

Heatwave Vulnerability in Hounslow

Nick Benoit, Jerry Brown, Benjamin Mattiuzzi, Connor Murphy



London Borough
of Hounslow



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Roadmap

- Project Goals
- Previous Project Review
- Identification of Vulnerability Data
 - Indices of Multiple Deprivation
 - MOSAIC
 - Census Age Data
 - Indoor Temperature Model
 - GIS Maps from Earthlight
- Data Assessment
- Conclusions
- Recommendations

Project Goals



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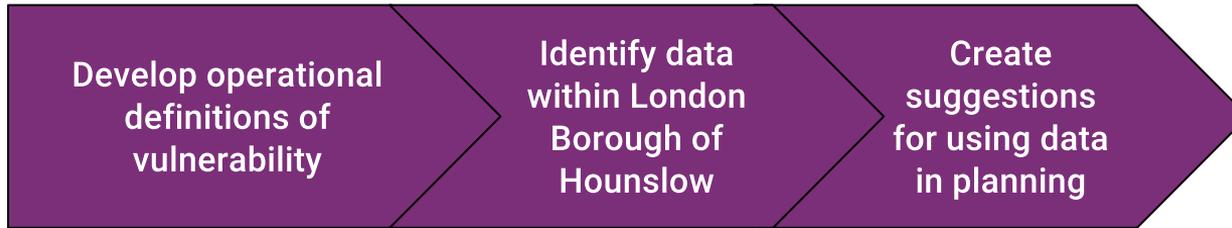


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Project Goals

Main Objective: Identify data within the London Borough of Hounslow for use in heatwave emergency planning



Project Partners: Greater London Authority, Public Health England, University College London, London Climate Change Partnership

Previous Project Review



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LUCID

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graph TD; LUCID[LUCID] --- M1[Module 1]; LUCID --- M2[Module 2]; LUCID --- M3[Module 3]; LUCID --- M4[Module 4]; LUCID --- M5[Module 5]; M1 --- M1_Tasks[Model Development]; M2 --- M2_Tasks[Validity Testing]; M3 --- M3_Tasks[Energy Use Urban form Local Temp.]; M4 --- M4_Tasks[Application on Health]; M5 --- M5_Tasks[Final Report];
```

Module 1

Model
Development

Module 2

Validity
Testing

Module 3

Energy Use
Urban form
Local Temp.

Module 4

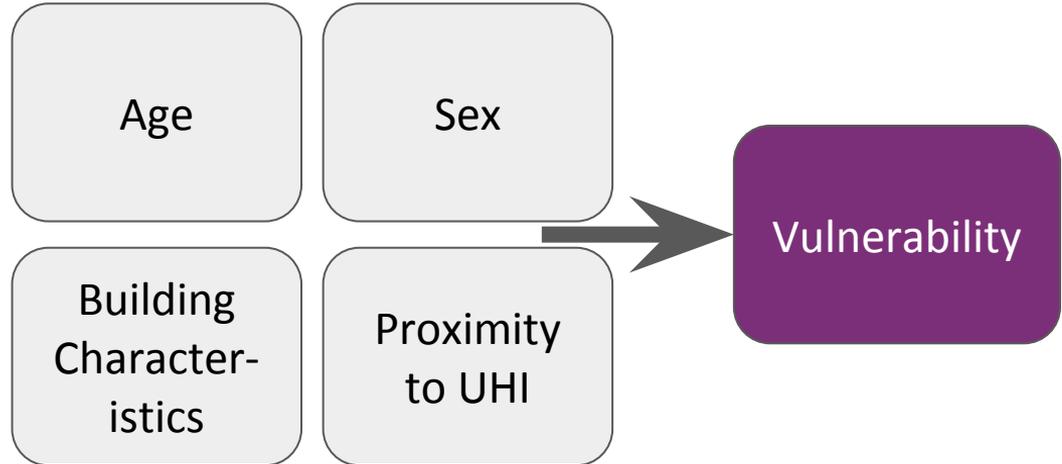
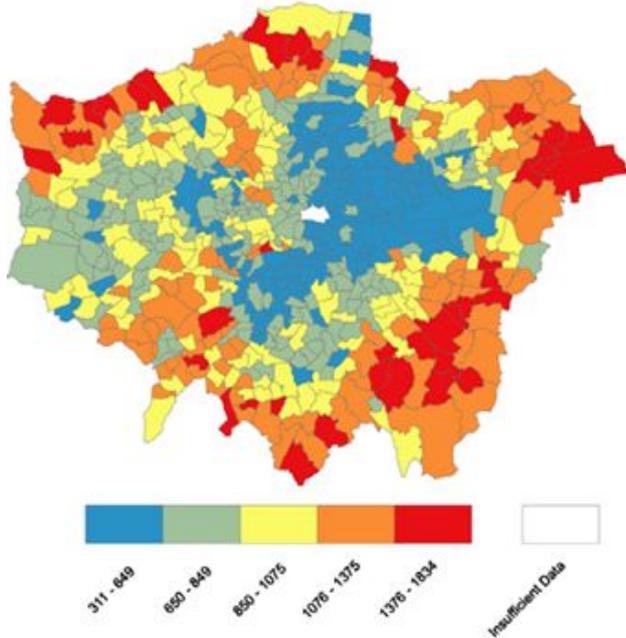
Application
on Health

Module 5

Final Report



Triple Heat Jeopardy



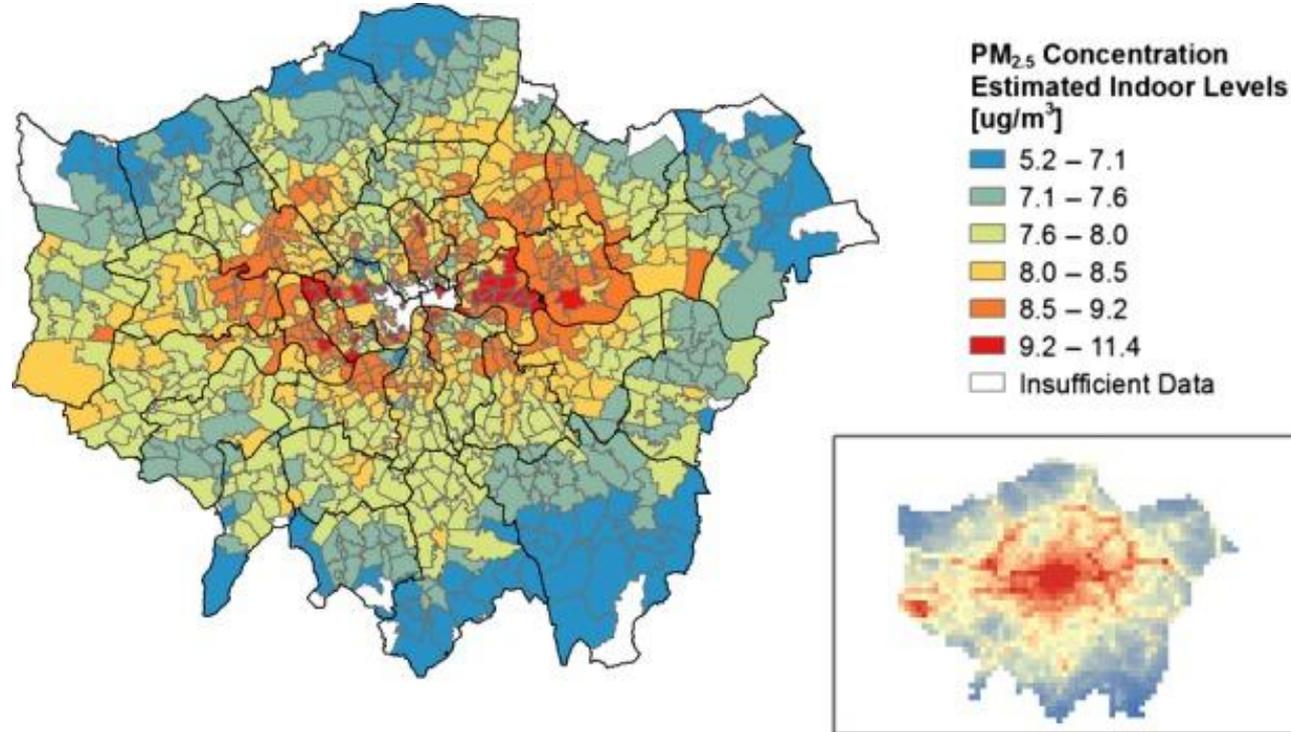


AWESOME

Air pollution and WEather-related health impacts: methodological study based on Spatio-temporally disaggregated multi-pollutant models for present-day and future.



AWESOME

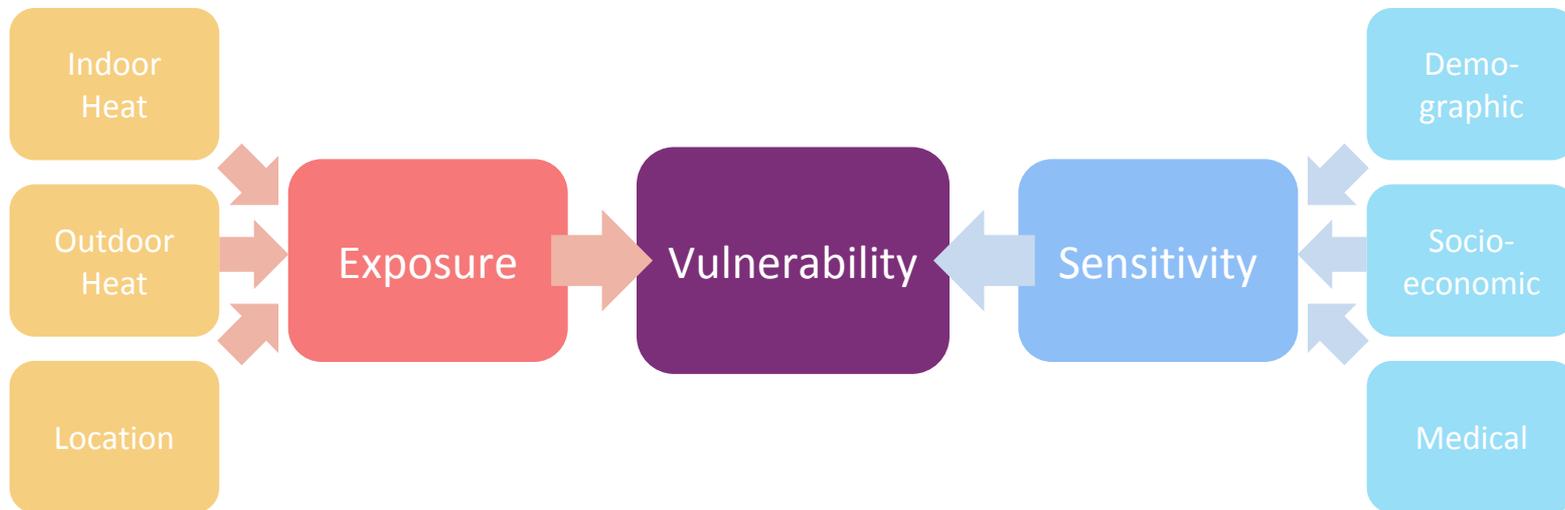


Average simulated PM_{2.5} Concentration in London.

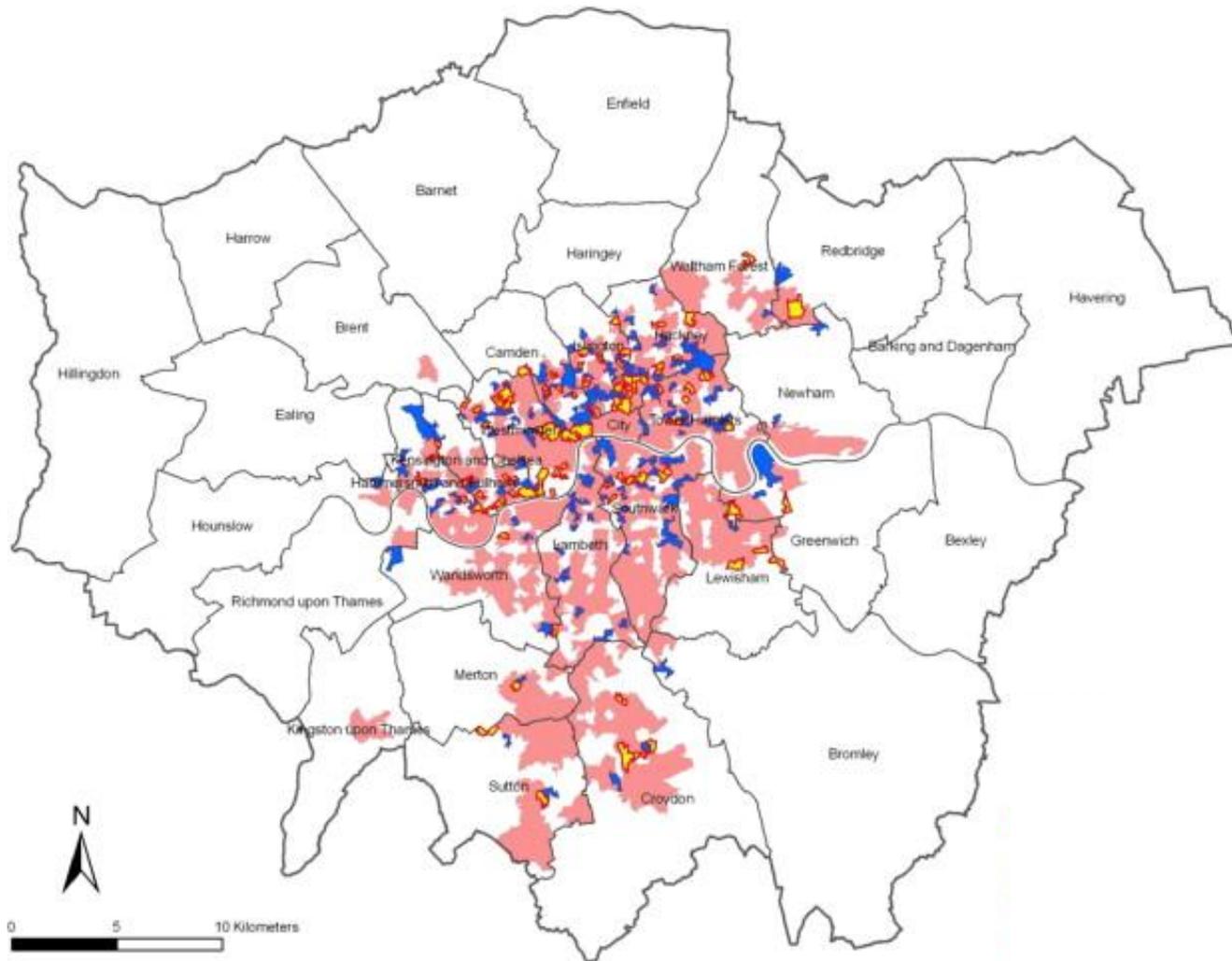
The inset is an image of the estimated PM_{2.5} Concentration used in the model.



Heatwave Vulnerability Index



Vulnerability to heat is consists of many more factors than shown here.
See: Wolf & McGregor, 2013



Individual exposure and adaptive capacity

Identification of Vulnerability Data



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London Borough of Hounslow

Housing Investment Team

Rory Prendergast
Martin Tompkins

GIS Team

Vinesh Govind

Health and Wellbeing

Laura Maclehose

Adult Social Care

John Morgan
Andrew Heap

Information Governance

Matthew Kay

**Head of Contingency
Planning and
Resilience**

Twm Palmer

Hounslow Heatwave Steering Group

University College London

Anna Mavrogianni
Jonathon Taylor
Clive Shrubsole

Public Health England

Angie Bone
Ross Thompson

Greater London Authority

Emer O'Connell
Annette Figueiredo

World Health Organization

Tanja Wolf

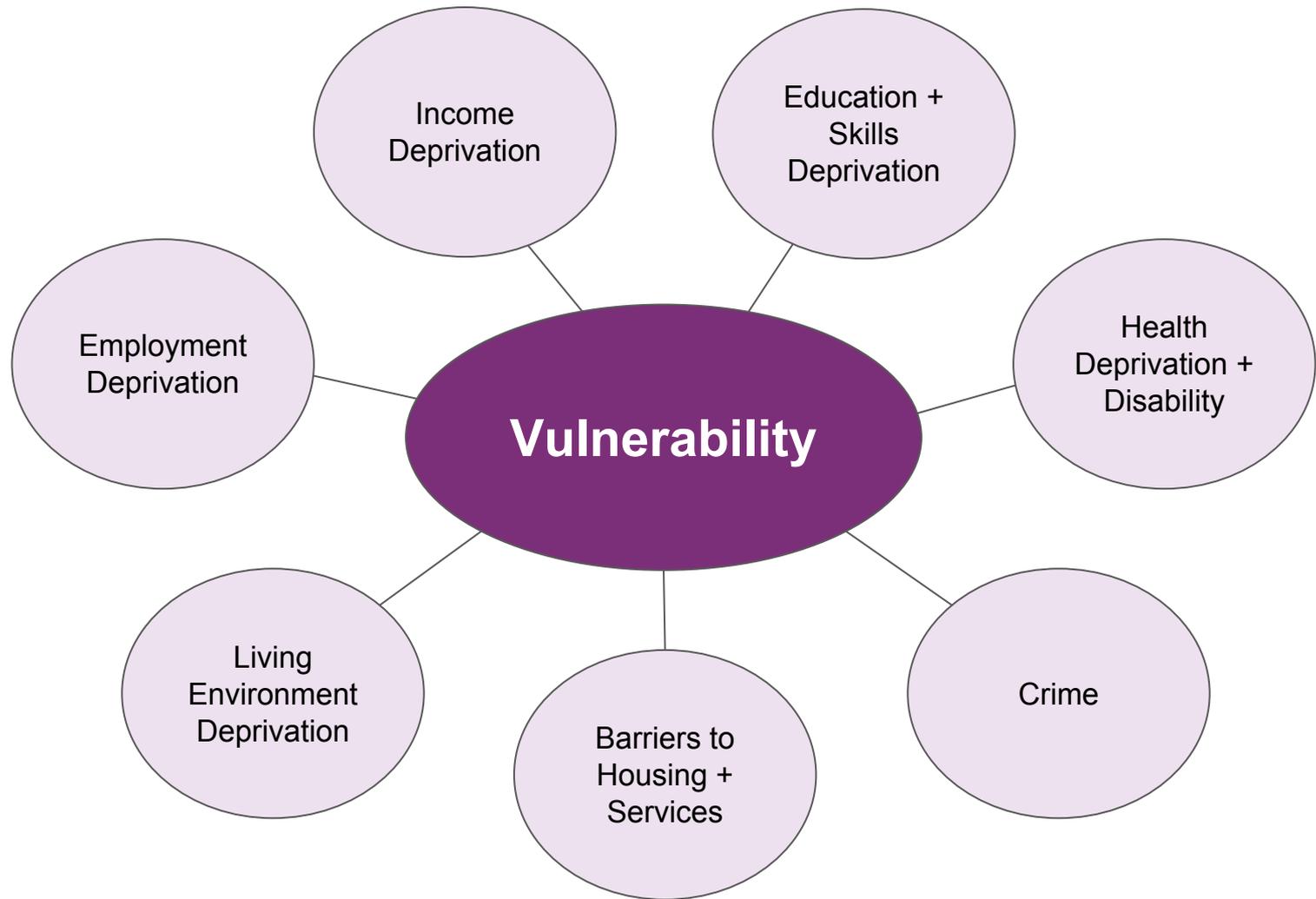
Indices of Multiple Deprivation



London Borough
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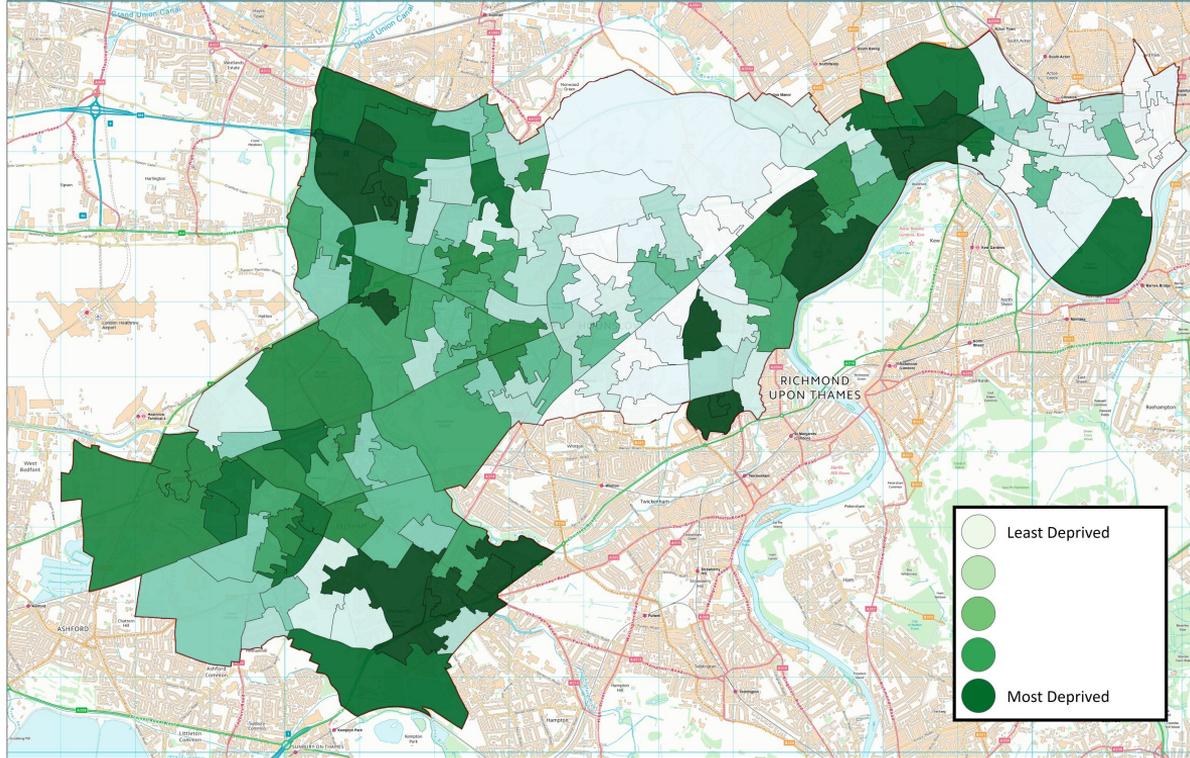


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Domain	Weight
Income deprivation	22.50%
Employment deprivation	22.50%
Education, skills and training deprivation	13.50%
> <i>Skills subdomain</i>	6.75%
> <i>Children and Young People subdomain</i>	6.75%
Health deprivation and disability	13.50%
Crime	9.33%
Barriers to housing and services	9.33%
> <i>Wider Barriers subdomain</i>	4.67%
> <i>Geographical Barriers subdomain</i>	4.67%
Living Environment deprivation	9.33%
> <i>Indoor subdomain</i>	6.22%
> <i>Outdoors subdomain</i>	3.11%

Hounslow IMD Deciles 2010

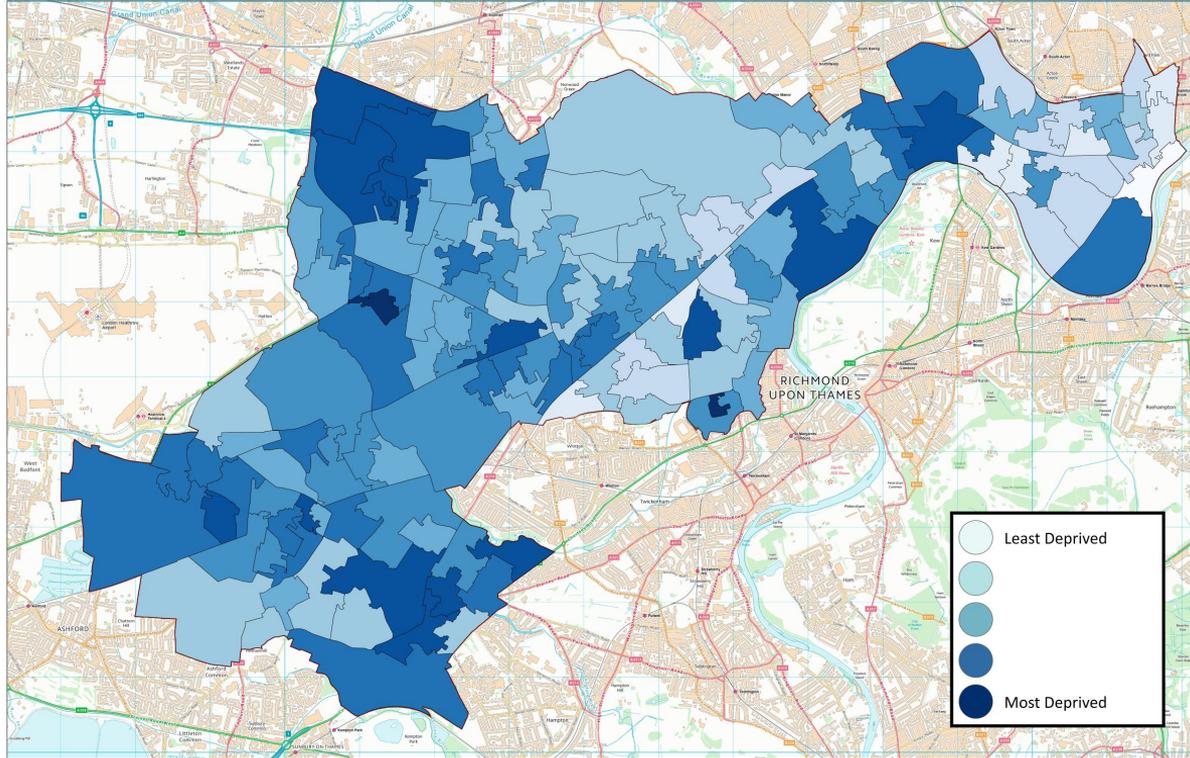


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0 0.25 0.5 0.75 1 Kilometres

1:20000

Hounslow IMD Deciles 2015



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0 0.25 0.5 0.75 1 kilometres 1:20000

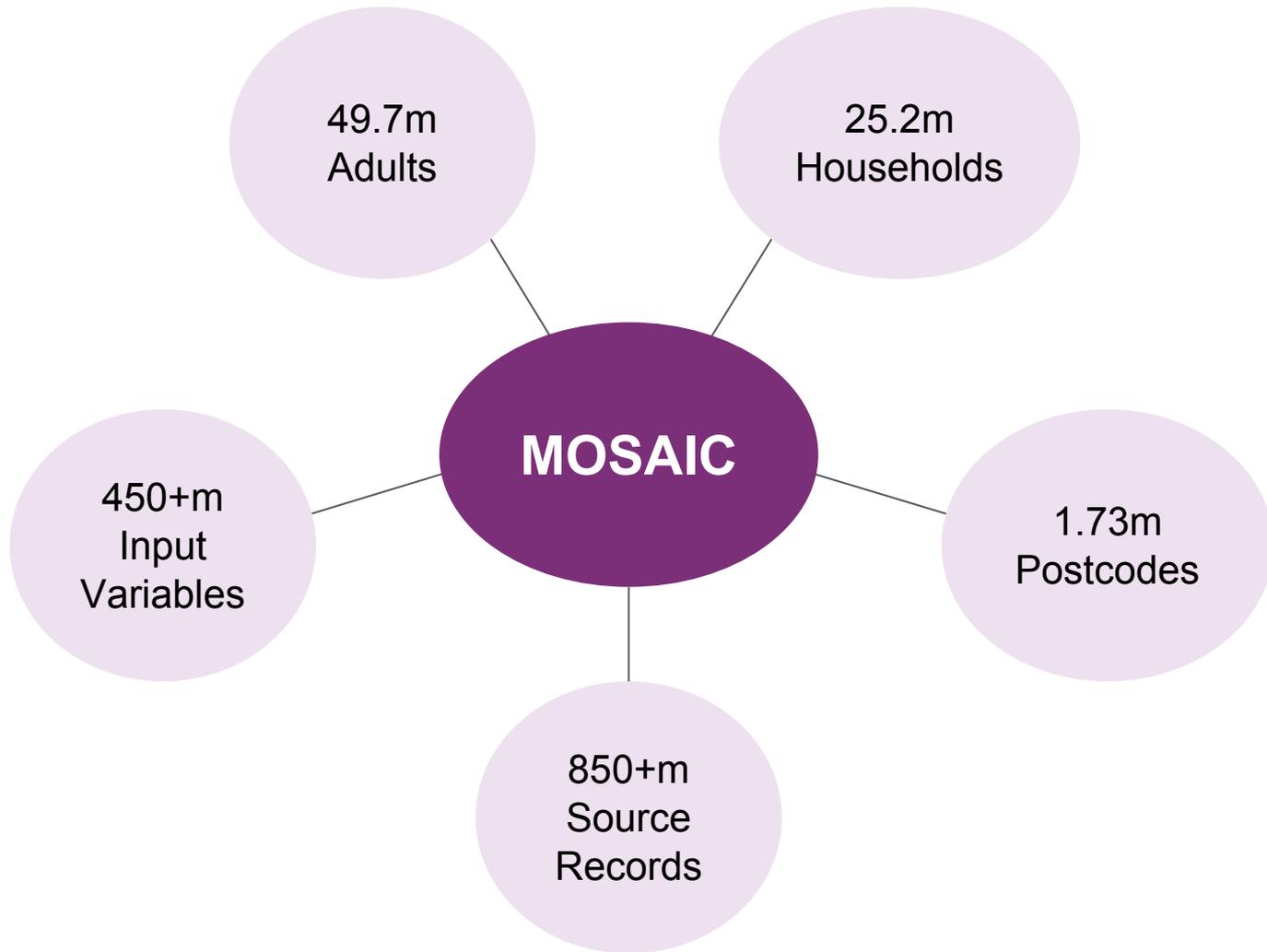
MOSAIC



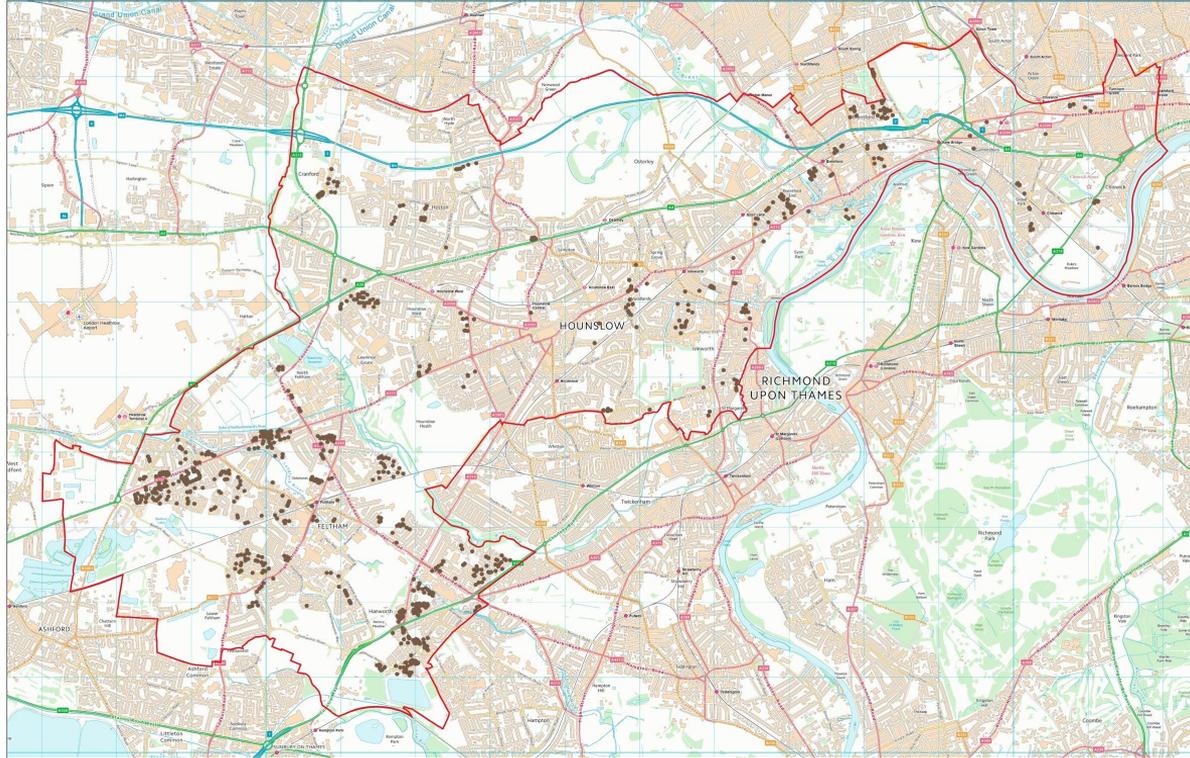
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WPI



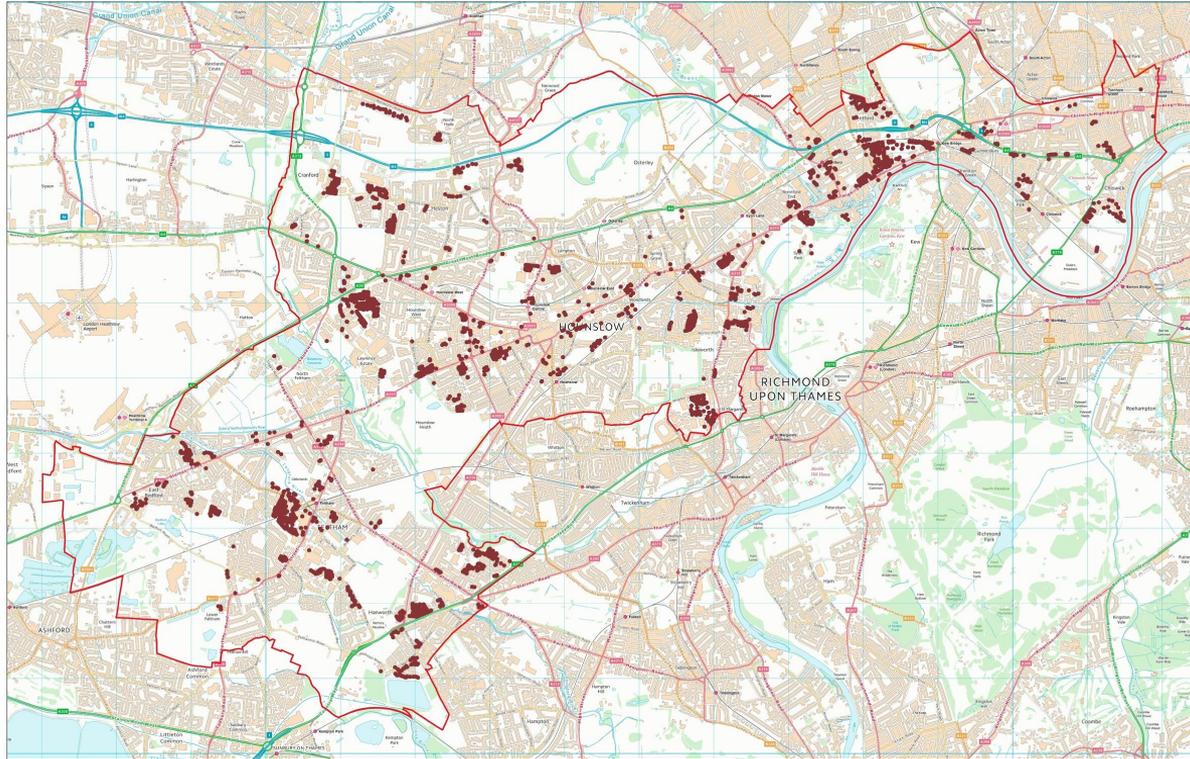
MOSAIC Group N



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0 0.25 0.5 0.75 1 1.25 Kilometres

MOSAIC Group O



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0 0.25 0.5 0.75 1 2000
kilometres

Person Aged 65+ (Census)

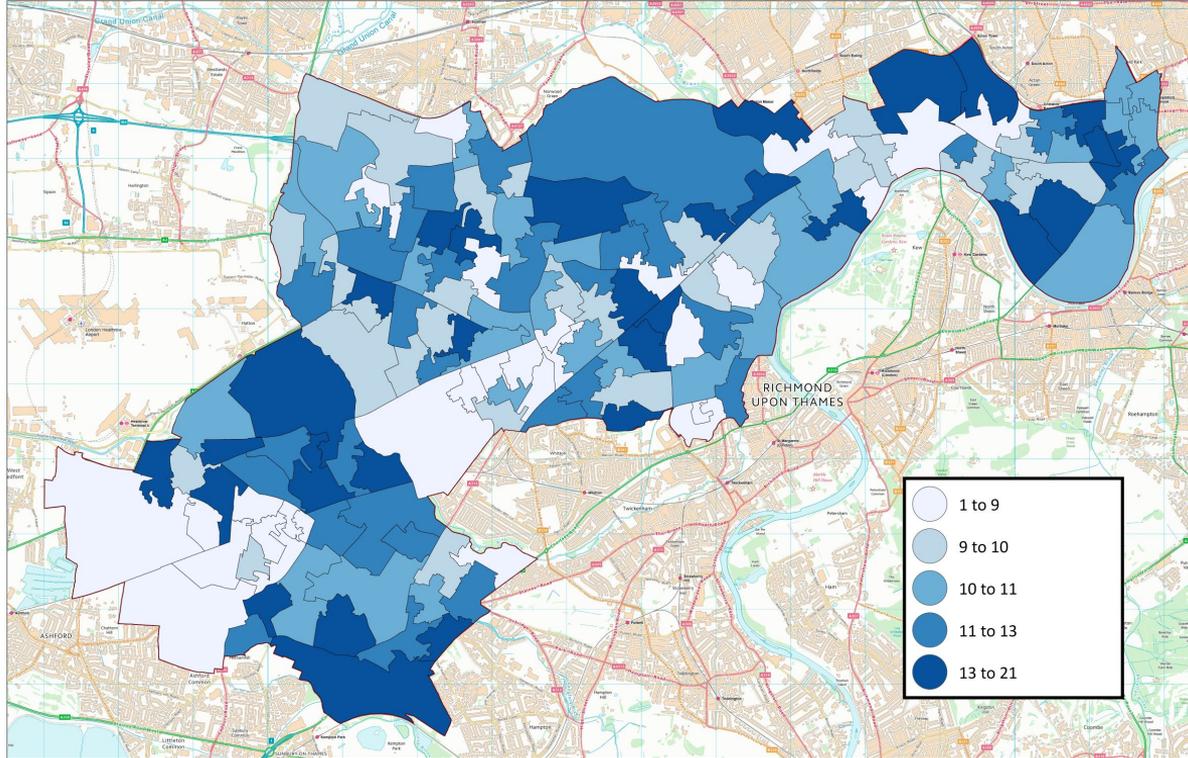


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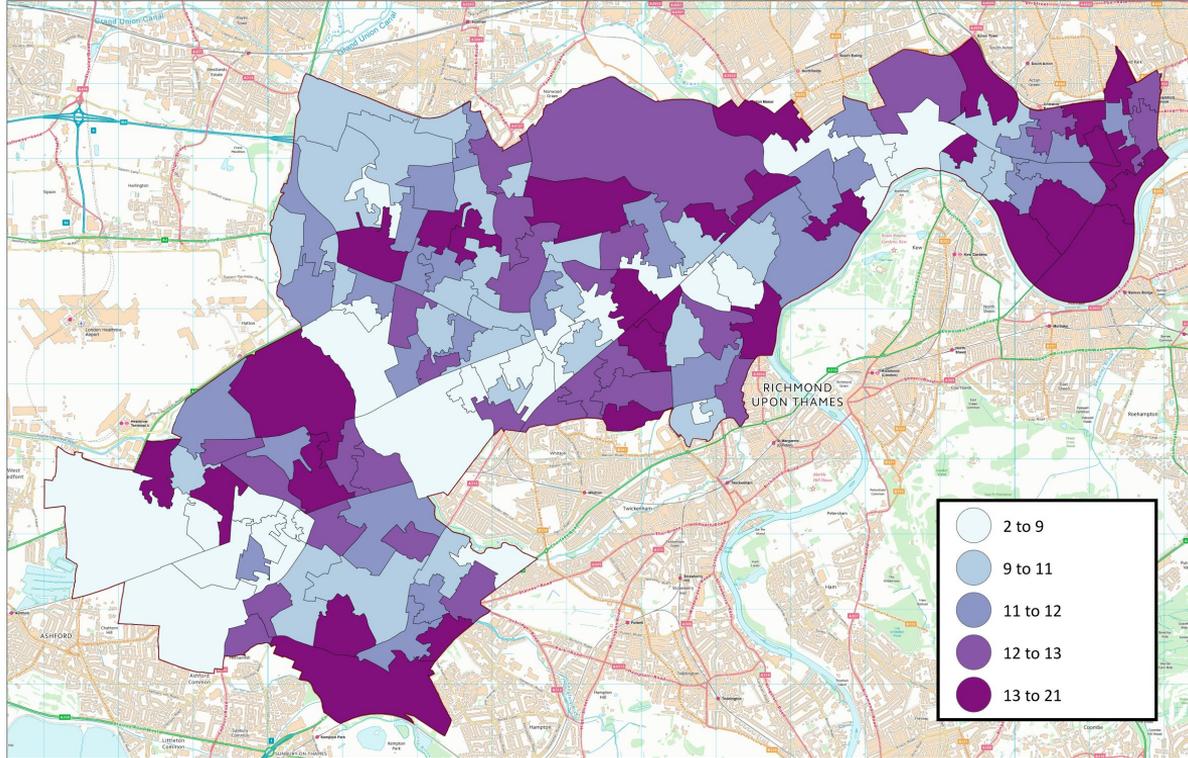
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2011 Census Hounslow Residents Aged 65+



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2015 Midyear Estimates Citizens Aged 65+



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0 0.25 0.5 0.75 1 kilometres 1:20000

Indoor Temperature Model

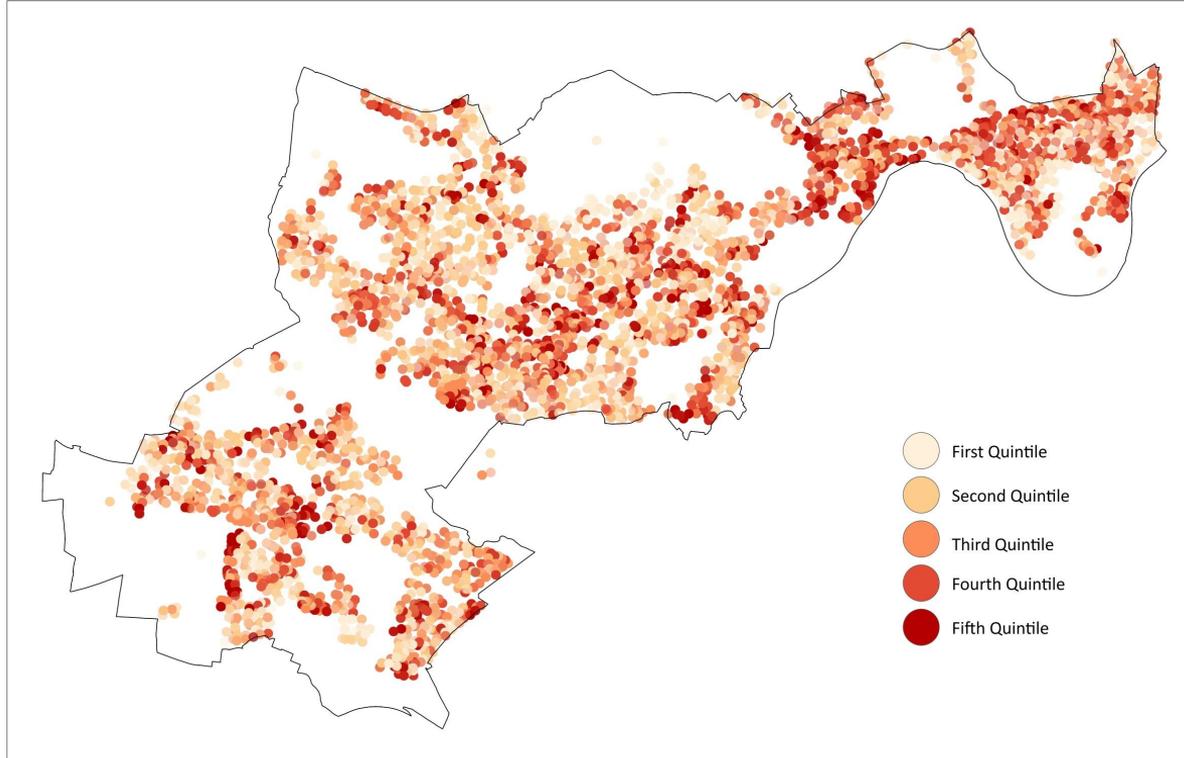


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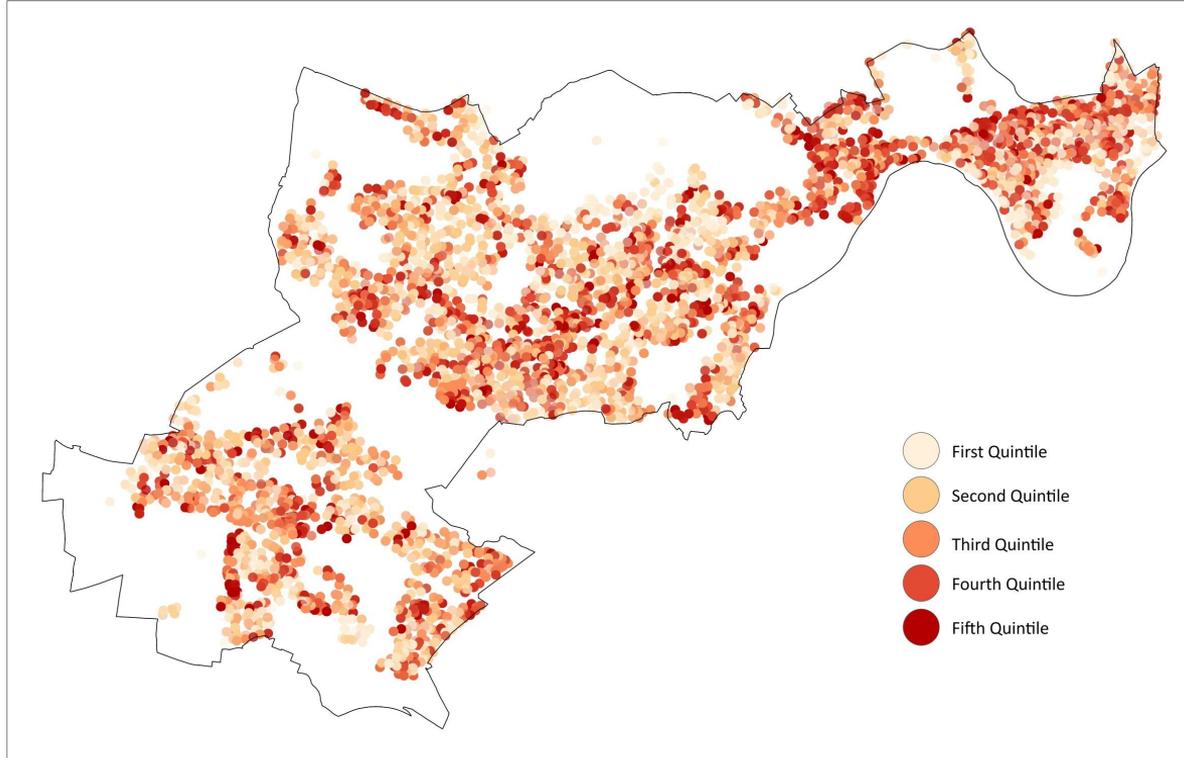
WPI

Indoor Overheating 18 C Outdoor Temperature



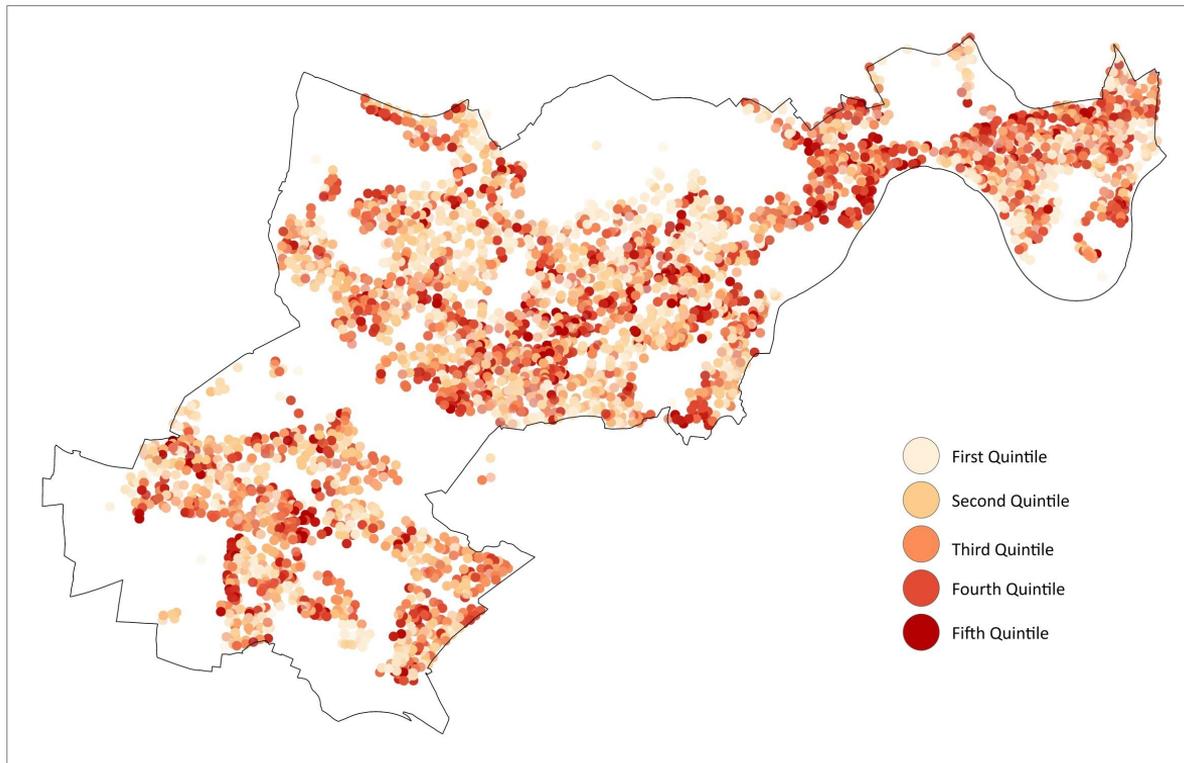
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Indoor Overheating 20 C Outdoor Temperature



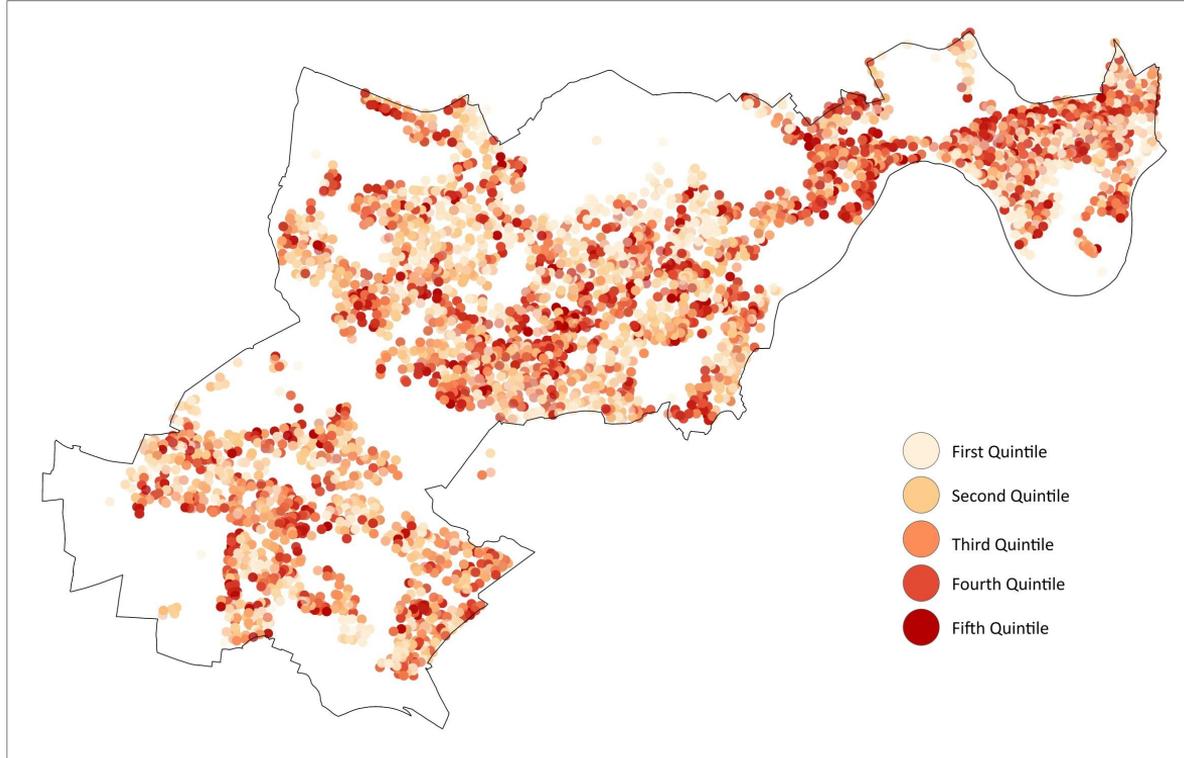
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Indoor Overheating 22 C Outdoor Temperature



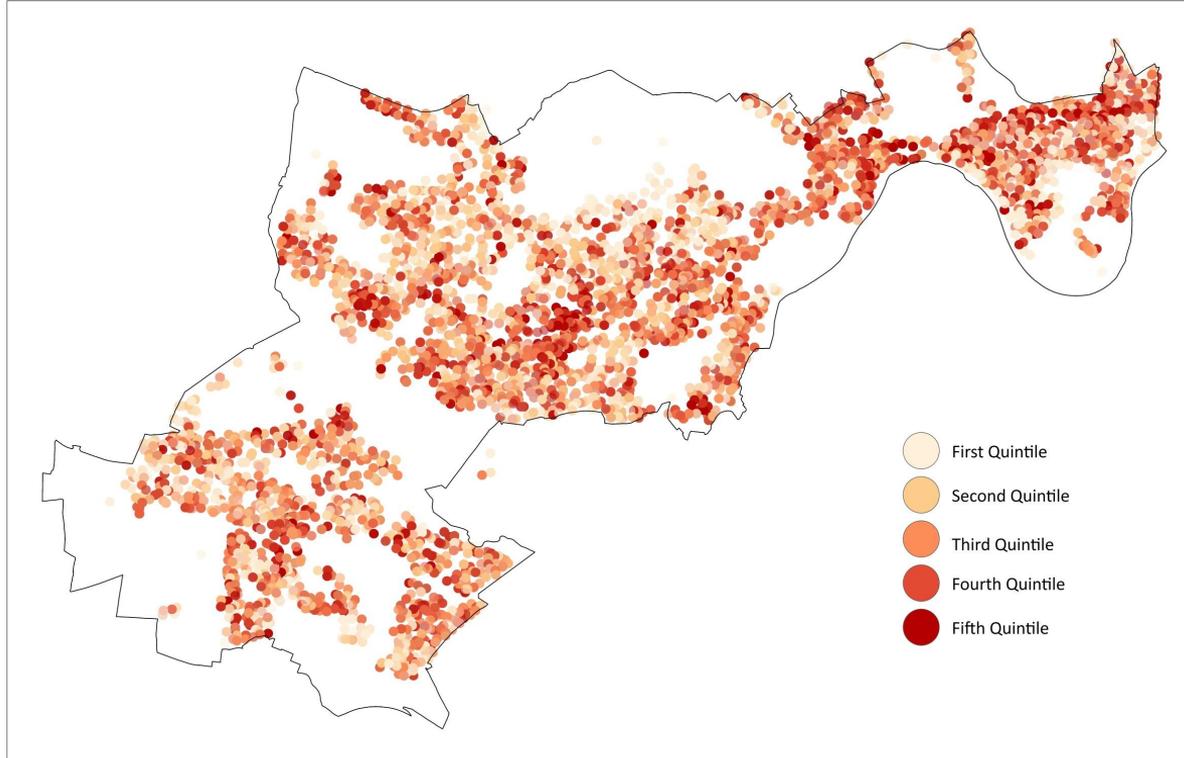
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Indoor Overheating 24 C Outdoor Temperature



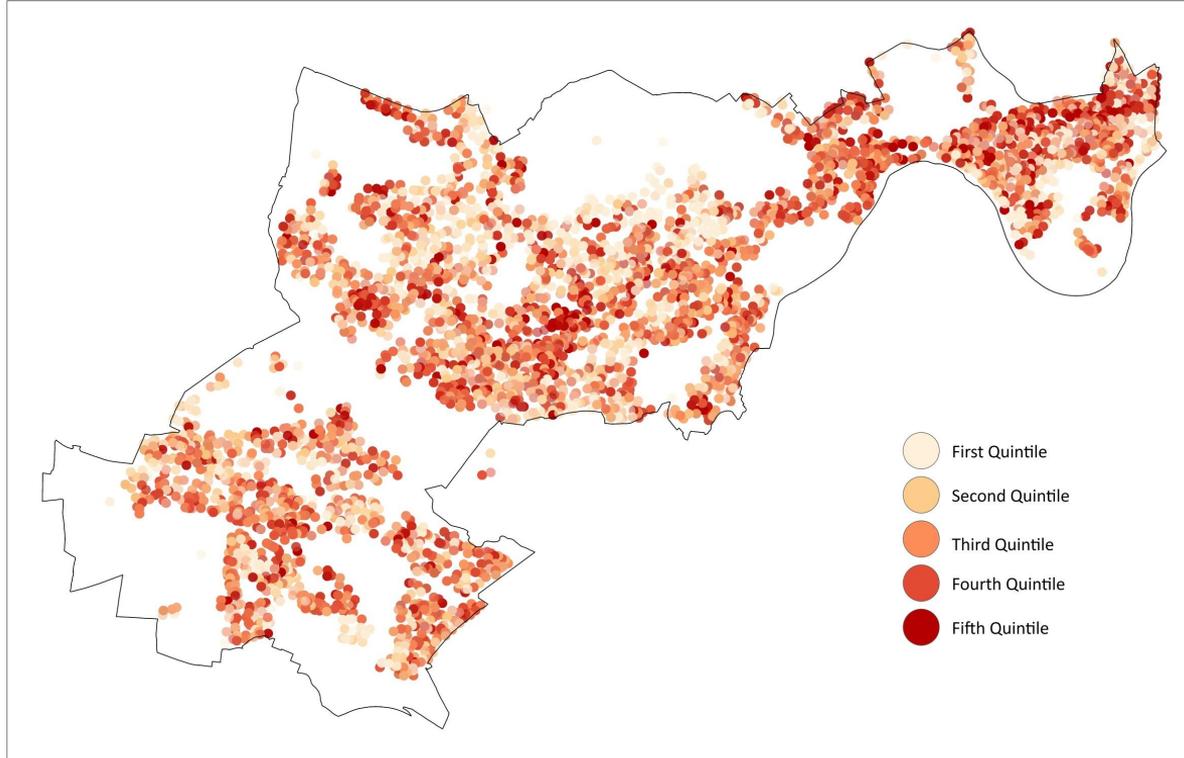
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Indoor Overheating 26 C Outdoor Temperature



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Indoor Overheating 28 C Outdoor Temperature



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Other GIS Maps

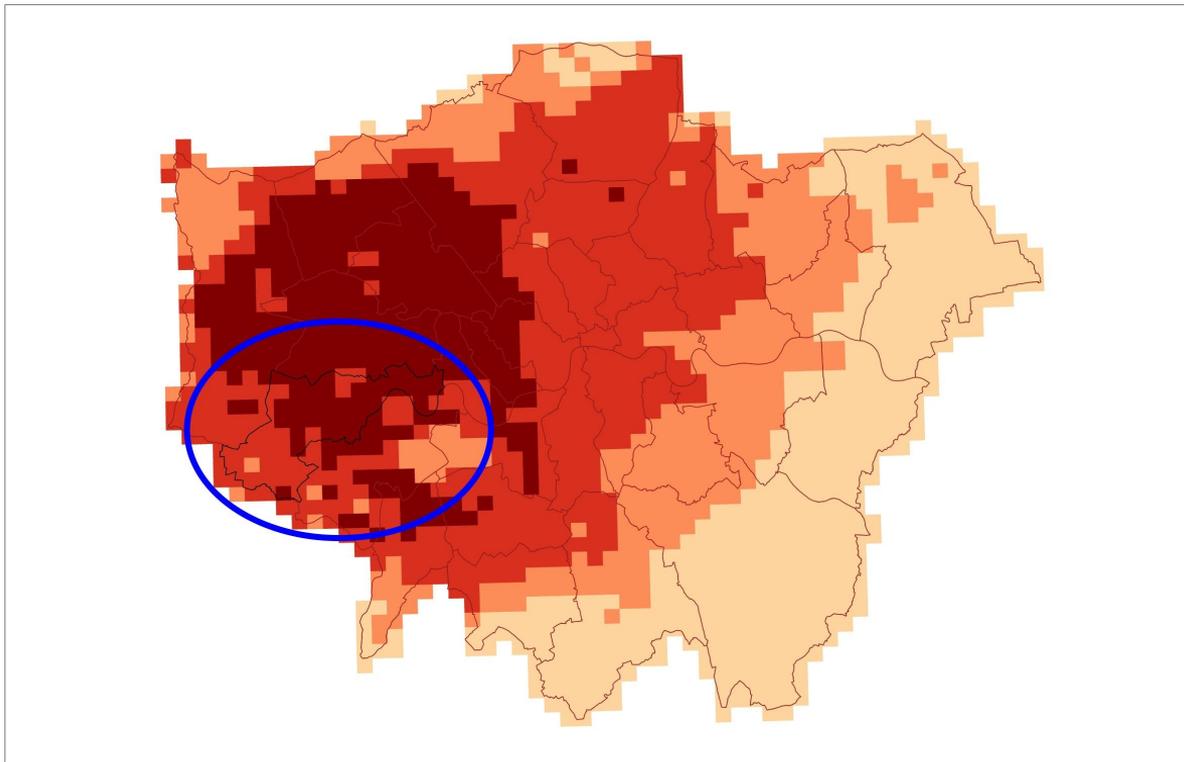


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London Urban Heat Island

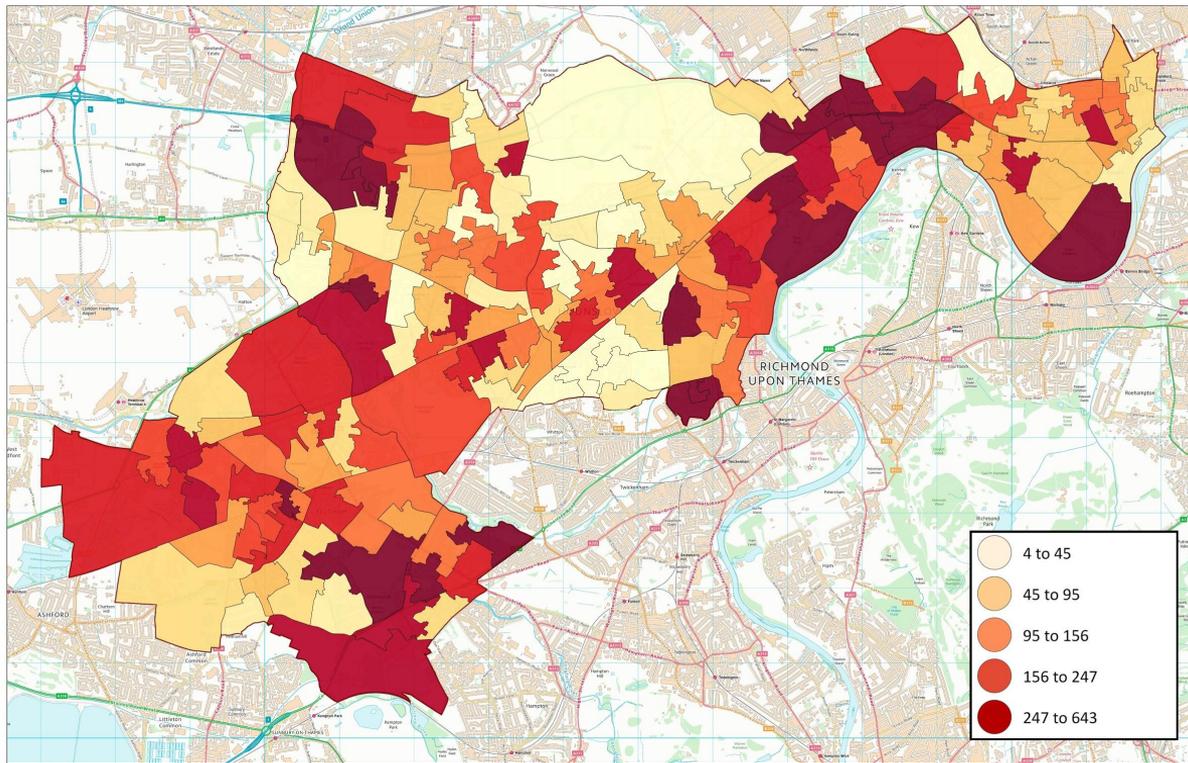


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0 1 2 3 4 kilometres

1:100,000

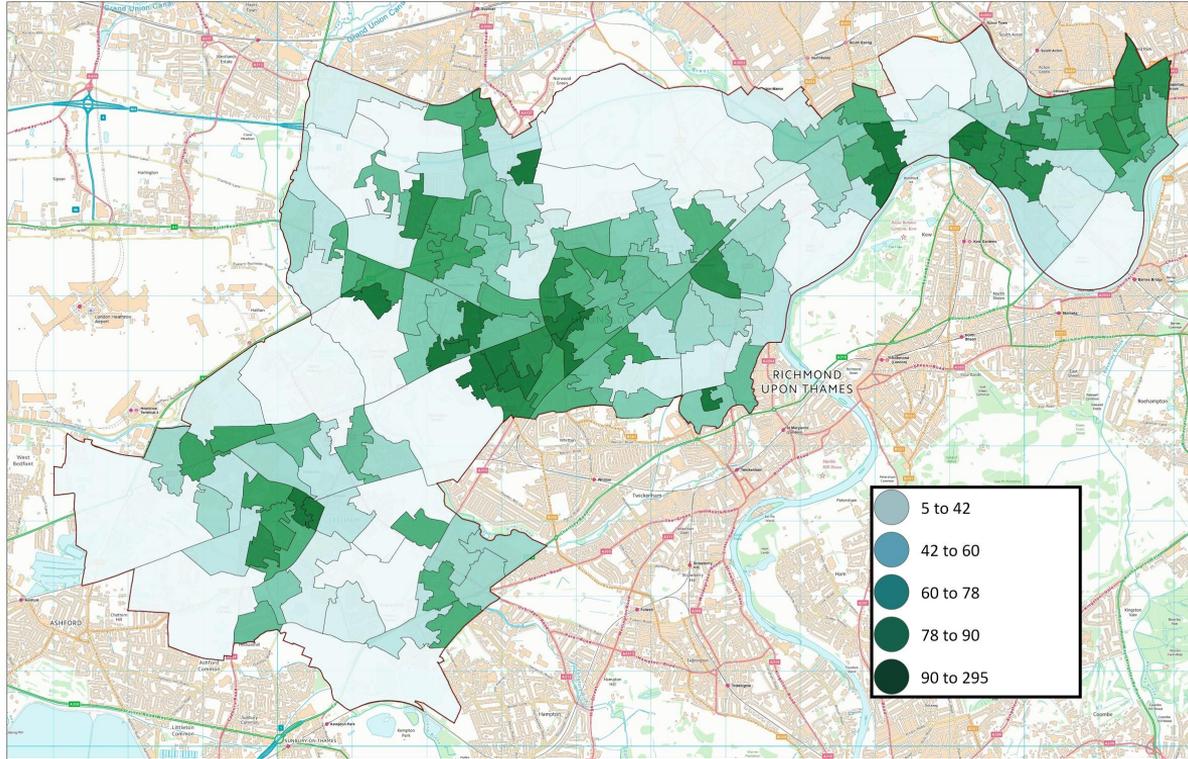
Rented Tenure



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0 0.25 0.5 0.75 1 kilometres
1:20000

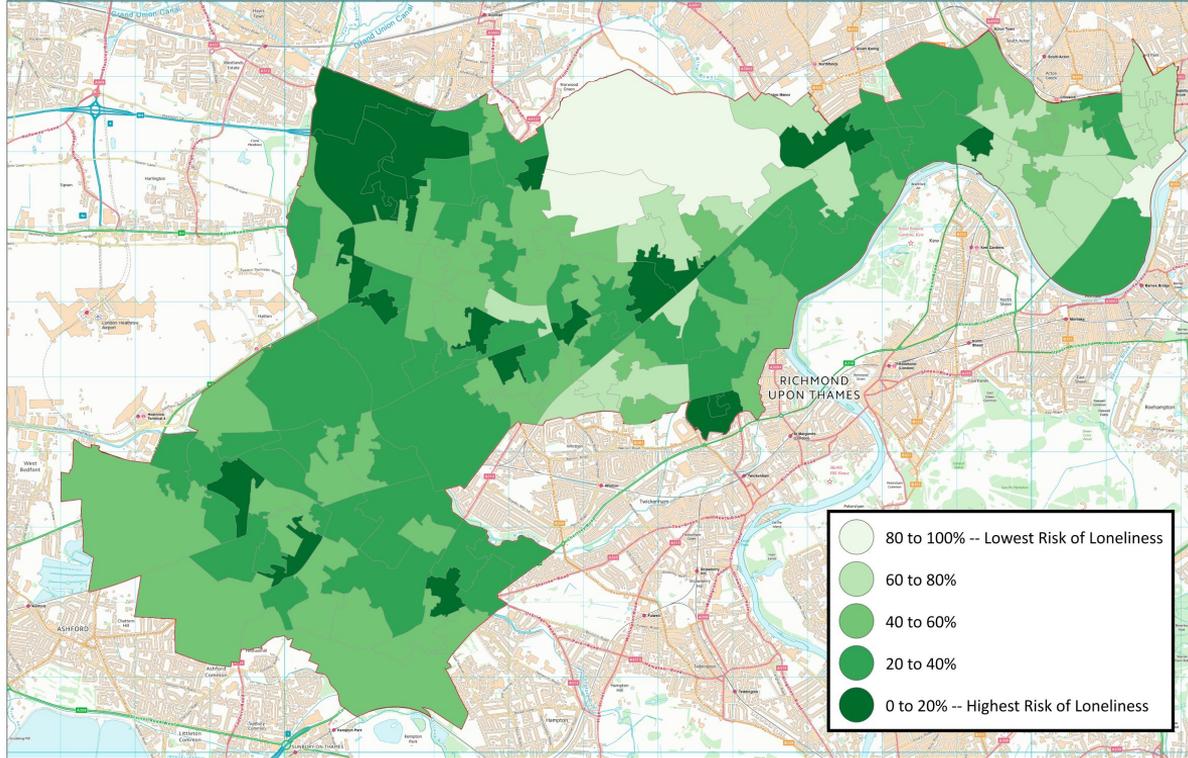
Population Density



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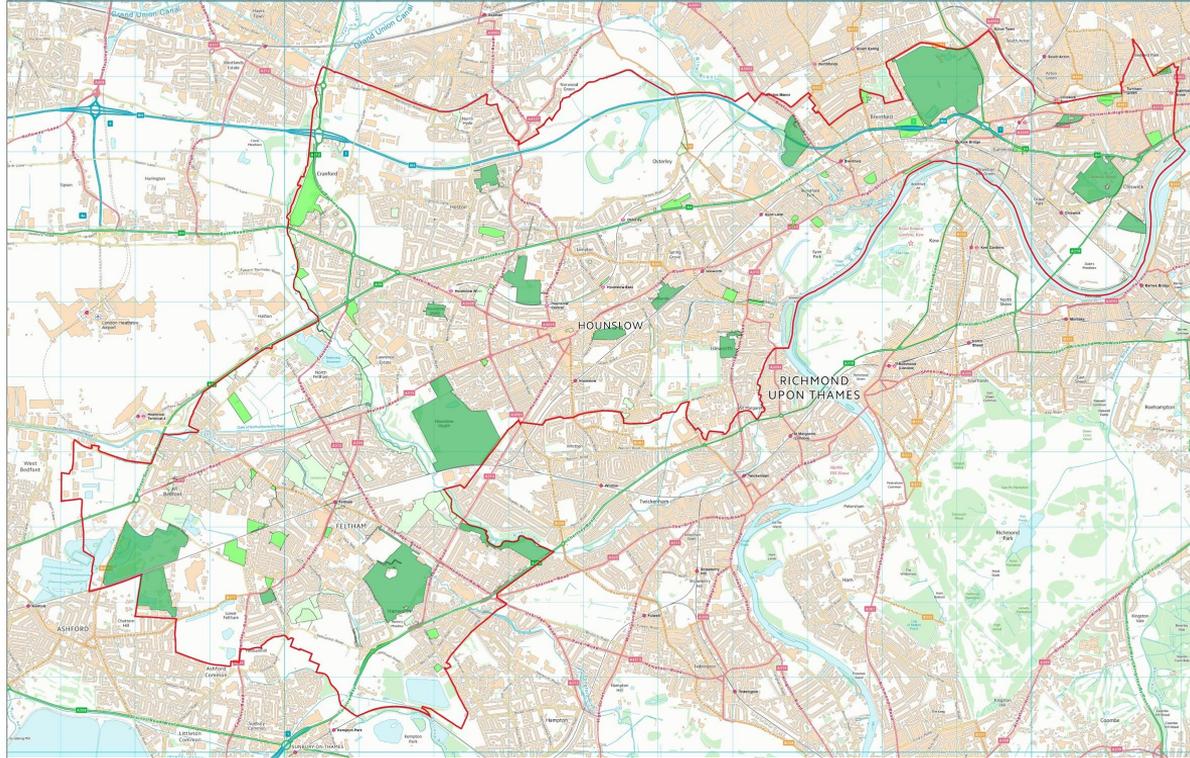
0 0.25 0.5 0.75 1 kilometres 1:20000

Risk of Loneliness in Older People



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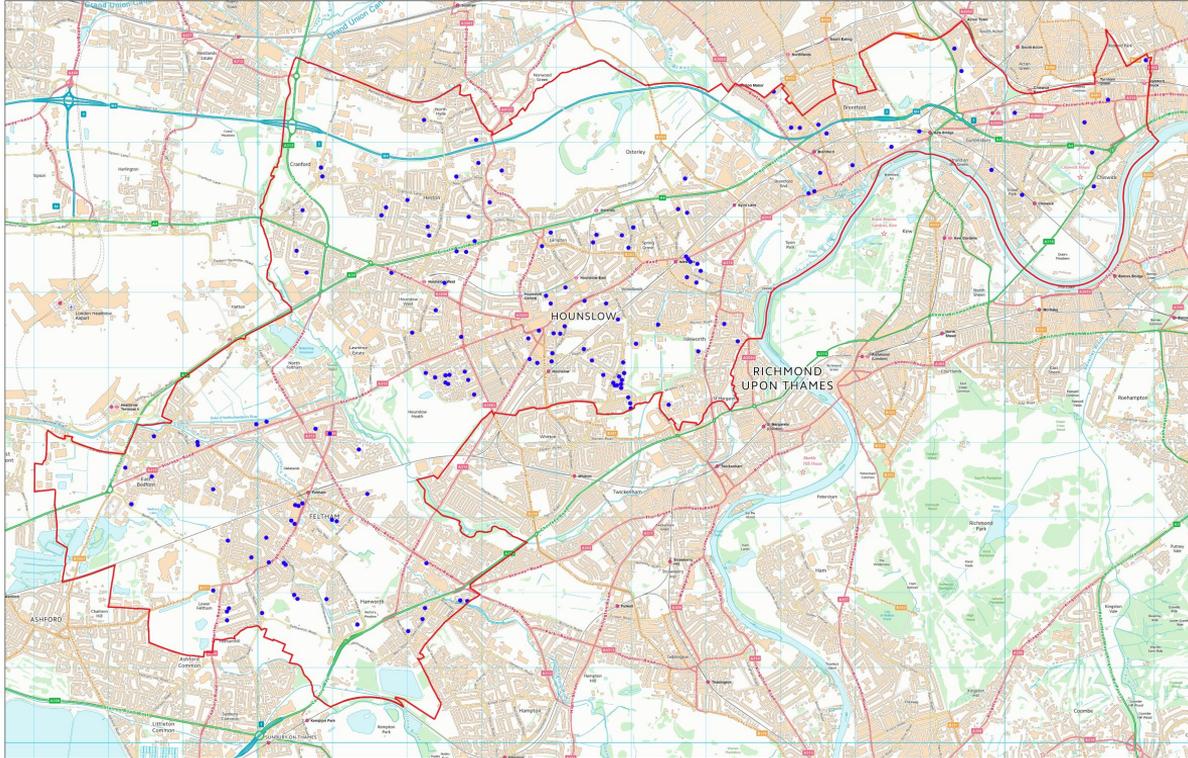
Key, Secondary, and Tertiary Parks



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0 0.25 0.5 0.75 1 kilometres
1:20,000

Households with no Central Heating



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0 0.25 0.5 0.75 1 kilometres 1:20000

Data Assessment



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Census Data

- Easily Accessible
- Not up to date
- Reliable
- Aggregated at Lower Super Output Area level
- Very relevant
- Complete



EPC Data

- Easily Accessible
- Semi-recent
- Semi-reliable
- Address-level
- Relevant
- Incomplete



Social Housing Data

- Semi-accessible
- Up-to-date
- Reliable
- Individually addressed
- Relevant
- Incomplete



GIS Database

- Semi-accessible
- Semi-current
- Semi-reliable
- Variable resolution
- Relevant
- Variable completeness



Indoor Temperature Model

- Semi-accessible
- Can be up to date (model needs to be run with current data)
- Semi-reliable
- Individually addressed
- Relevant
- Semi-complete

Conclusions



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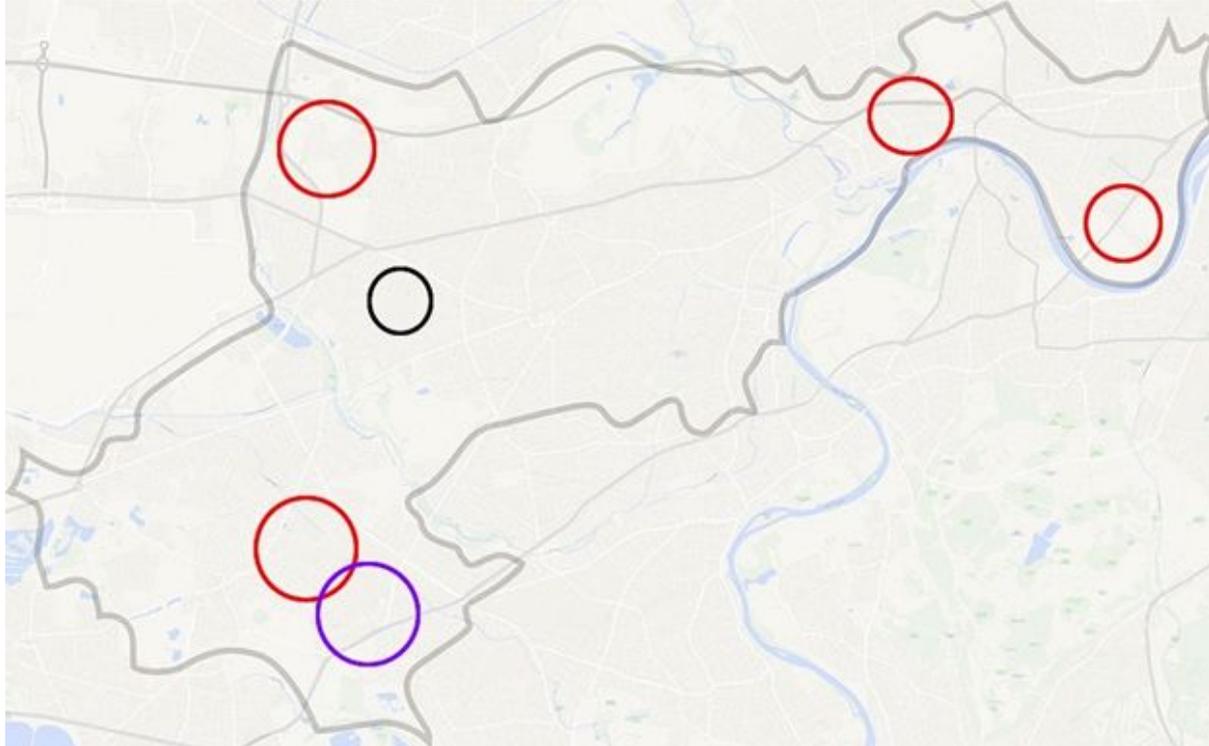
WPI

Area	Count	Vulnerabilities
Hounslow West	8	Indices of Multiple Deprivation MOSAIC Group N MOSAIC Group O Rented Tenure Population Density/Parks – Dense Houses of Multiple Occupation Age - Census 2011 Risk of Loneliness
Cranford	7	Indices of Multiple Deprivation MOSAIC Group N MOSAIC Group O Rented Tenure Population Density/Parks – Not dense with Green Space Houses of Multiple Occupation Risk of Loneliness
Brentford	7	Indices of Multiple Deprivation MOSAIC Group N MOSAIC Group O Rented Tenure Population Density/Parks – Dense Age - Census 2011 Risk of Loneliness

Area	Count	Vulnerabilities
Chiswick	7	Indices of Multiple Deprivation MOSAIC Group O Rented Tenure Population Density/Parks – Less Dense with Green Space Houses of Multiple Occupation Age - Mid-year 2015 estimate Risk of Loneliness
Feltham	7	MOSAIC Group O Rented Tenure Population Density/Parks – Dense Houses of Multiple Occupation Age - Census 2011 Risk of Loneliness Central Heating
Hanworth	6	MOSAIC Group N MOSAIC Group O Rented Tenure Population Density/Parks – Not dense with Green Space Age - Census 2011 Risk of Loneliness



Vulnerable Areas





Indoor Temperature Model





Privacy Impact Assessment



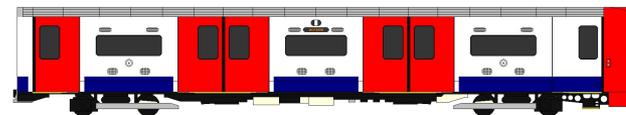
Piccadilly line

Week 3:
Began PIA

Week 7:
No Response



Week 4:
Submitted PIA





Identified Data Table

Dataset	Source	Contact	Origin of Data	Format	Resolution	Protected Anonymity	Refresh Rate	Specified Vulnerability (ies)	Completeness/Coverage	Data Access
Census Data	N/A	N/A	Office of National Statistics	CSV / Excel	LSOA	✓	10 years	Age, Population, Ethnicity, Population Density, Housing Occupancy	Fully complete/Country	Public
London Datastore	Greater London Authority	N/A	N/A	Varies: Excel, CSV, PDF, Website, ZIP, XML, Shapefile, Misc.	Borough level	✓	Rolling	Urban Heat Island	Complete but cannot see past borough level	Public
EPC Housing Data	Department for Communities and Local Government	Rory Prendergast	Individual Contractors	Excel	Address		Rolling	Indoor Heat Exposure	Only covers private homes being newly rented, sold, or revovated	Public
Indices of Multiple Deprivation	GIS / Earthlight	Vinesh Govind	Department for Communities and Local Government	GIS layer / Excel	Varied	✓	Rolling	Sensitivity (Deprivation)	Fully complete/Country	Public / Borough staff for Earthlight



Places to Look for More Data

Health and
Wellbeing Team

General
Practitioners

Clinical
Commissioning
Groups

Recommendations



London Borough
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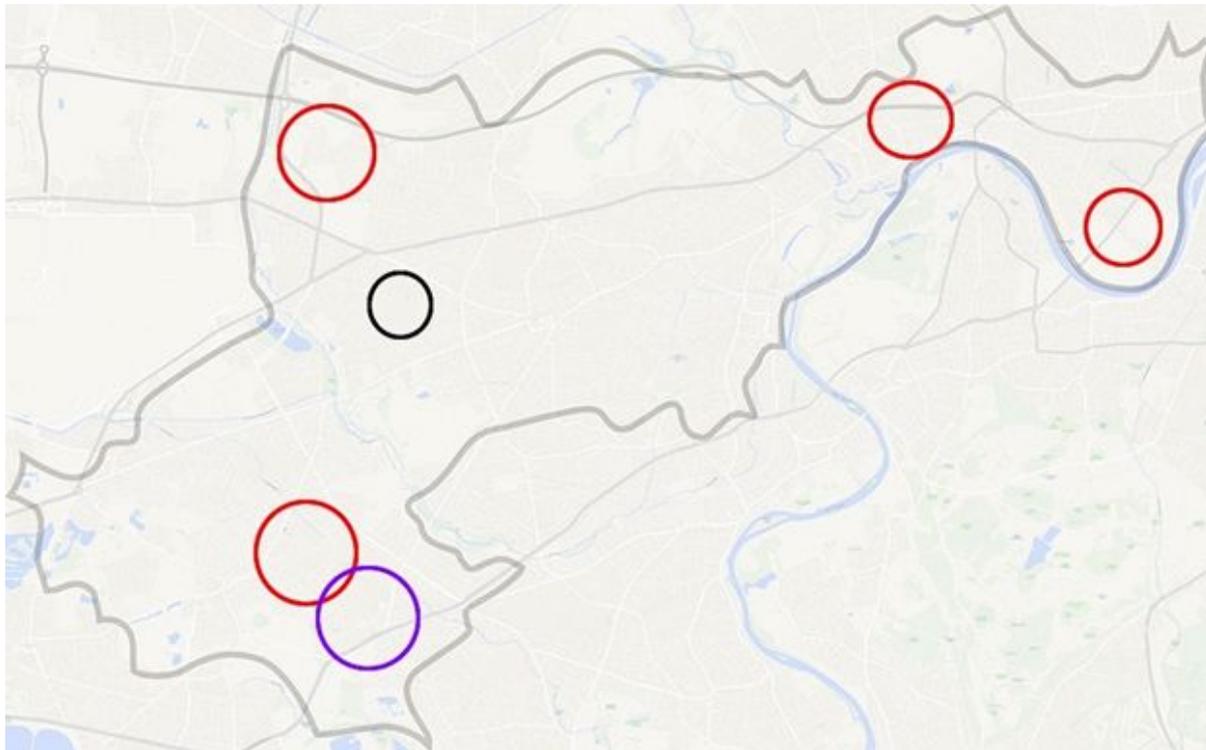


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Is it worthwhile?



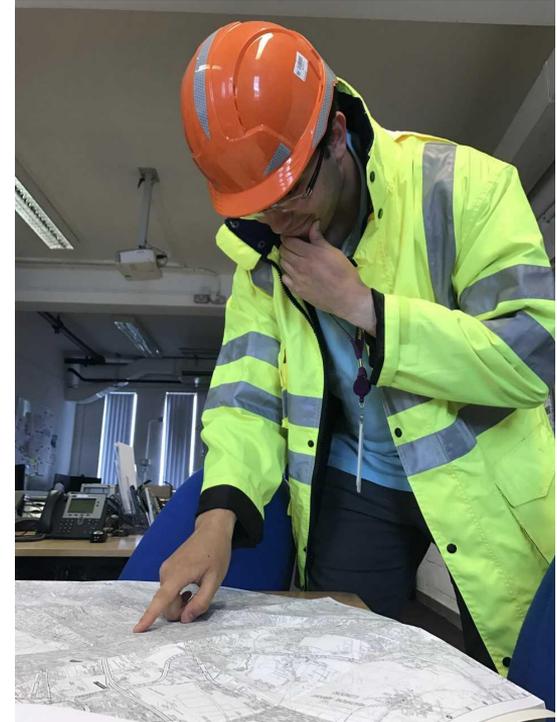
Targeted Warning & Informing





Emergency Planning

- Targeted warning and informing - using the method most likely to get through
- Place cooling centers where they will be most effective
- Allocate response resources effectively





Long Term Development

- Improvement projects for social housing
- Improved energy efficiency performance
- Urban planning
- Green space improvement



Munro, E. (2012, September 2). Lampton Park, London Borough of Hounslow, TW3 [Digital image]. Retrieved June 19, 2017.



Acknowledgments

Thank you Dominic and Jennifer for being the greatest IQP advisors we could ever ask for, we couldn't have done it without you!

Twm, thank you for your guidance and advice. It was our pleasure to take the Piccadilly line to Hounslow every day.

Thank you to our colleagues in the London Borough of Hounslow and the Hounslow Heatwave Steering Group for donating your time, advice, and expertise.

Questions?

Hounslow-17E2@wpi.edu



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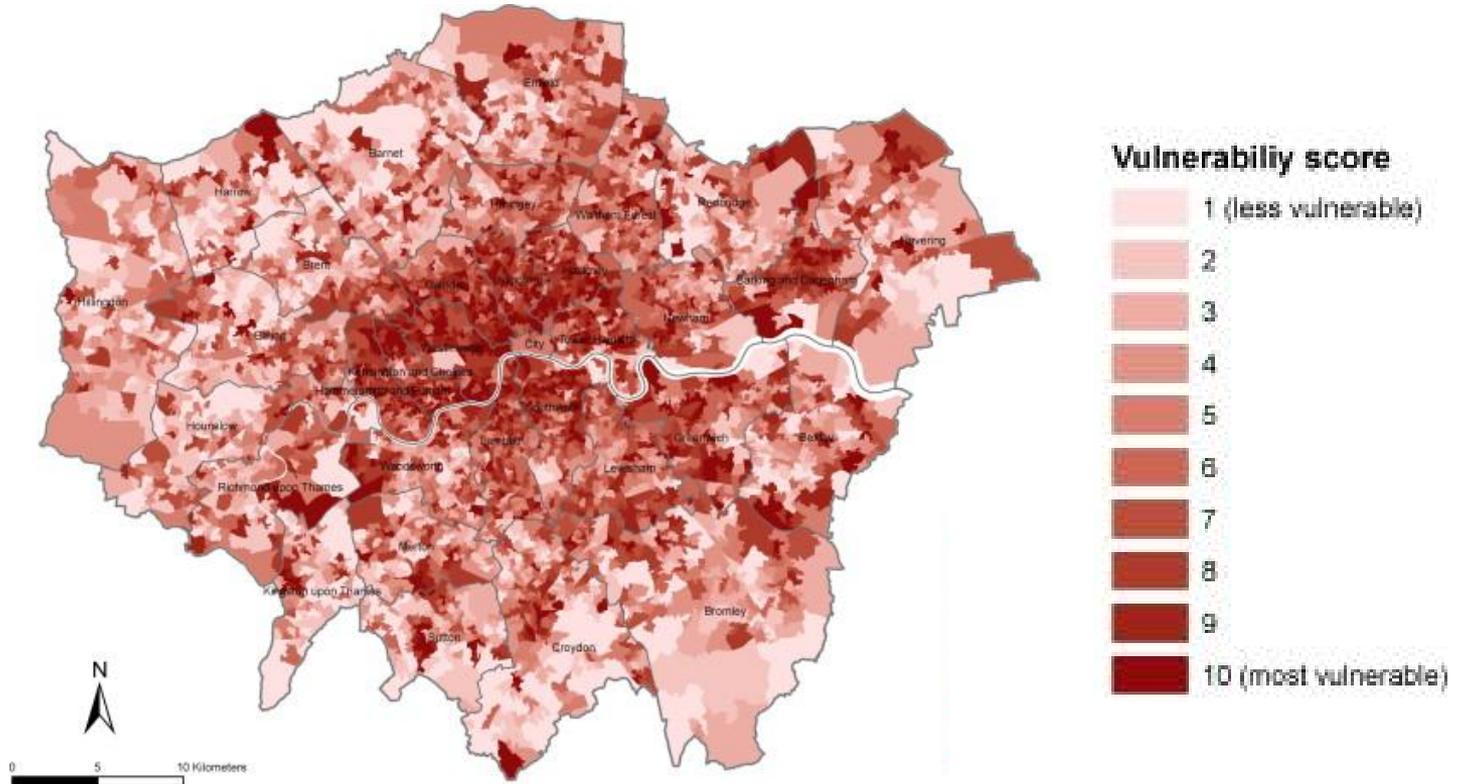


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- Taylor, J., Wilkinson, P., Davies, M., Armstrong, B., Chalabi, Z., Mavrogianni, A., Symonds, P., Oikonomou, E. & Bohnenstengel, S. I. (2015). Mapping the effects of Urban Heat Island, housing, and age on excess heat-related mortality in London. *Urban Climate*, 14, 517-528.
- Wolf, T., & McGregor, G. (2013). The development of a heatwave vulnerability index for London, United Kingdom. *Weather and Climate Extremes*, 1, 59-68.

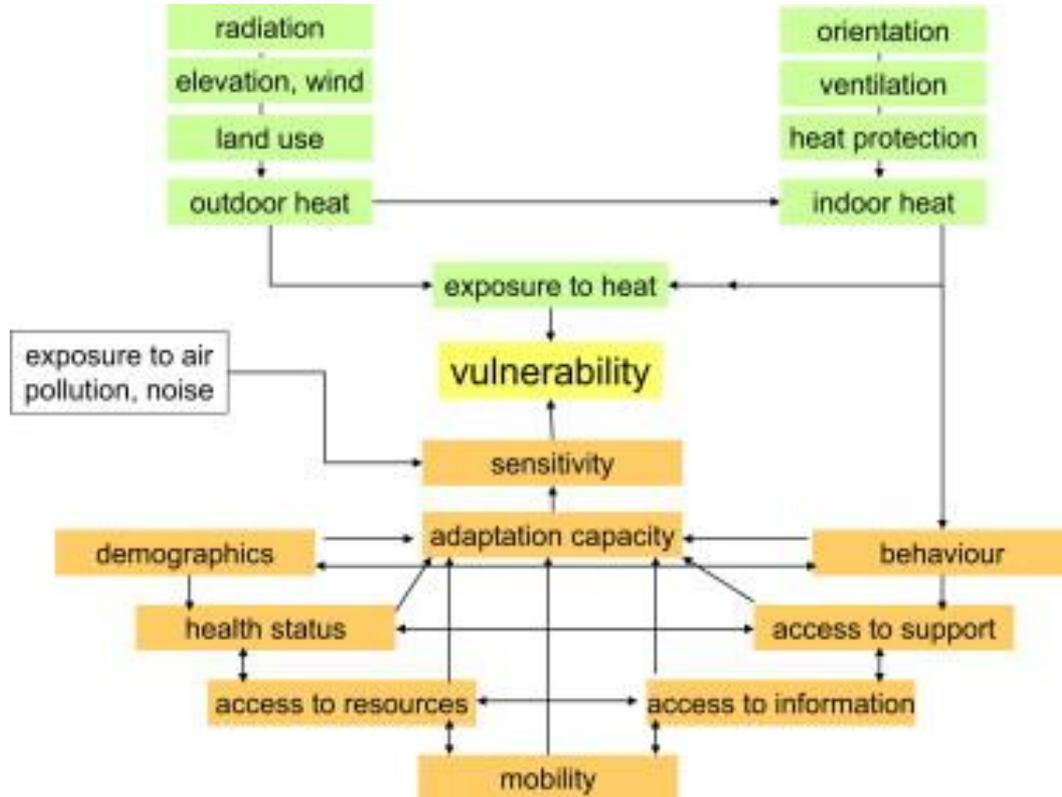


Heatwave Vulnerability Index





Heatwave Vulnerability Index



ADMS-Urban Model

- Traffic
- Industrial
- Commercial
- Domestic
- Other

Reading Urban Model (RUM)

- Thermodynamic energy
- Shadowing + Reflection
- Storage of heat in buildings
- Transport of heat into atmosphere

Calculate local temperature and air quality
RUM will determine boundary conditions
ADMS model will allow temp. variation calculations

Virtual London model

3D Representation of
London's built form

Ground surfaces from
aerial photos

Temperature Data

- Taxis with GPS technology
- Satellite data
- Fixed location temperature collection
- London Air Quality Network

Test new model against these temperature
measurements

