Urban Grammar

Making it easy to consider (Urban) Form & Function

Economic Data Science seminars – ONS

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@darribas

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@martinfleis

UNIVERSITY OF LIVERPOOL

The Alan Turing Institute

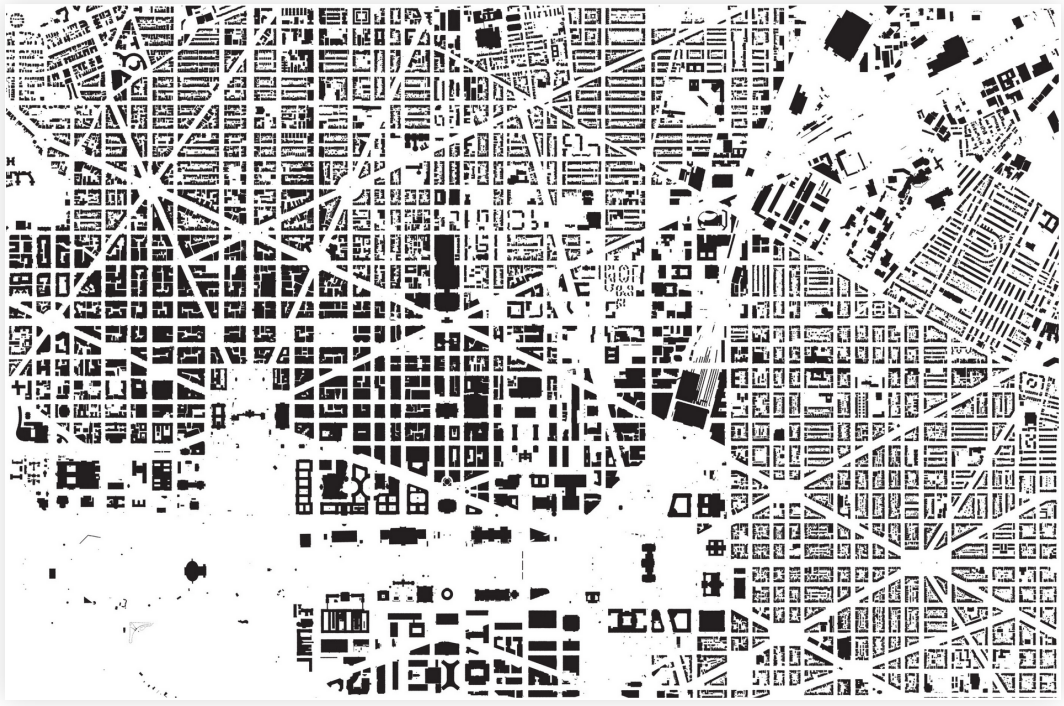
Geographic Data Science Lab

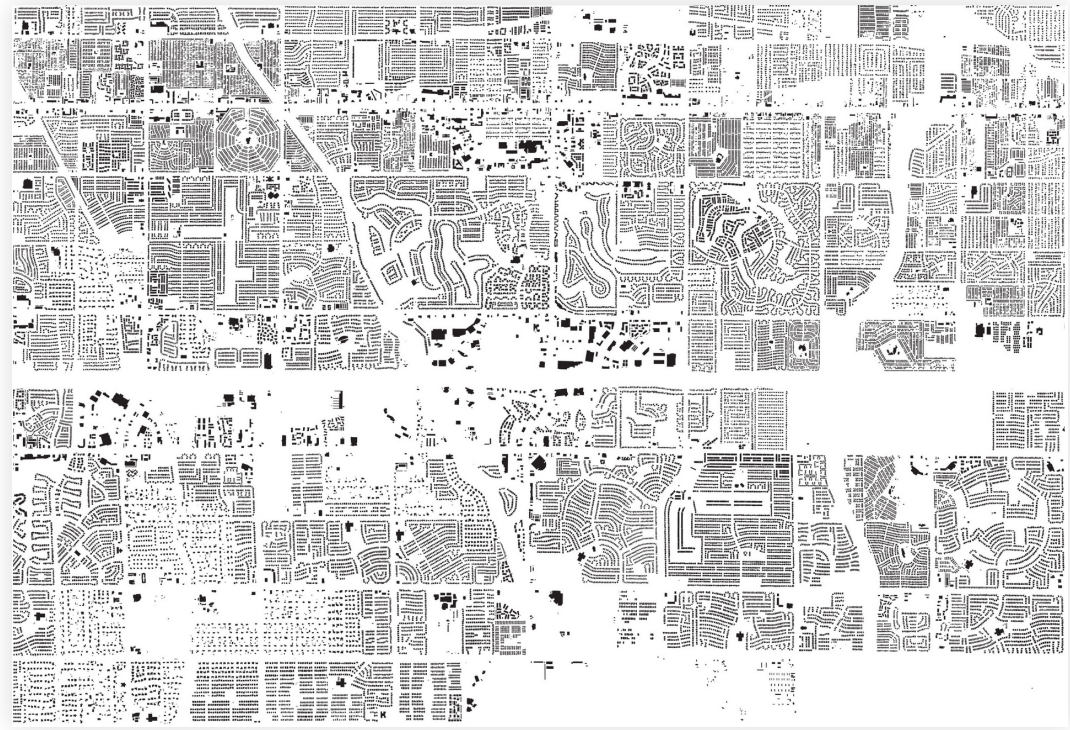
Today

- *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?

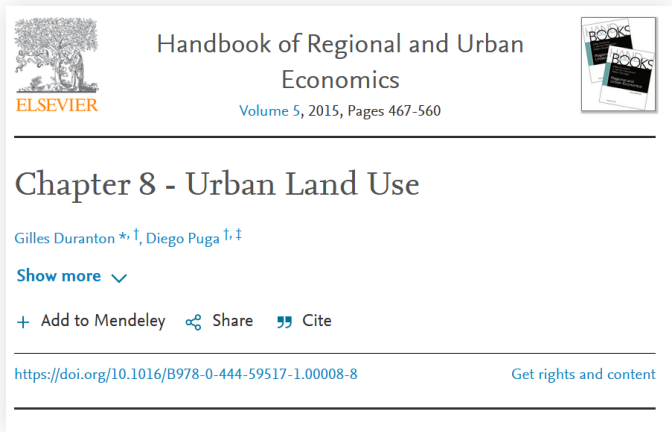
Encodes the past

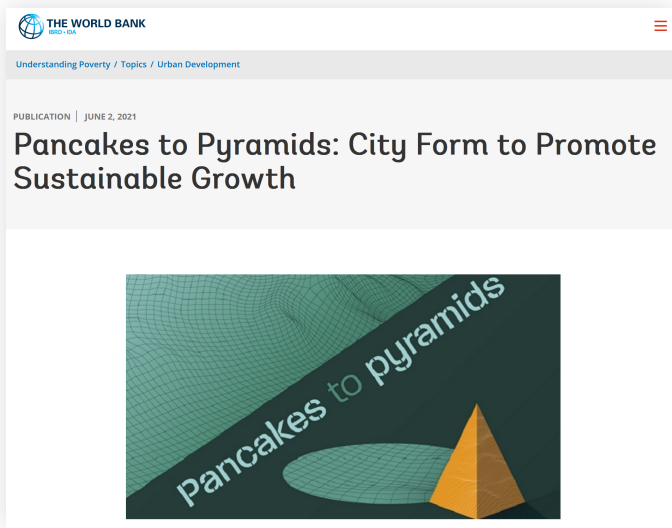
- Geography
- History
- Technology
- …

Frames the future

- Productivity
- Sustainability
- Quality of Life
- …

F&F in Economic(s/) policy





F&F in Economics

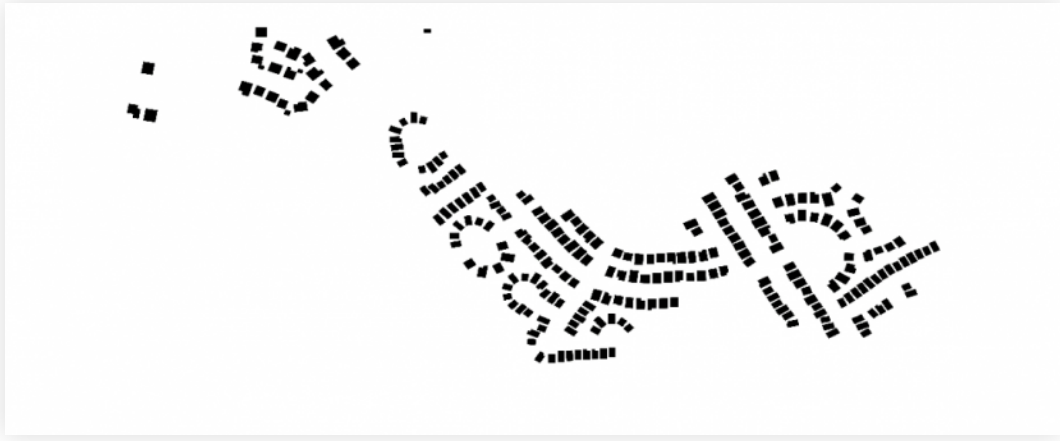
Critical to understand:

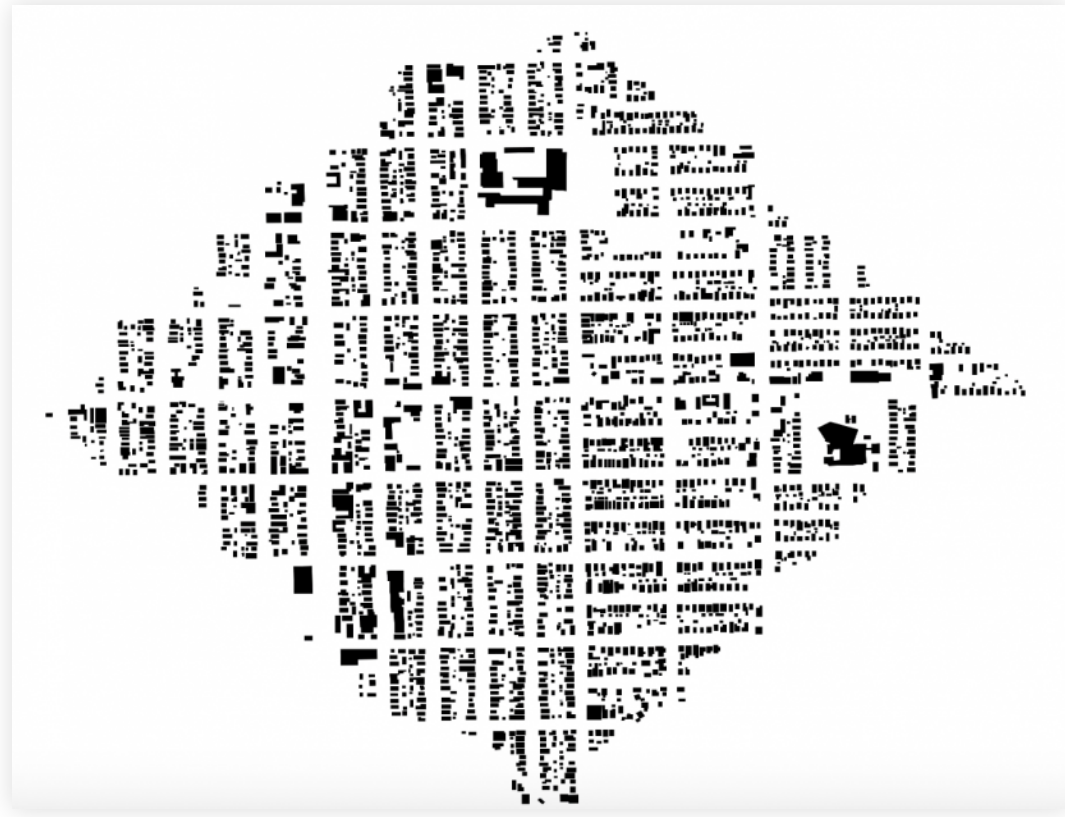
- Agglomeration economies
- Environmental/fiscal sustainability
- Urban/rural
- …

But often:

- Coarse
- Aggregate
- Ad-hoc
- …

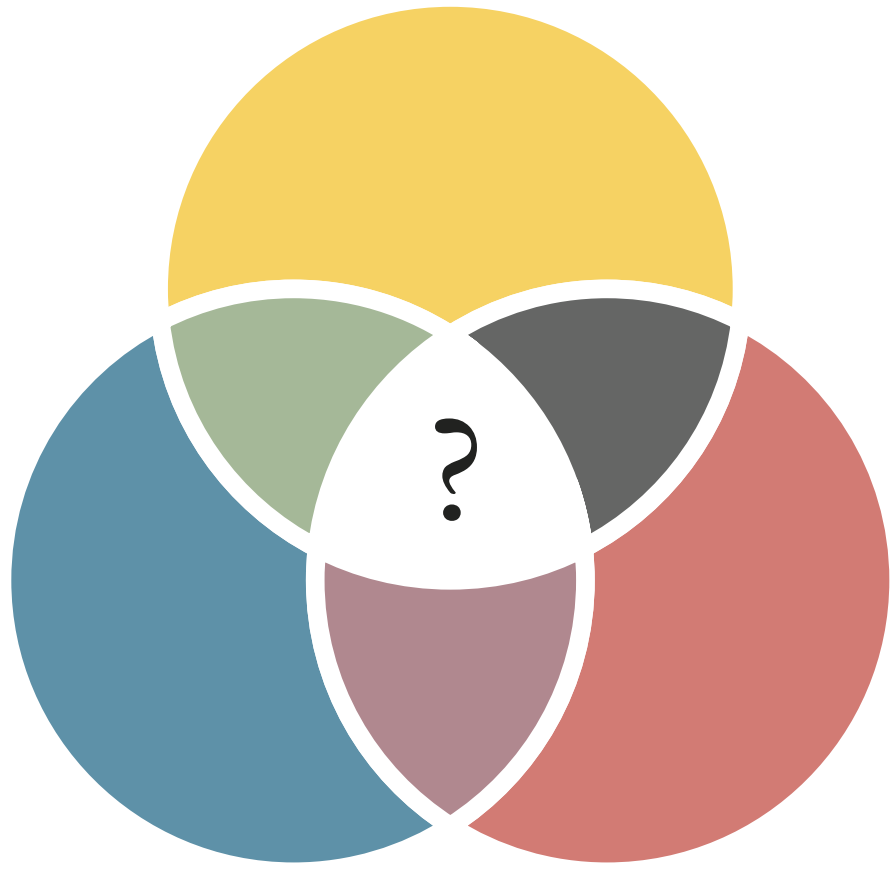
Detail matters…





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

detailed



scalable

consistent

Urban Grammar

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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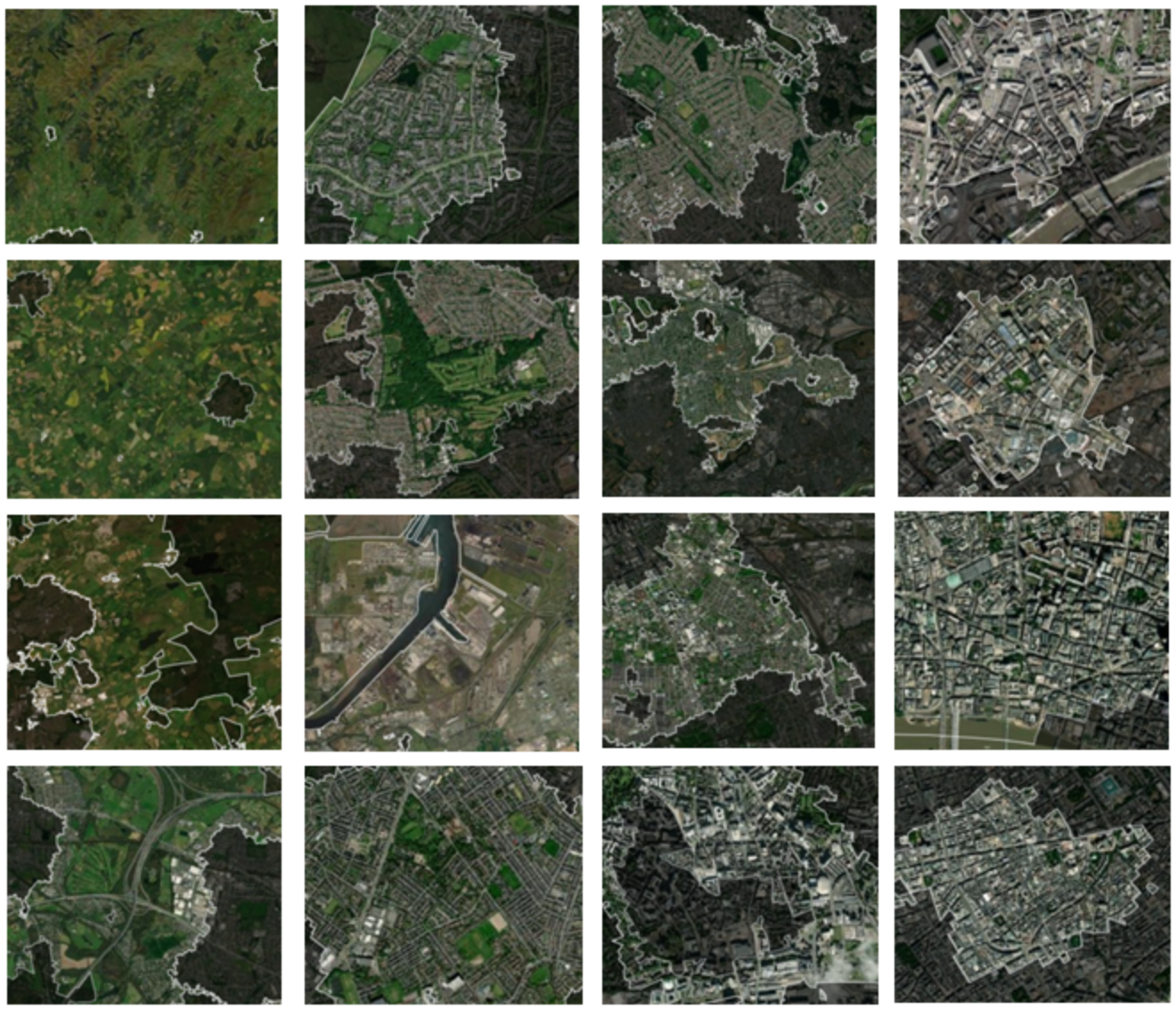
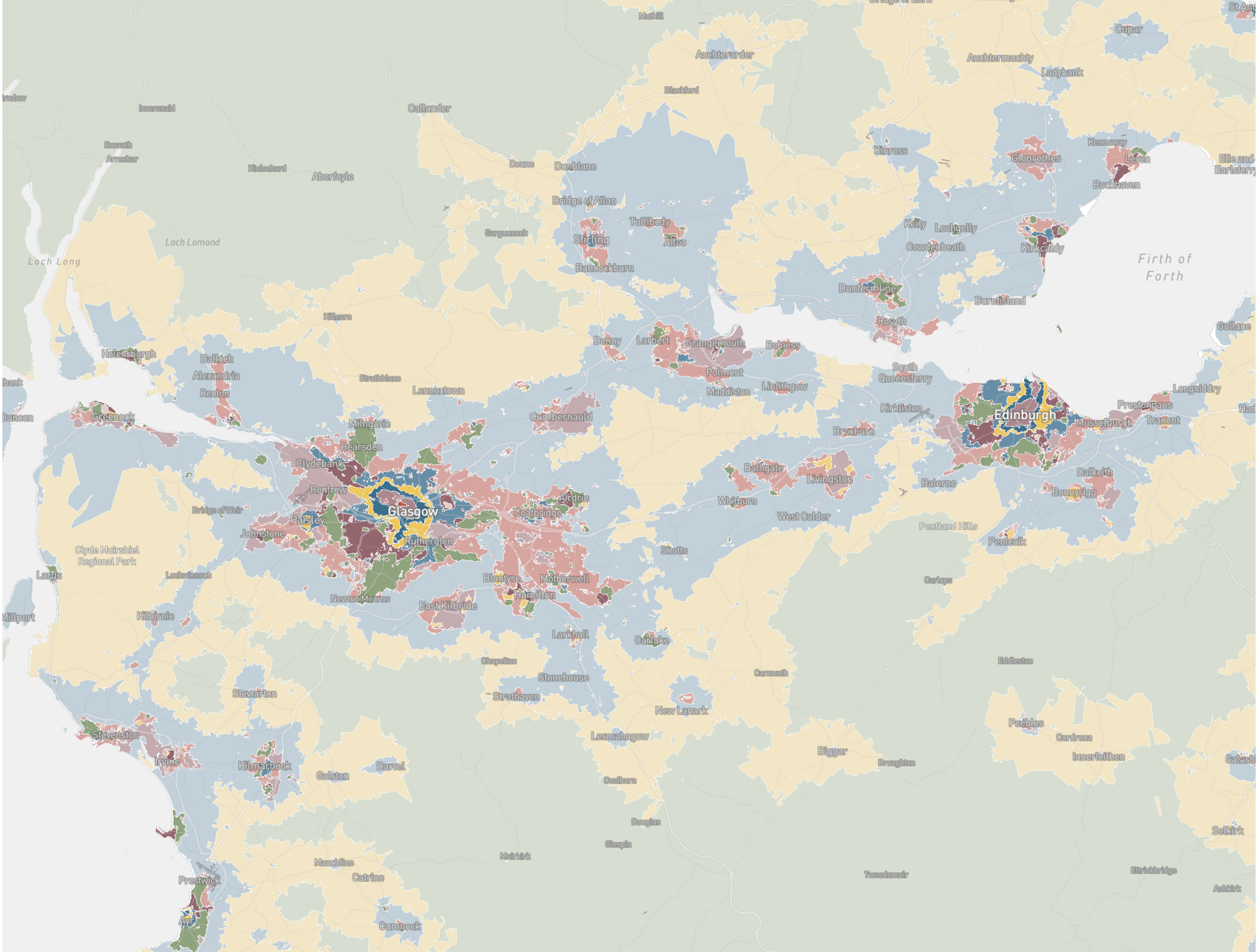
British Signatures



https://urbangrammarai.xyz/story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Blackford
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Arrochar
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Aberfoyle
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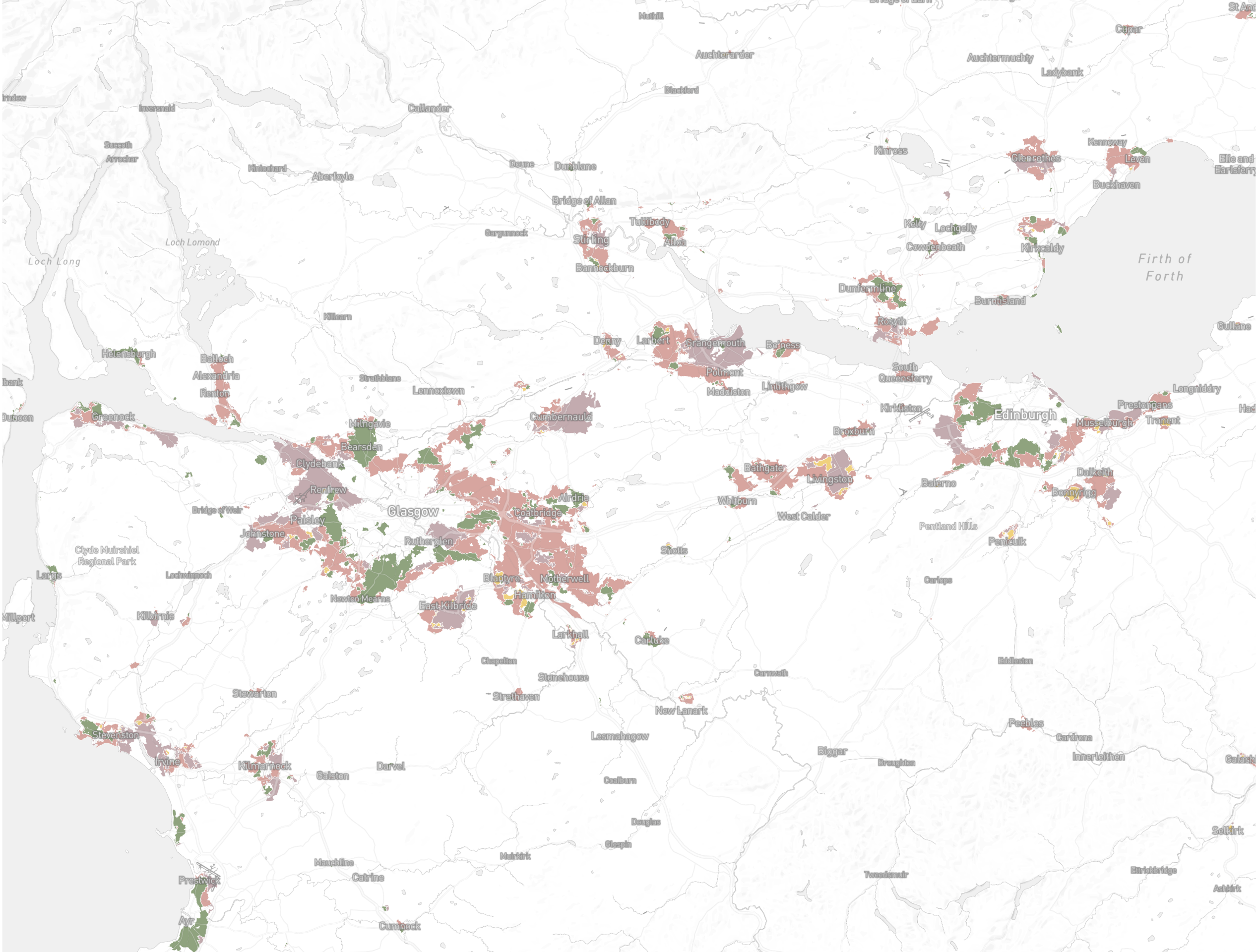
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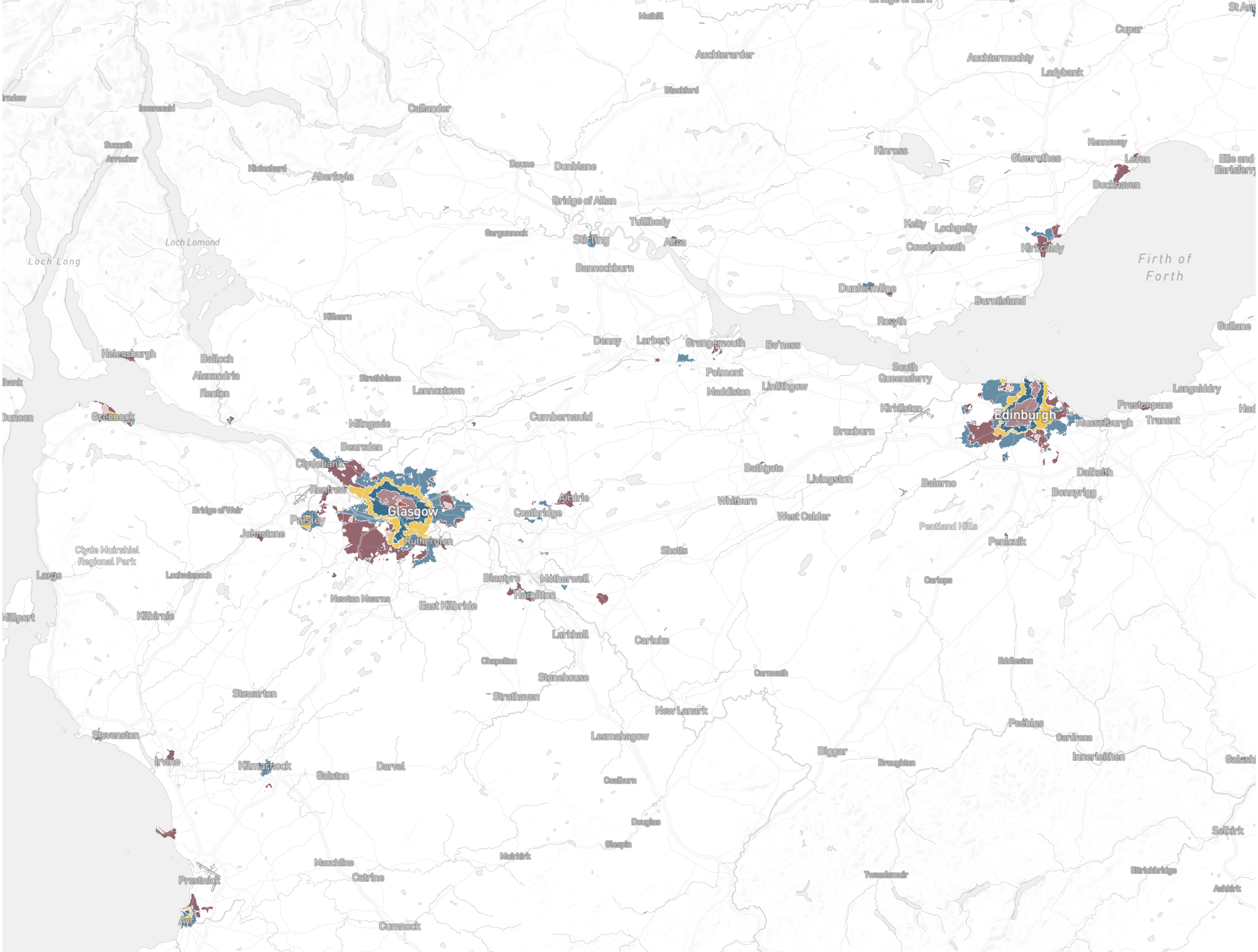
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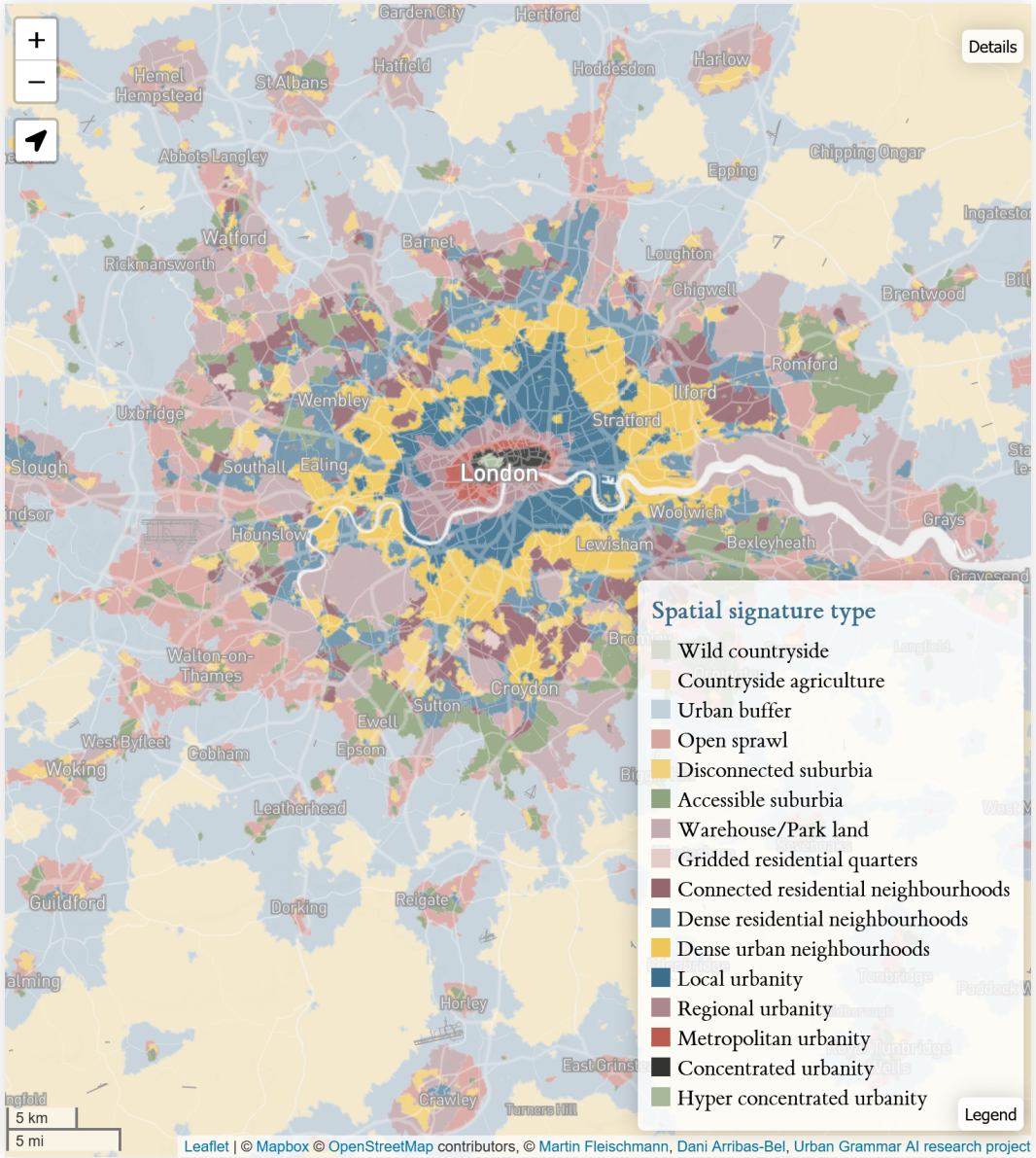

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Spatial Signatures of Great Britain

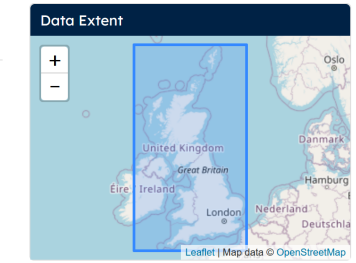
Population & Mobility Transport & Movement

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.



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Sub-classifications

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

Classifying urban form at national scale: The British morphosignatures

Dr Martin Fleischmann[1], Dr Daniel Arribas-Bel[1]

[1] 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 [a], Martin Fleischmann [a], Daniel Arribas-Bel [a, b], Alessia Calafiore [a], Francisco Rowe [a]

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https://doi.org/10.1016/j.dib.2022.108335

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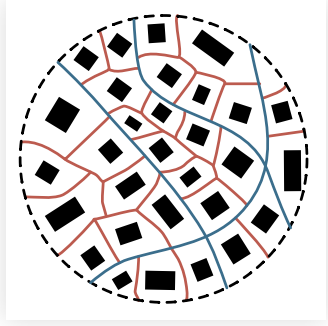
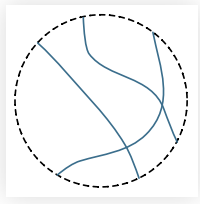
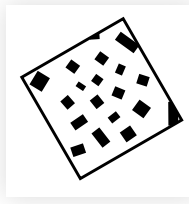
Building *Spatial Signatures*

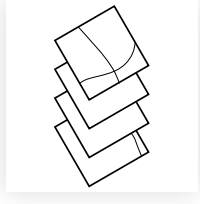
[STAGE] Delimiters Enclosure Anchors Encl. Tess. Characters Clusters Signatures

Enclosed Tessellation

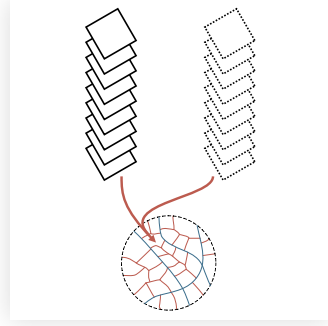




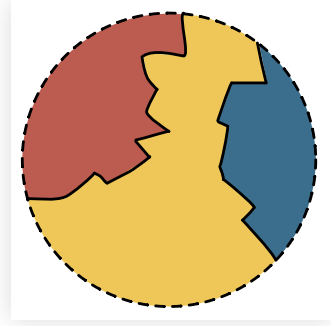


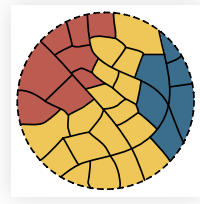


Embedding *form & function*



Spatial Signatures

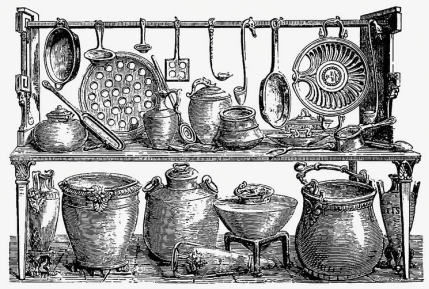


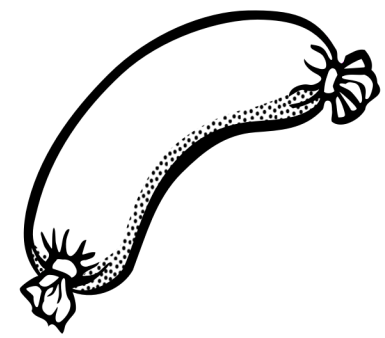


Meaningful spatial units

Enclosed tessellation

“Open by default”





- Data, data, data
- Methods, code
- Infrastructure

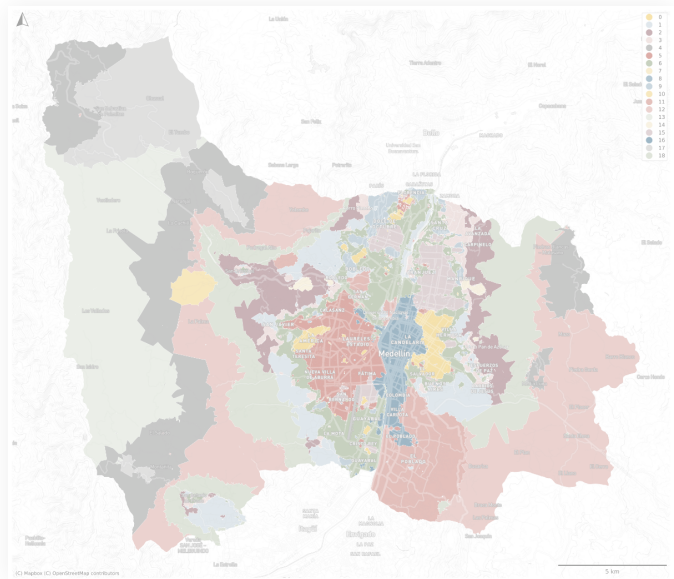
- Dissemination
- Open Data Products
- Journaling/reporting

https://urbangrammarai.xyz

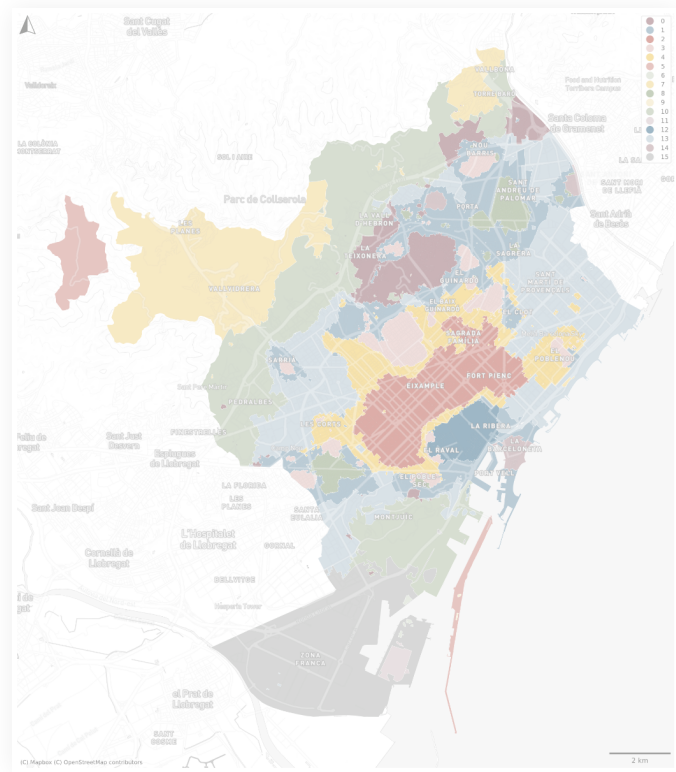
Lessons

Encoding

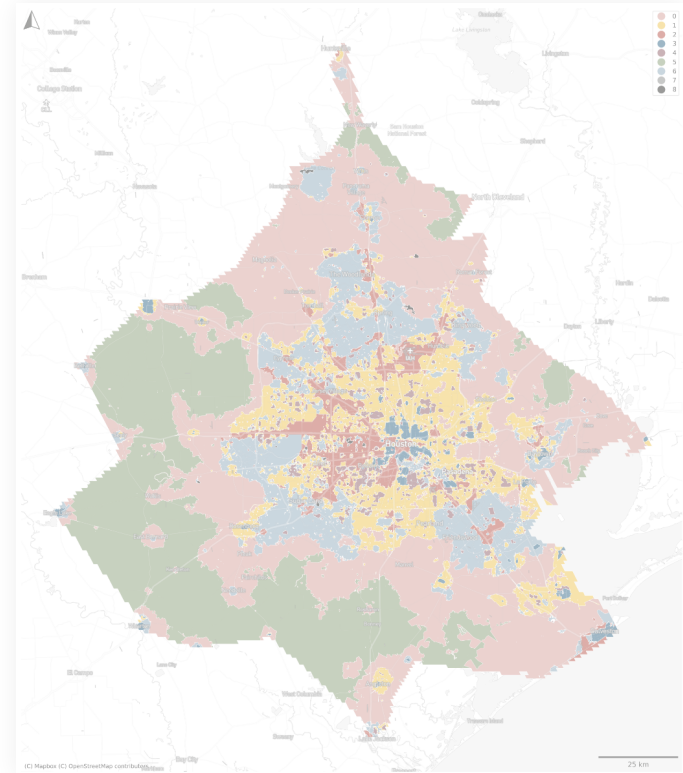
Geography



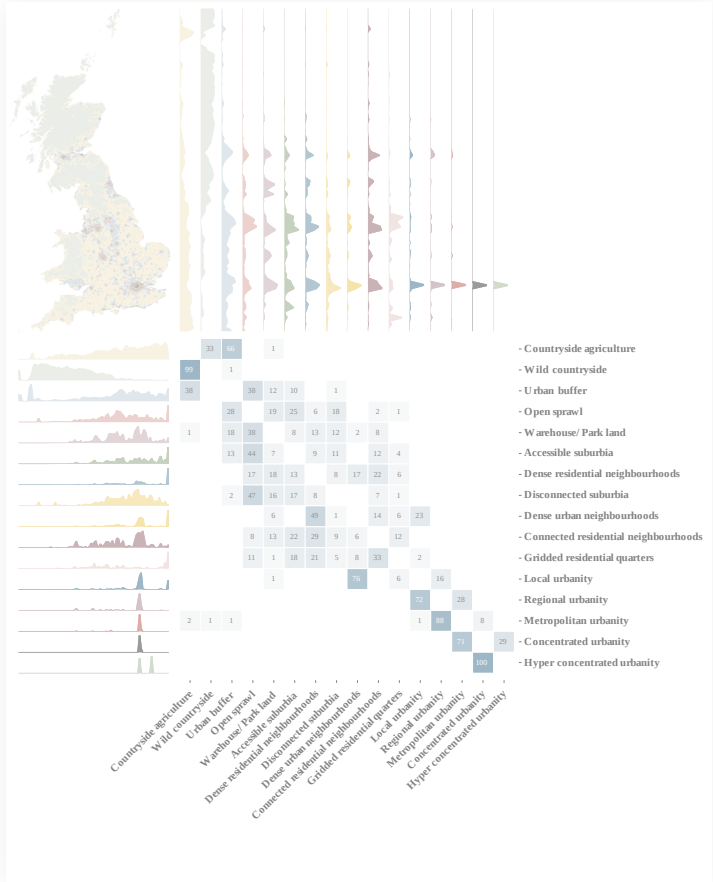
History



Technology



Hierarchy


- Countryside agriculture
- Wild countryside
- Urban buffer
- Open sprawl
- Warehouse/ Park land
- Accessible suburbia
- Dense residential neighbourhoods
- Disconnected suburbia
- Dense urban neighbourhoods
- Connected residential neighbourhoods
- Gridded residential quarters
- Local urbanity
- Regional urbanity
- Metropolitan urbanity
- Concentrated urbanity
- Hyper concentrated urbanity
Countryside agriculture
Wild countryside
Urban buffer
Open sprawl
Warehouse/ Park land
Accessible suburbia
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Local urbanity
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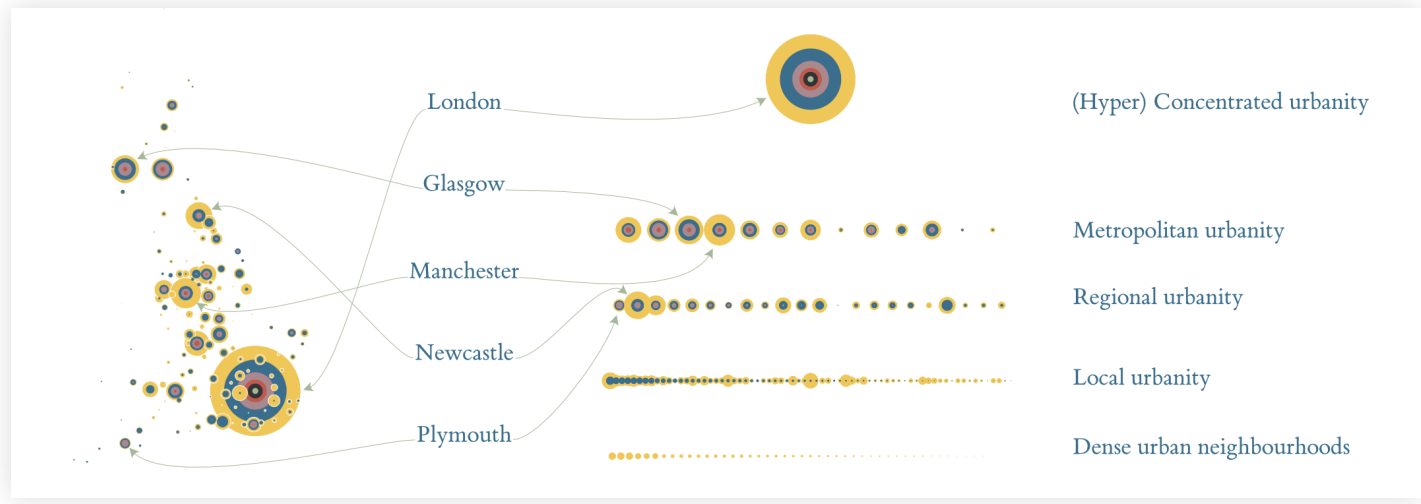
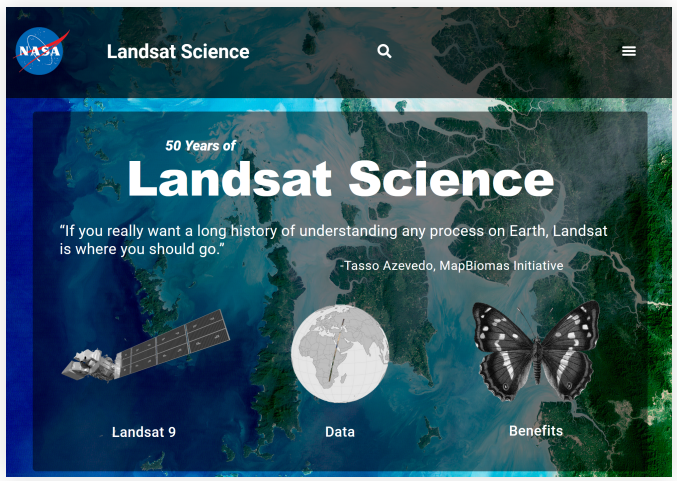
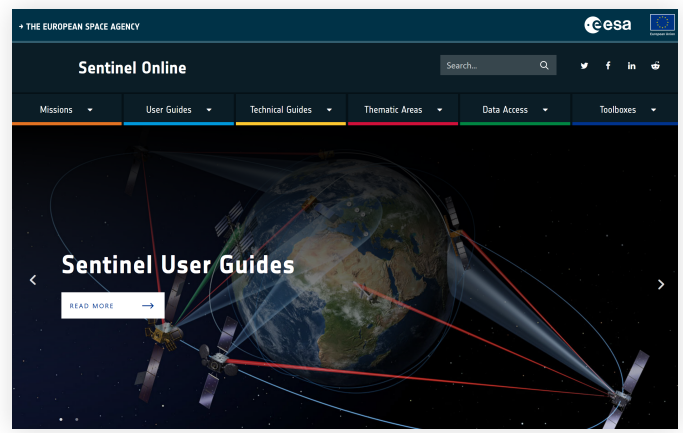
Metropolitan urbanity
Concentrated urbanity
Hyper concentrated urbanity


London
Glasgow
Manchester
Newcastle
Plymouth
(Hyper) Concentrated urbanity
Metropolitan urbanity
Regional urbanity
Local urbanity
Dense urban neighbourhoods

Framing?

A peek into the future


Landsat Science
50 Years of
Landsat Science
"If you really want a long history of understanding any process on Earth, Landsat is where you should go."
-Tasso Azevedo, MapBiomas Initiative
Landsat 9
Data
Benefits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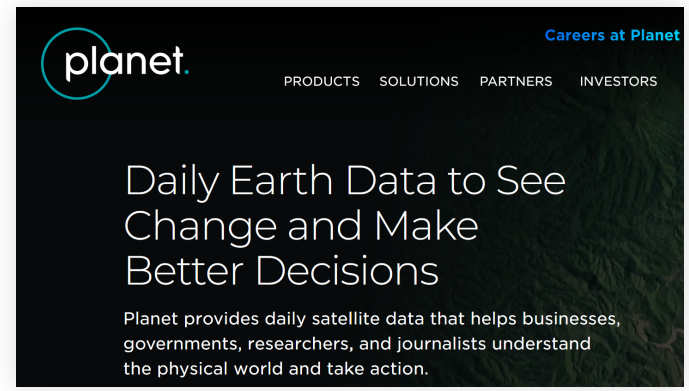
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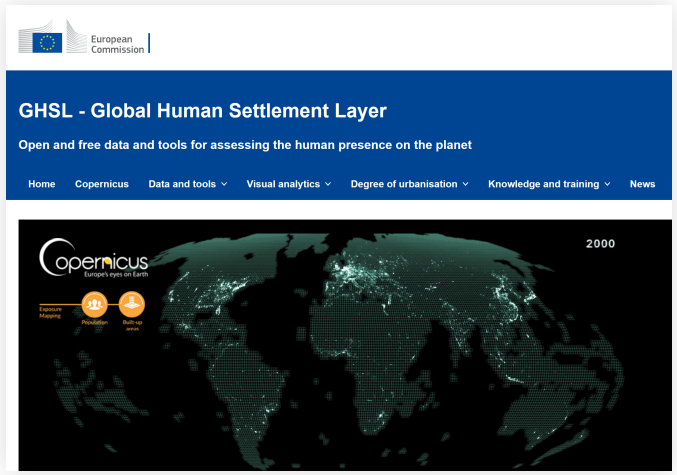
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Open and free data and tools for assessing the human presence on the planet
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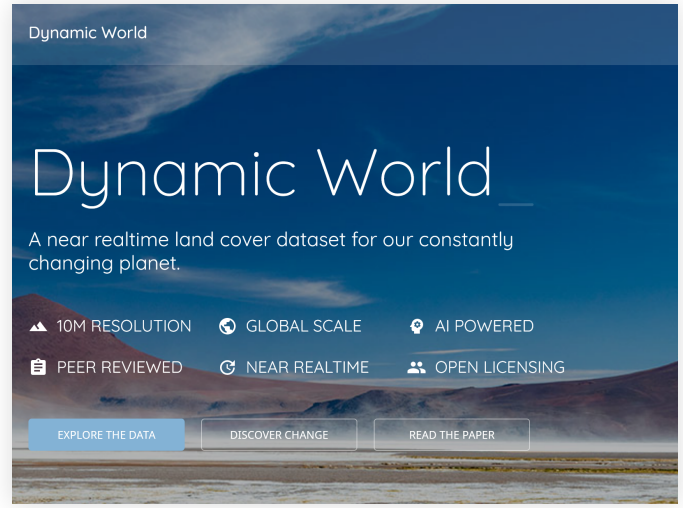
Dynamic World
Dynamic World
A near realtime land cover dataset for our constantly changing planet.
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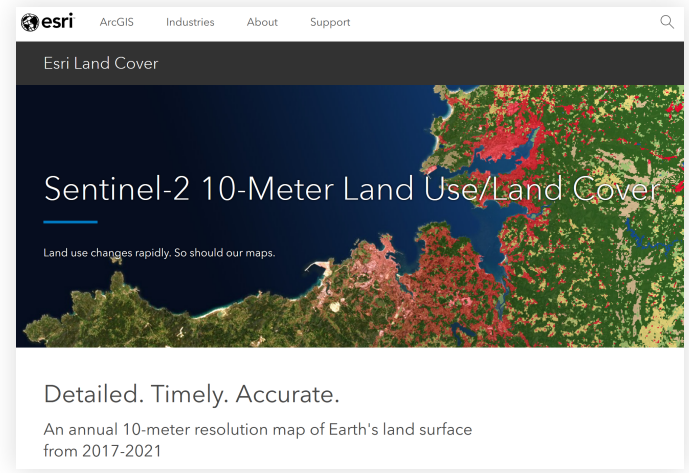
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Land use changes rapidly. So should our maps.
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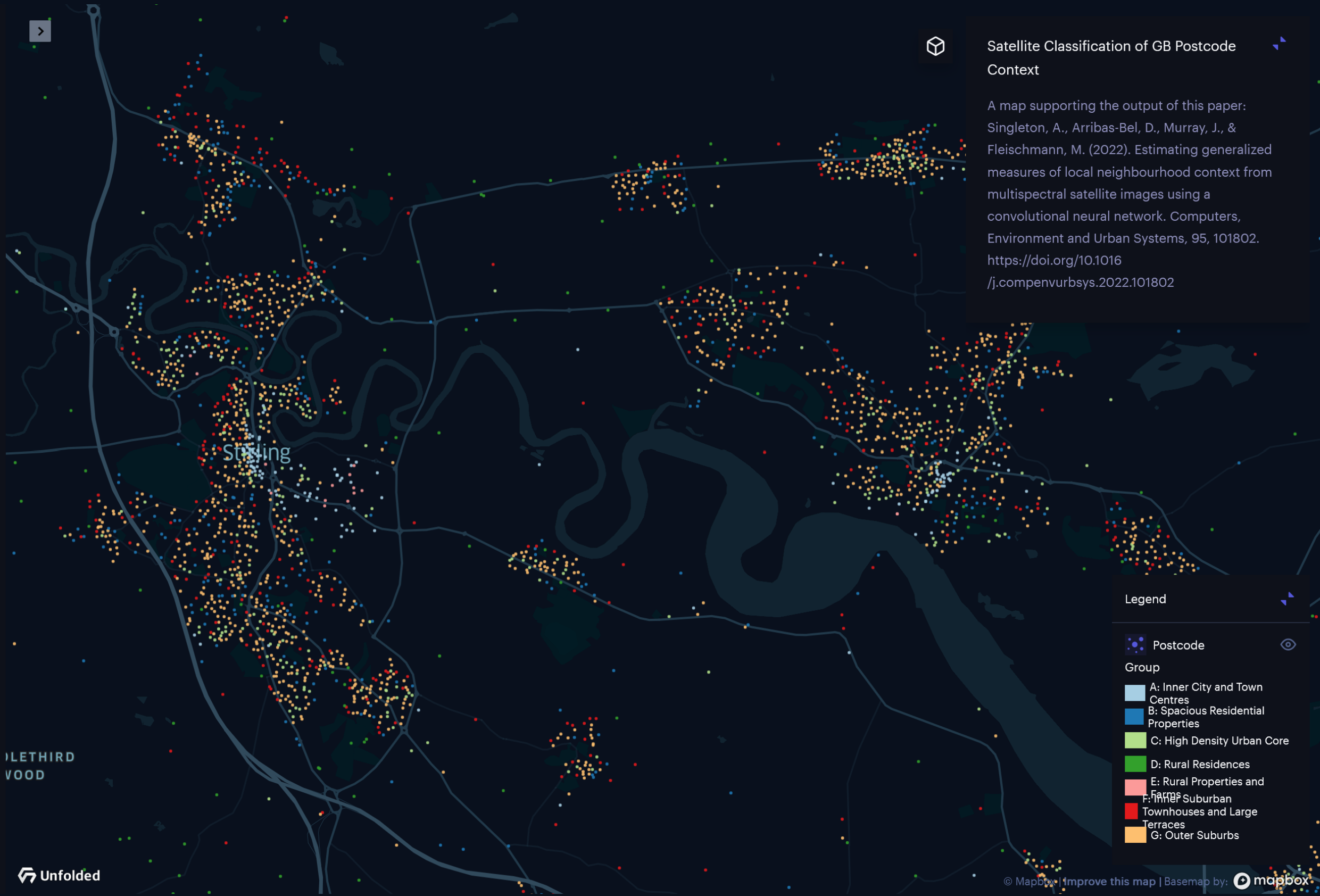
Two examples on Form & Function…


Satellite Classification of GB Postcode Context
A map supporting the output of this paper: Singleton, A., Arribas-Bel, D., Murray, J., & Fleischmann, M. (2022). Estimating generalized measures of local neighbourhood context from multispectral satellite images using a convolutional neural network. Computers, Environment and Urban Systems, 95, 101802. https://doi.org/10.1016/j.compenvurbsys.2022.101802
Legend
Postcode
Group
A: Inner City and Town Centres
B: Spacious Residential Properties
C: High Density Urban Core
D: Rural Residences
E: Rural Properties and Farms
F: Inner Suburban Townhouses and Large Terraces
G: Outer Suburbs
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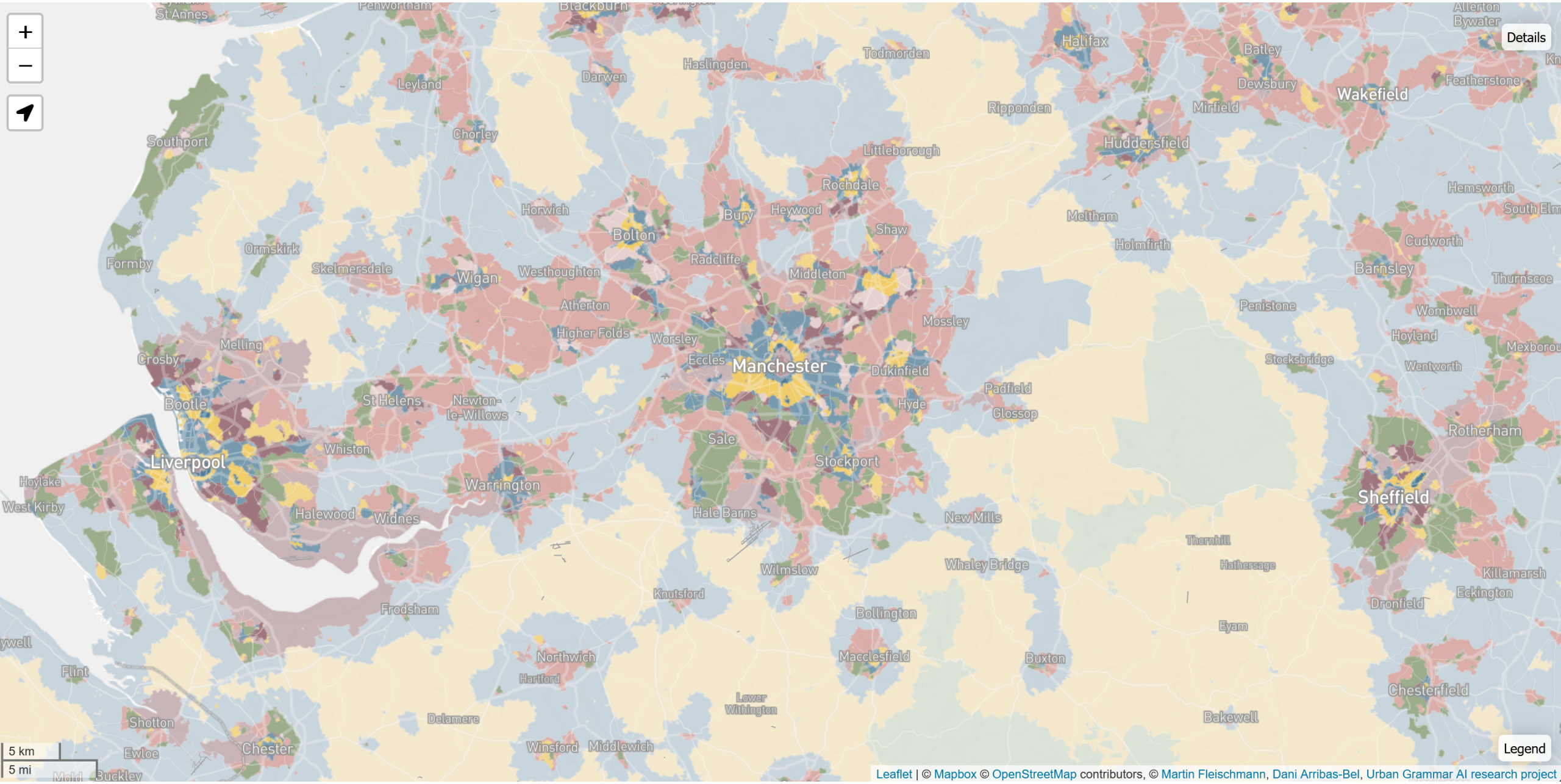
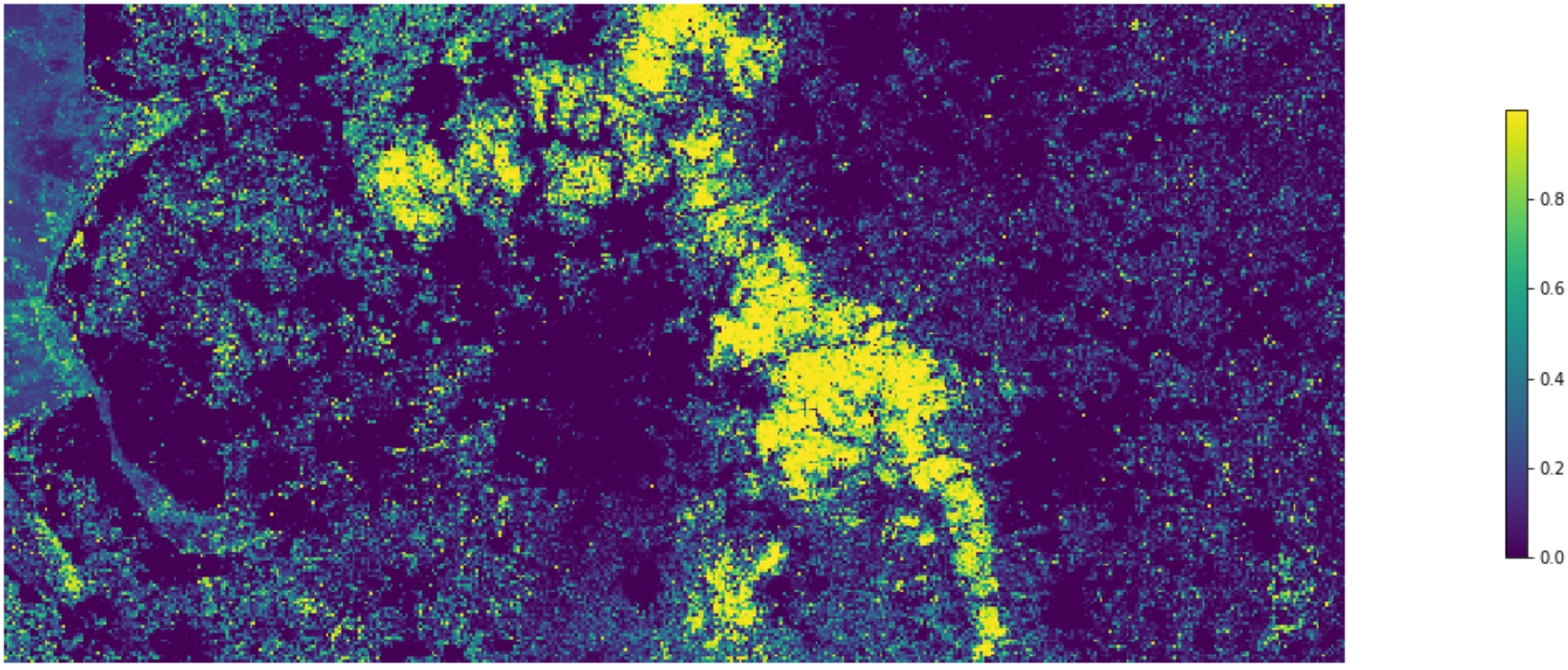
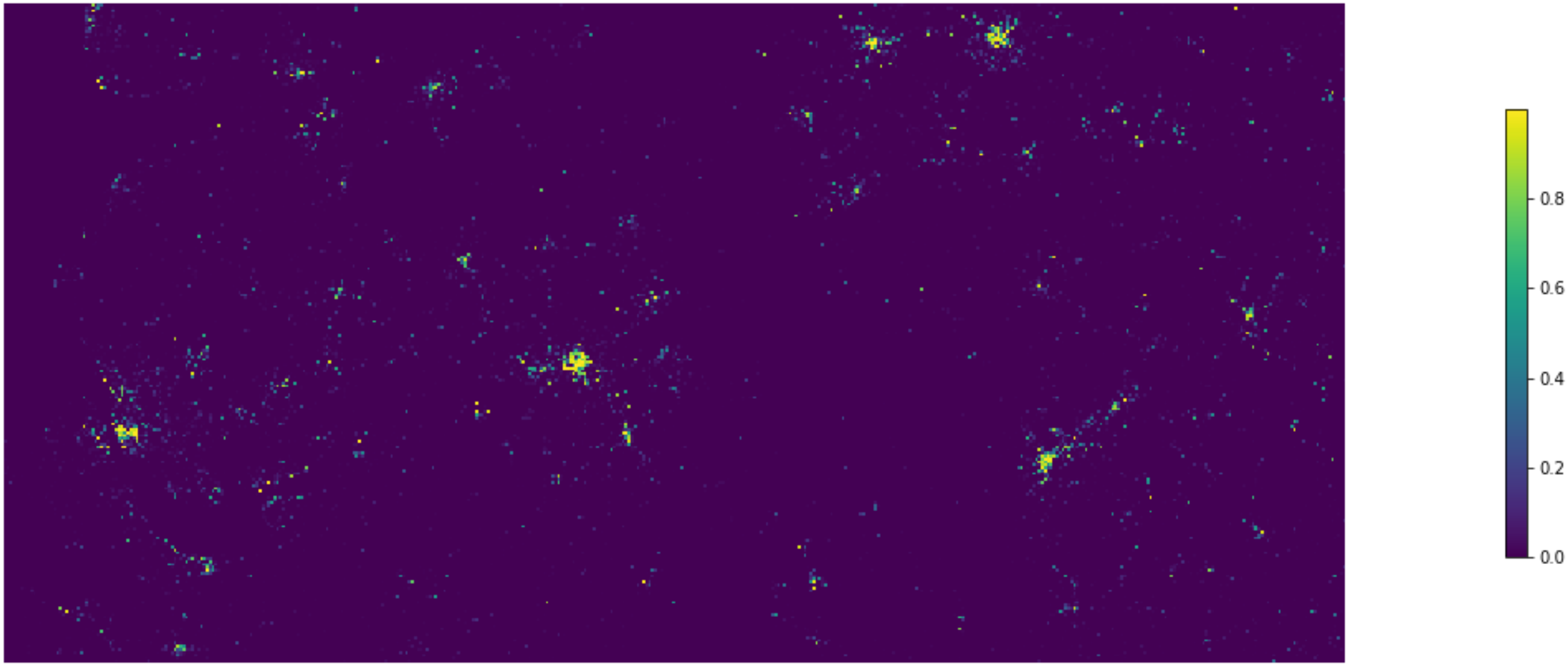

Details
Legend
5 km
5 mi
Leaflet | © Mapbox © OpenStreetMap contributors, © Martin Fleischmann, Dani Arribas-Bel, Urban Grammar AI research project
St Annes
Penwortham
Blackburn
Halifax
Batley
Dewsbury
Wakefield
Featherstone
Todmorden
Haslingden
Darwen
Leyland
Ripponden
Mirfield
Chorley
Southport
Huddersfield
Littleborough
Rochdale
Hemsworth
Horwich
Bury
Heywood
Meltham
Bolton
Shaw
Holmfirth
Cudworth
Ormskirk
Formby
Skelmersdale
Radcliffe
Barnsley
Wigan
Westhoughton
Middleton
Thurnscoe
Penistone
Atherton
Mossley
Wombwell
Higher Folds
Worsley
Hoyland
Melling
Crosby
Eccles
Manchester
Stocksbridge
Dukinfield
Wentworth
Padfield
Bootle
St Helens
Newton-le-Willows
Hyde
Glossop
Rotherham
Sale
Whiston
Liverpool
Stockport
Hoylake
Warrington
Sheffield
West Kirby
Halewood
Widnes
Hale Barns
New Mills
Thornhill
Wilmslow
Whaley Bridge
Hathersage
Killamarsh
Knutsford
Eckington
Dronfield
Bollington
Eyam
Frodsham
Northwich
Macclesfield
Buxton
Flint
Hartford
Lower Withington
Chesterfield
Shotton
Delamere
Bakewell
Ewloe
Chester
Winsford
Middlewich
Mold
Buckley

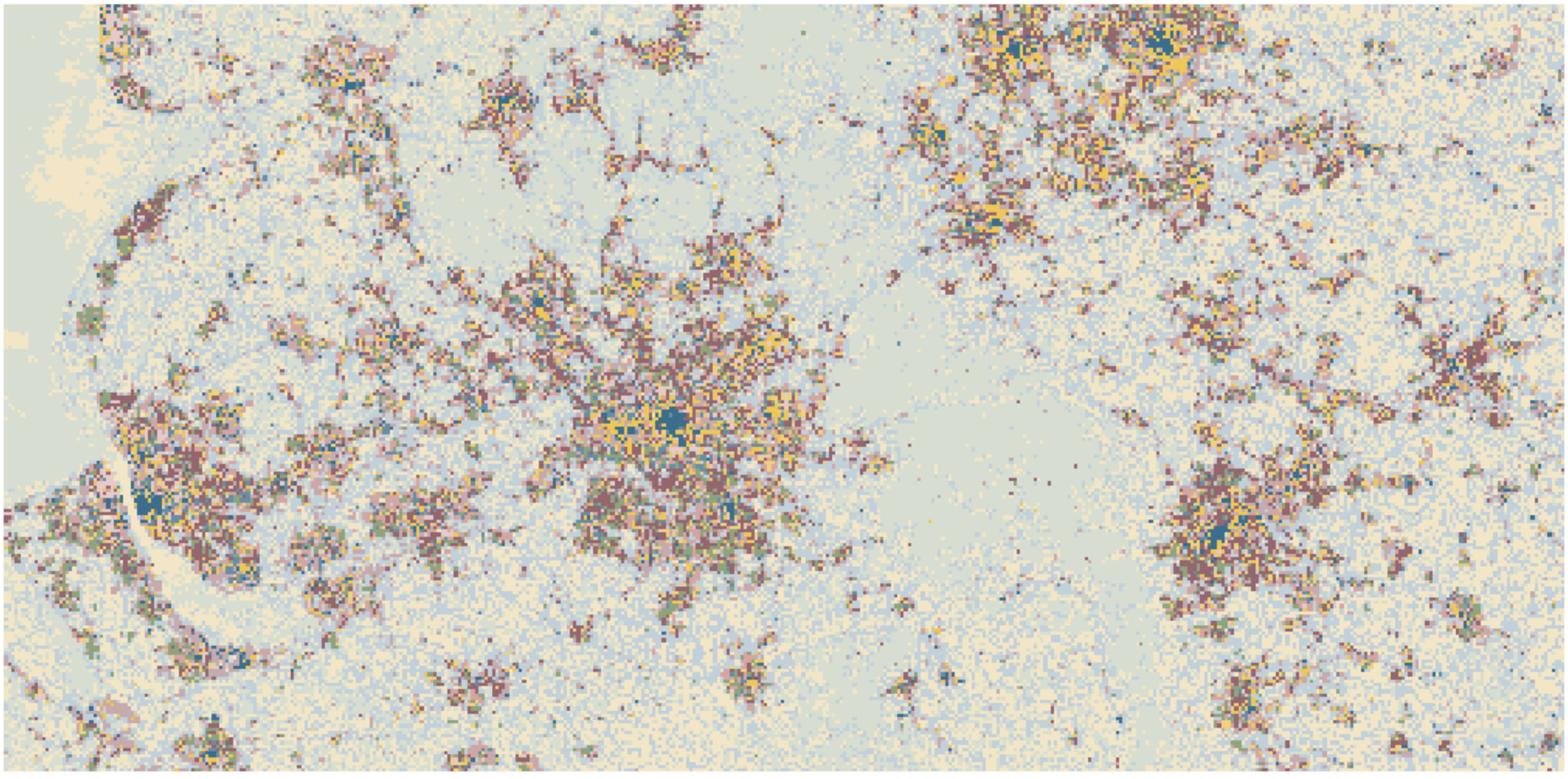
Source: Sentinel-2 cloudless



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

Urban Grammar

Making it easy to consider (Urban) Form & Function

Economic Data Science seminars – ONS

Dani Arribas-Bel
@darribas

Martin Fleischmann
@martinfleis

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