

Web Mapping & Analysis

Data Backends I - Data Architecture & Formats

Dani Arribas-Bel

Today

- Spatial Data
- Spatial Data Formats
- Selecting the right format

Spatial Data

Traditional Spatial Data

In the “old days” only:

- Mapping agencies (e.g. OS)
- Administrative organizations (e.g. Land Registry)
- Military
- Large companies (e.g. Google)
- ...

could afford the generation of spatial dataset.

New Spatial Data

Today, this list has **expanded** to essentially **anyone** with access to (cheap) geospatial technology

Overview

Analysis

Premium 

Heart Rate

Est Power Curve

Est 25W
Distribution

Dani Arribas-Bel – Ride



12:54 PM on Sunday, October 2, 2016

Lunch Ride

Add a description

STRAVA LABS
View Flybys 

40.3 km 1:44:53 223 m

Distance Moving Time Elevation

173 W Estimated Avg Power

1,088 kJ

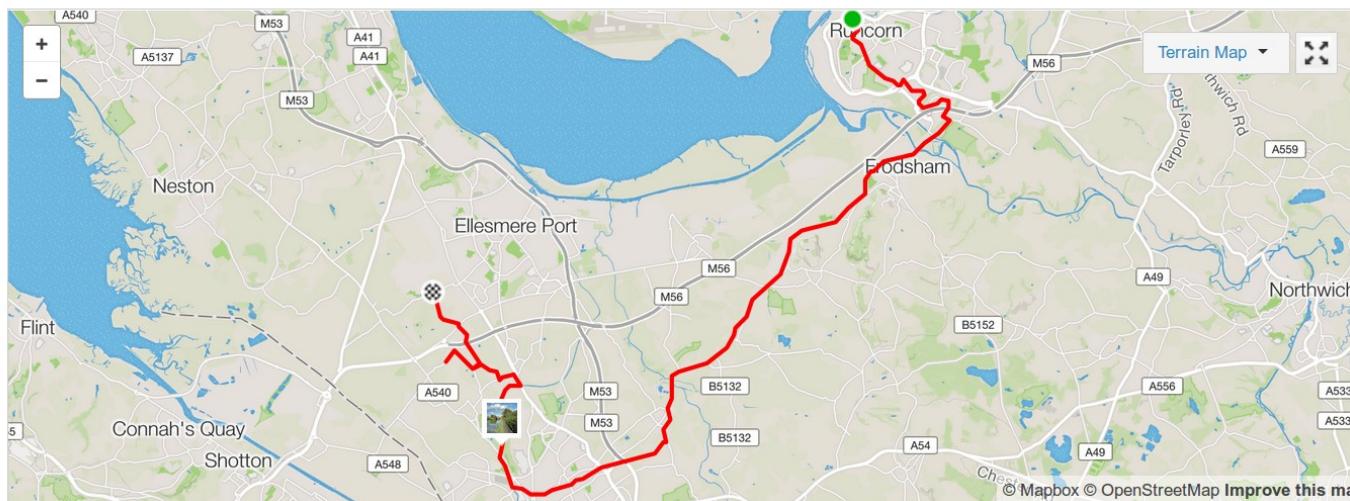
Energy Output

Speed Avg Max Show More

23.1 km/h 46.8 km/h

Elapsed Time 2:08:22

Device: Strava Android App Bike: CrossBeast



Segments

Learn more about segments

	Name	Time	Speed	Power	VAM	HR
★	Standing start 1.1 km 23m 2%	3:01	23.3 km/h	236 W	—	—
★	RCC to Lights 0.7 km 7m 1%	2:01	21.9 km/h	168 W	—	—
★	Clifton Road 1.3 km 11m -1%	4:08	19.8 km/h	152 W	—	—
★	Coniston Close Climb 0.4 km 5m 0%	1:32	18.0 km/h	114 W	—	—
★	Bike Bible CC - Slalom De Beechwood! 1.3 km 30m -2%	4:15	19.6 km/h	125 W	—	—
★	Down Wood Ln 0.5 km 11m -2%	1:07	28.2 km/h	41 W	—	—
★	Two bridges dash 1.3 km 15m 0%	4:16	19.1 km/h	247 W	—	—

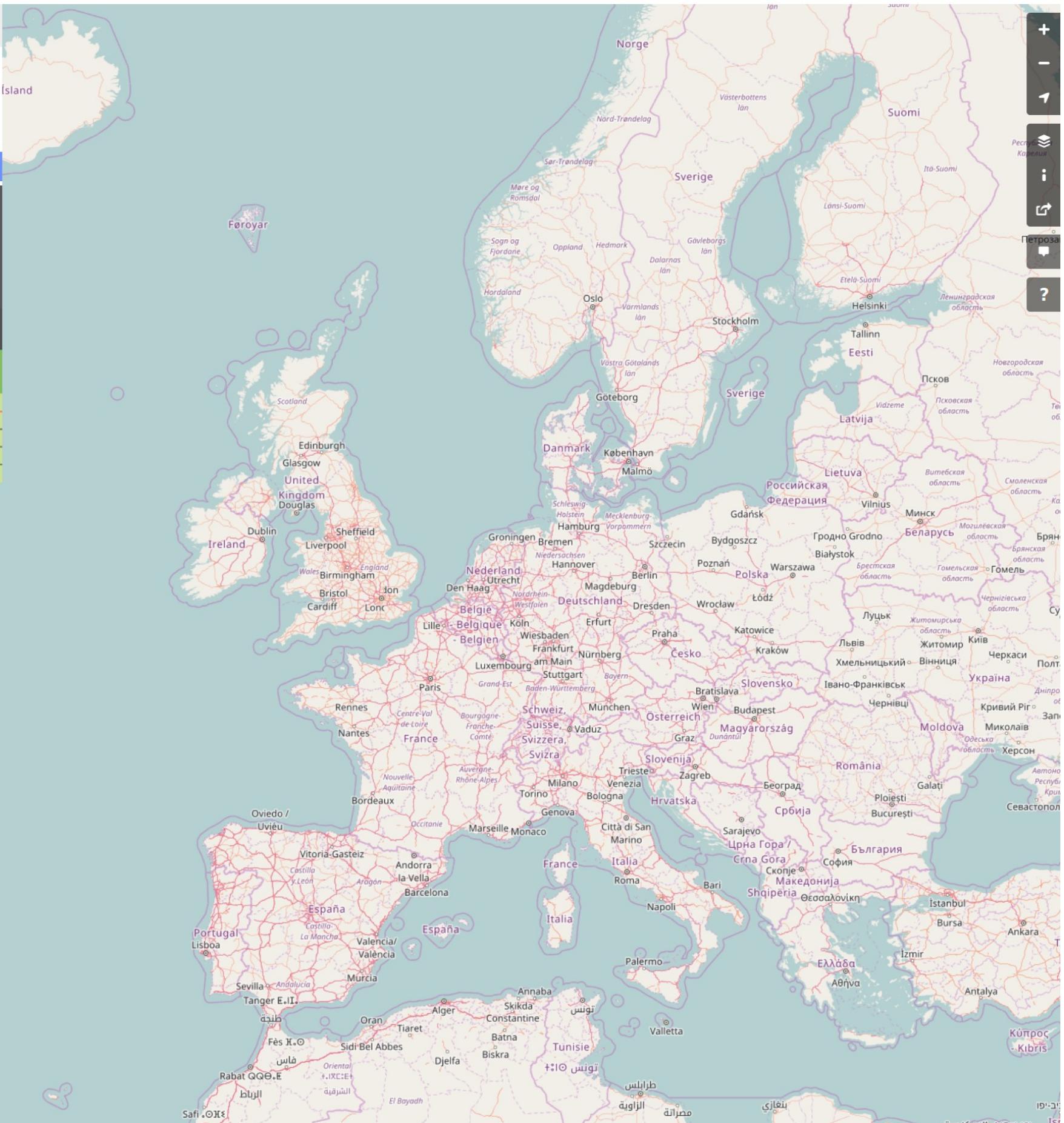
Search Where am I? Go 

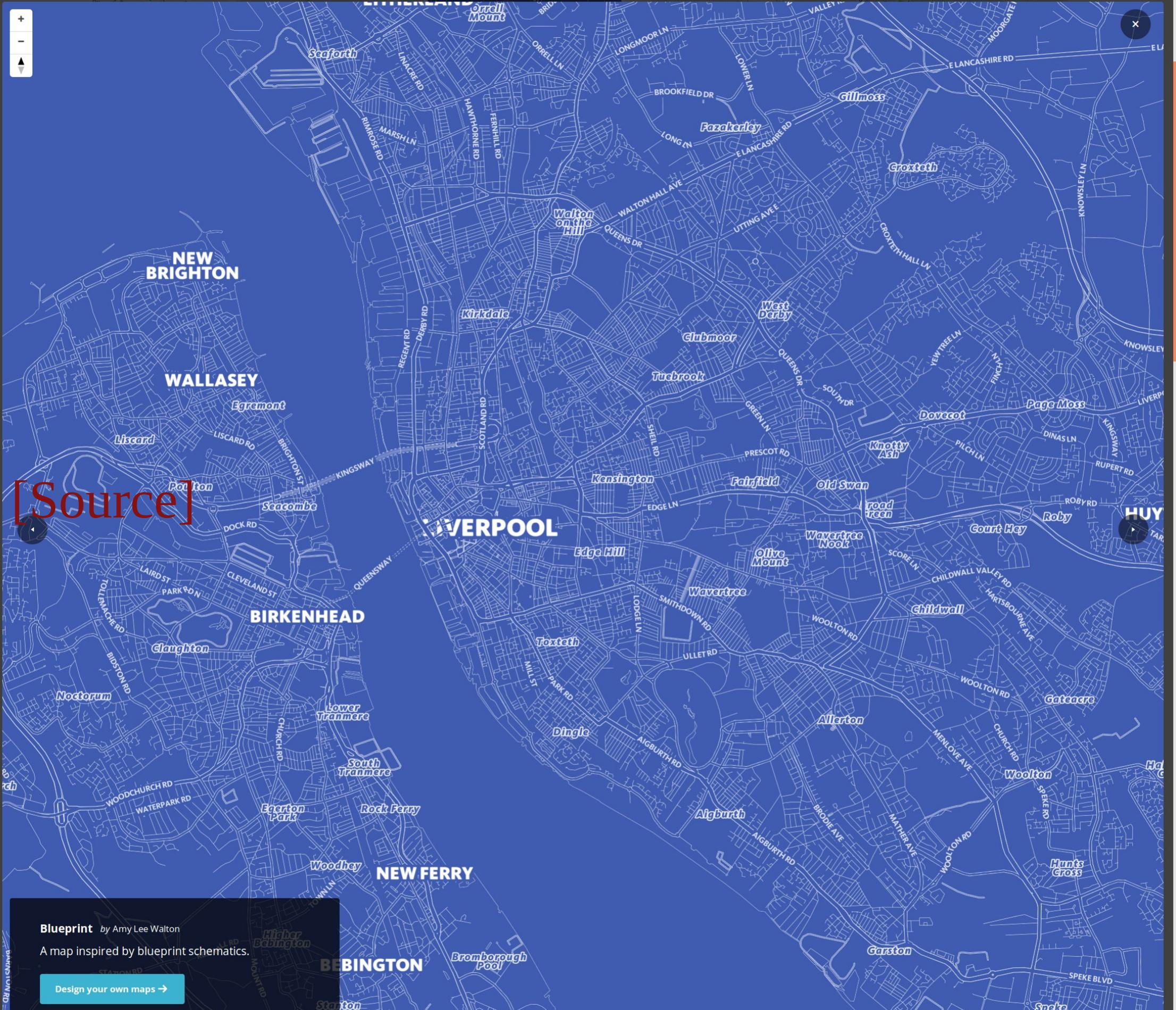
Welcome to OpenStreetMap!

OpenStreetMap is a map of the world, created by people like you and free to use under an open license.

The image features a green magnifying glass icon with a white circular center. Inside the circle is a red heart. Below the magnifying glass is a green puzzle piece shape, suggesting a map. The entire graphic is set against a dark grey background. At the top left, there's a blue bar with white text: 'Learn More' on the left and 'Start Mapping' on the right. In the top right corner of the main area, there is a small white 'X'. At the bottom, a green horizontal bar contains the text 'OpenStreetMap Funding Drive 2016' in white. Below this, a large white button with a black outline reads 'Donate Today!' in bold letters. Underneath the button, the text 'Support a Growing OpenStreetMap' is displayed in a smaller white font.

[Source]





Blueprint by Amy Lee Walton

A map inspired by blueprint schematics.

Design your own maps →

[Source]



Data Models

How we represent the world in a computer

- Vector
- Raster

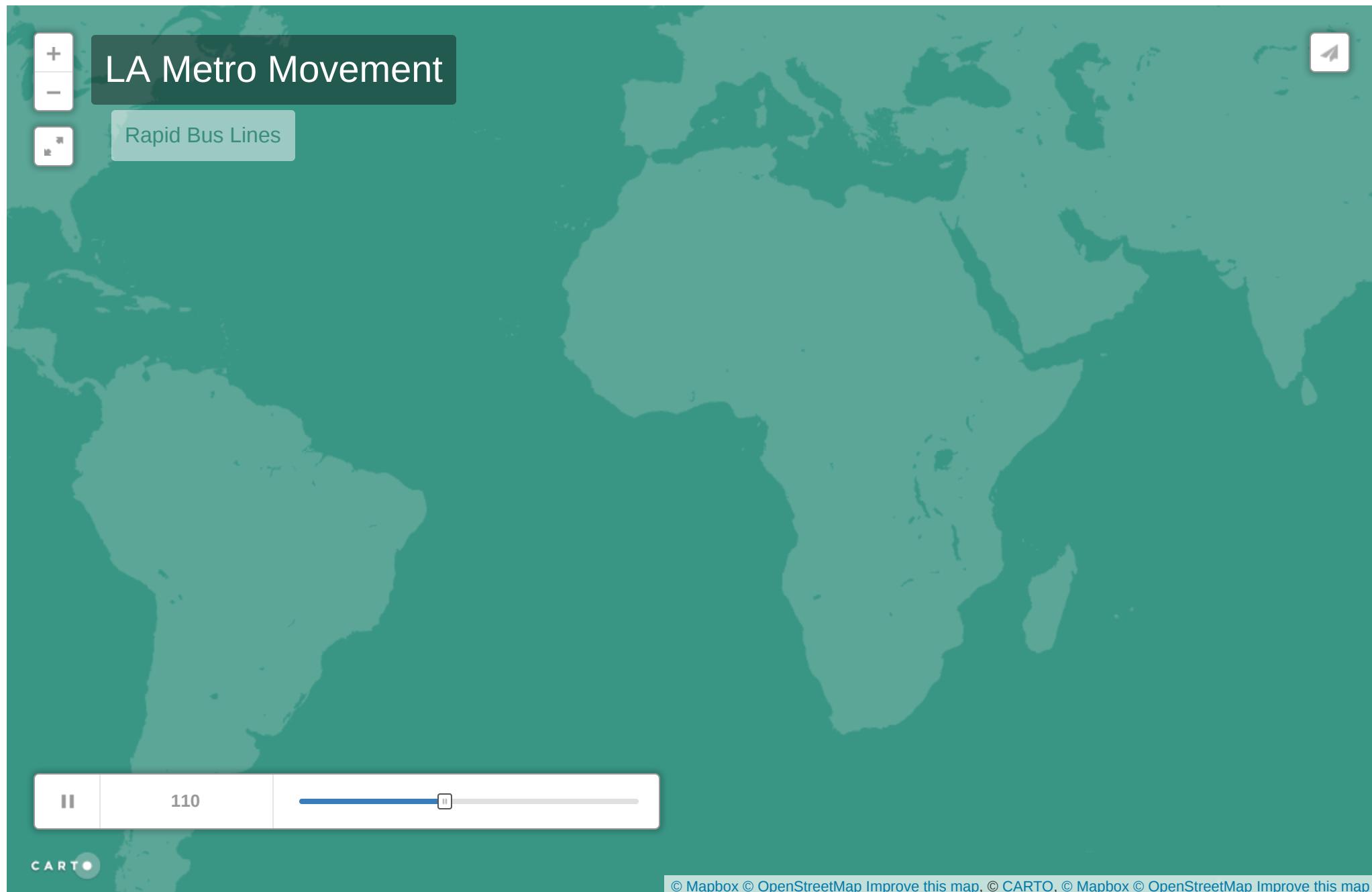
Vector

Represent each entity with a shape or geometry.

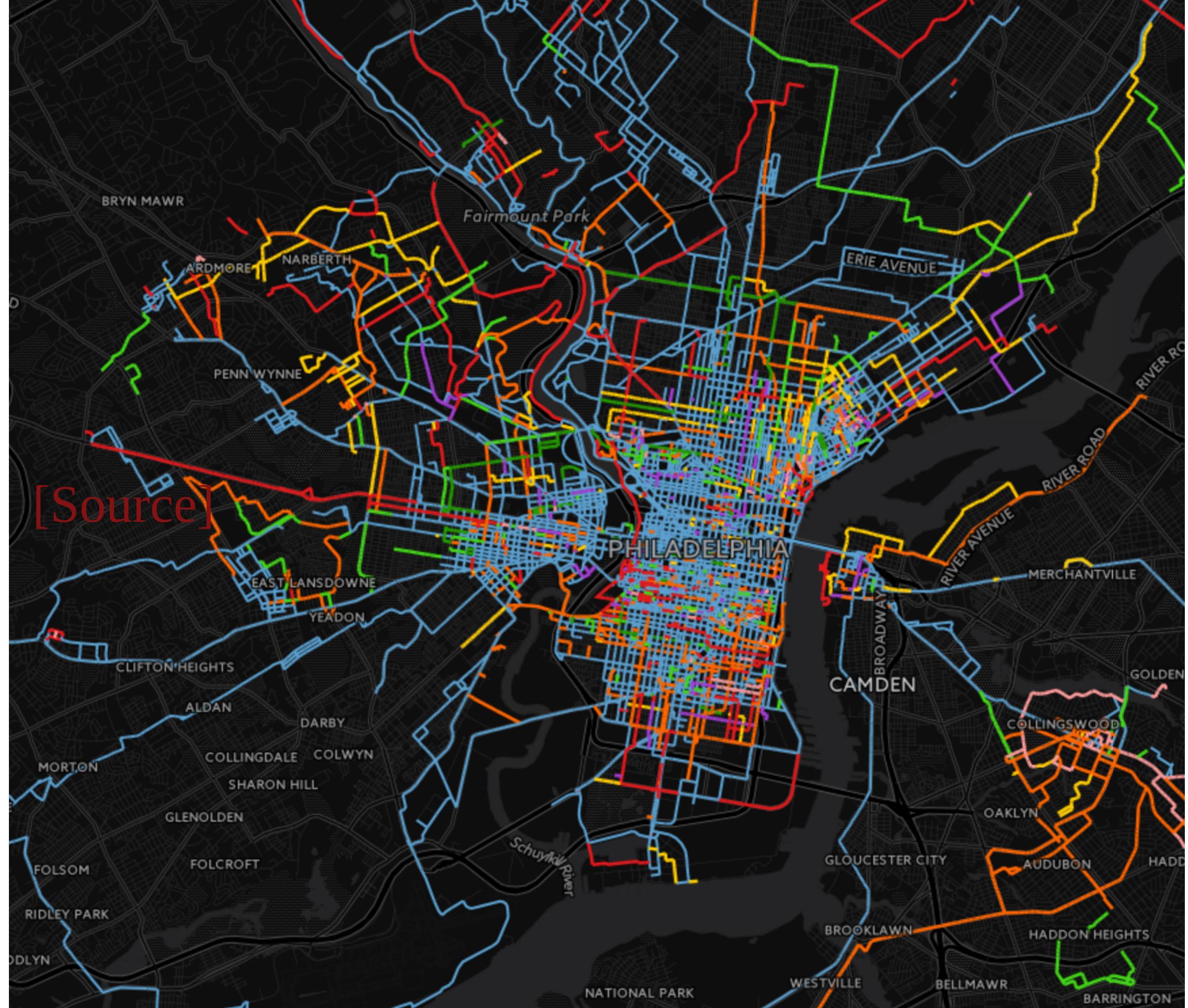
Simple features:

- (Multi-)Points
- (Multi-)Lines
- (Multi-)Polygons

Divide space into a **finite** set of entities



Map created by ★ [d9a](#)



[Source]

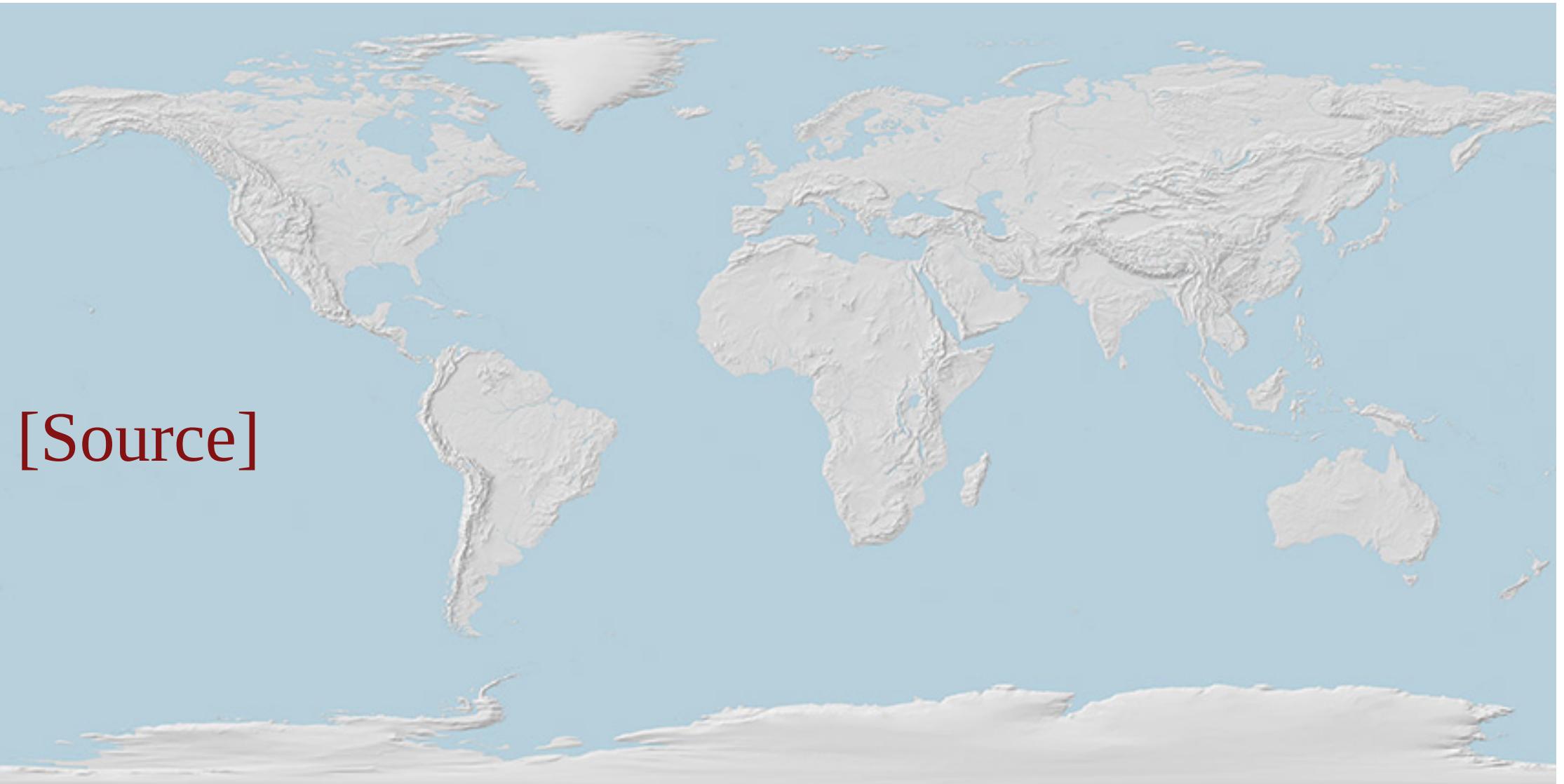


Raster

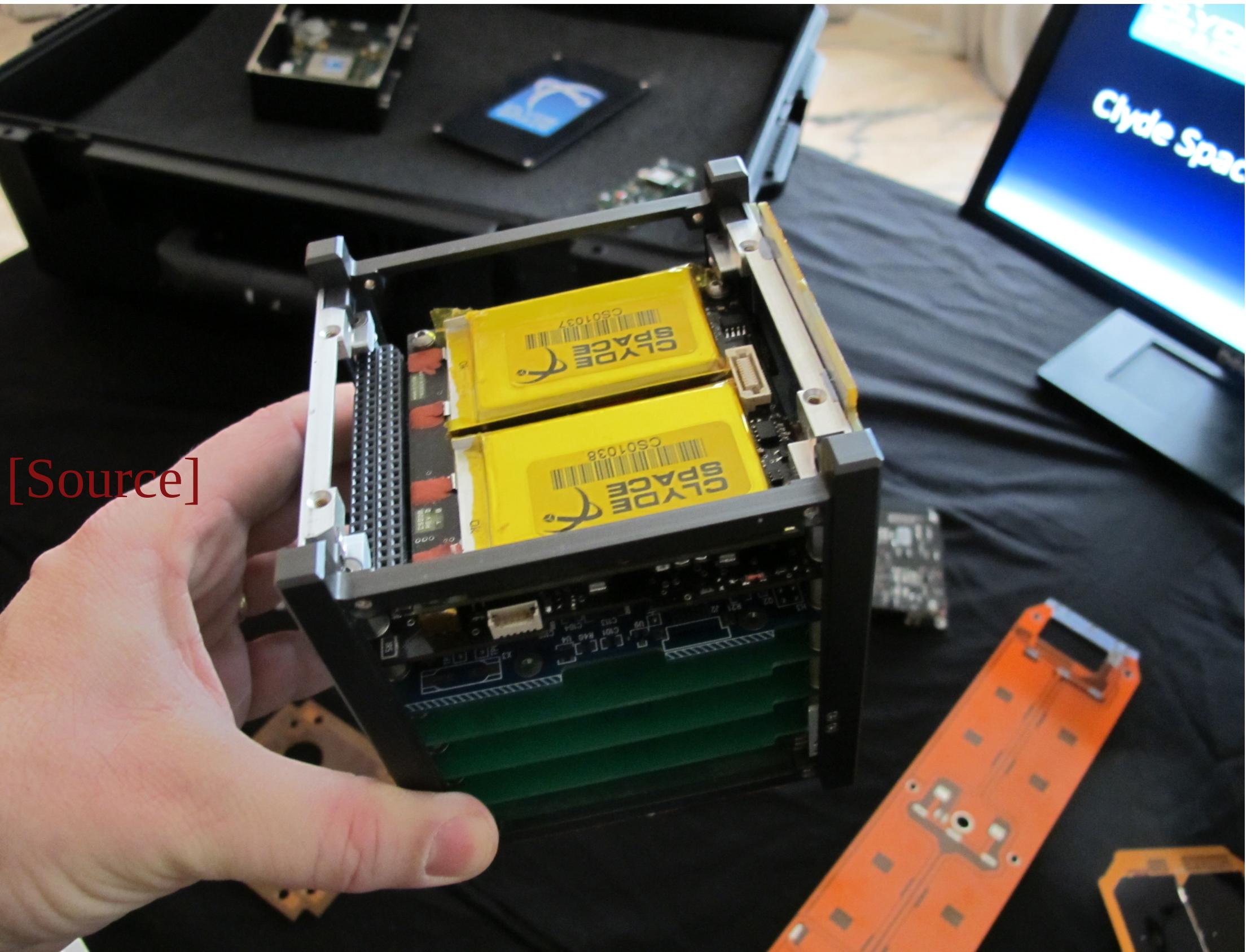
Use an **image** and control pixel colors to encode value

The value assigned for each cell represents the attribute of that cell

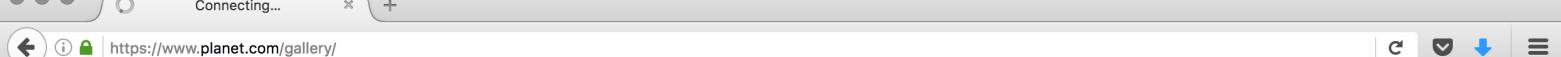
- **Continuous** variables, surfaces (temperature, density, elevation...)
- Satellite images (land cover, land use...)



[Source]



[Source]

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GALLERY



Iguazú National Park September 23, 2016

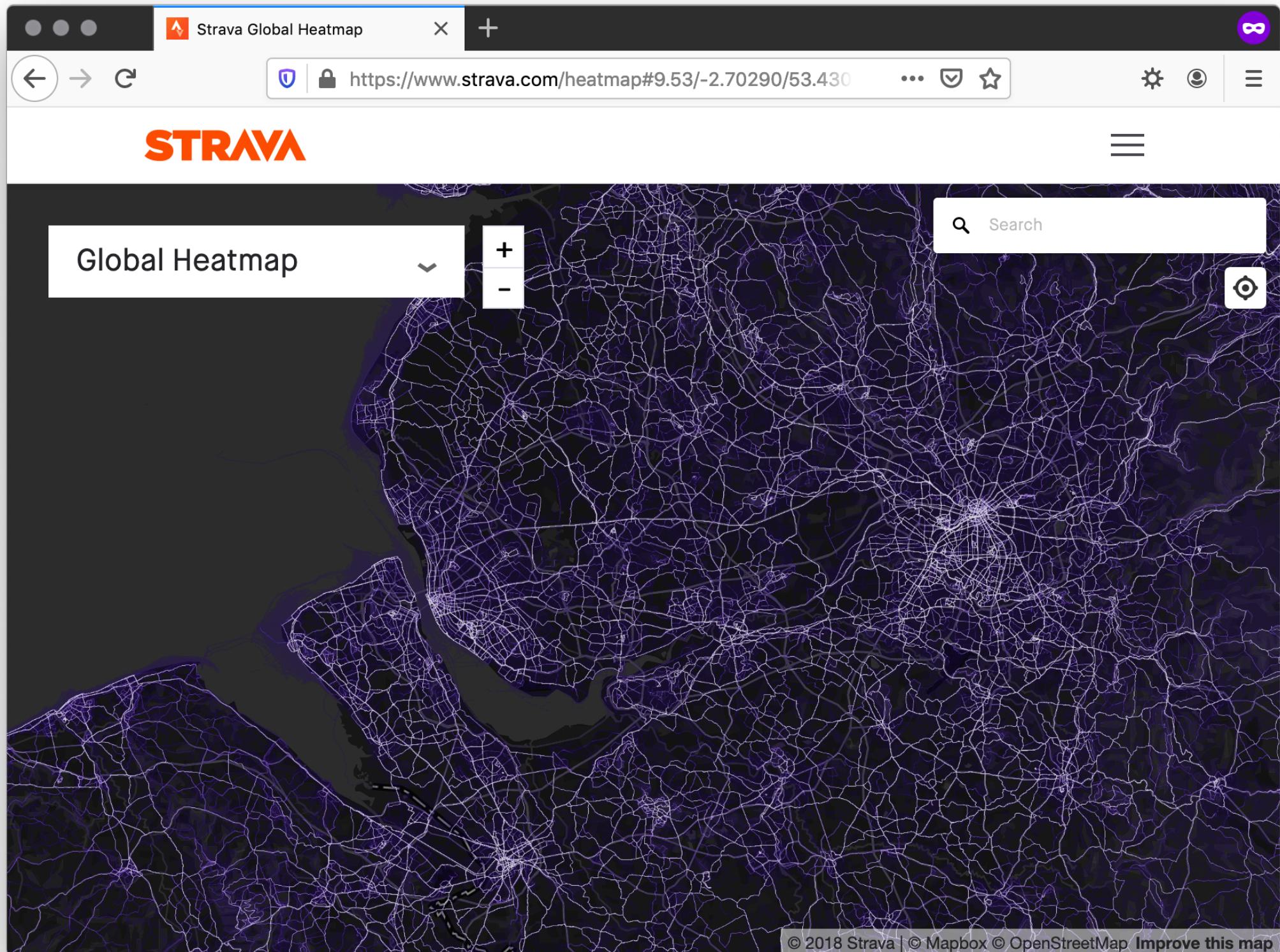
Büyük Tokaç September 20, 2016

Yukon River September 19, 2016

Al Taka Mountains September 19, 2016

Sidney Tornado September 18, 2016

Copenhagen September 18, 2016



Spatial Data Formats

Spatial Data Formats

In principle...

- Points, lines, polygons → Vector formats
- Images, surfaces → Raster formats

But these boundaries are blur...

Global Human Settlement - Hon X

https://ghsl.jrc.ec.europa.eu

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European Commission
Global Human Settlement

European Commission > EU Science Hub > GHSL

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GHSL - Global Human Settlement Layer

A new open and free tool for assessing the human presence on the planet

- Produces new global spatial information, evidence-based analytics and knowledge describing the human presence on the planet
- Operates in an open and free data and methods access policy (open input, open method, open output)
- Supported by the Joint Research Centre (JRC) and the DG for Regional Development (DG REGIO) of the European Commission, together with the international partnership [GEO Human Planet Initiative](#) GEO GROUP ON EARTH OBSERVATIONS

09/10/2019 [Mapping European Cities and Settlements from Space with Copernicus data](#) - European Week of Regions and Cities - Building SQUARE - Brussels Convention Centre, Room 314+316

1975

Click here to find out about the technology behind this image

1 2 3 4 5 6

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LUCAS - Land use and land cov X

https://ec.europa.eu/eurostat/statistics-explained/index.php/LUCAS_-_Land_use_and_land_cover

eurostat
Statistics Explained

NAVIGATION ▾ ONLINE PUBLICATIONS ▾ TOOLS ▾

LUCAS - Land use and land cover survey

No update is planned for this article

The European Union (EU) is composed of a diverse range of landscapes: it is home to a wide variety of flora and fauna and includes some of the most and least densely populated areas of the world. This background article provides information on the Land Use/Cover Area frame Survey (LUCAS), a survey that provides harmonised and comparable statistics on land use and land cover across the whole of the EU's territory.

The data collected by LUCAS provides harmonised information for studying a range of socioenvironmental challenges, such as [land take](#), soil degradation or biodiversity.

Full article + Direct access to

- Other articles
- Tables
- Database
- Dedicated section
- Publications
- Methodology
- Legislation
- Visualisations
- External links

Notes

- ↑ <https://www.sciencedirect.com/science/article/pii/S1462901115300654> The new assessment of soil loss by water erosion in Europe
- ↑ <http://onlinelibrary.wiley.com/doi/10.1111/ejss.12499/full> LUCAS Soil, the largest expandable soil dataset for Europe: a review
- ↑ <https://ec.europa.eu/jrc/en/publication/lucas-2018-soil-component-sampling-instructions-surveyors> LUCAS 2018 - soil component: Sampling Instructions for Surveyors

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Traditionally

Vector

- Single files: shapefiles, etc.
- Client-server (geo-)DBs: PostGIS, etc.

Raster

- Mostly (single) image formats: GeoTIFF, etc.

However...

Many of these formats were designed for an *offline* world, so display some of the following:

- Binary (“non-streamable”)
- “Unqueriable”
- Complex format structures

LUCAS - Land use and land cov X

https://ec.europa.eu/eurostat/statistics-explained/index.php/LUCAS_-_Land_use_and_land_cover

eurostat
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- ↑ <http://onlinelibrary.wiley.com/doi/10.1111/ejss.12499/full> LUCAS Soil, the largest expandable soil dataset for Europe: a review
- ↑ <https://ec.europa.eu/jrc/en/publication/lucas-2018-soil-component-sampling-instructions-surveyors> LUCAS 2018 - soil component: Sampling Instructions for Surveyors

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Modern formats

New formats have appeared in part “*fixing*” those issues, but also responding to web needs:

- Streamable (e.g. **GeoJSON**)
- Queriable (e.g. **PostGIS/Geopackage**)
- Single file (e.g. **.mbtiles**)

Let’s explore a bit more on a couple of them...

GeoJSON

.mb/vtiles

Selecting the right format



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