

Urban Design & Green Infrastructure Annual Meeting October 12th 2022

Research questions across 4 scales:-

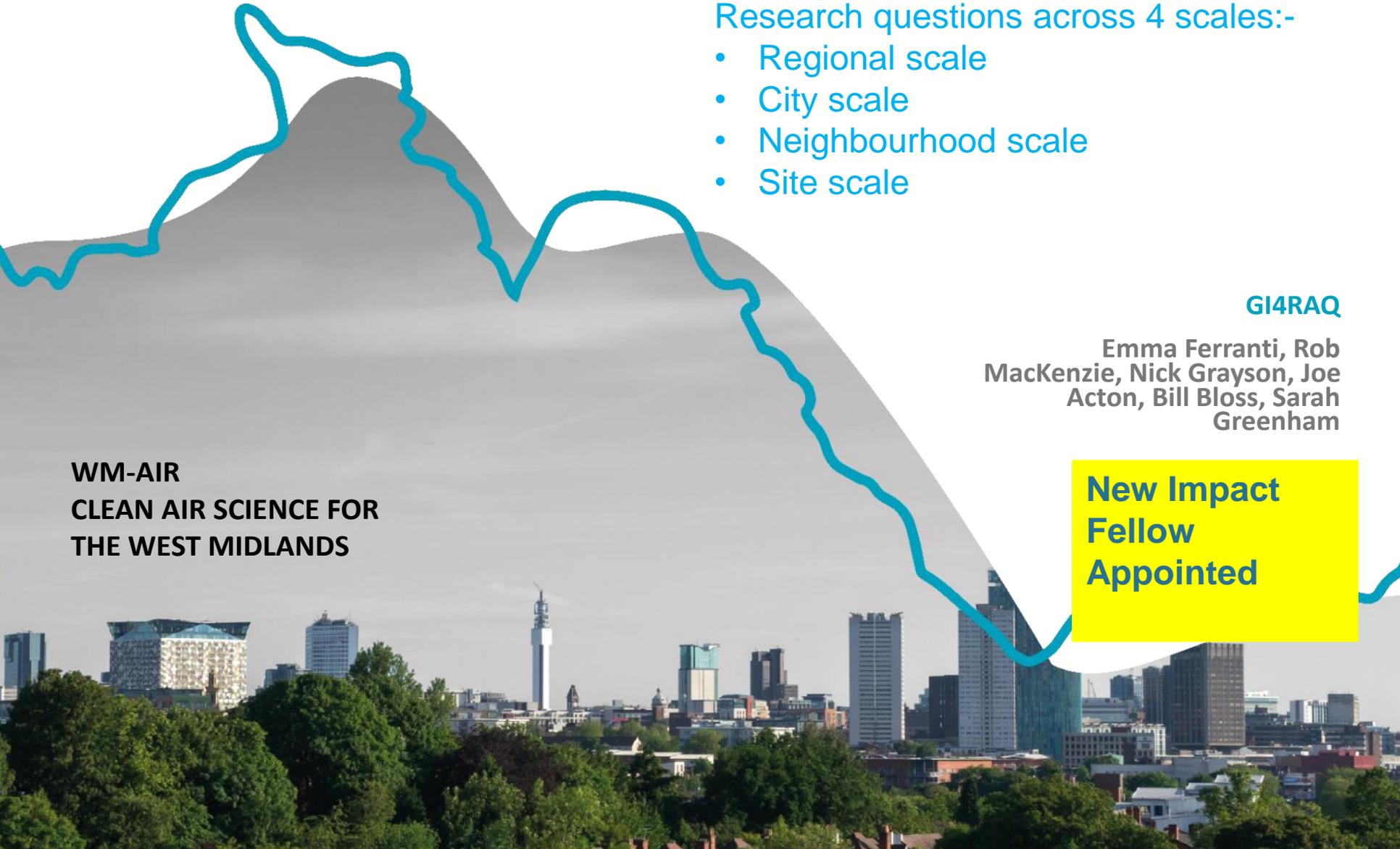
- Regional scale
- City scale
- Neighbourhood scale
- Site scale

GI4RAQ

Emma Ferranti, Rob
MacKenzie, Nick Grayson, Joe
Acton, Bill Bloss, Sarah
Greenham

WM-AIR
CLEAN AIR SCIENCE FOR
THE WEST MIDLANDS

**New Impact
Fellow
Appointed**



Birmingham 2022 Commonwealth Games air quality measurements

- AQ monitoring and public engagement at Alexander Stadium
- Sensors deployed at Alexander and Edgbaston Stadiums
- Daily air quality updates provided to CWG organising committee

Team effort!

Alexander Stadium measurements:

- Zongbo Shi
- Vipul Lal Chandani
- Mao du
- Siqi Hou

Sensor measurements

- Nicole Cowell

Public engagement:

- Clarissa Baldo
- Deepchandra Srivastava
- Catherine Muller
- Bill Bloss

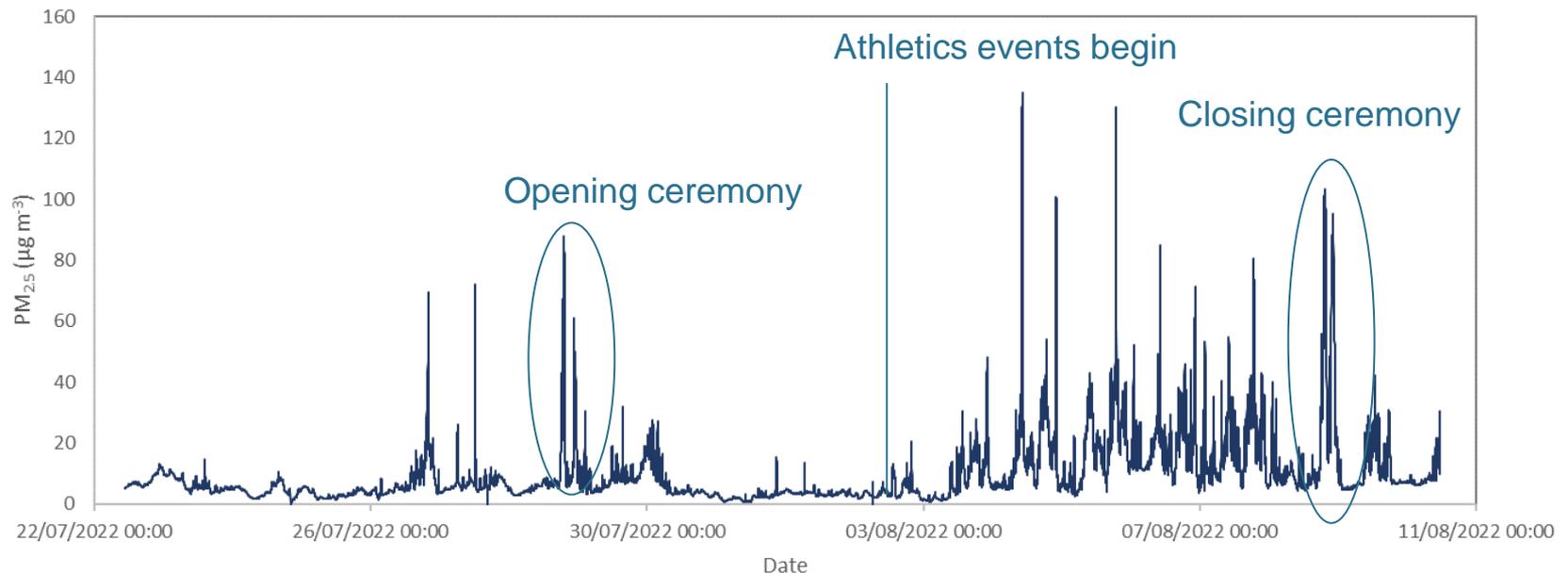
Data analysis

- Bowen Liu



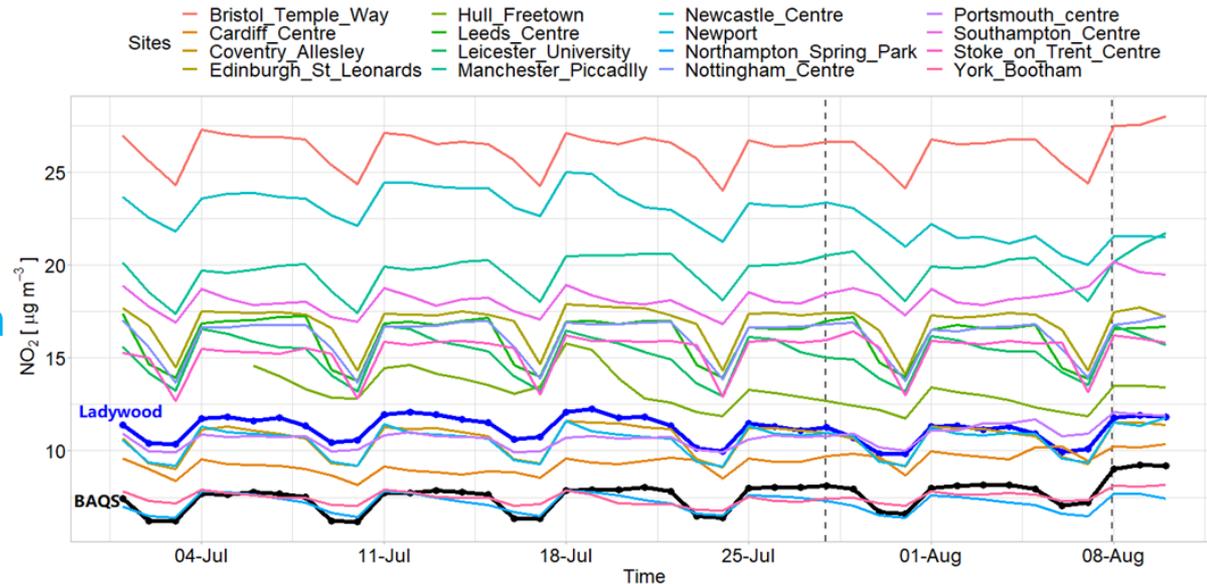
PM_{2.5} concentrations at Alexander stadium

- Background air quality was good during the Games period with events taking place between polluted periods in mid-July and mid-August
- Measurements Alexander Stadium showed high local concentrations for short periods, likely driven by cooking and fireworks



Impact of Games on background concentrations in Birmingham

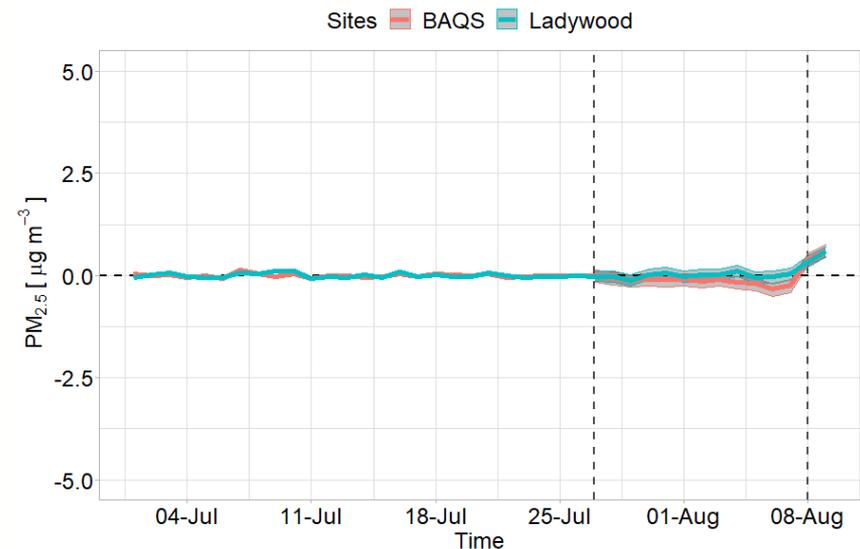
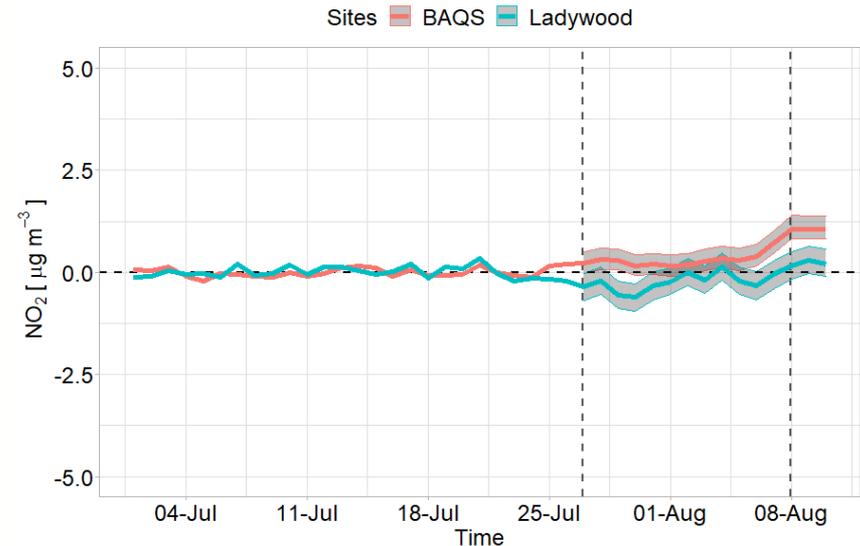
- Impact on background air quality assessed for two urban background sites:
 - BAQS on the UoB campus
 - Ladywood AURN site in central Birmingham
- Data de-weathered to remove the impact of meteorology
- A synthetic control method was used to evaluate the impact of the Games period on air quality



Impact on background concentrations in Birmingham

Urban Design & Green Infrastructure

- The Games had little causal impact on background fine particulate ($PM_{2.5}$) or nitrogen dioxide (NO_2) concentrations in the city



Urban Design for Air Quality

- Extensive local authority stakeholder engagement – planning, ecology, environmental health officers, more
 - Understand how planning and local air quality management intersect
 - Create & shape new conversations within and across local authorities
 - Thanks to all those who took part in discussion in 2021
- Outputs
 - two-sided Design Charter summarising key points
 - CPD with regional RTPI in March 2022, led by local authority colleagues, for planners; hope to scale up to national CPD. **Thanks to those who took part, esp. Steve Dewar**
 - Publication *Urban air quality: examining the links between planning and Local Air Quality Management*

URBAN DESIGN FOR AIR QUALITY

Urban design influences where air pollution is produced, how it disperses through streets and neighbourhoods, and where, when, and how much people are exposed. Good urban design improves air quality.

Air quality mitigation strategies fit broadly into three categories:

1. REDUCE

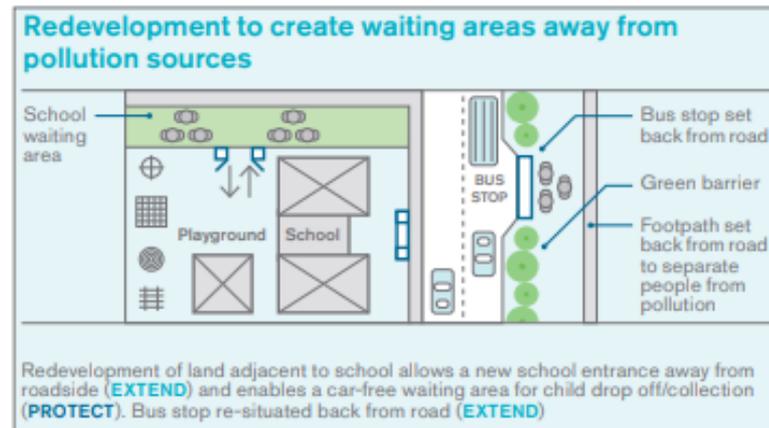
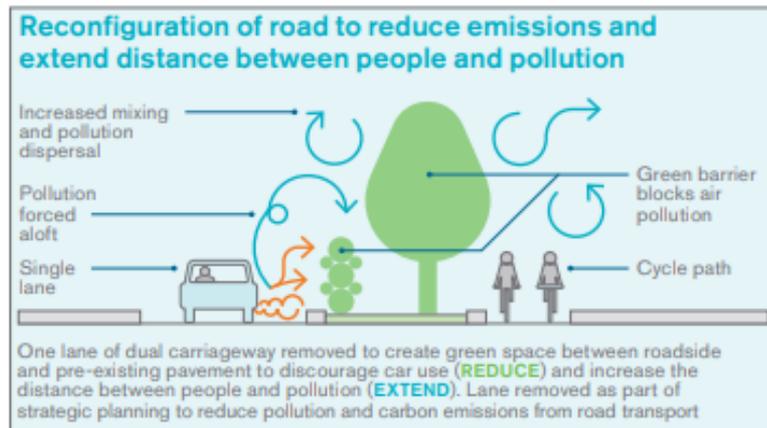
Reducing air pollution emissions is the most effective way to improve air quality. Road transport is one of the largest sources of air pollution in urban areas. Mitigation measures include facilitating active transport by creating walkways and cycleways, providing links to public transport, electric car charging points, and discouraging wood/coal combustion.

2. EXTEND

Increasing the distance between pollution source and human receptor allows for air pollution to disperse (mix into cleaner air), and can reduce exposure. This can be actual distance, or an “effective” distance, when barriers force polluted air to take a longer path, or via a heterogeneous surface that creates eddies and encourages mixing.

3. PROTECT

Older adults (>65), children (<12) and those with certain pre-existing health conditions (e.g. asthma, COPD) are most vulnerable to air pollution. Extra care must be taken to separate people and pollution in places where these vulnerable groups gather and wait, such as in front of hospitals, schools, or at bus stops.



http://epapers.bham.ac.uk/3493/1/WM-Air_Design_Charter.pdf



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Ferranti, EJS., Acton, WJF., Lindop, A., Wolstencroft, M., Han, U.P., Levine, J.G., MacKenzie, AR., Grayson, N. 2021. Urban Design for Air Quality. A Design Charter produced by the WM-Air Project

EARLY AIR QUALITY THINKING

Air quality should be considered at the earliest stages of planning and design, before the position of infrastructure and buildings is decided. Consider:

i. What is the current air quality on site?

If the site lies in an air quality management area (AQMA) or a clean air zone (CAZ) then planners and designers must consider how the site can **improve** existing air quality. Consulting with environmental health officers is essential as at least 3 months' air quality monitoring may be required pre application in AQMAs.

ii. How will the development change air quality in the development and surrounding neighbourhood?

1.1 REDUCE existing and new transport emissions by linking to public transport or mobility schemes (e.g. e-scooters), or creating/linking to cycleways or footpaths.

1.2 REDUCE existing and future combustion emissions by avoiding residential log burners or solid fuel combustion sources, and preventing

new industrial/commercial combustion in areas with air quality concerns.

2.1 EXTEND Opening up the site to promote wind flow can help air pollution disperse (mix away). A mixed height surface can promote the formation of eddies to encourage mixing and pollution dispersion.

iii. How are people on the development and surrounding neighbourhood exposed to air pollution?

Air pollution is generally highest at source. Separate people, especially vulnerable groups from air pollution sources.

2.2 EXTEND Separate pavements and cycleways from road traffic pollution.

2.3 EXTEND Avoid bus stops near busy intersections or where vehicles idle.

Set bus stops back from roadside.

2.4 EXTEND Set buildings back from roads (e.g. car park in front of building) to reduce the exposure of residents. In roadside buildings locate sensitive rooms (where people spend a lot of time) away from roadside.

3.1 PROTECT Avoid co-locating vulnerable groups with pollution sources,

e.g. hospital bus stop next to idling cars. Locate school drop off/collection areas away from roadside.

3.2 PROTECT Avoid locating school playgrounds or play areas close to pollution sources.

GREEN INFRASTRUCTURE

Green infrastructure in itself is not the solution to air pollution. The amount of pollution removed or deposited on tree or shrub leaves is very low when compared to urban pollution concentrations.

As a component of good urban design, green infrastructure can help to:

REDUCE emissions by encouraging usage of cycleways and footpaths;

EXTEND the distance between pollution sources and individuals via mixed planting to create heterogeneous surfaces, or grass verges between roads and footpaths and;

PROTECT vulnerable people (e.g. green barriers).

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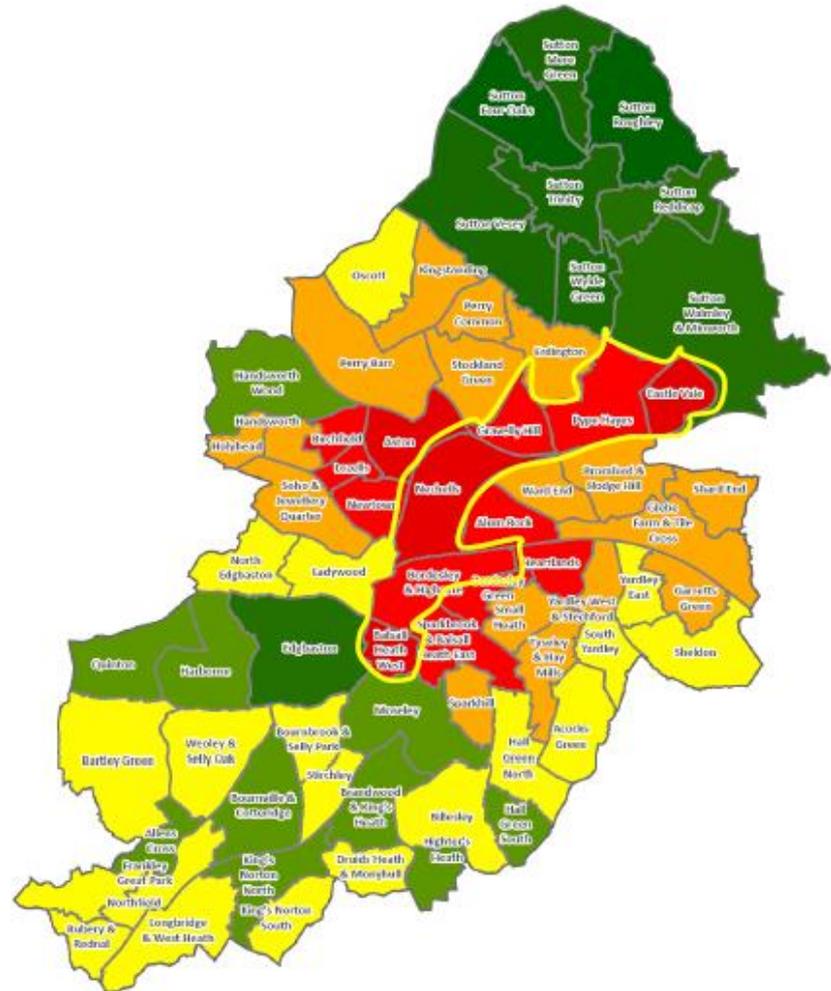


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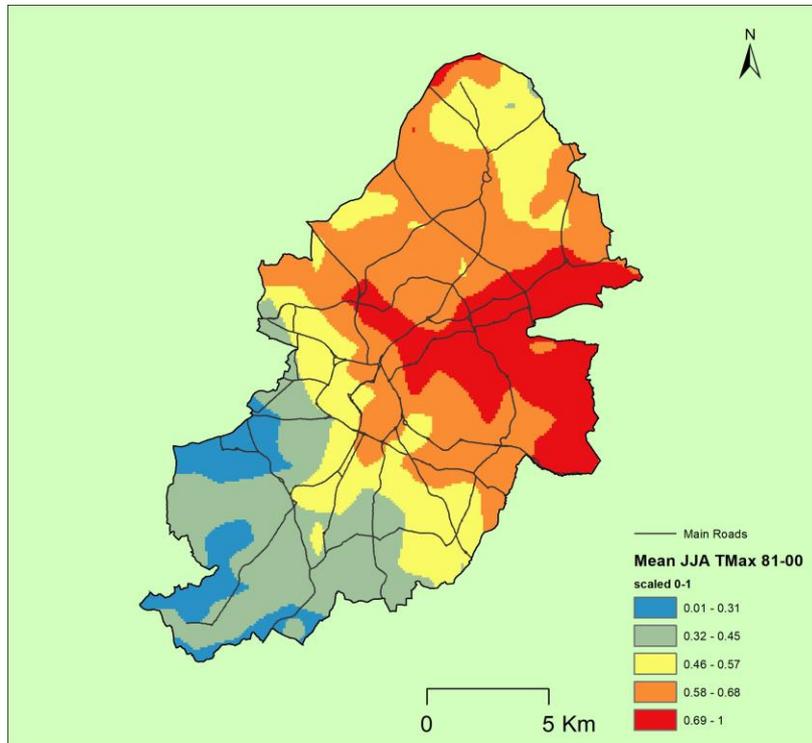
City scale next activities

- **UDGI team** working to convert existing Environmental Justice map to **Climate Risk & Vulnerability Map GIS**; adding UHI & AQ
- Better highlight the **‘Hot Spots’** demanding different planning/ Urban Design solutions.

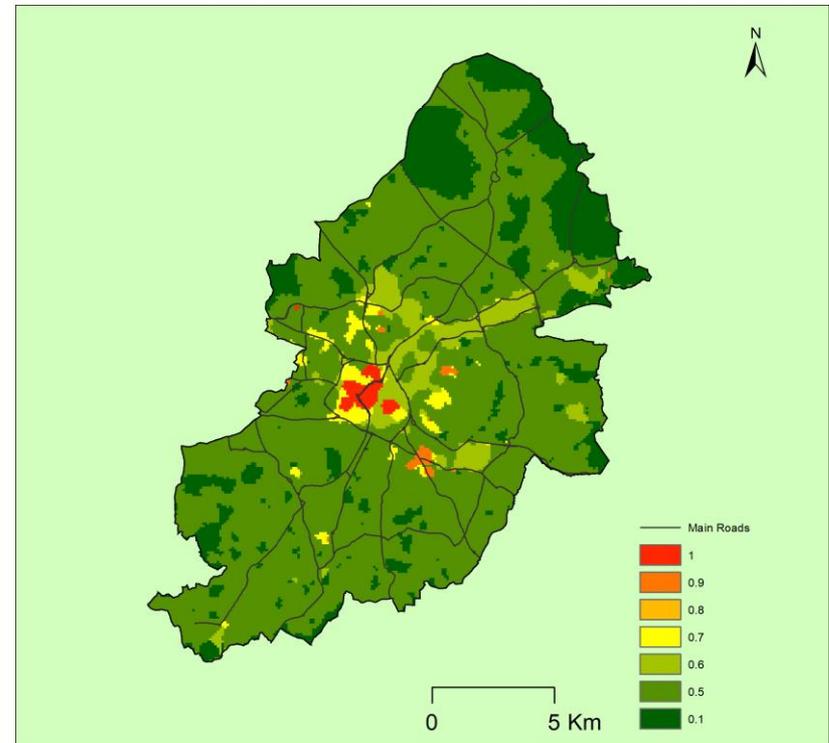


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Ordnance Survey 100021325.
2014 daily mean urban heat island intensity (oC) at 1 km resolution
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observation network and GHS-built data, R Basset et al 2020
Environ. Res. Lett. 15 114014 <https://doi.org/10.1088/1748-9326/abbb51>
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- Demonstration of approach – overheating risk
- Approach is scalable, transferable, using open access data
- Birmingham is testbed – we'd like to work with other regions

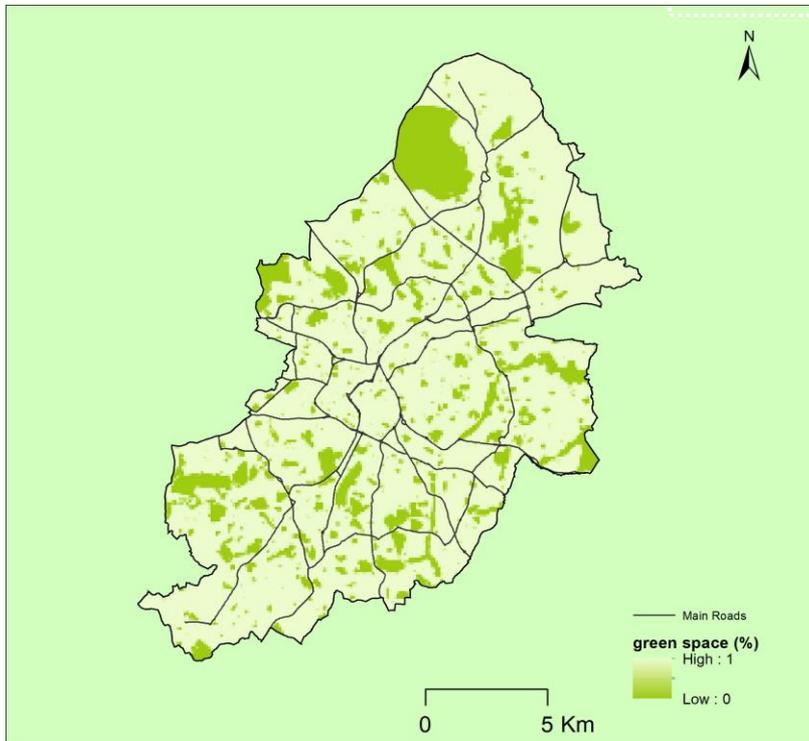


Max summer temperature, UKCP18

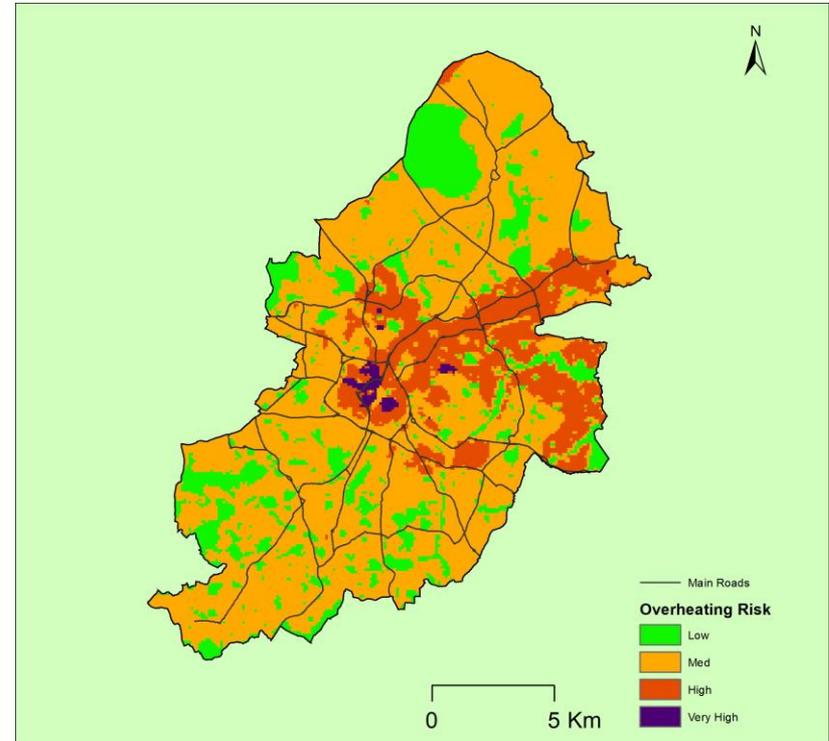


Local Climate Zones

- Demonstration of approach – overheating risk
- Approach is scalable, transferable, using open access data
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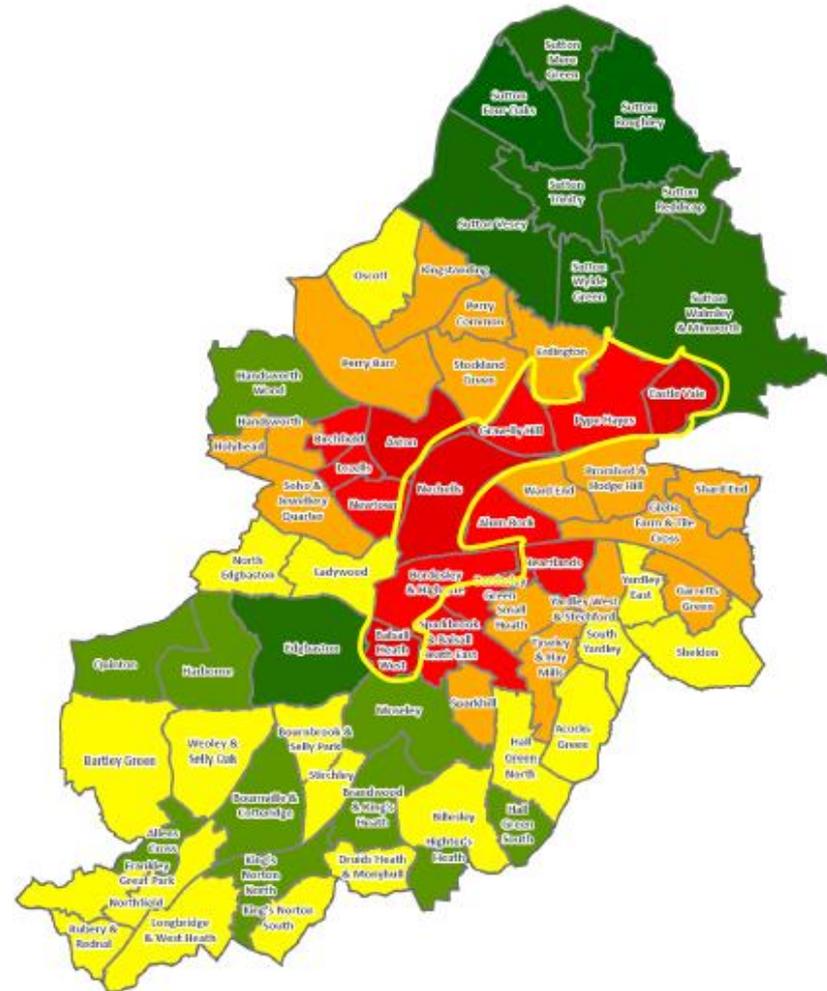
ONS Access to GreenSpace



Overheating Risk

City scale next activities

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- Better highlight the **‘Hot Spots’** demanding different planning/ Urban Design solutions.
- **Potential solutions** to be tested through case studies;
- City improvements programme to be monitored via the Health Strand **AQ-LAT**
- City centre **Climate Walk**



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New Resources

- **Urban Design for Air Quality**

<http://epapers.bham.ac.uk/3493/>

- **Trees and Urban Air Quality: A Briefing Note**

<http://epapers.bham.ac.uk/4112/>

Partner Resources

- **First Steps in Trees in New Developments**

<http://epapers.bham.ac.uk/4109/>

- **First Steps in Urban Air Quality**

<http://epapers.bham.ac.uk/3069/>

- **First Steps in Urban Heat**

<http://epapers.bham.ac.uk/3452/>

- **First Steps in Valuing Trees & Green Infrastructure**

<http://epapers.bham.ac.uk/3226/>

- **Trees Planning and Development**

<https://www.tdag.org.uk/trees-planning-and-development.html>

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TREES AND URBAN AIR QUALITY: A BRIEFING NOTE

Key messages

1. Trees alone are not the solution to air pollution. They can create a localised positive benefit for air quality by changing the dispersion of pollution, but the amount of pollution deposited onto trees is not significant on an urban scale.
2. Air pollution can damage trees.
3. Emissions of VOCs from trees can, under the correct conditions, create ozone pollution. This is only relevant when creating new woodlands.

