Towards a Sustainable Urban Environment (SUE)

Examining the role of the East London Green Grid in improving air quality

PUrE launch event 24th June 2009

Impact of PM10 pollution

- PM10 originates from road traffic, industry and power production
- Elevated PM10 concentrations are linked to adverse health impacts
- Adverse health impacts have led to introduction of air quality standards
- Health costs from PM10 pollution in the UK of £9.1 to 21.4 billion
- Vegetation establishment is one measure for reducing PM10

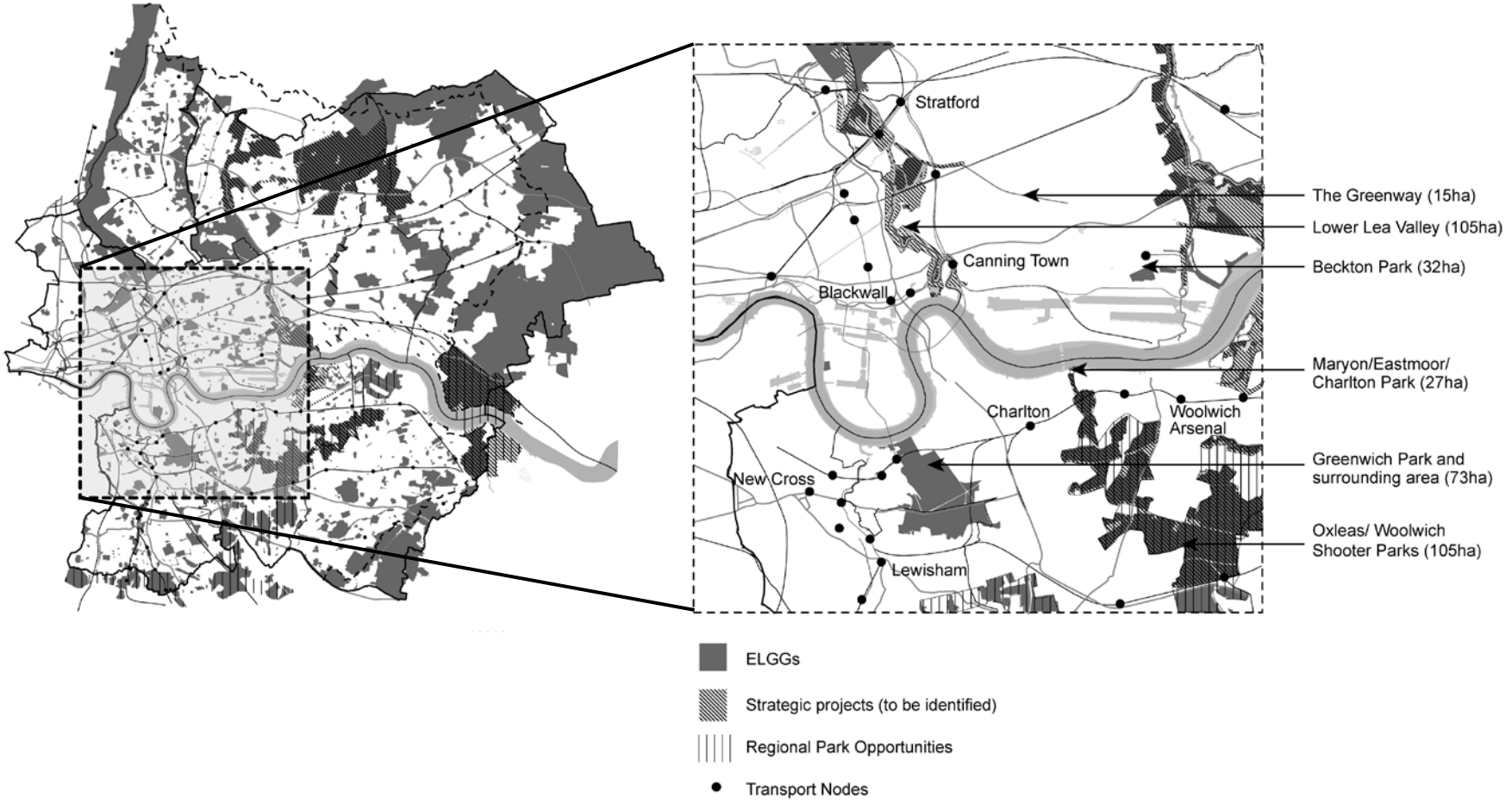
East London Green Grid

- '…network of interlinked, multi-purpose and high quality open spaces
- …connect areas where people live and work with town centres, public transport, the countryside in the urban fringe and the River Thames.'

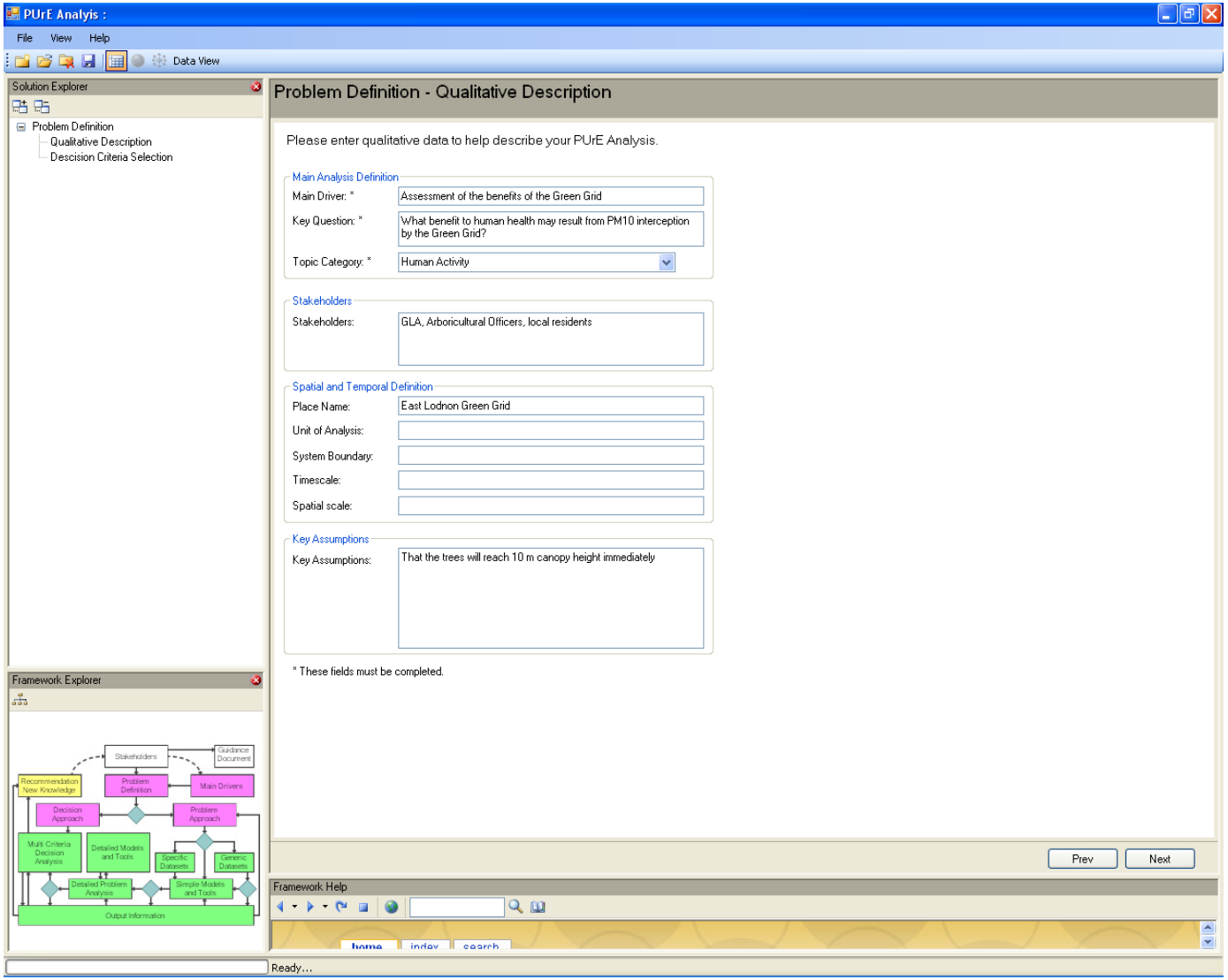
(GLA, 2006)

- East London Green Grid is the delivery mechanism for 'Greening the Gateway'
- Air quality improvement is not a primary driver

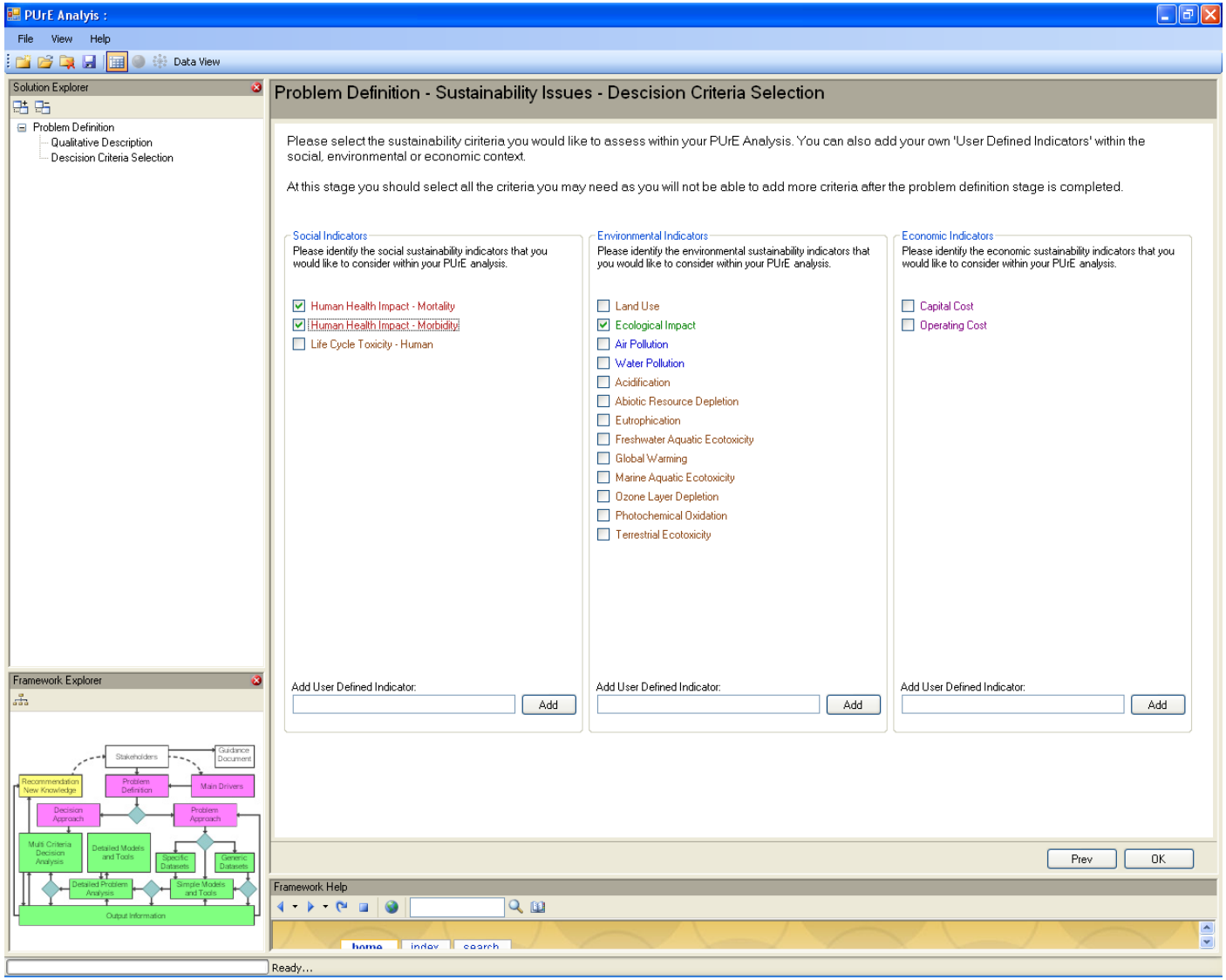
ELGG Study area



The PUrE Approach



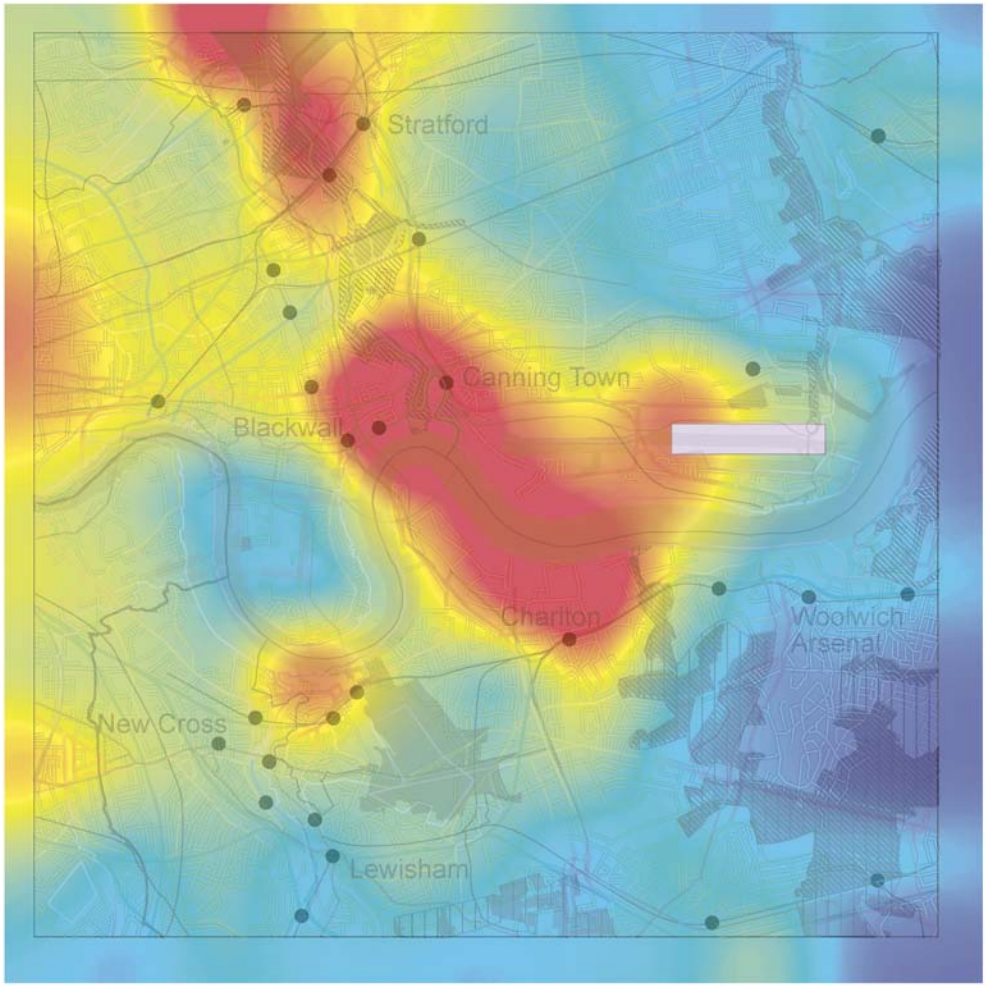
The PUrE Approach



Air dispersion modelling

- Sources include traffic, industry and airport
- Data taken from:
  - London Atmospheric Emissions Inventory
  - Meteorological station at Heathrow airport
- ADMS-Urban used to model hourly PM10 concentrations
- Concentrations reported at 1.5 m receptor height
- 18 receptor locations were used to input concentrations over ELGG

Air dispersion modelling



PM_{10} concentrations (µg m^{-3})

High: 25.43

Low: 22.92

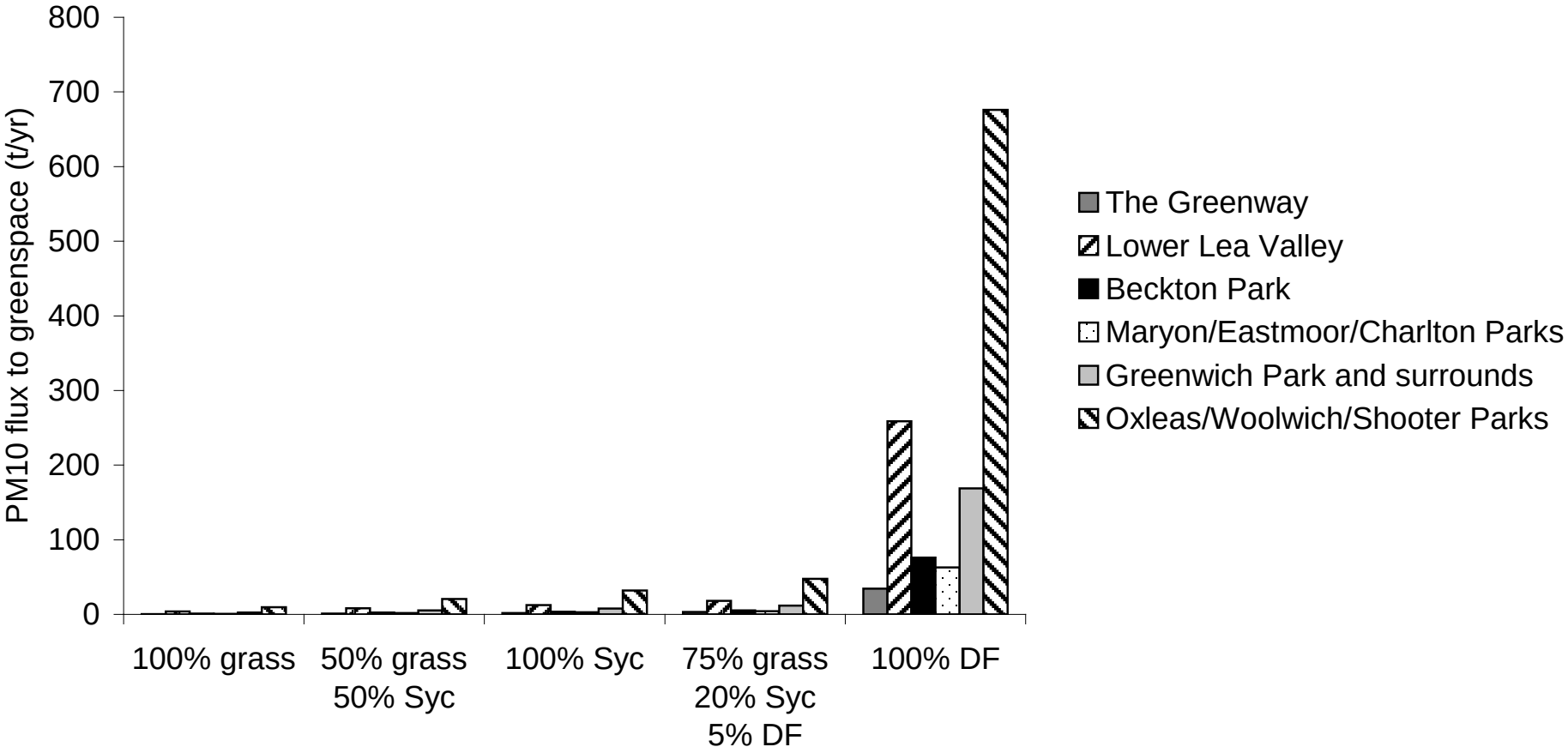
PM10 interception modelling

- Based on the Urban Forest Effects model from the USDA
- Modified with published relationships between wind speed and deposition velocity for different species
- Input parameters:
  - Greenspace area
  - Leaf area index
  - Canopy height
  - Latitude of study area
  - Meteorological data
  - PM10 concentrations

PM10 interception modelling

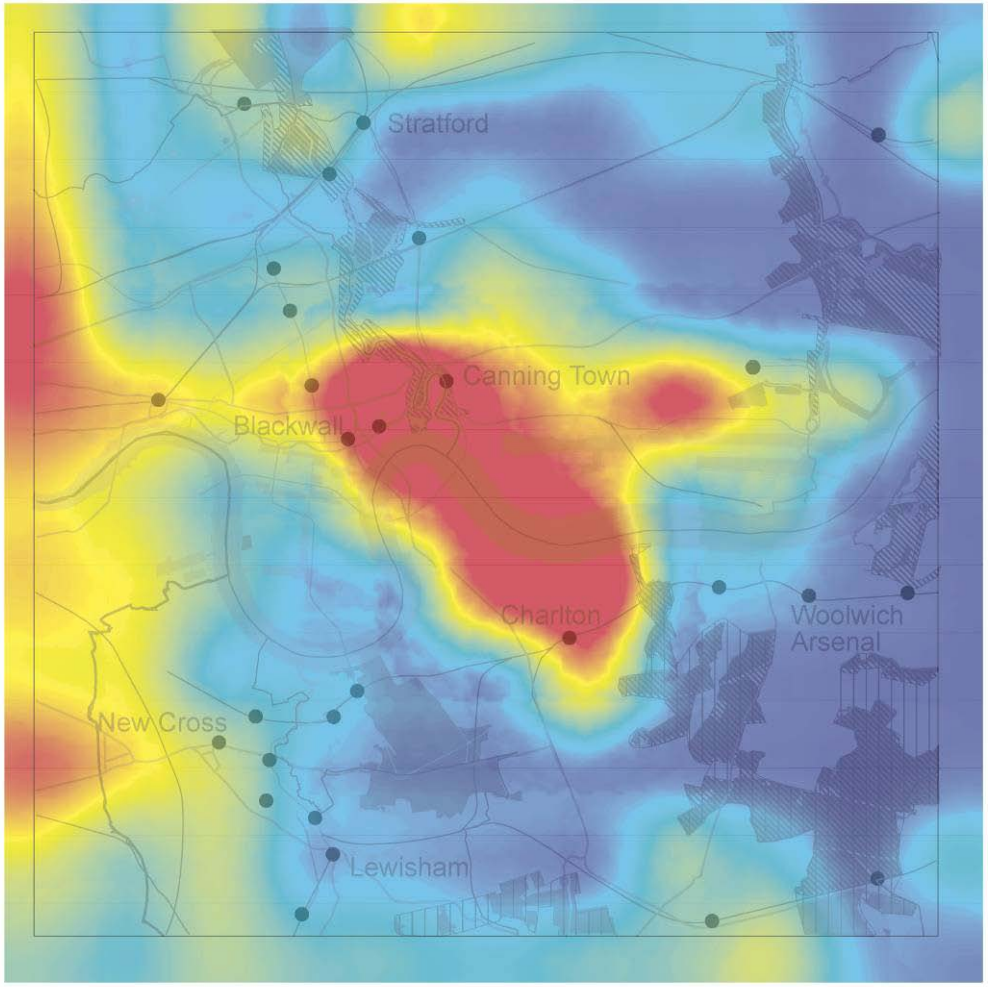
- Modelled five scenarios of vegetation composition
  - 100% grassland
  - 50% grassland
    50% sycamore maple
  - 100% sycamore maple
  - 100% Douglas fir
  - 75% grassland
    20% sycamore maple
    5% Douglas fir

PM10 interception modelling



- Used the 75% grassland, 20% sycamore maple and 5% Douglas fir scenario in the human health modelling
- Outputs from PM10 interception modelling input into ADMS-Urban

PM10 interception modelling



PM_{10} concentrations (µg m^{-3})

High: 25.43

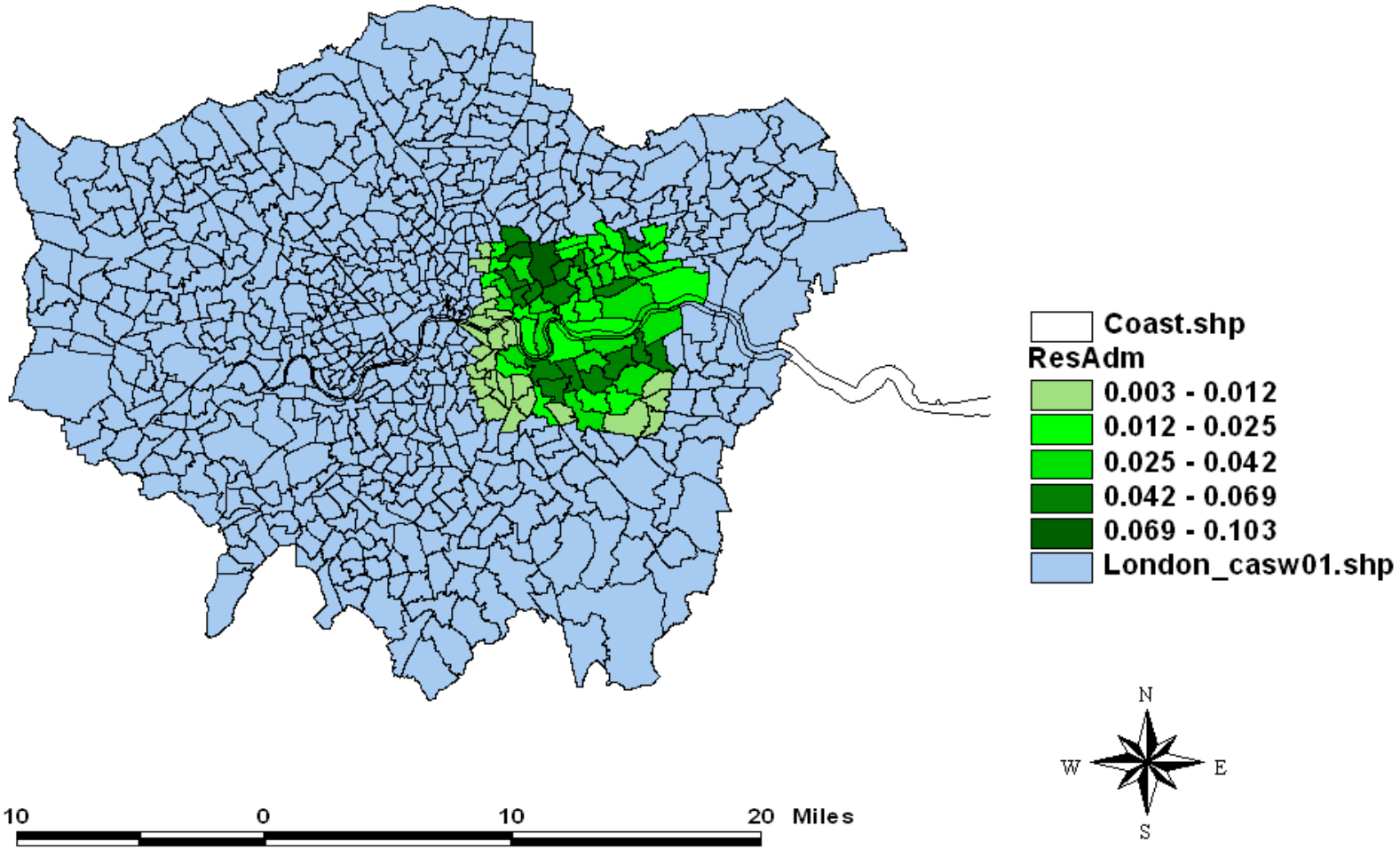
Low: 22.92

Reductions in PM10 concentration

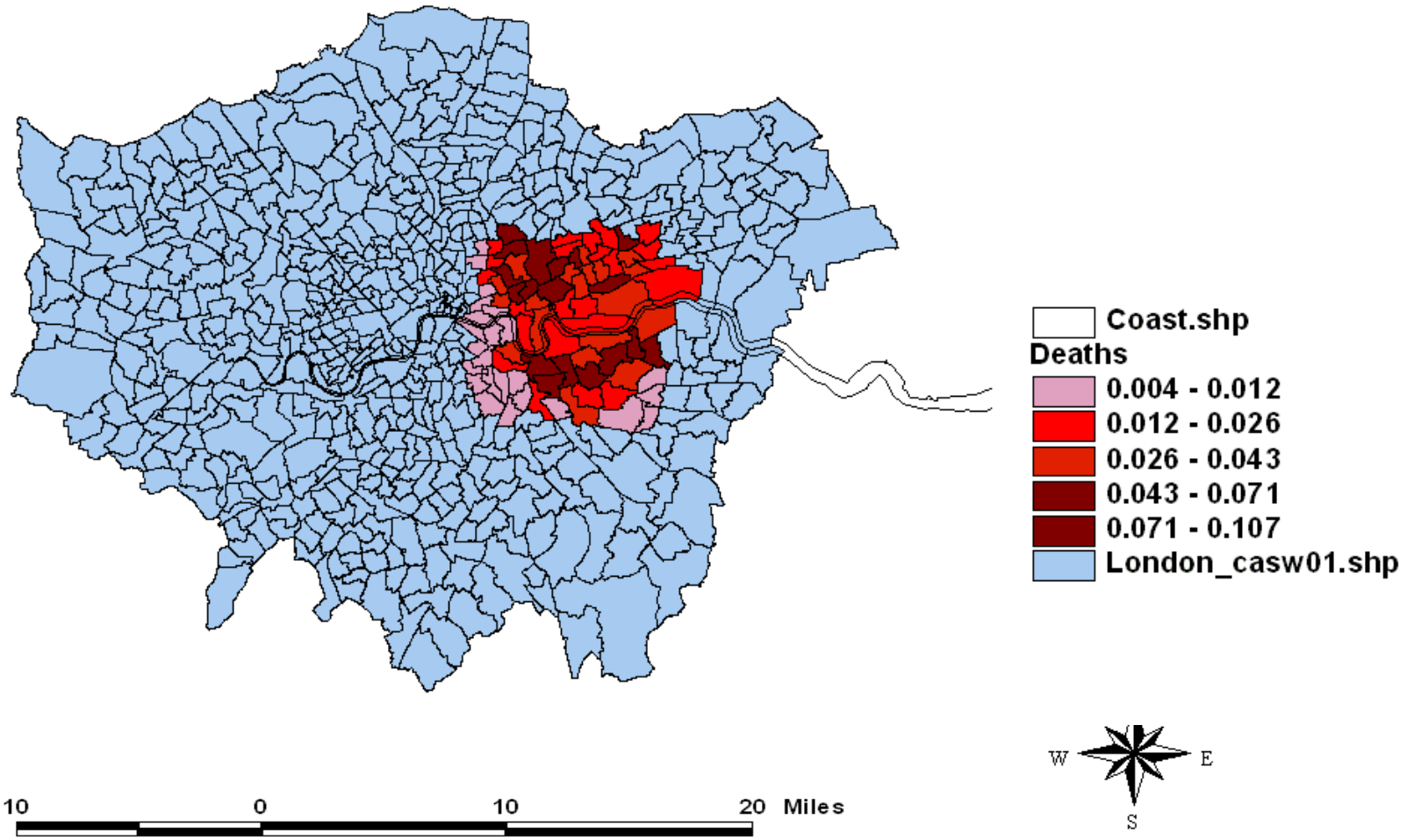
Human health modelling

- Based on exposure-response relationships between PM10 concentrations and mortality and respiratory hospital admissions
- Models the short-term health effects of exposure
- Carried out at a ward level and the results for the whole study area calculated

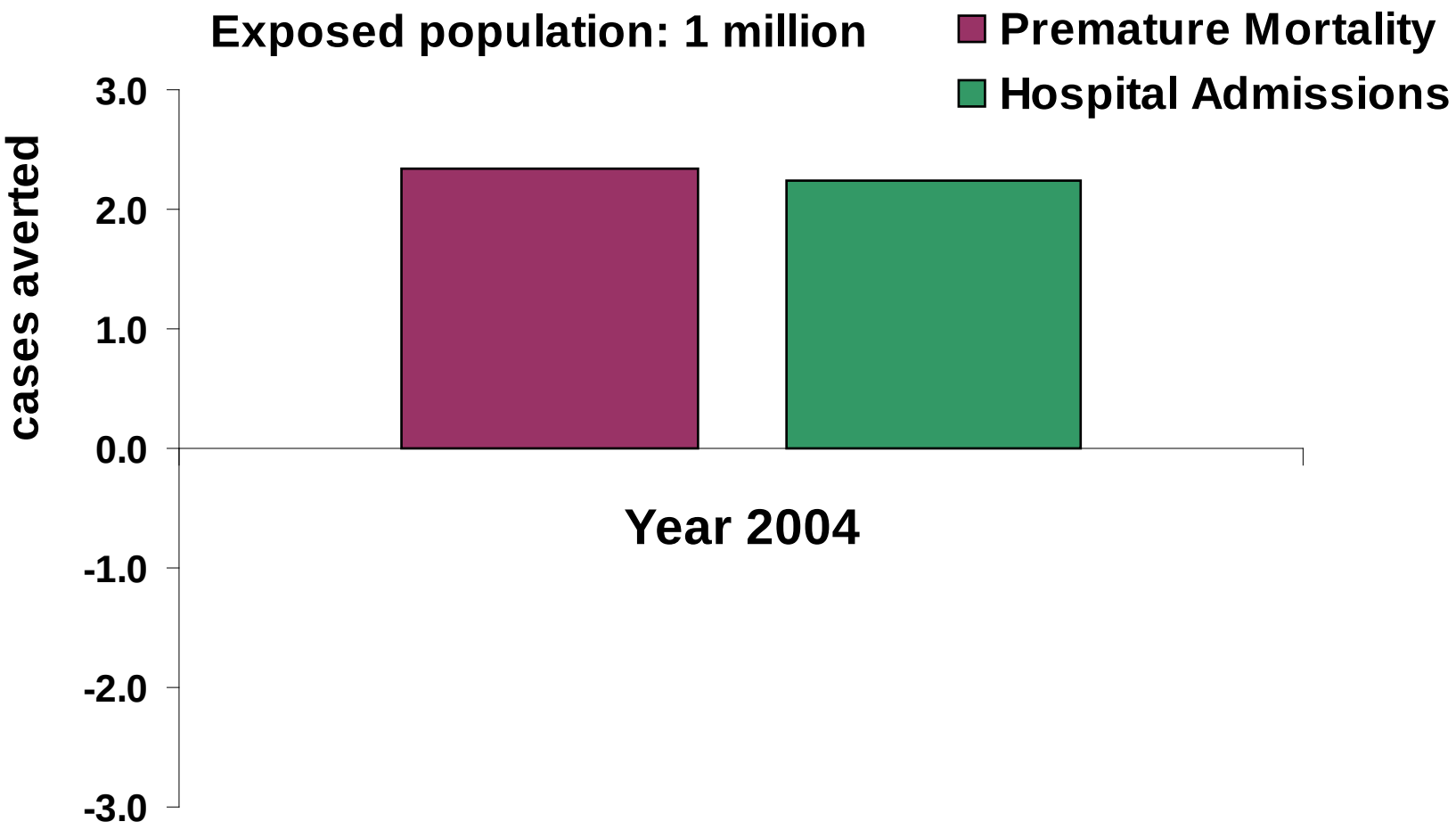
Health Impact Assessment – 1
Respiratory hospital admissions averted



Health Impact Assessment – 2
Premature deaths averted



Health Benefits East London Green Grid



Practical considerations

- Greenspace design must take account of a diverse range of drivers
- Species selection could be targeted around ‘hot spots’ of pollution
- Health benefits could include long-term effects, improvements in physical activity and mental health
- Adverse effects of greenspace could include pollen and VOC emissions and damage to property
- PUrE can be used to estimate the improvements in air quality from such schemes

Output: Recent publication

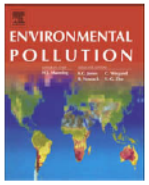
ARTICLE IN PRESS

Environmental Pollution xxx (2009) 1–9

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol



An integrated tool to assess the role of new planting in PM_{10} capture and the human health benefits: A case study in London

Abhishek Tiwary [a], Danielle Sinnett [b,*], Christopher Peachey [b], Zaid Chalabi [c], Sotiris Vardoulakis [c], Tony Fletcher [c], Giovanni Leonardi [d], Chris Grundy [c], Adisa Azapagic [a], Tony R. Hutchings [b]

[a] School of Chemical Engineering and Analytical Sciences, Environment and Sustainable Technology Division, The University of Manchester, PO Box 88, Sackville St, Manchester, M60 1QD, UK
[b] Land Regeneration and Urban Greenspace Research Group, Centre for Forestry and Climate Change, Forest Research, Alice Holt Lodge, Farnham, Surrey, GU10 4LH, UK
[c] Public & Environmental Health Research Unit, London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, UK
[d] Centre for Radiation, Chemical, and Environmental Health Hazards, Health Protection Agency, Chilton, Didcot, Oxfordshire OX11 0RQ, UK

A combination of models can be used to estimate particulate matter concentrations before and after greenspace establishment and the resulting benefits to human health.

ARTICLE INFO

Article history:
Received 20 January 2009
Received in revised form
21 April 2009
Accepted 3 May 2009

Keywords:
Air quality
Green grid
Urban greenspace
Particulate matter
Health impacts

ABSTRACT

The role of vegetation in mitigating the effects of PM_{10} pollution has been highlighted as one potential benefit of urban greenspace. An integrated modelling approach is presented which utilises air dispersion (ADMS-Urban) and particulate interception (UFORE) to predict the PM_{10} concentrations both before and after greenspace establishment, using a 10 × 10 km area of East London Green Grid (ELGG) as a case study. The corresponding health benefits, in terms of premature mortality and respiratory hospital admissions, as a result of the reduced exposure of the local population are also modelled. PM_{10} capture from the scenario comprising 75% grassland, 20% sycamore maple (*Acer pseudoplatanus* L.) and 5% Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco) was estimated to be 90.41 t yr^{-1}, equating to 0.009 t ha^{-1} yr^{-1} over the whole study area. The human health modelling estimated that 2 deaths and 2 hospital admissions would be averted per year.