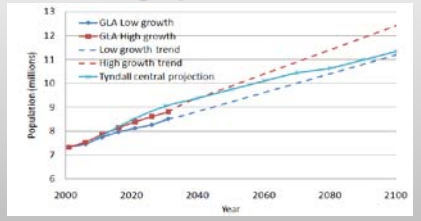
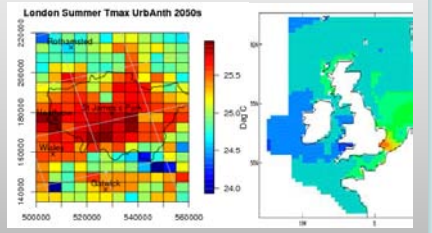
**Urban Integrated Assessment Facility**

## Demographic scenarios

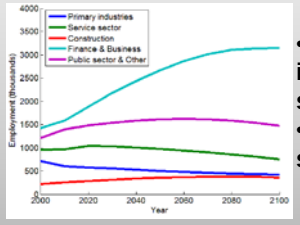



## City-scale climate scenarios

- Temperature
- Precipitation
- Sea level rise
- Storm surge

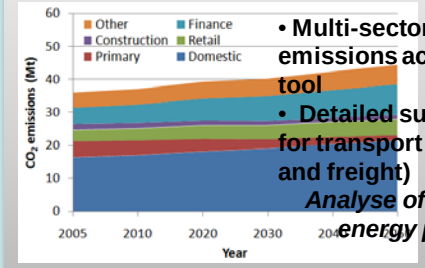



## MDM-E3 Multi-sector city-scale economics module




- Dynamic resource interactions between sectors
- Specialist energy sector module

## Greenhouse gas emissions assessment module



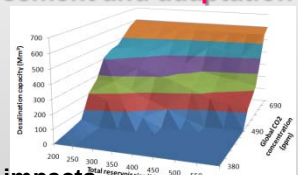

- Multi-sectoral emissions accounting tool
- Detailed sub-modules for transport (personal and freight)

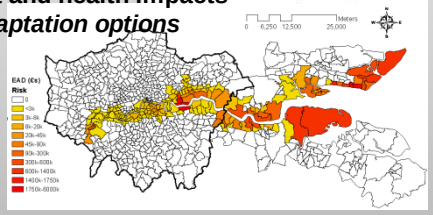
*Analyse of city-scale energy policies*

## Climate impacts assessment and adaptation planning

Analyse risks of
- Flooding
- Drought
- Urban heat and health impacts

*Test adaptation options*





## Interface for testing of policy options

Working with key London stakeholders

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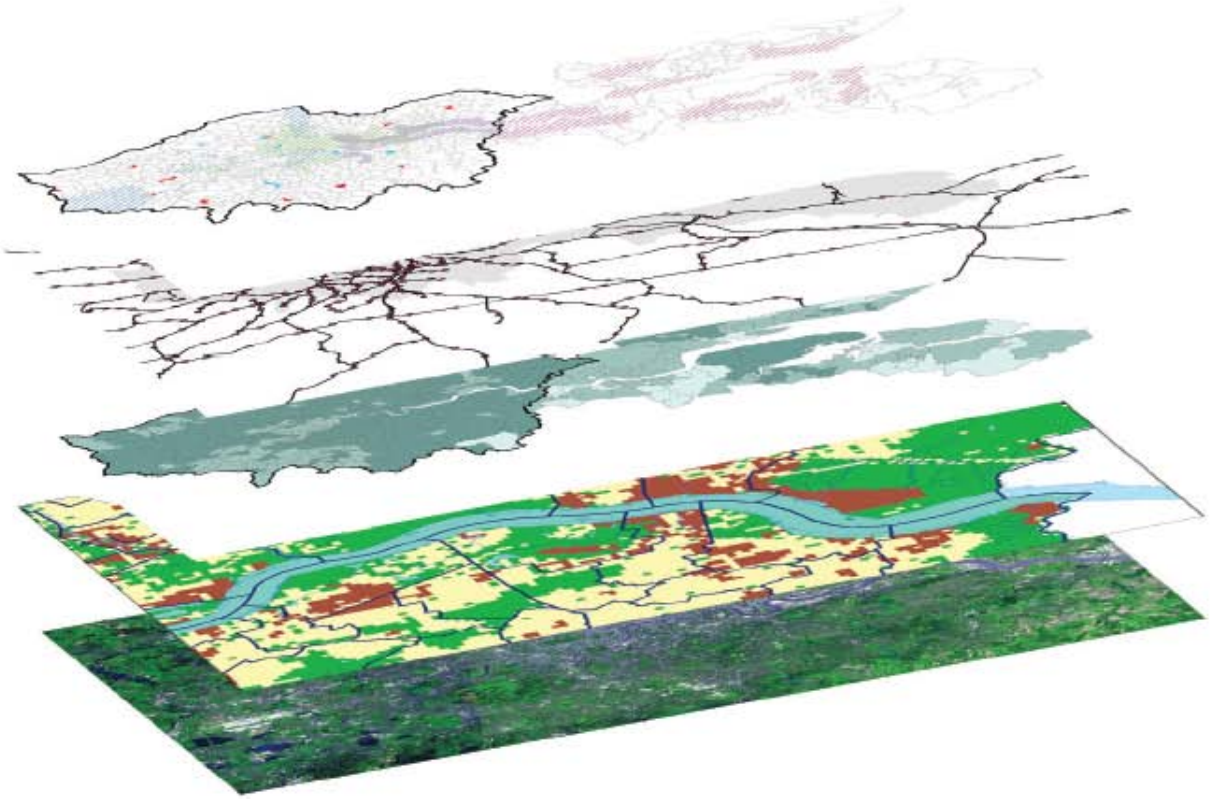
# Land use and transport



Planning policy:
Attractors, constraints etc

Transport network and generalised cost of travel

Spatial allocation of population and employment

High resolution downscaling of development

The real world

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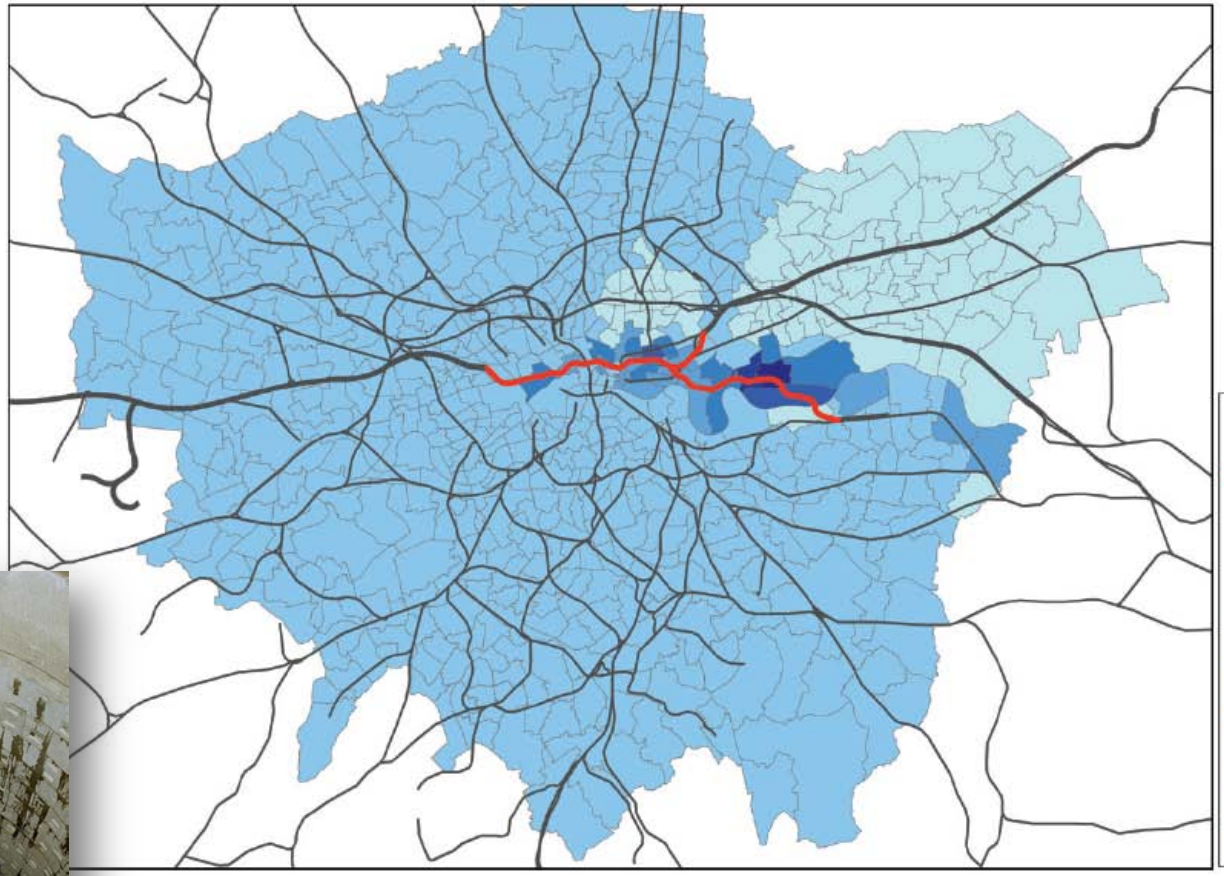
# Transport infrastructure investment






*Reduction in travel times from Heathrow to all other census wards within the GLA boundary by rail after the construction of CrossRail.*

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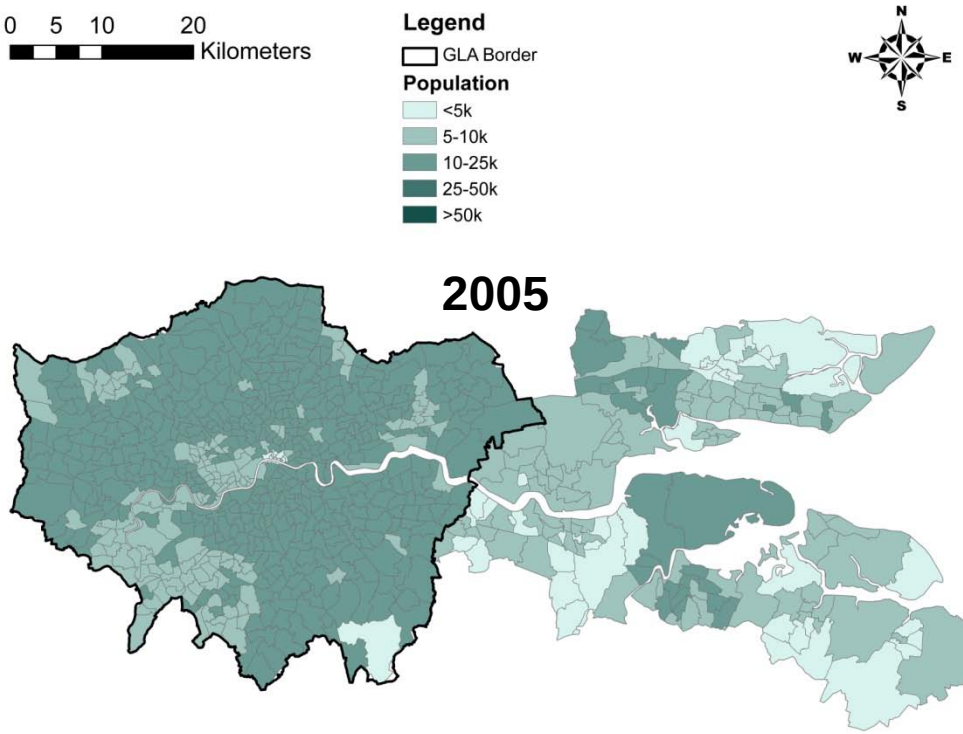
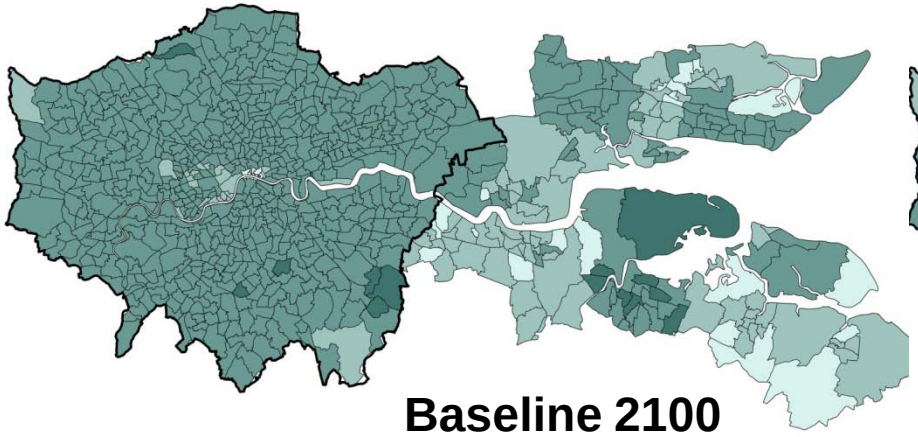
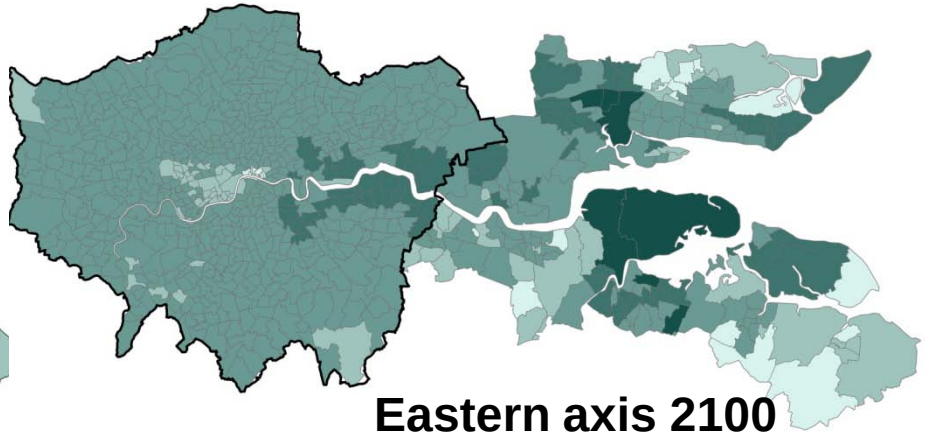
# Land use futures 2100



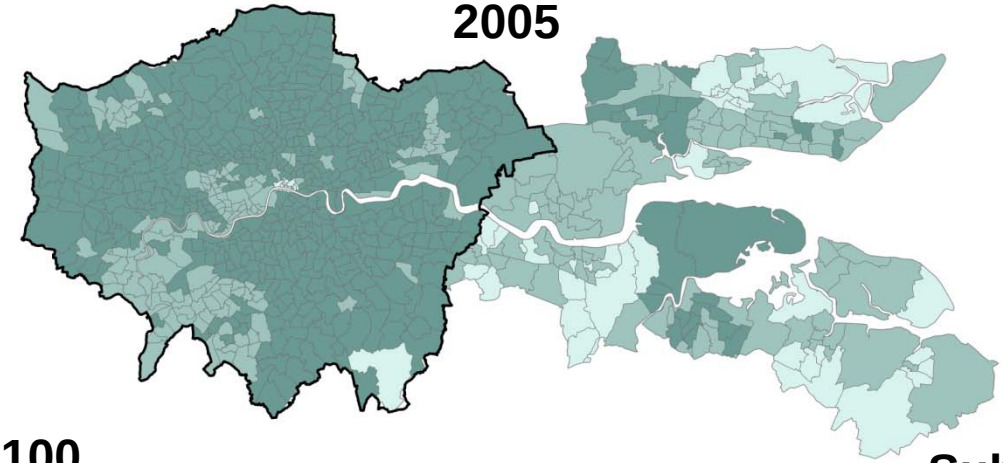


Baseline 2100

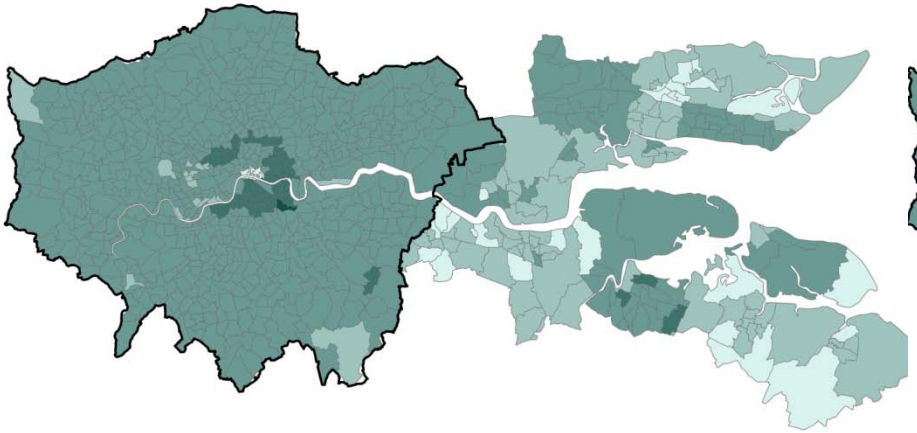


Eastern axis 2100

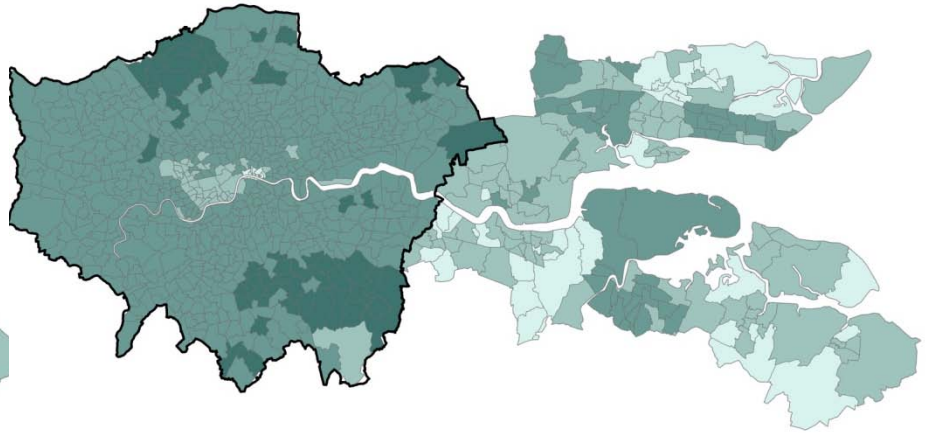
2005



Centralisation 2100



Sub-urbanisation 2100



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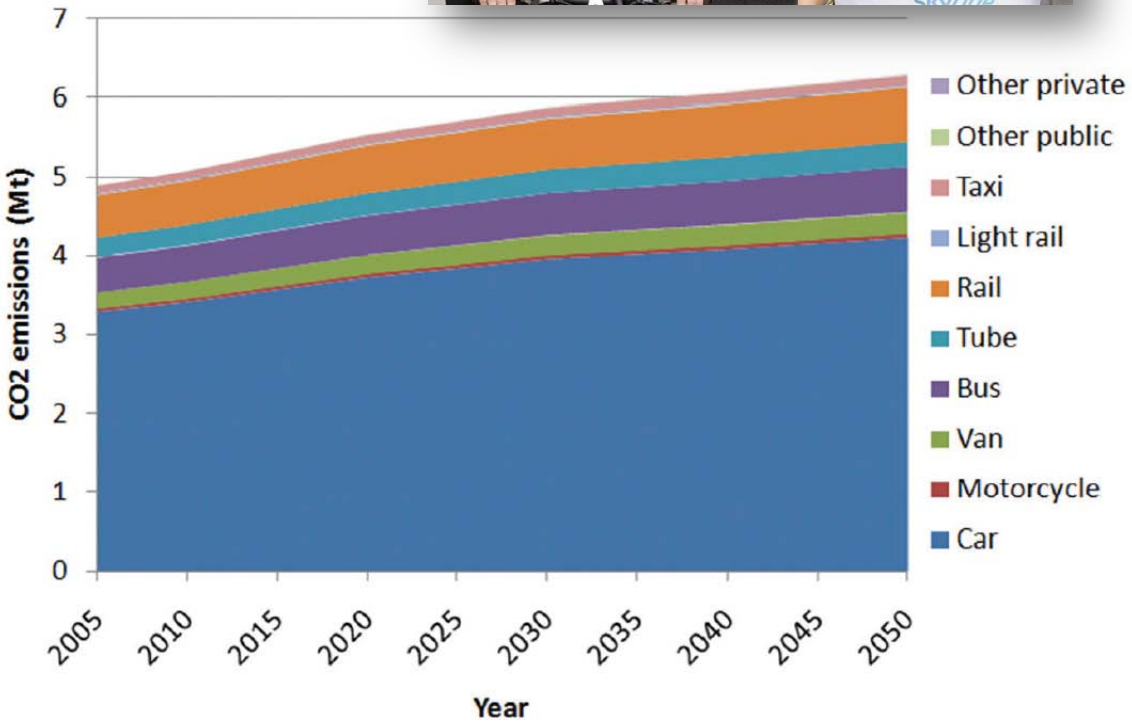
# Emissions from personal transport


## Analysed options for emissions reduction:

- ***Option 1: Implementation of the London Mayor's Climate Change Action Plan***: ~12% reduction by 2025 (relative to base line)
- ***Option 2: Additional savings from potential technological advances:*** ~23% reduction by 2025
- ***Option 3: Technological advances and increased demand for zero carbon modes of transport incentivised by carbon trading:*** ~25% reduction by 2025
- ***Option 4: Substantial modal shift to walking and cycling, supported by appropriate changes to London's transport infrastructure***:

BUT can achieve >80% reduction by 2050!!!

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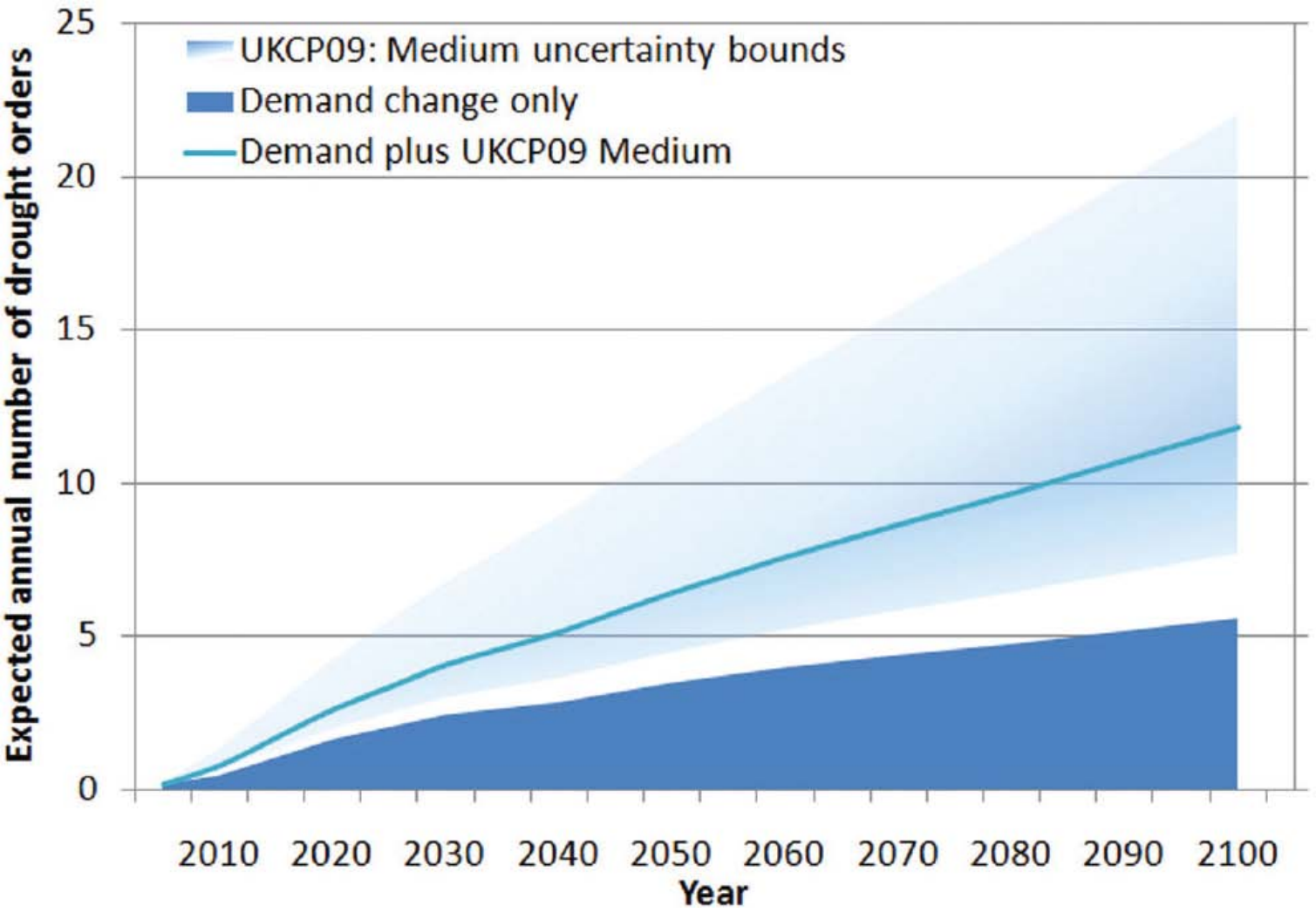
# Water scarcity



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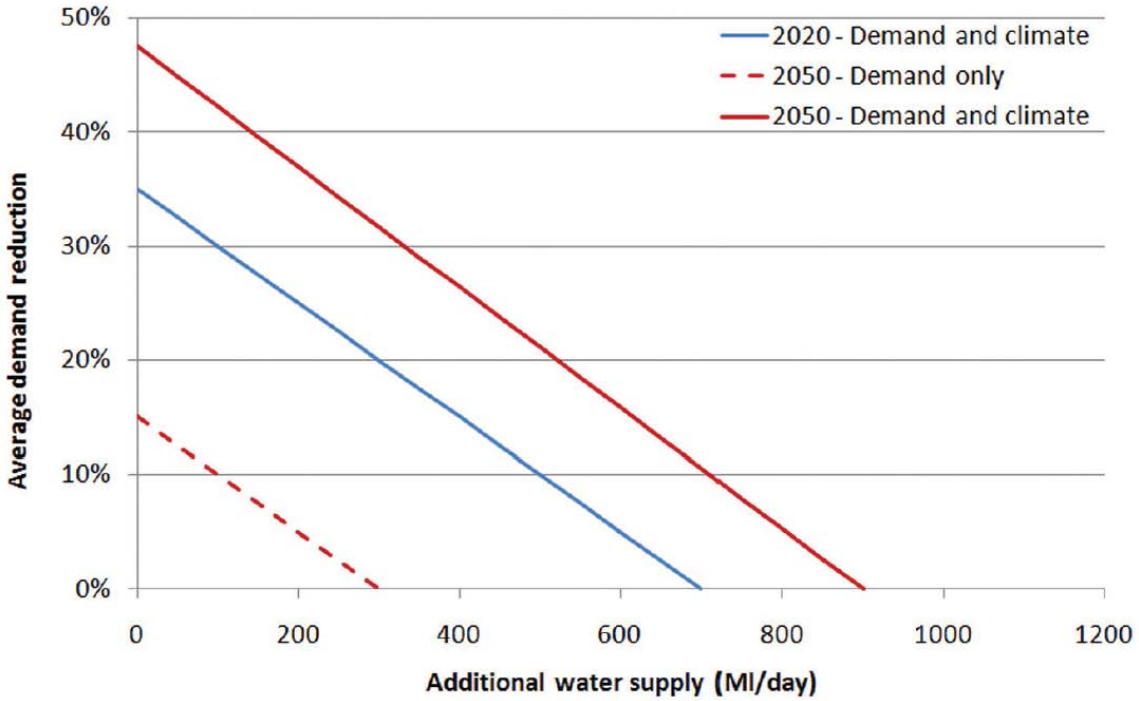
# Trade-offs in water management

## Demand v supply



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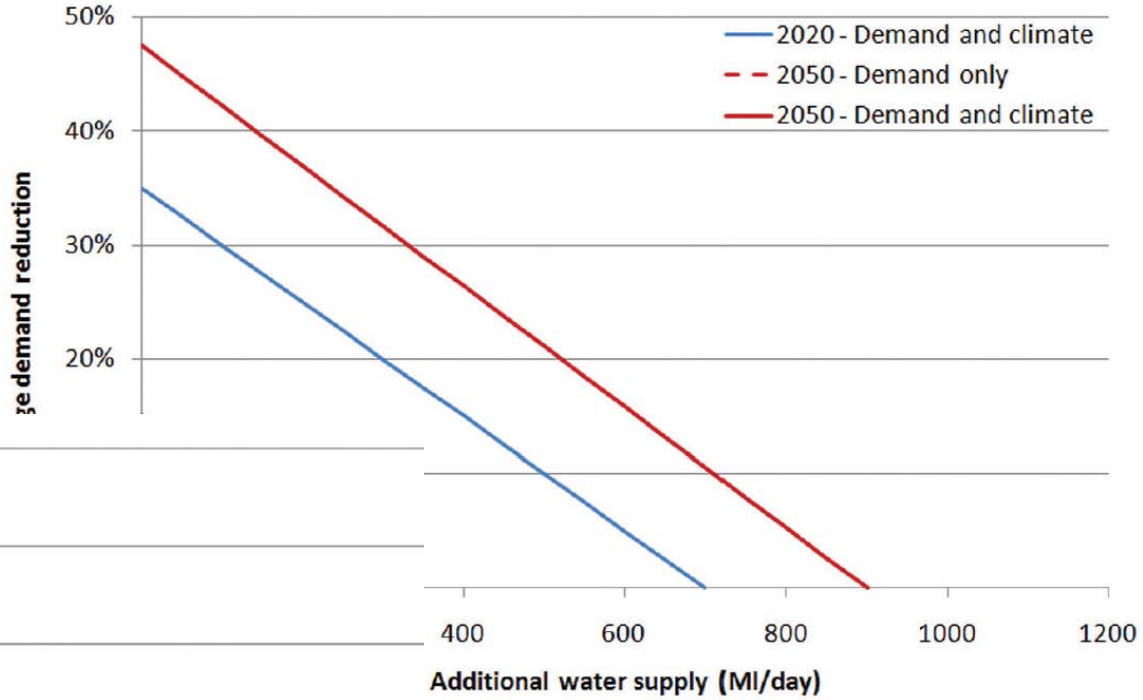


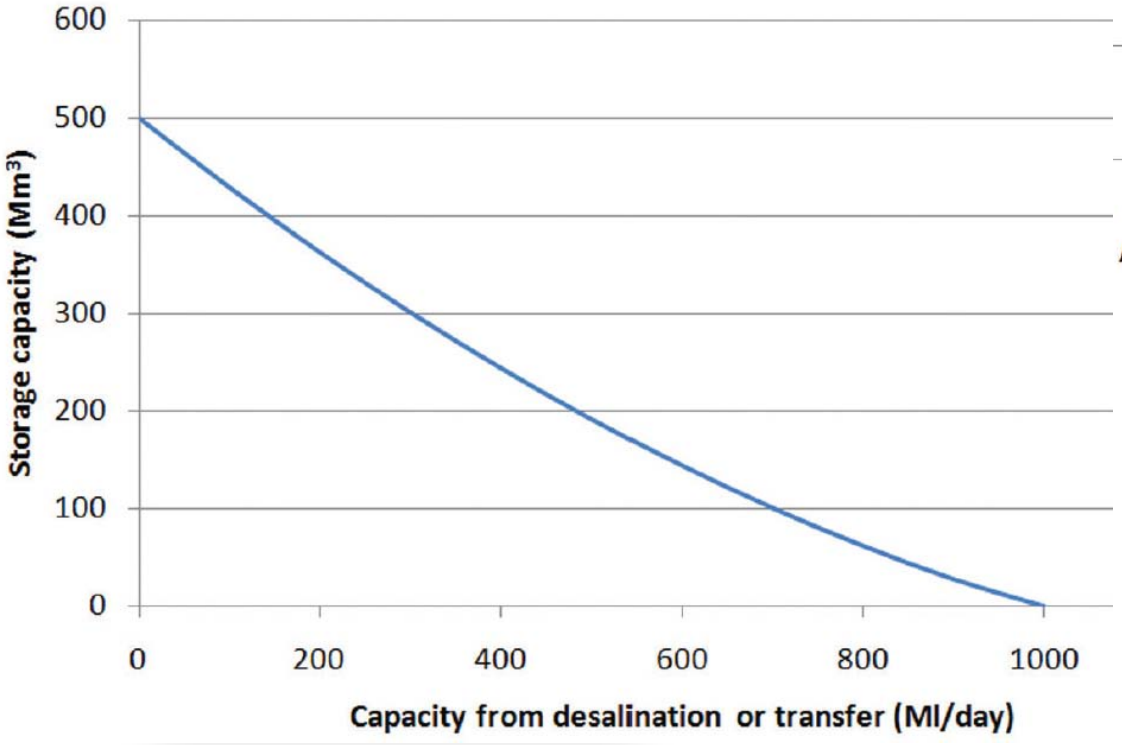


## Storage v new resources

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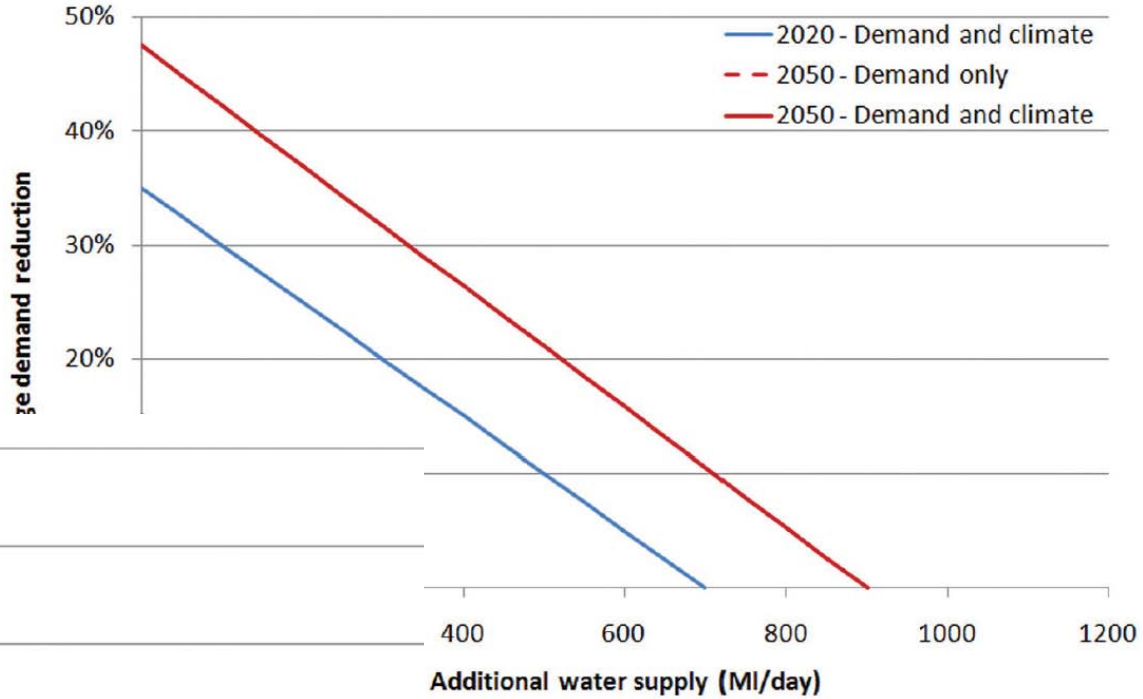
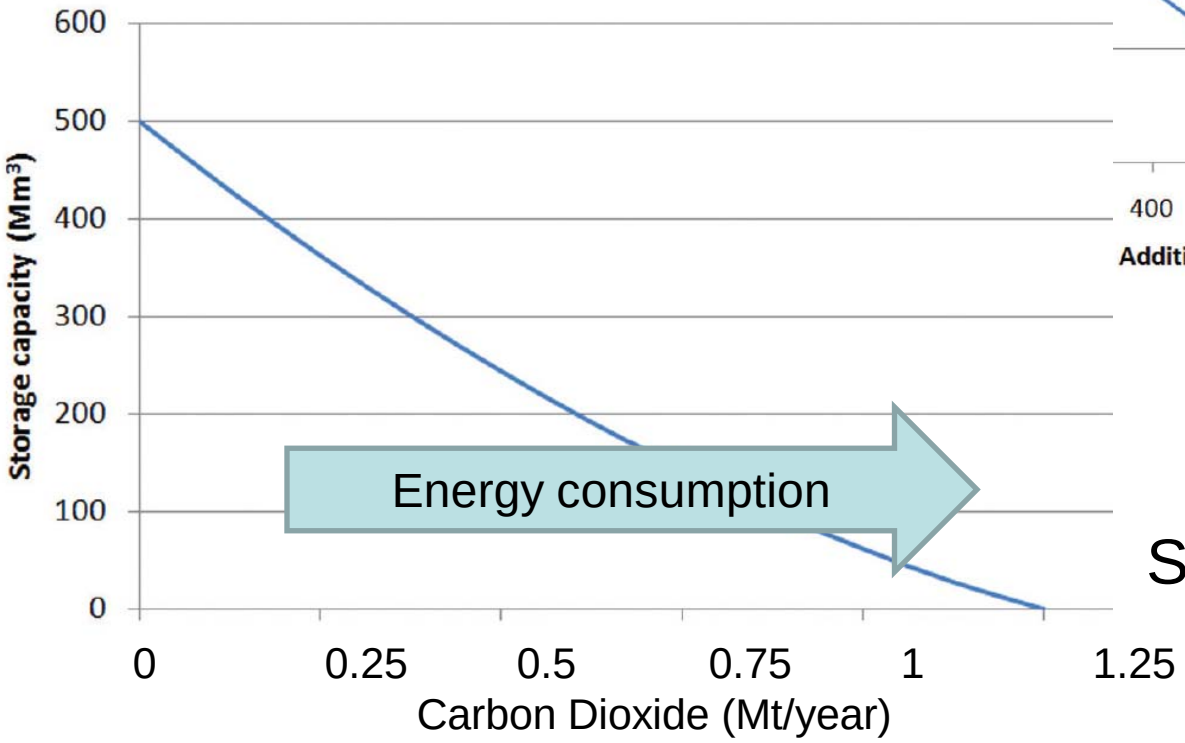
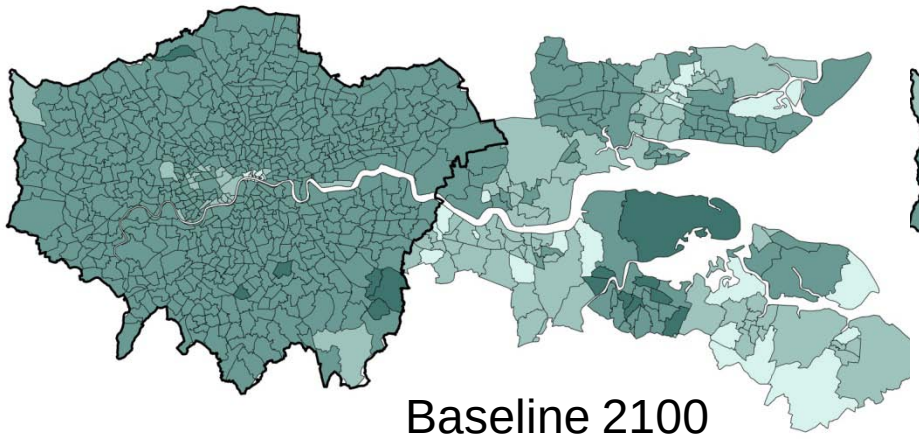
# Trade-offs in water management

## Demand v supply

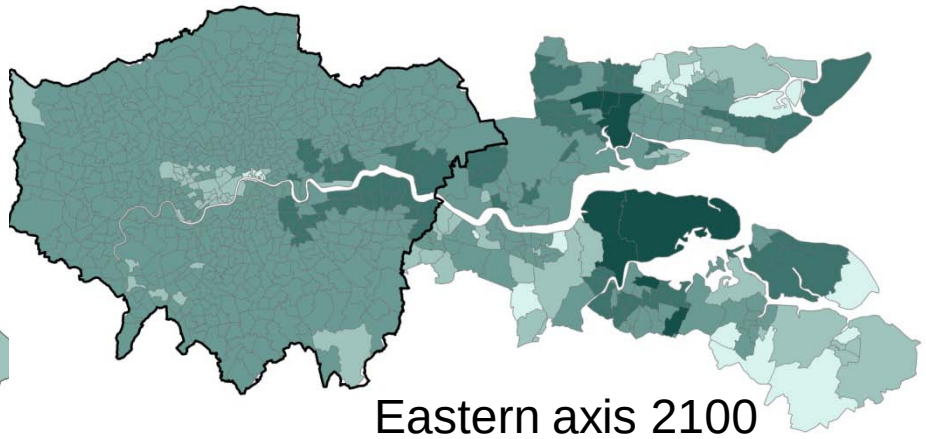


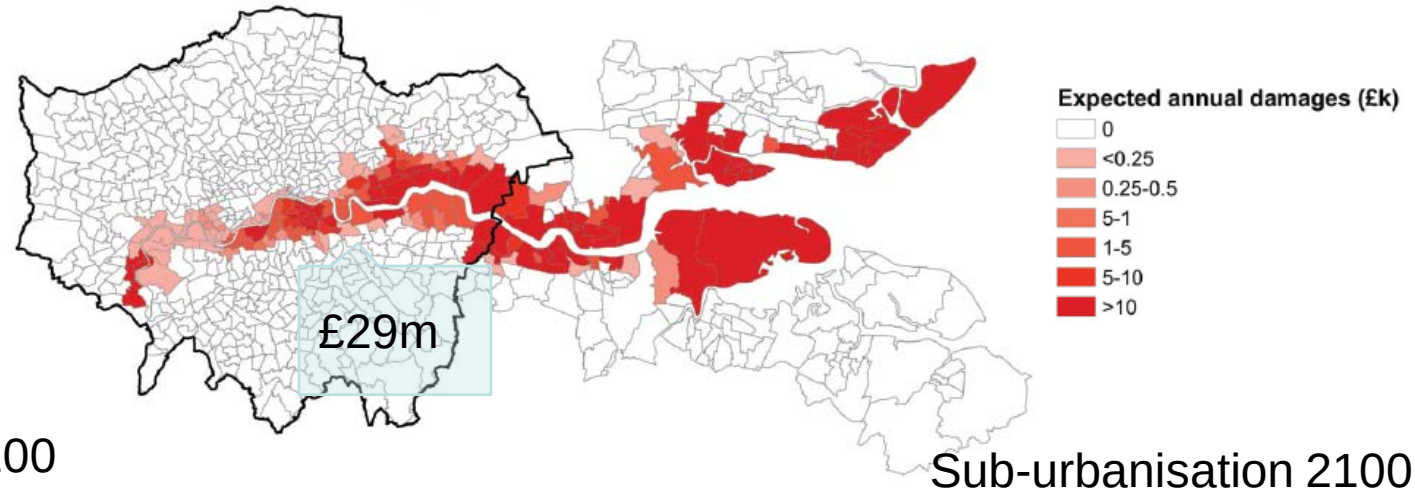

## Storage v new resources



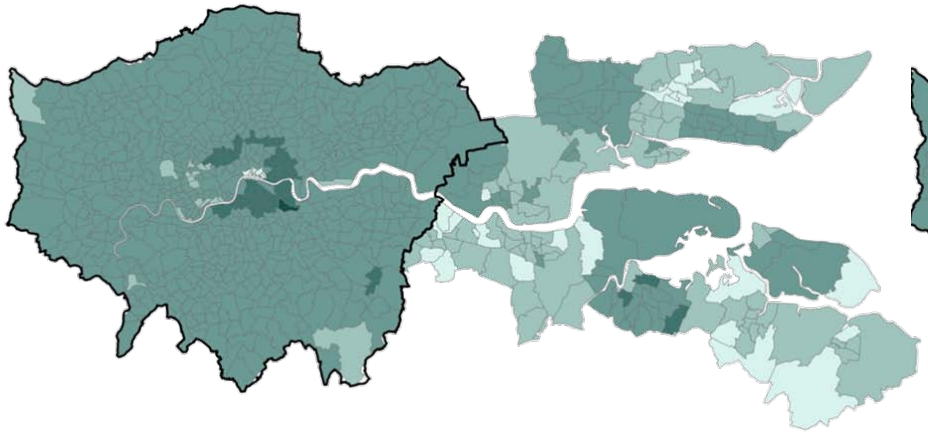
Baseline 2100



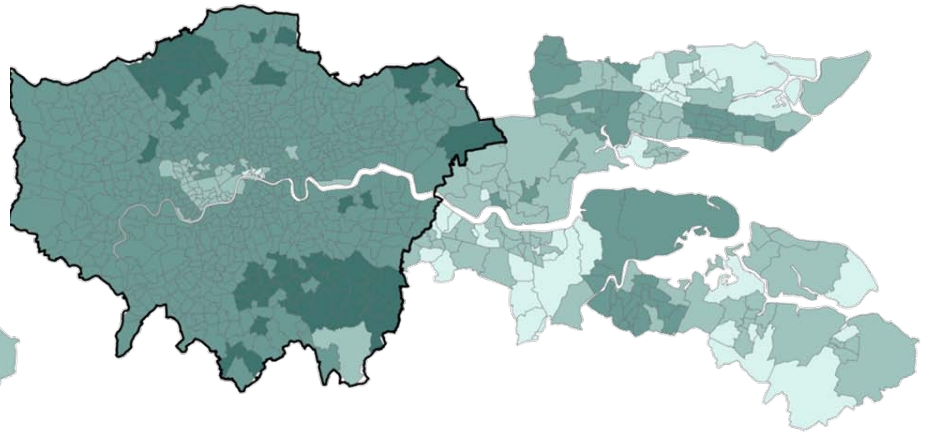
Eastern axis 2100

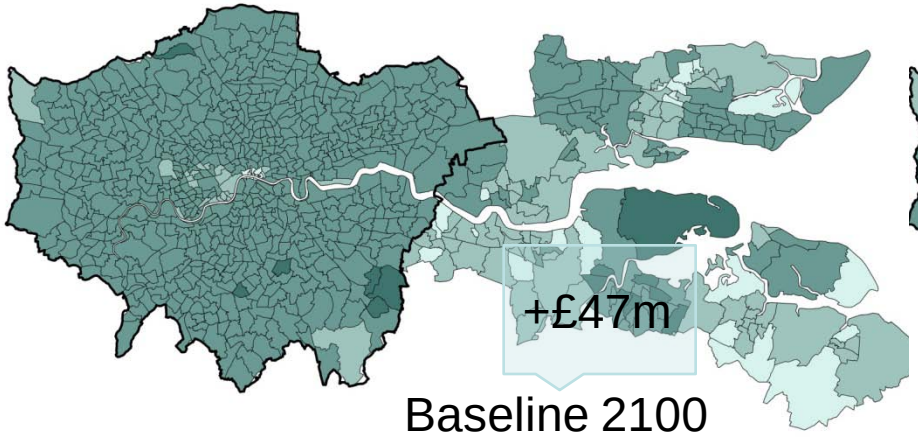



Centralisation 2100



Sub-urbanisation 2100



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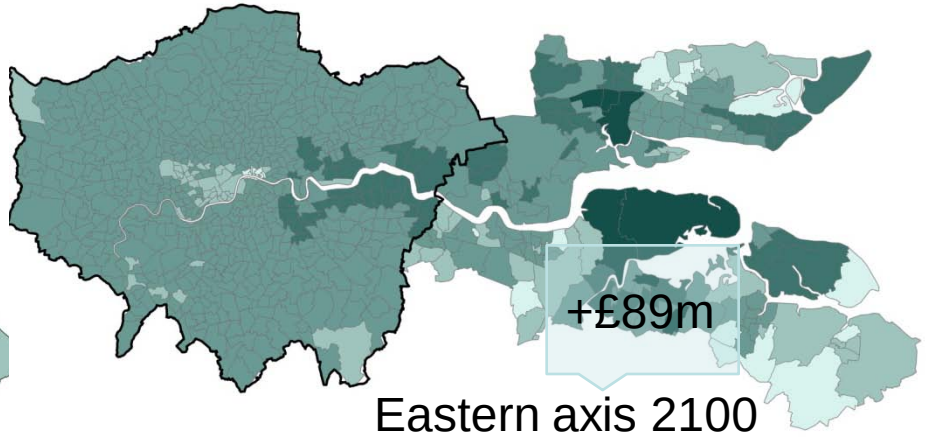
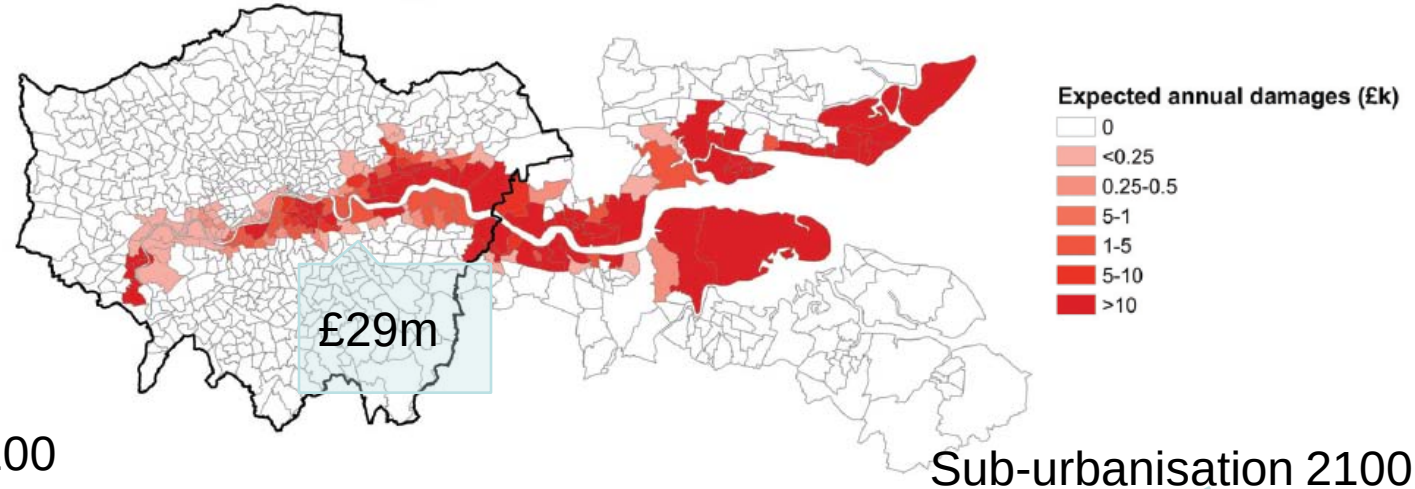
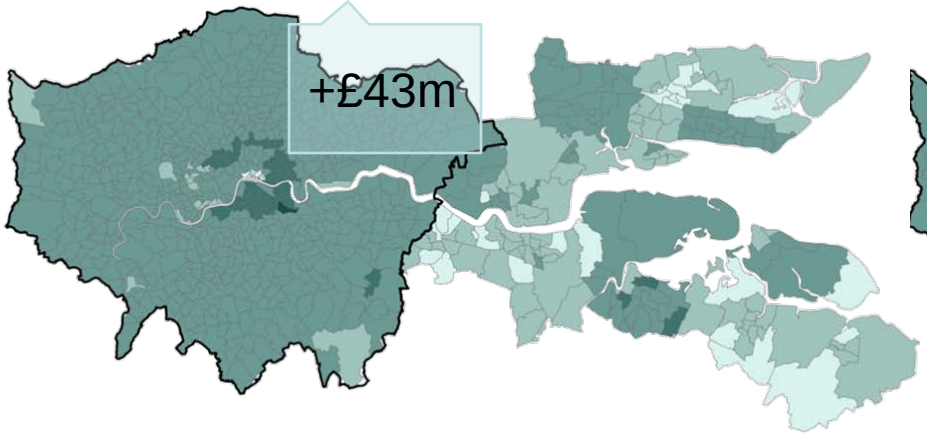



Eastern axis 2100




Centralisation 2100

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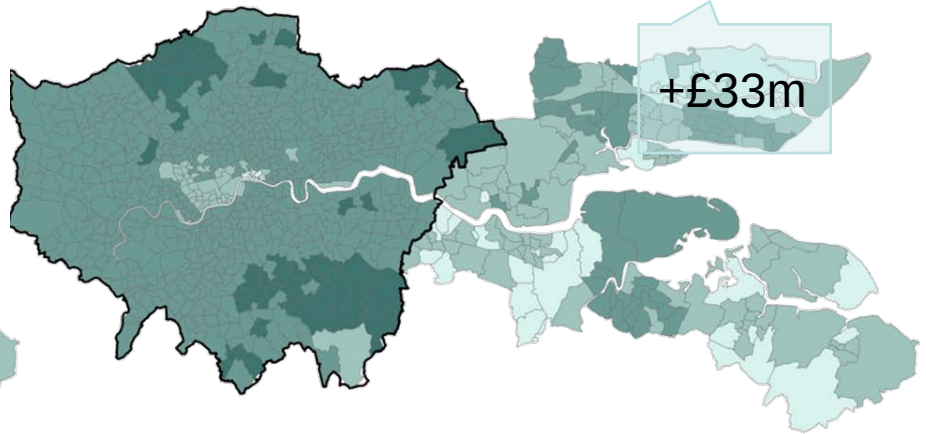

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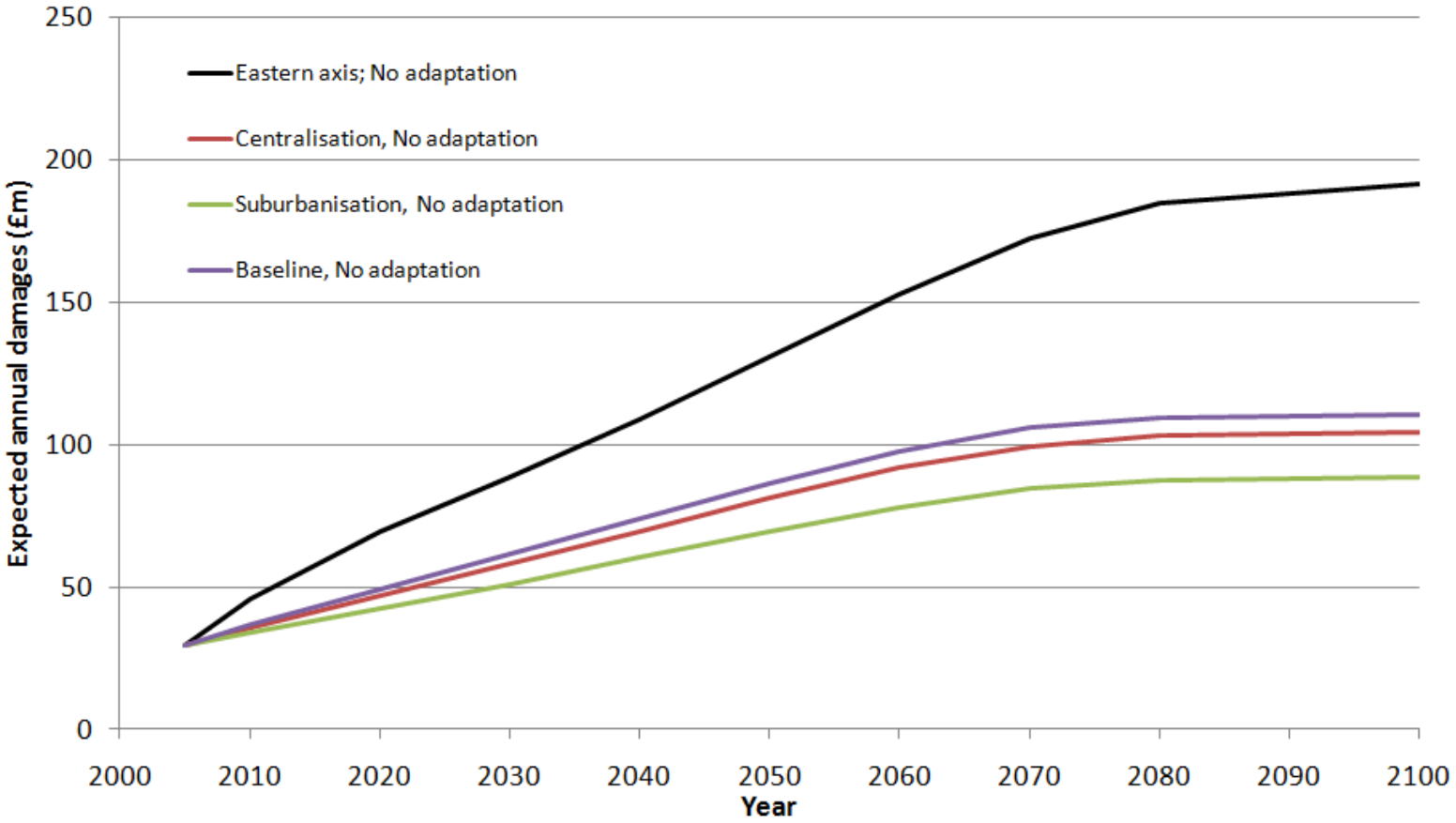
# Flood risk in the tidal Thames



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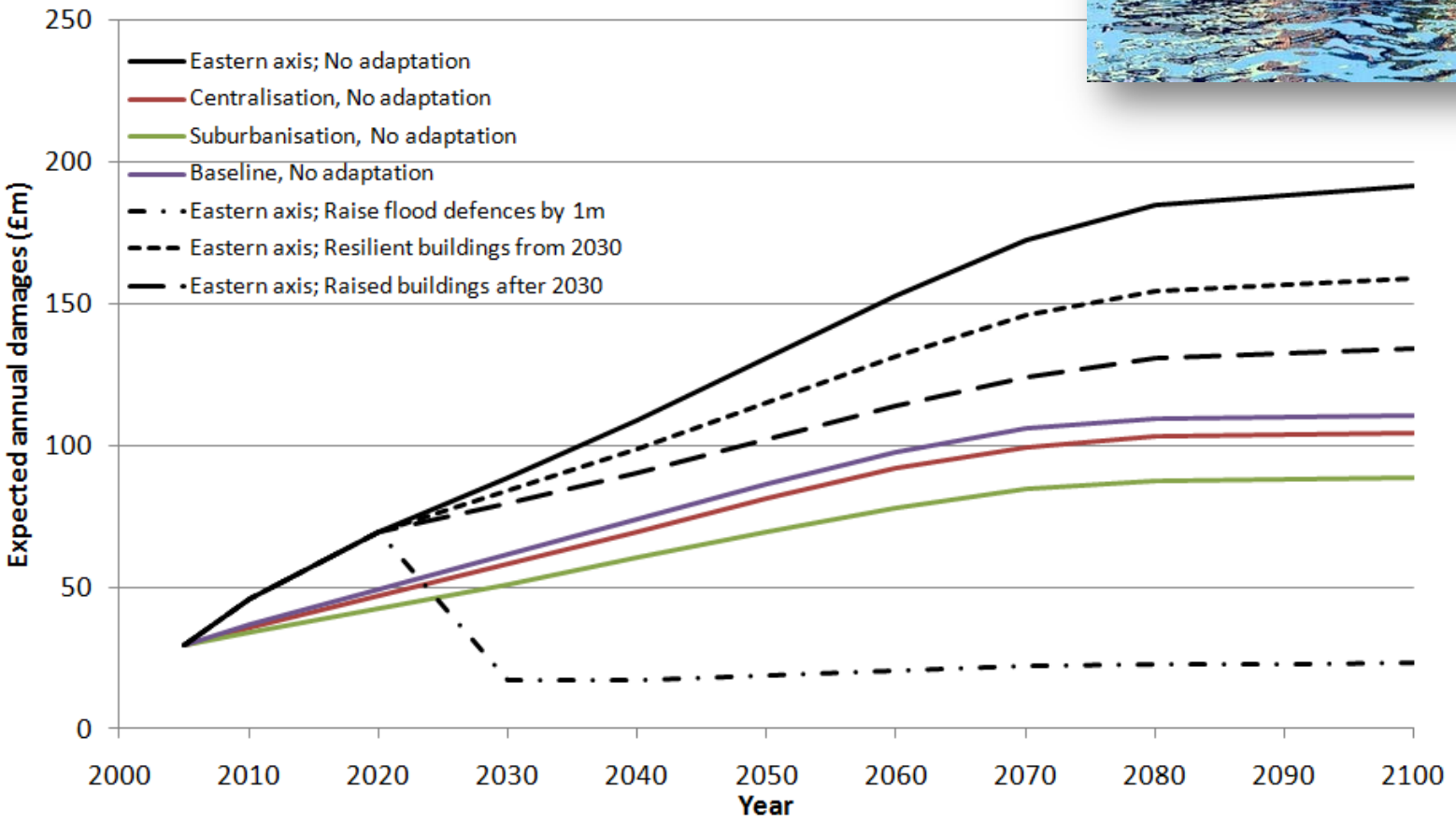

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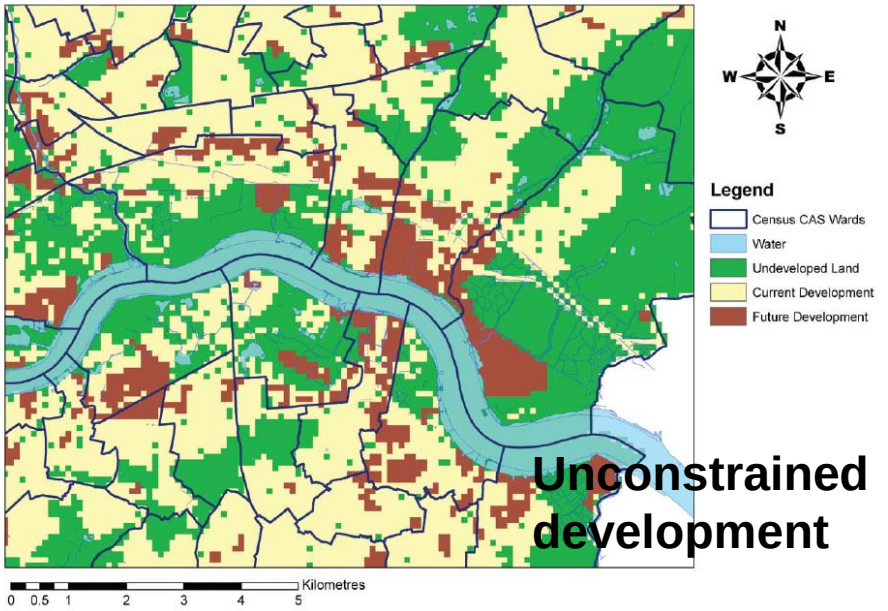
# Adaptation to reduce risk




**Unconstrained development**

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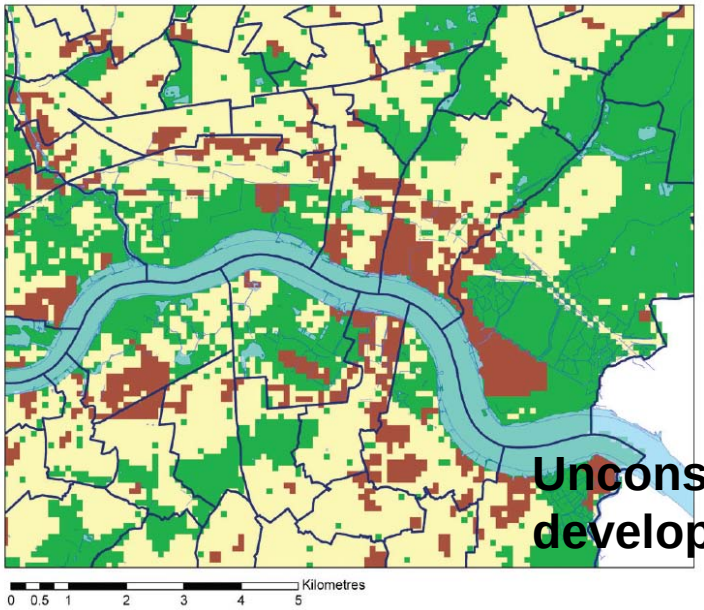
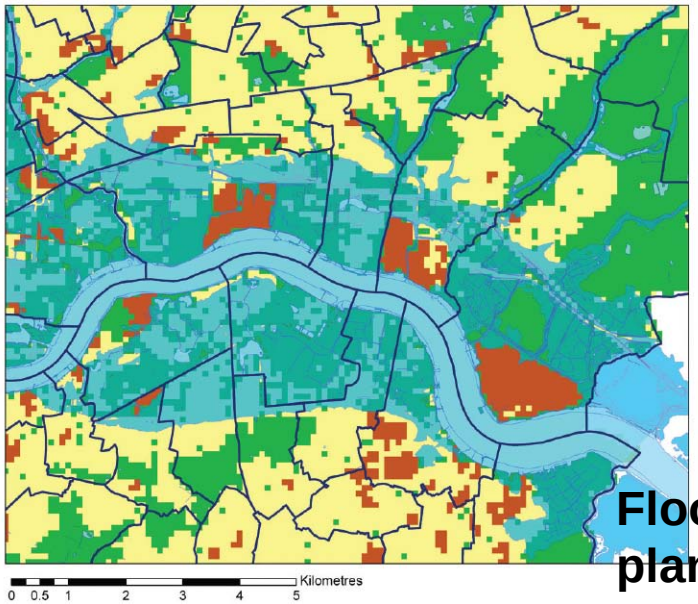
# Adaptation to reduce risk




**Unconstrained development**




**Floodplain planning**

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# Some final thoughts

- By virtue of their population density cities are a focused opportunity to reduce vulnerability and emissions
- Engineers and planners are aware of the challenge *but* often lack necessary tools
- Innovative approaches to adaptation and mitigation can be developed by evidence-based *integrated assessment* of urban systems
- So.... can cities grow whilst reducing emissions and vulnerability to climate impacts?
  - Local government action insufficient, but important: centres of innovations and local level is where many issues best addressed
  - Today's decisions will alter our vulnerability and emissions for years to come: we must be wary of 'lock-in'
  - No magic bullet - a portfolio of measures is required
  - Socio-economic vs. climate change
  - Demand reduction vs. supply increase
  - Tradeoffs between mitigation, adaptation, living density etc.
  - Substantial infrastructure change may be required and this takes time
  - Spatial planning plays a central role in mediating vulnerability and emissions

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## Advisory Panel

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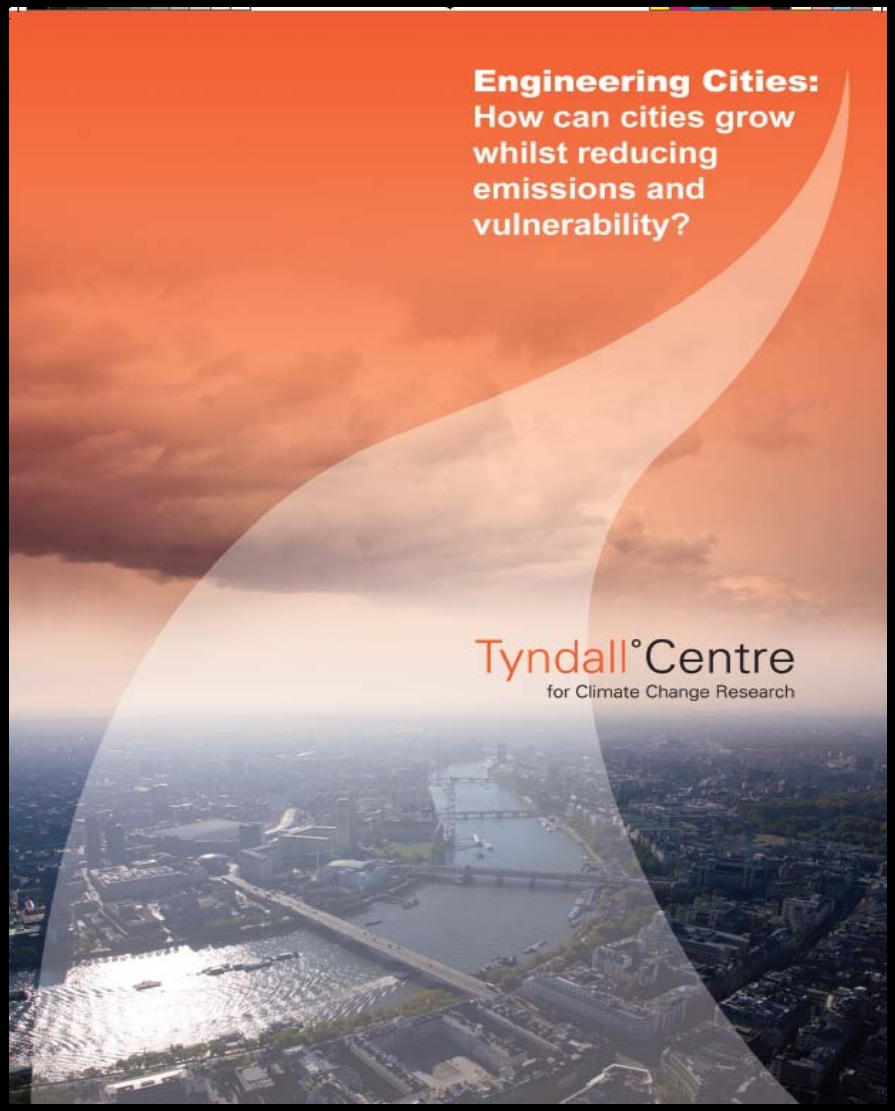


*"We have come to recognise how integrated modelling of the type delivered by the Tyndall Centre Cities programme can help to bring different stakeholders together to develop common understanding of processes and consequences of long term change.*

*That collective understanding is essential if we are to manage change rather than become its victims."*

Alex Nickson,
Strategy manager: climate change adaptation and water,
Greater London Authority

**http://www.ncl.ac.uk/ceser/downloads/2009/tyndallcitiesreport.pdf**