

# Urban Grammar

*Developing better characterisations of  
(urban) form and function*

Social Data Science

The Alan Turing Institute

Dani Arribas-Bel

@darribas

Martin Fleischmann

@martinfleis



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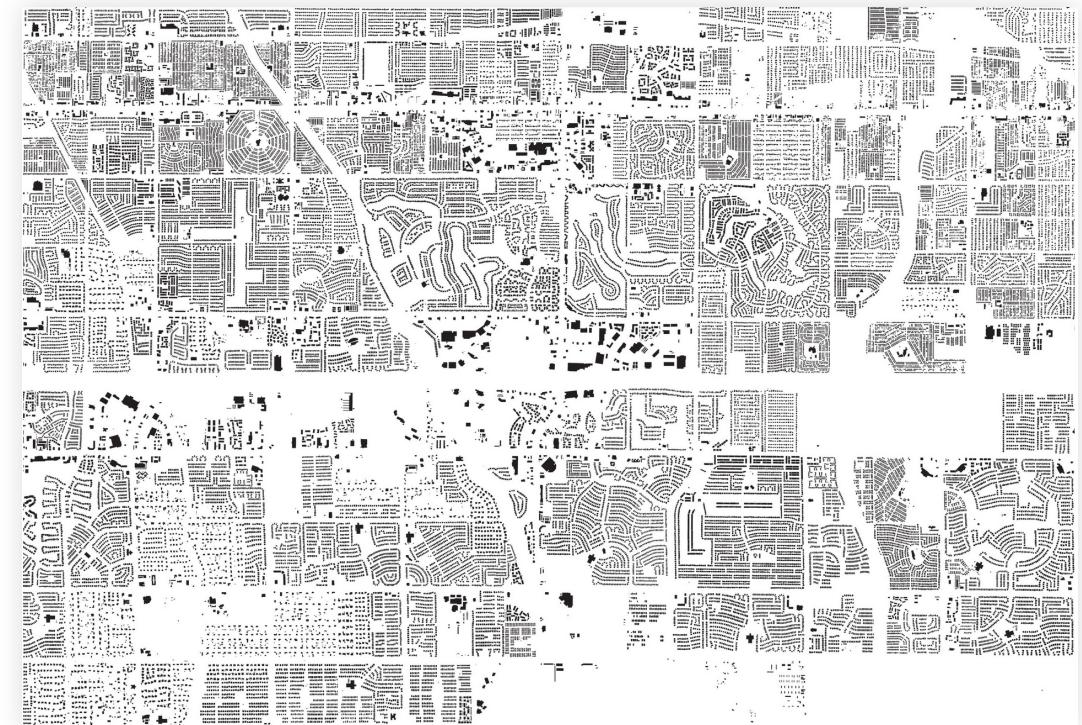
Geographic  
Data Science  
Lab

# Today

- *Urban* Form & Function
- Urban Grammar
- A peek into the future

(Urban) Form & Function

# How we arrange “stuff” in cities matters...



Source: *A map of every building in America* ([New York Times](#))

# Form & Function

Form

*What does it look like?*

“Physical structure and appearance of cities”

Function

*What is it used for?*

“Activities that take place within an environment”

# *Why* Form & Function?

*Encodes* the past

- Geography
- History
- Technology
- ...

*Frames* the future

- Productivity
- Sustainability
- Quality of Life
- ...

# F&F in Social Science/Policy

 **Handbook of Regional and Urban Economics**  
Volume 5, 2015, Pages 467-560



**Chapter 8 - Urban Land Use**

Gilles Duranton \*†, Diego Puga †‡

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<https://doi.org/10.1016/B978-0-444-59517-1.00008-8> [Get rights and content](#)

 **Journal of Urban Economics**  
journal homepage: [www.elsevier.com/locate/jue](http://www.elsevier.com/locate/jue)

**The economic effects of density: A synthesis\***

Gabriel M. Ahlfeldt <sup>a,1,\*</sup>, Elisabetta Pietrostefani <sup>b</sup>

<sup>a</sup>London School of Economics and Political Sciences (LSE) and Centre for Economic Policy Research (CEPR), Houghton Street, London WC2A 2AE, United Kingdom  
<sup>b</sup>London School of Economics and Political Sciences (LSE), Houghton Street, London WC2A 2AE, United Kingdom

Cities in Bad Shape: Urban Geometry in India - American Economic Association — Mozilla Firefox

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> Cities in Bad Shape: Urban Geometry in India

## Cities in Bad Shape: Urban Geometry in India

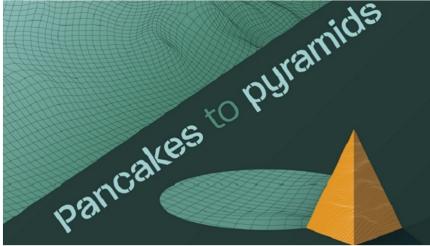
Mariaflavia Harari

AMERICAN ECONOMIC REVIEW  
VOL. 110, NO. 8, AUGUST 2020  
(pp. 2377-2421)

 **THE WORLD BANK**  
Understanding Poverty / Topics / Urban Development

PUBLICATION | JUNE 2, 2021

### Pancakes to Pyramids: City Form to Promote Sustainable Growth



 **Rethinking Urban Sprawl**  
MOVING TOWARDS SUSTAINABLE CITIES



  
**NEW URBAN AGENDA**

# F&F in Social Science

Critical to understand:

- Agglomeration economies
- Neighborhood effects
- Environmental sustainability
- ...

But often:

- Coarse
- Aggregate
- Ad-hoc
- ...

# Detail matters...

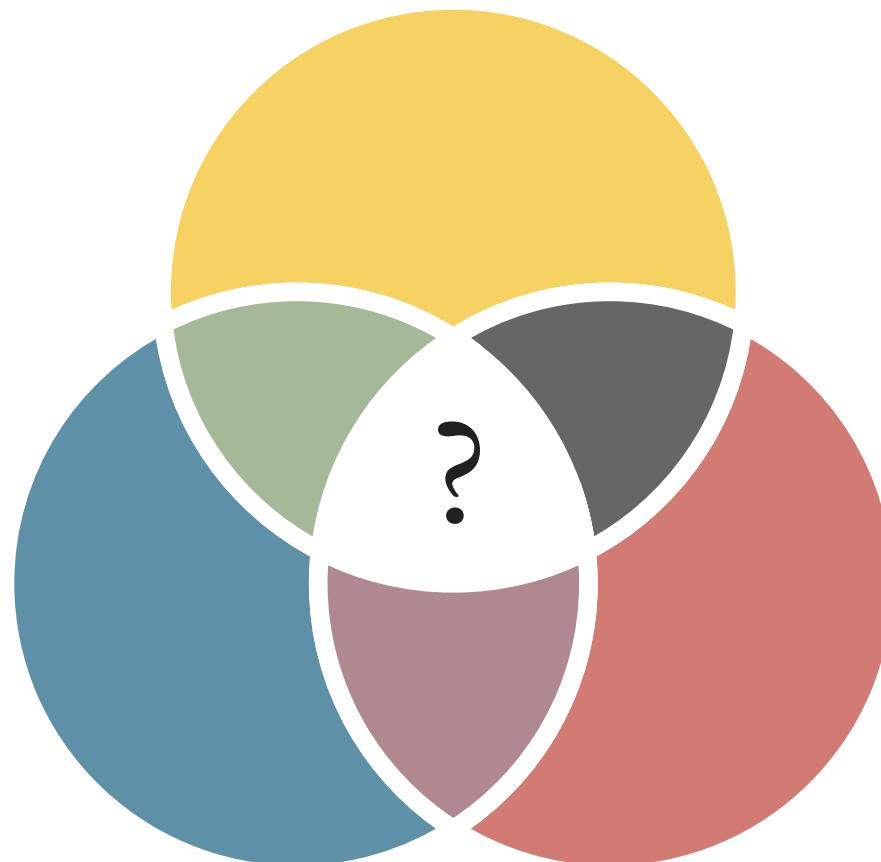


Source: *Six 15-minute walks capture the diversity, history of Houston neighborhoods* ([Urban Edge](#))

detailed

scalable

consistent



# Urban Grammar



# The Alan Turing Institute



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## Urban Grammar

Learning an urban grammar from satellite data through AI

[Learn more ↓](#)

Project status  
Ongoing

Related programmes  
[Urban analytics](#)



*Characterisations of space based on form and function  
designed to understand urban environments*

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designed to understand urban environments*

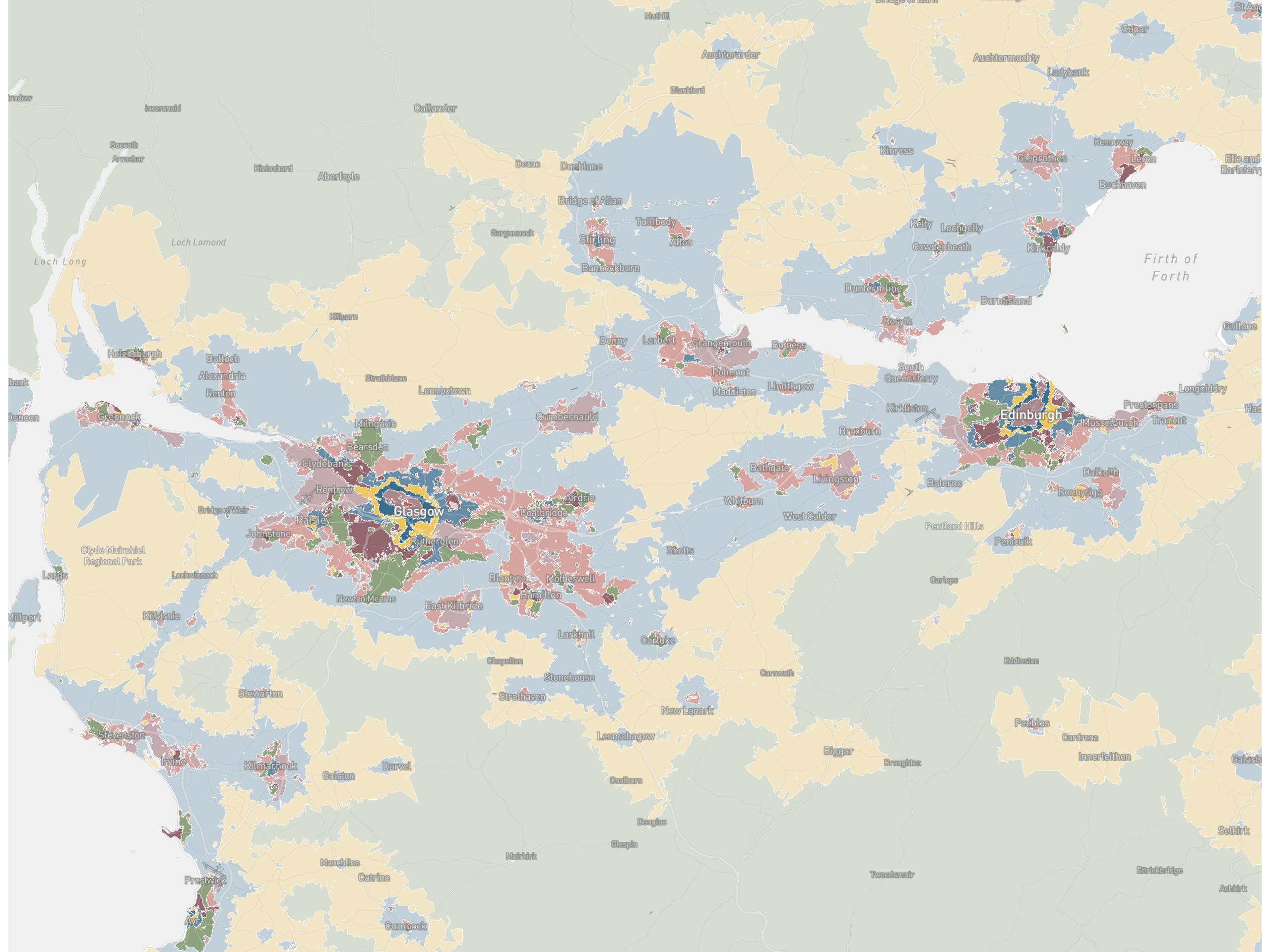
*Characterisations of space based on form and function  
designed to understand urban environments*

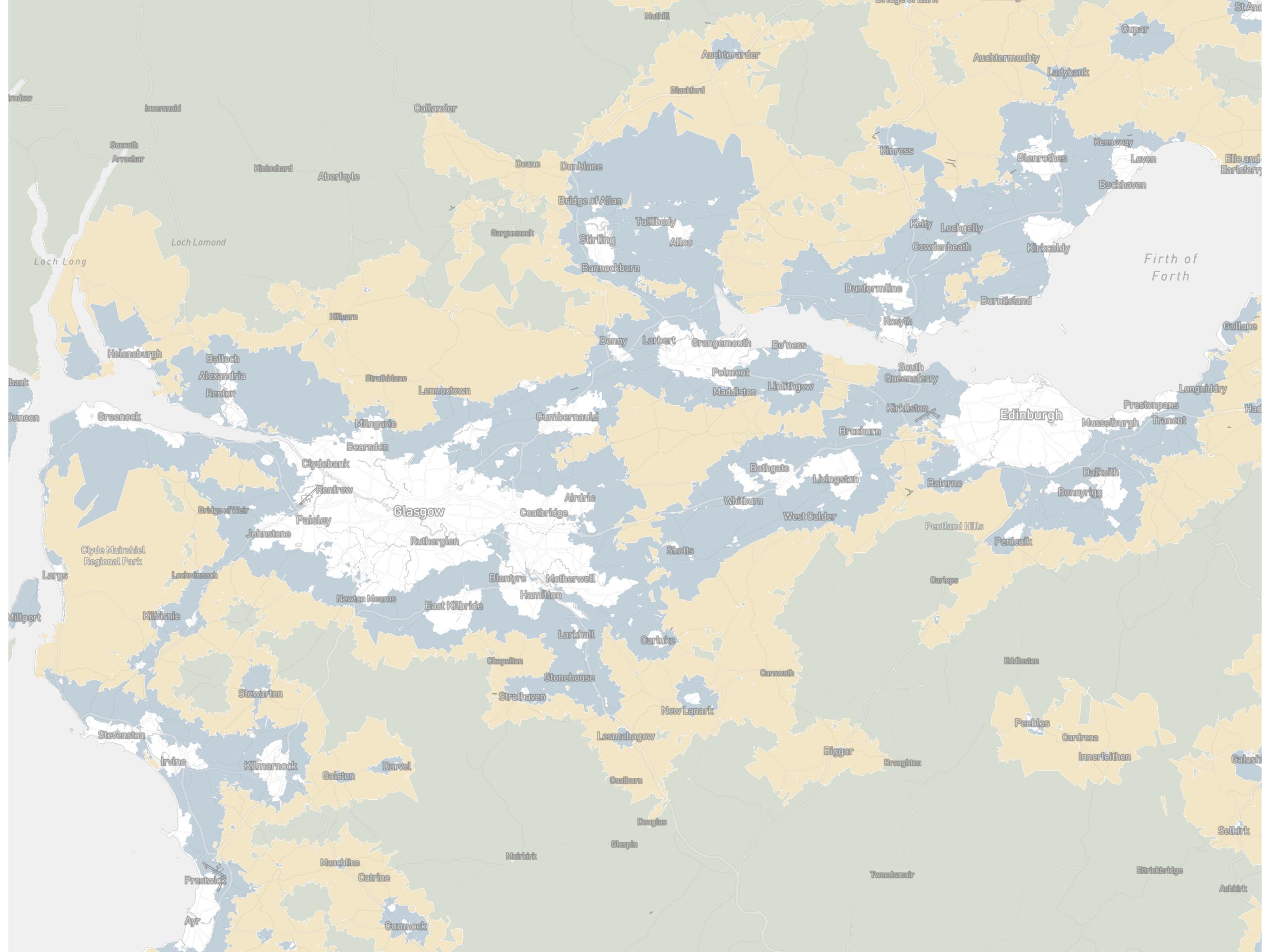
*Characterisations of space based on form and function  
designed to understand urban environments*

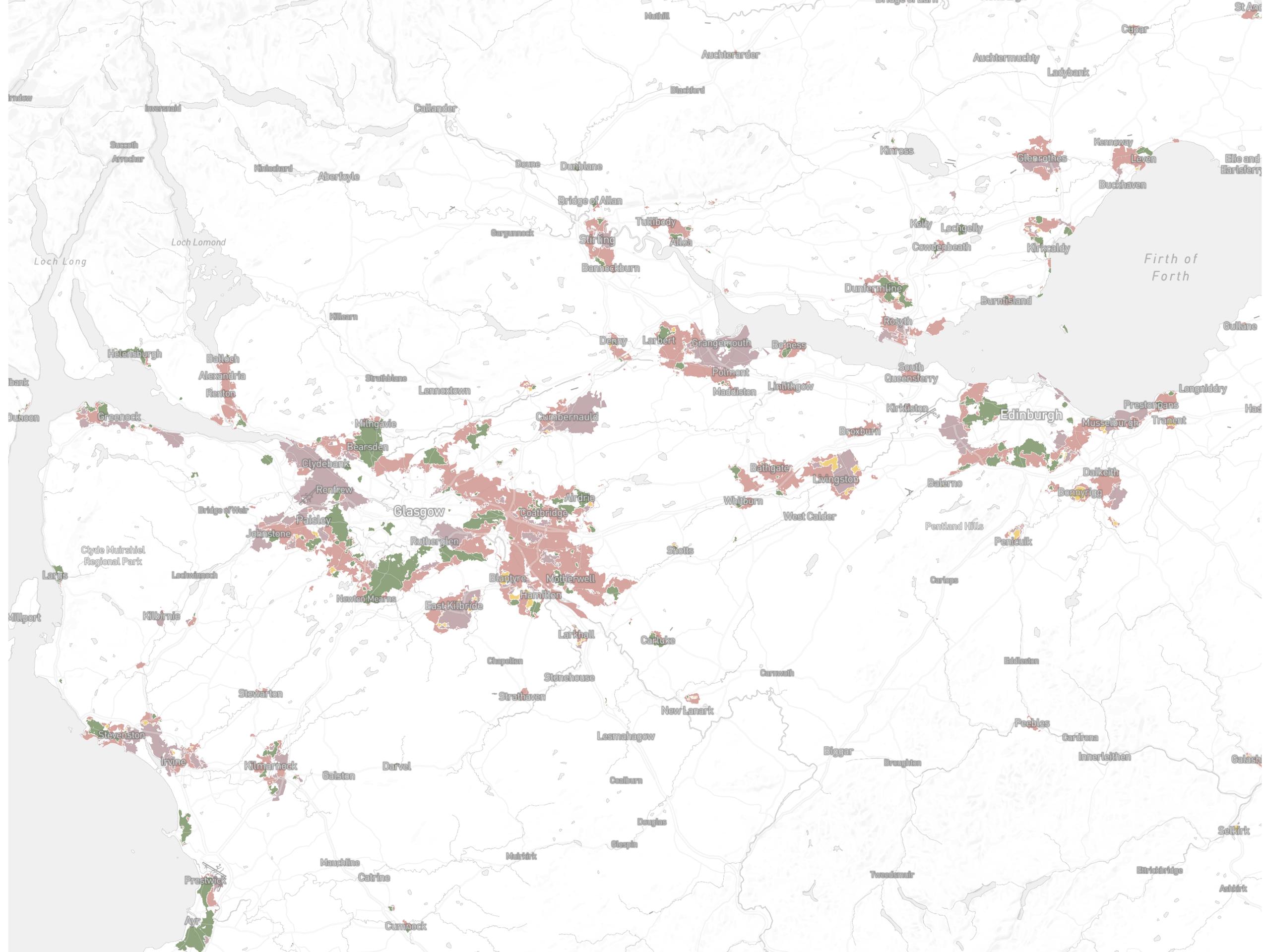
# British Signatures

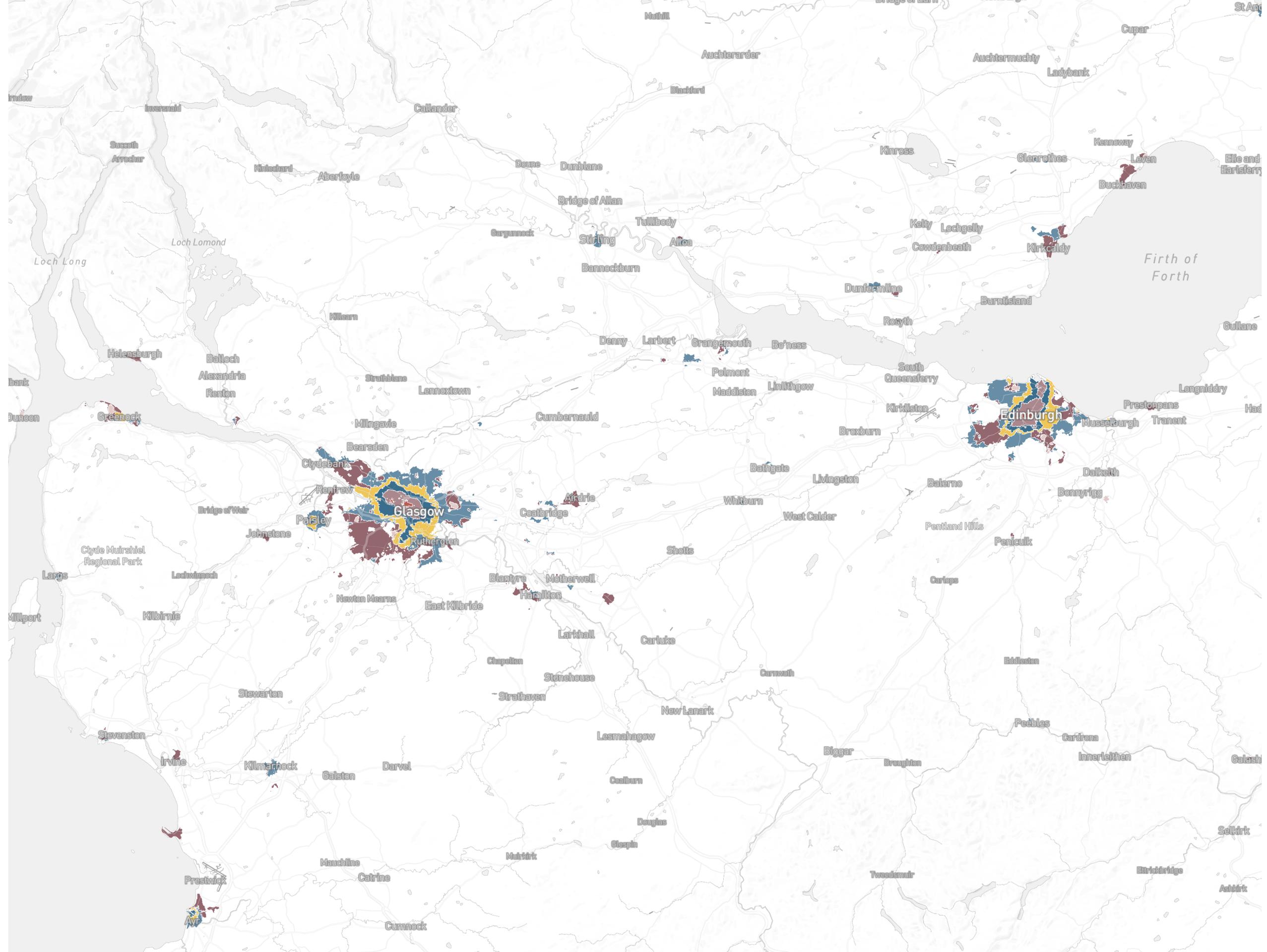


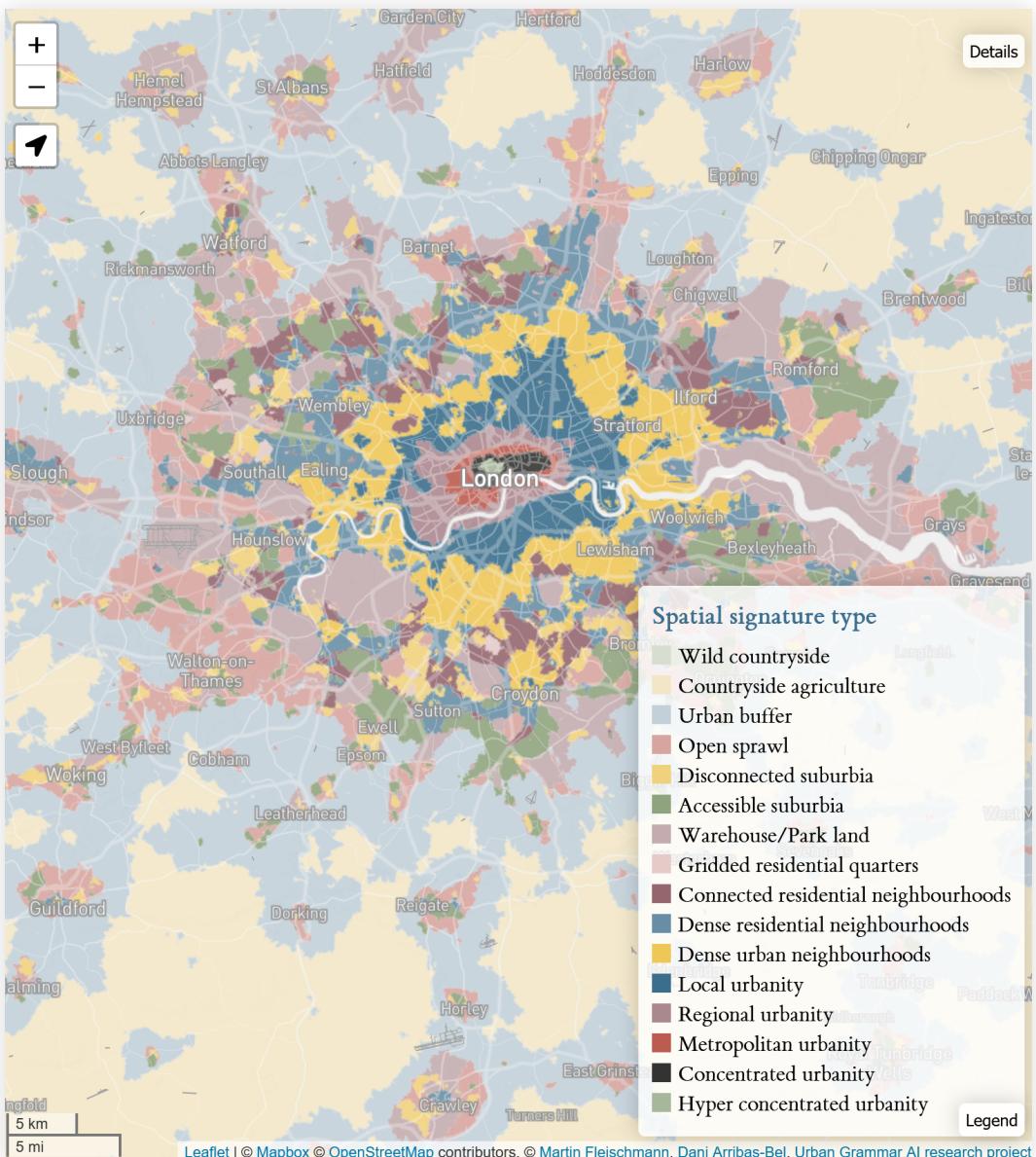
<https://urbangrammarai.xyz/story>











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## Spatial Signatures of Great Britain

Population & Mobility Transport & Movement

Geographical Characterisation of British Urban Form and Function using the Spatial Signatures Framework

Spatial signatures characterise space based on form and function in a way designed to understand urban environments. This data product, part of the Urban Grammar project, contains a typology of spatial signatures in Great Britain. Each type has a distinct character capturing what the place looks like (form) and how it is used (function).

The data product contains bespoke Signature geometry with signature type, summary of input variables per each geometry and per each type, interpolation of signature types to OA and LSOA geometry and short pen portraits for the typology, shorthand descriptions of the characteristics of each signature type.

The interactive map showing the typology is available at <https://urbangrammarai.xyz/great-britain/>. More details about the project can be found at the project website <https://urbangrammarai.xyz>.

**Data Extent**

Leaflet | Map data © OpenStreetMap

**License**

UK Open Government Licence (OGL)

Habitat International  
Volume 128, October 2022, 102641

**Spatial Signatures - Understanding (urban) spaces through form and function**

Daniel Arribas-Bel <sup>a,b</sup>, Martin Fleischmann <sup>b,c</sup>

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**Geographical characterisation of British urban form and function using the spatial signatures framework**

Martin Fleischmann & Daniel Arribas-Bel

*Scientific Data* 9, Article number: 546 (2022) | Cite this article

1184 Accesses | 20 Altmetric | Metrics



# Sub-classifications

XXVIII International Seminar on Urban Form  
ISUF2021: URBAN FORM AND THE SUSTAINABLE AND PROSPEROUS CITIES  
29<sup>th</sup> June – 3<sup>rd</sup> July 2021, Glasgow

**Classifying urban form at national scale: The British morphosignatures**

Dr Martin Fleischmann<sup>1</sup>, Dr Daniel Arribas-Bel<sup>1</sup>

<sup>1</sup> Geographic Data Science Lab, Department of Geography and Planning, University of Liverpool, UK



 ELSEVIER

Data in Brief  
Volume 43, August 2022, 108335  


Data Article

**Functional signatures in Great Britain: A dataset**

Krasen Samardzhiev <sup>a</sup>  , Martin Fleischmann <sup>a</sup> , Daniel Arribas-Bel <sup>a, b</sup> , Alessia Calafiore <sup>a</sup> , Francisco Rowe <sup>a</sup> 

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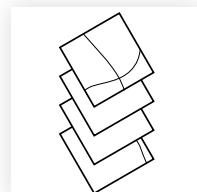
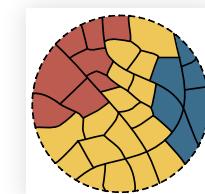
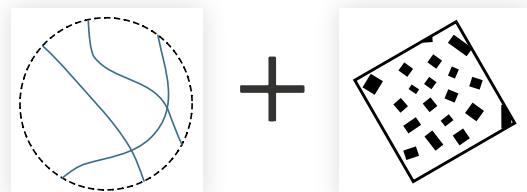
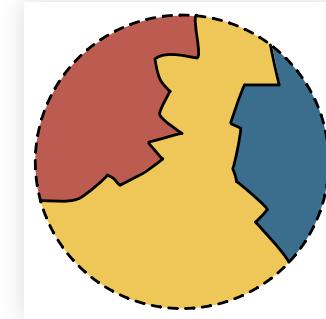
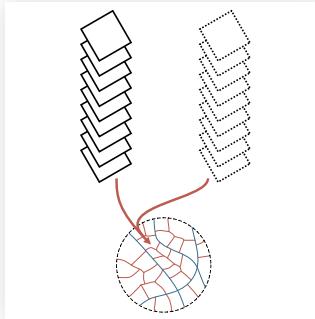
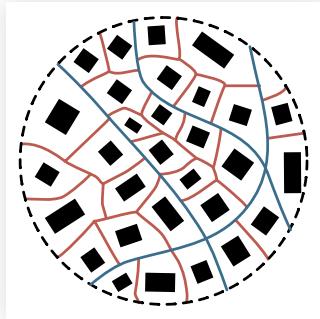
# Building Spatial Signatures

[STAGE] Delimiters Enclosure Anchors Encl. Tess. Characters Clusters Signatures

Enclosed  
Tessellation

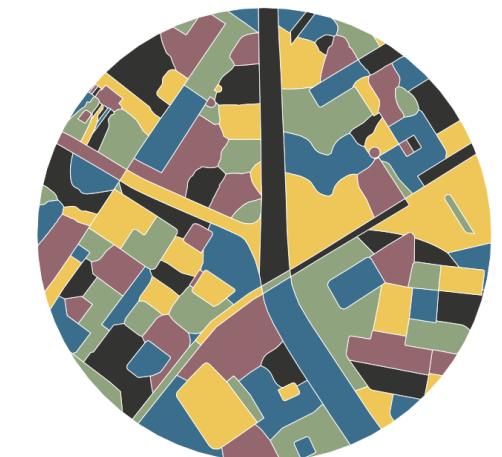
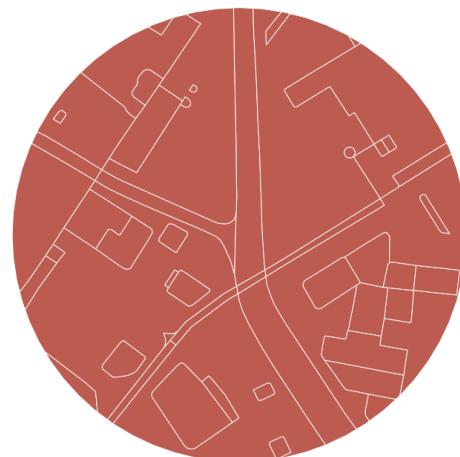
Embedding  
*form & function*

Spatial  
Signatures

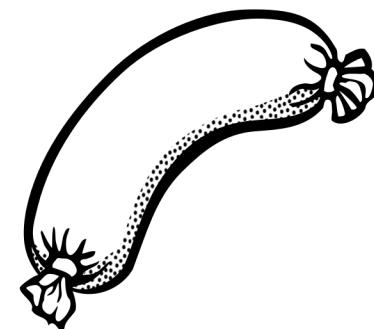


# Meaningful spatial units

Enclosed tessellation



# *“Open by default”*



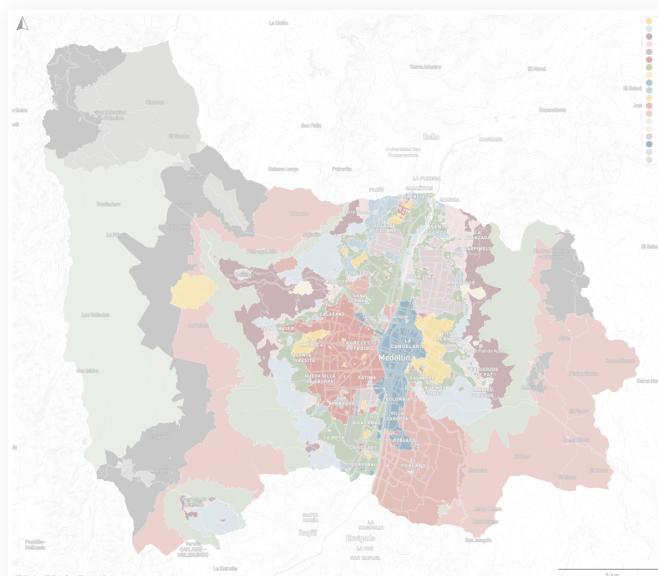
- Data, data, data
- Methods, code
- Infrastructure
- Dissemination
- Open Data Products
- Journaling/reporting

<https://urbangrammarai.xyz>

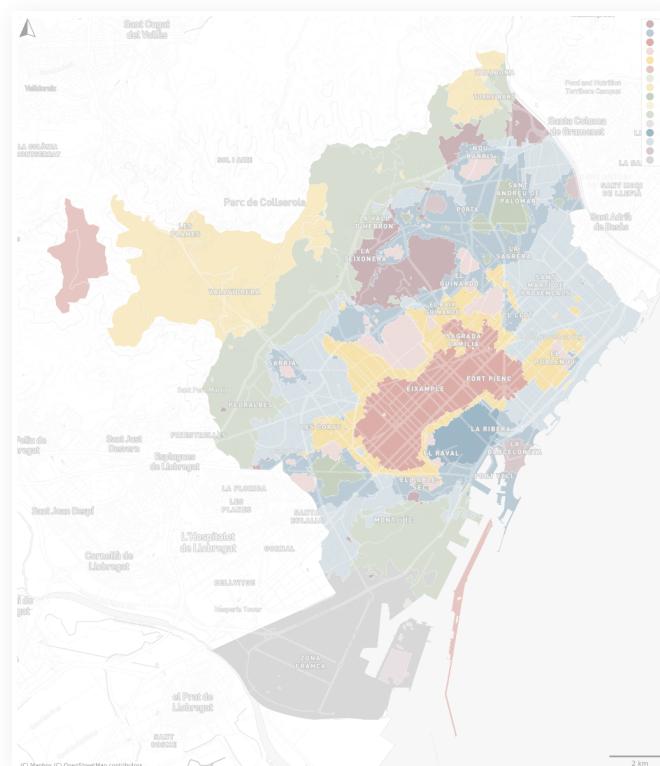
# Lessons

# *Encoding*

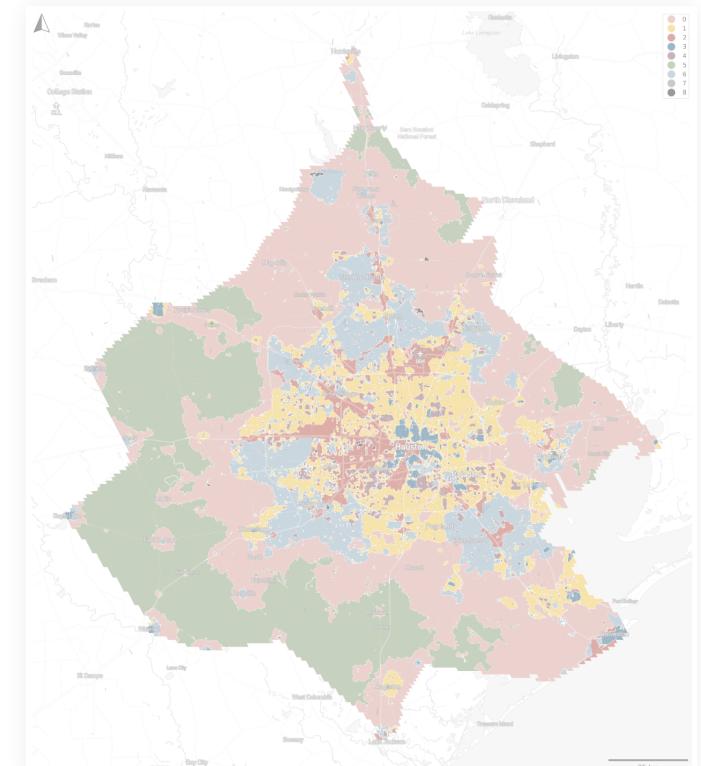
Geography



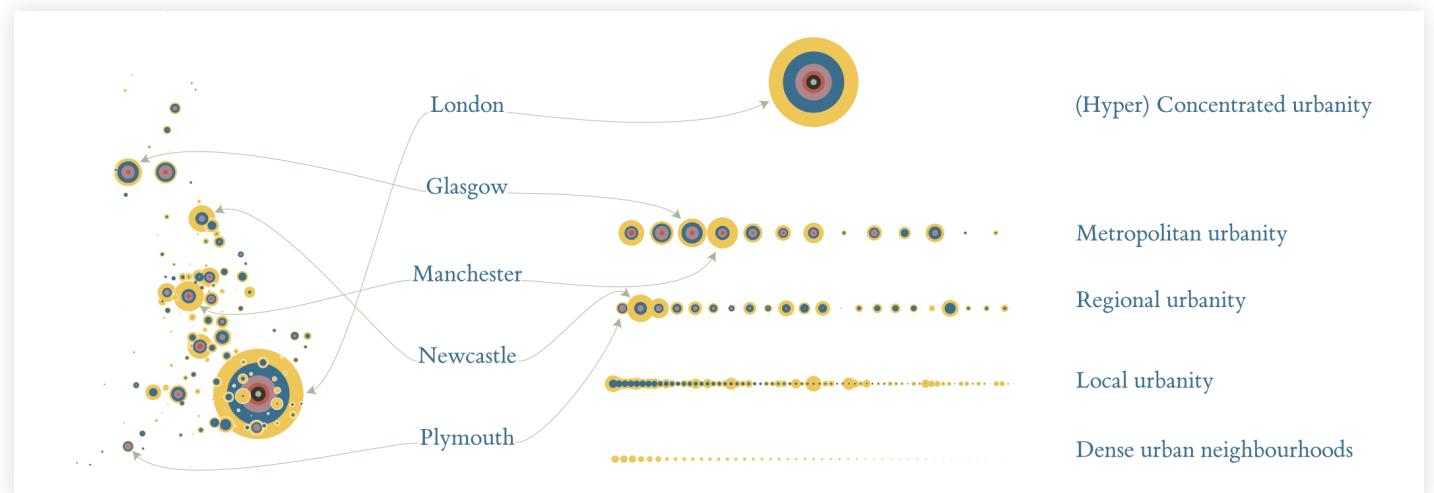
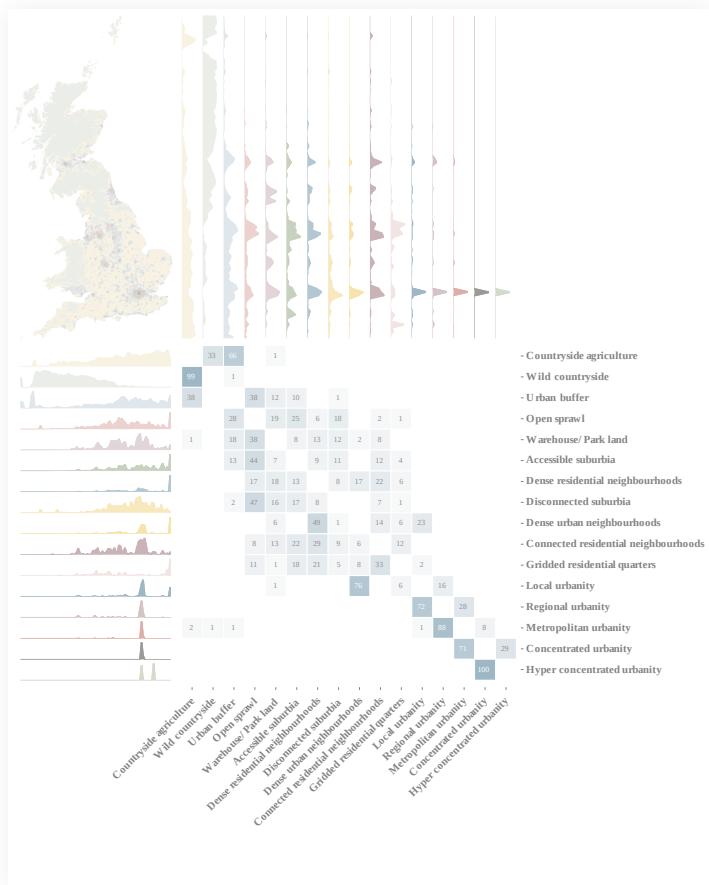
History



Technology



# Hierarchy

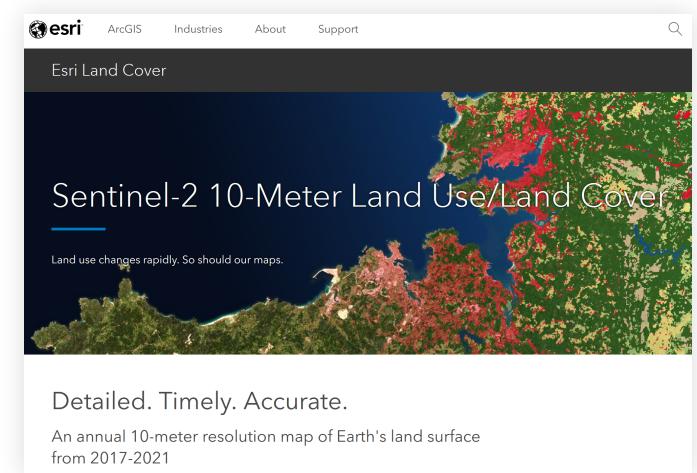
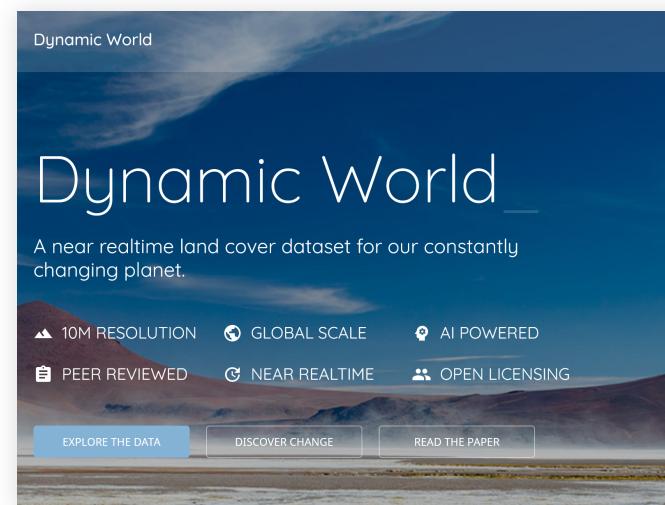
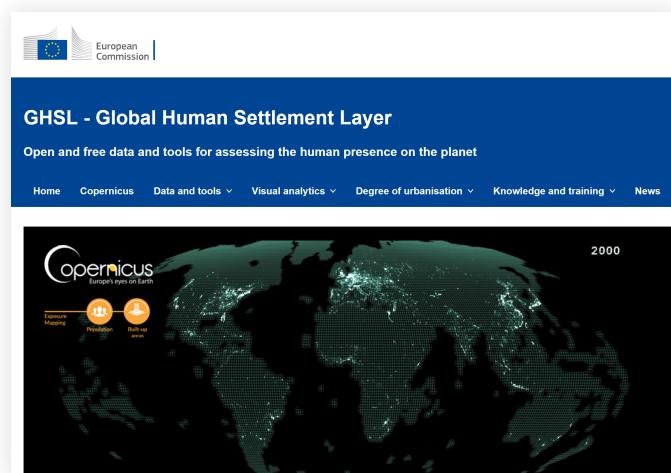
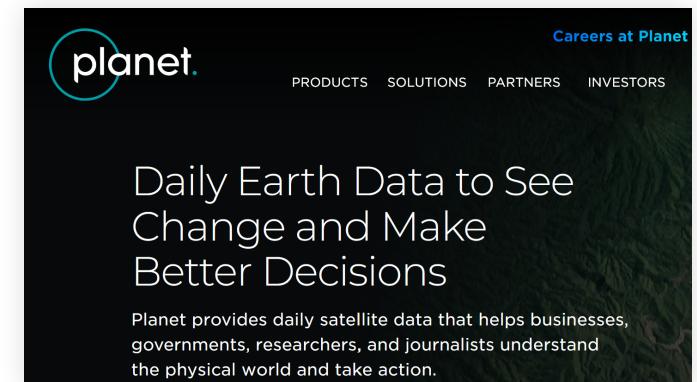


*Framing?*

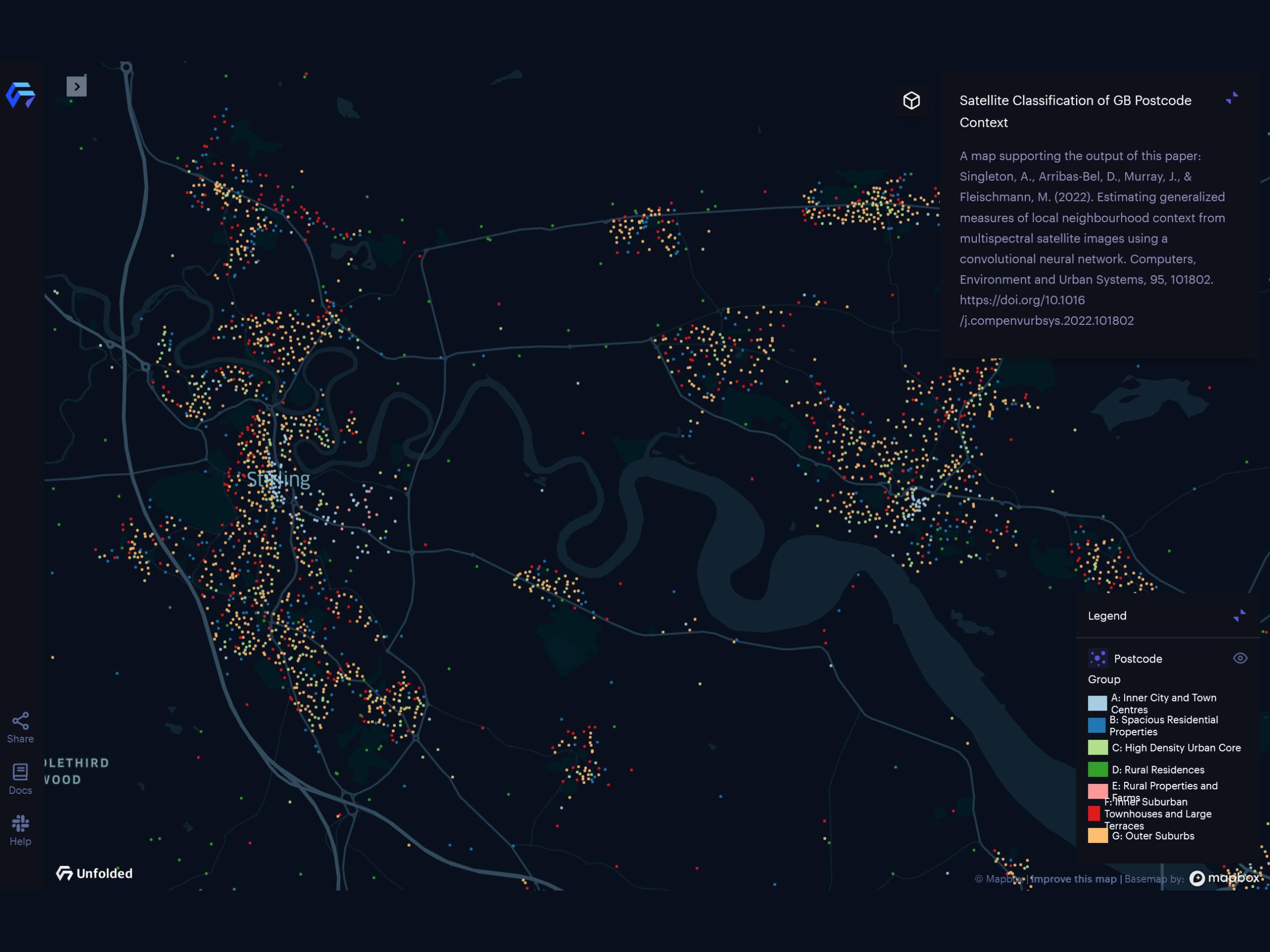
A peek into the future

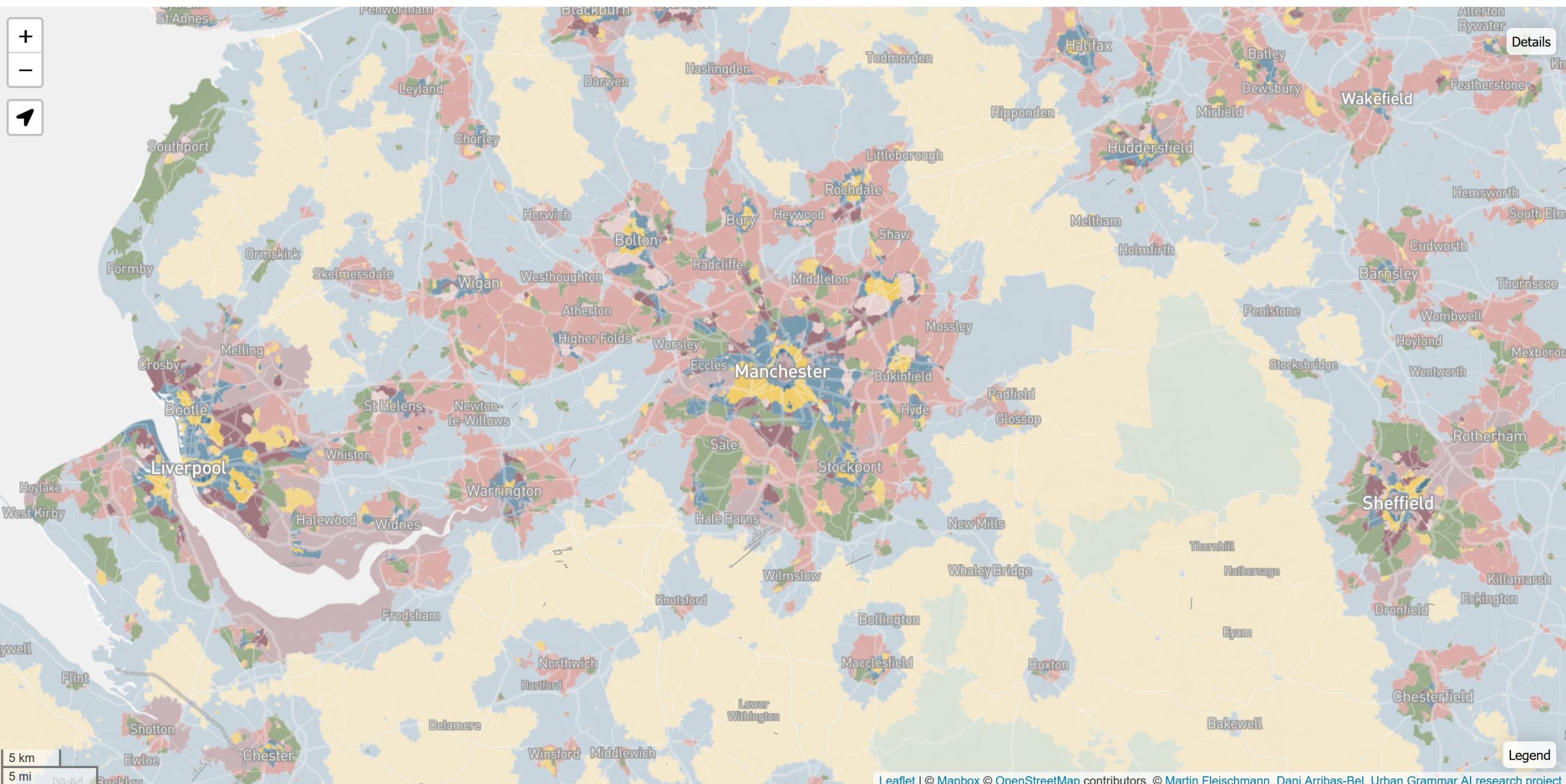
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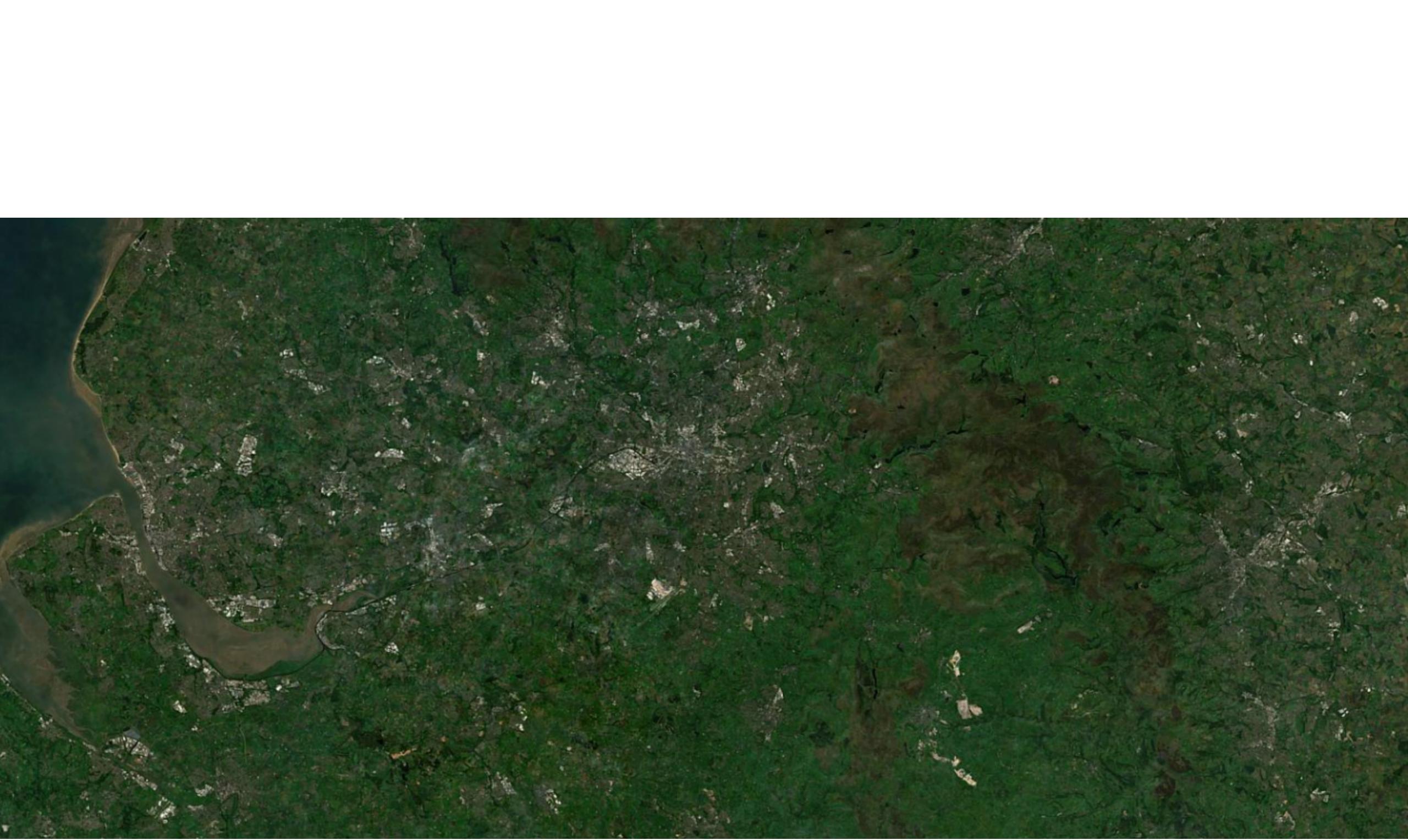
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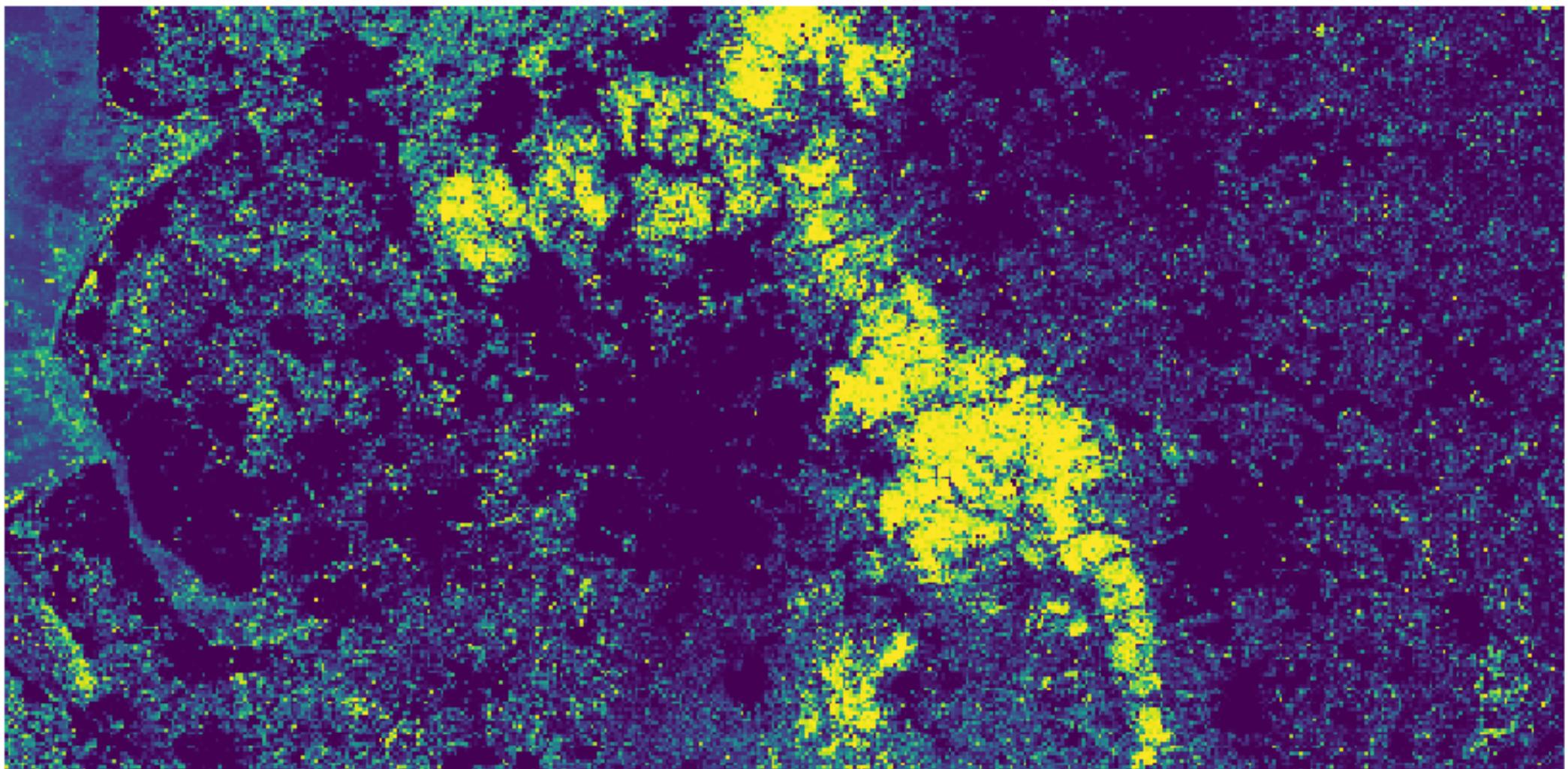
*Two examples on Form & Function...*



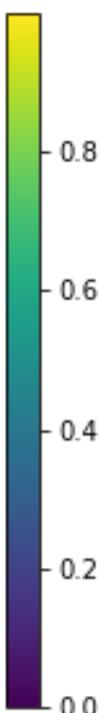


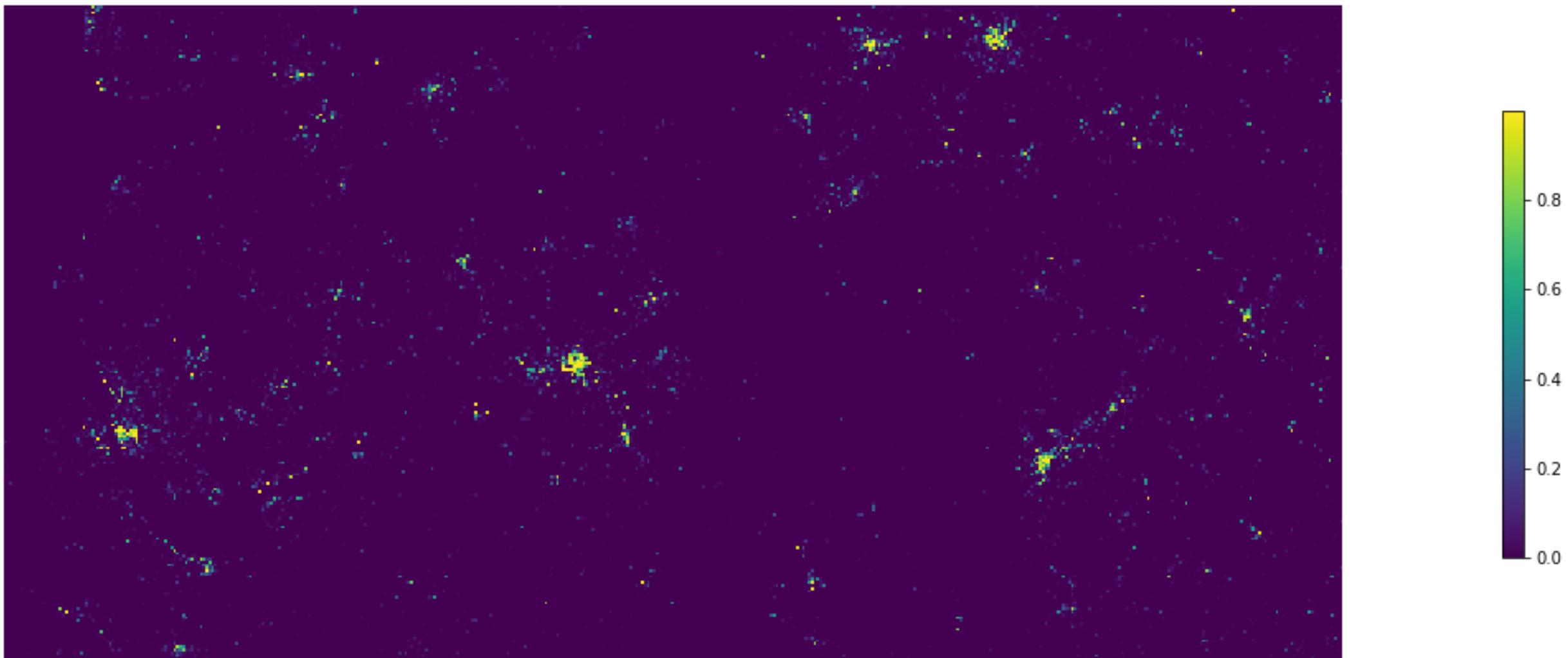


Source: Sentinel-2 cloudless

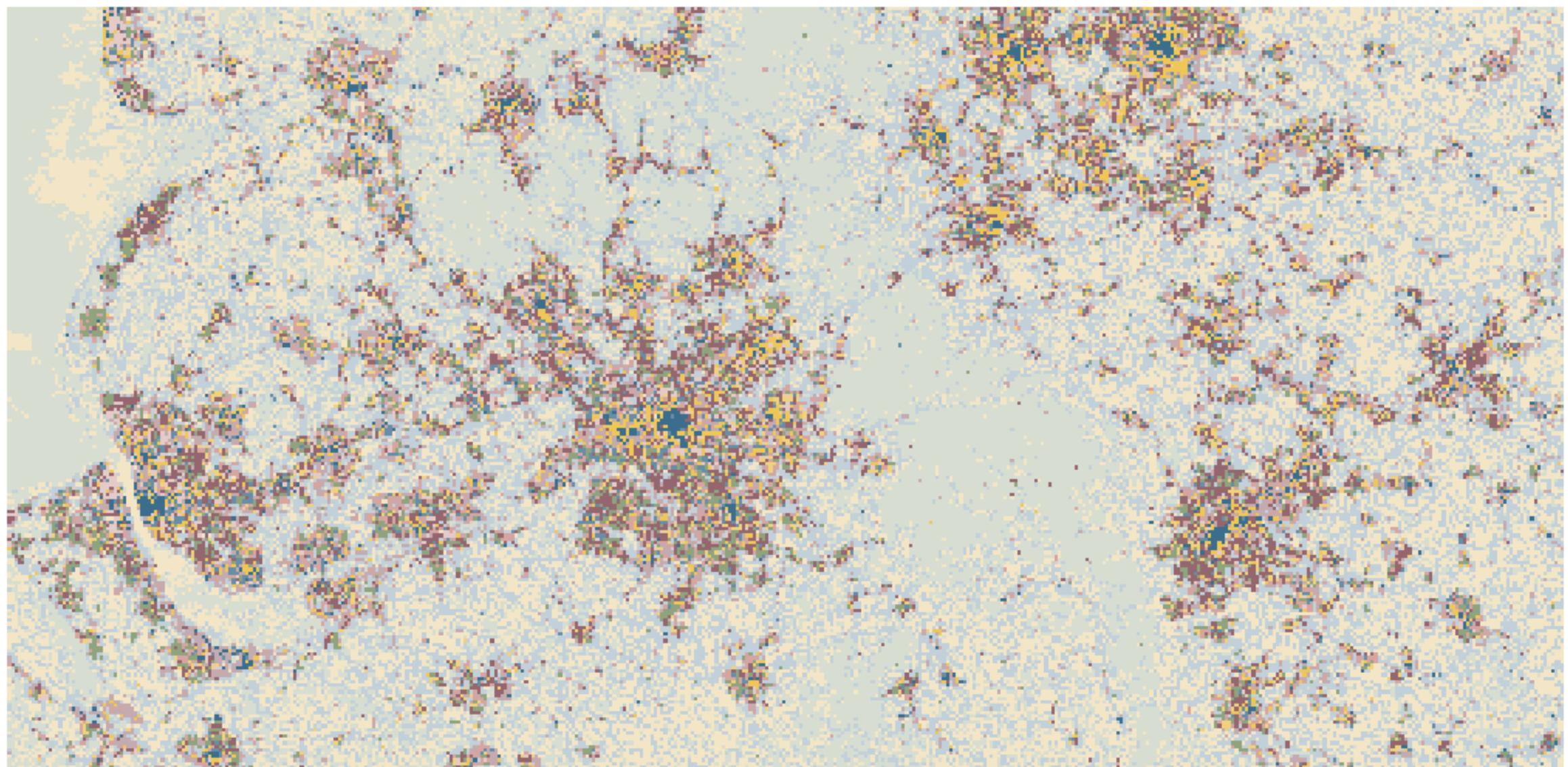


Wild countryside (320x320m)





Urbanity (320x320m)



Predicted class (320x320m)

# The Future

- *Are we there yet?* Certainly not
- *Can we even get there?* Maybe
- *Worth trying?* Absolutely!

# Wrap up

(Urban) form & function...

- underpin many social processes
- are becoming easier to measure better
- You should use them more in your work!

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