

# Advanced GIS

Raphaëlle ROFFO

Sciences Po - Urban School

# Session 3

Raster data (continued)  
&  
Bivariate Choropleths

# Today's plan

1. Tutorial: Feedback, Q&A
2. Raster calculations: examples and use cases
3. Intro to bivariate choropleth maps

# Session 3 Tutorial

# Take-away from the tutorial

1. Extracting vector shapes from a processed raster layer  
(polygonize tool)
2. Georeferencing a non-spatial image
3. Digitising new features using satellite imagery, to create an original dataset

# Digitizing to support humanitarian missions

Mapping our world together



EXPLORE PROJECTS

MY CONTRIBUTIONS

LEARN

ABOUT

<https://www.hotosm.org>

Difficulty level ▾

Projects to map ▾

More filters

Sort by ▾

Search Projects

Showing 14 of 787

URGENT

#10796  
**Adamawa State-Numan LGA -Citizen Science Mapathon for Flood**

The month of April is a global Citizen Science Month! with exciting Citizen

2232 total contributors

Beginner Mapper

URGENT

#11039  
**Sokoto State -Sabon Birni-Mapathon For Vulnerable Flood Disaster**

Sabon Birni LGA has been listed as one of the highly probable flood risk

1405 total contributors

Beginner Mapper

URGENT

#11844  
**Benue State -Citizen Science Mapathon for Vulnerable Flood**

Logo LGA has been listed as one of the highly probable flood risk LGA's in

818 total contributors

Beginner Mapper

HIGH

#6665  
**Cucuta Colombia #MigrationCrisis**

Colombia has seen an influx of refugees moving through the country.

4012 total contributors

Beginner Mapper

HIGH

#6979  
**Missing Maps: Forecast-based Action in Central Asia**

Central Asia is a region which is especially prone to natural disasters.

2626 total contributors

Beginner Mapper

HIGH

#8171  
**Kinshasa - Ndjili watershed**

During the rainy season, Kinshasa regularly faces heavy rains. A number

HIGH

#10430  
**Cartographie de Gossi, Cercle de Gourma-Rharous, Tombuctou**

Ce projet de Cartographie s'inscrit dans le cadre des activités de

HIGH

#10692  
**Mapeamento de localidades ribeirinhas amazônicas no norte**

O projeto objetiva mapear as localidades ribeirinhas do município

HIGH

#11013  
**OSM Monsoon Mapping and Validation Challenge of Illam District**

"OSM Monsoon Mapping and Validation Challenge of Illam District"

HIGH

#11525  
**Mapping Bedket Municipality, Nepal**

This project is created to improve the data quality of the Bedket

# Humanitarian OpenStreetMap



**BENUE STATE -CITIZEN SCIENCE  
MAPATHON FOR VULNERABLE  
FLOOD COMMUNITIES IN LOGO  
LGA-NIGERIA • #254**

🕒 1 hour, 59 minutes left

[COMPLETION](#)   [INSTRUCTIONS](#)   [HISTORY 25](#)

Please check the history tab for relevant comments.

▼ SPECIFIC TASK INFORMATION

Buildings Quick Tutorial: Buildings -  
<https://www.youtube.com/watch?v=ISLe6rjtgi0>

Please accurately outline all the buildings you can find.  
The outline should be for the full size of the building even  
if it is partly covered by trees in the imagery.

Take care to not include the building shadow in the  
building outline.

After tagging as a building, please leave all the 'Fields'  
empty - this information is added later by local mappers.

After drawing the outline and tagging as a building, use  
the 'Q' key in the iD web editor to "square" the corners.

mapbox Terms & Feedback | 100 m Edits by Pavy\_555, Calina Novak, Frans S, and 3 others | 2.20.2

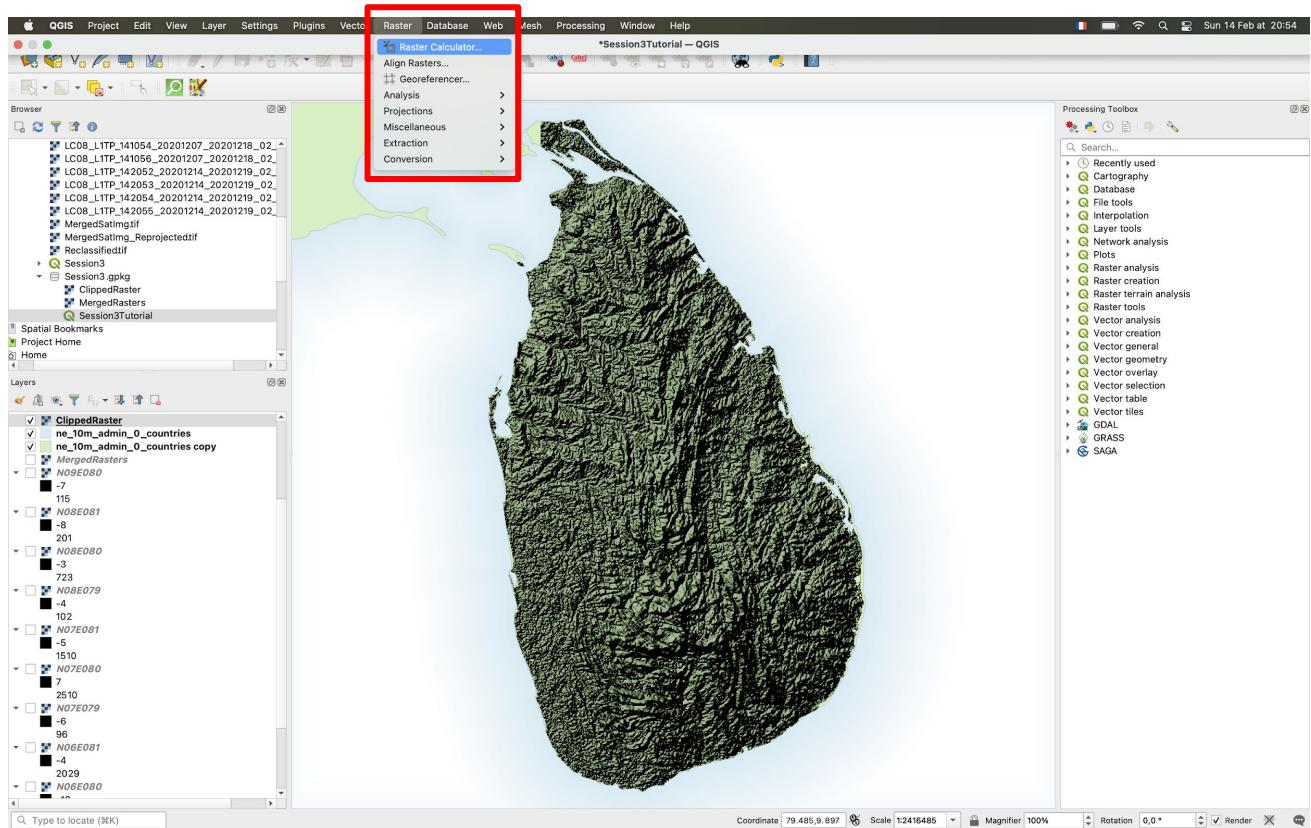
Questions?

# Raster calculation: use cases

# Raster calculations

Raster calculations are a powerful tool in spatial analytics.

You can access the Raster Calculator under the **Raster** menu.

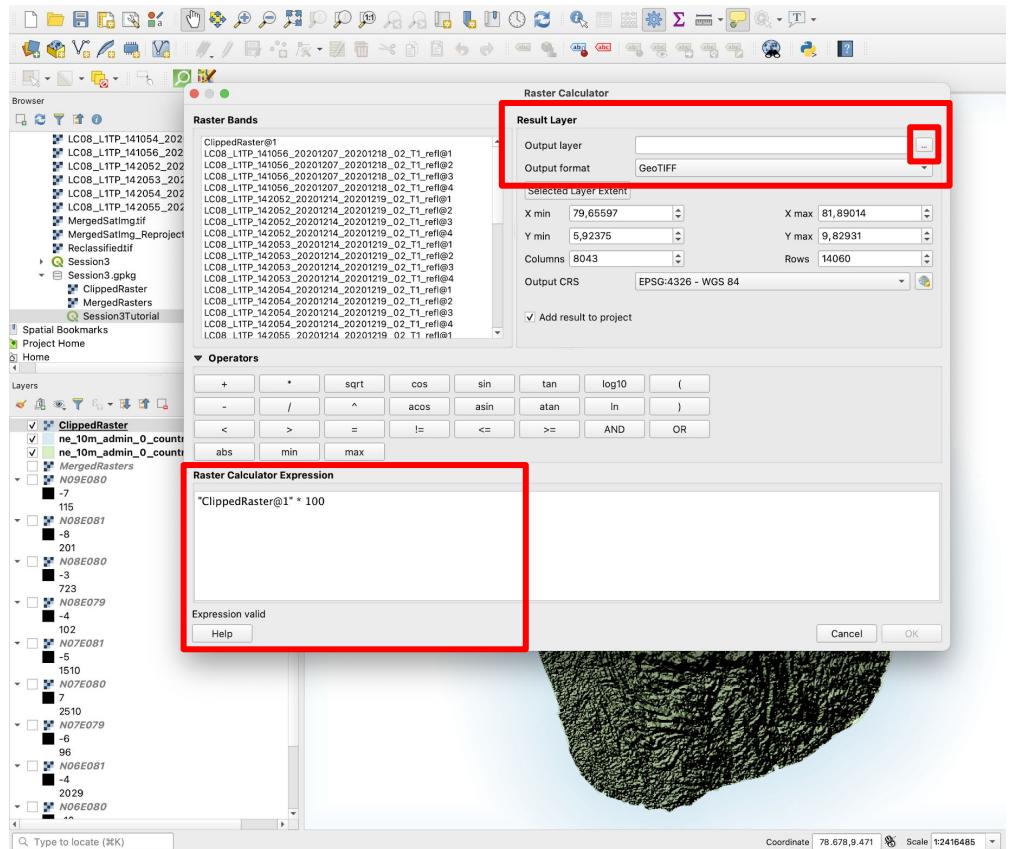


# Raster calculations

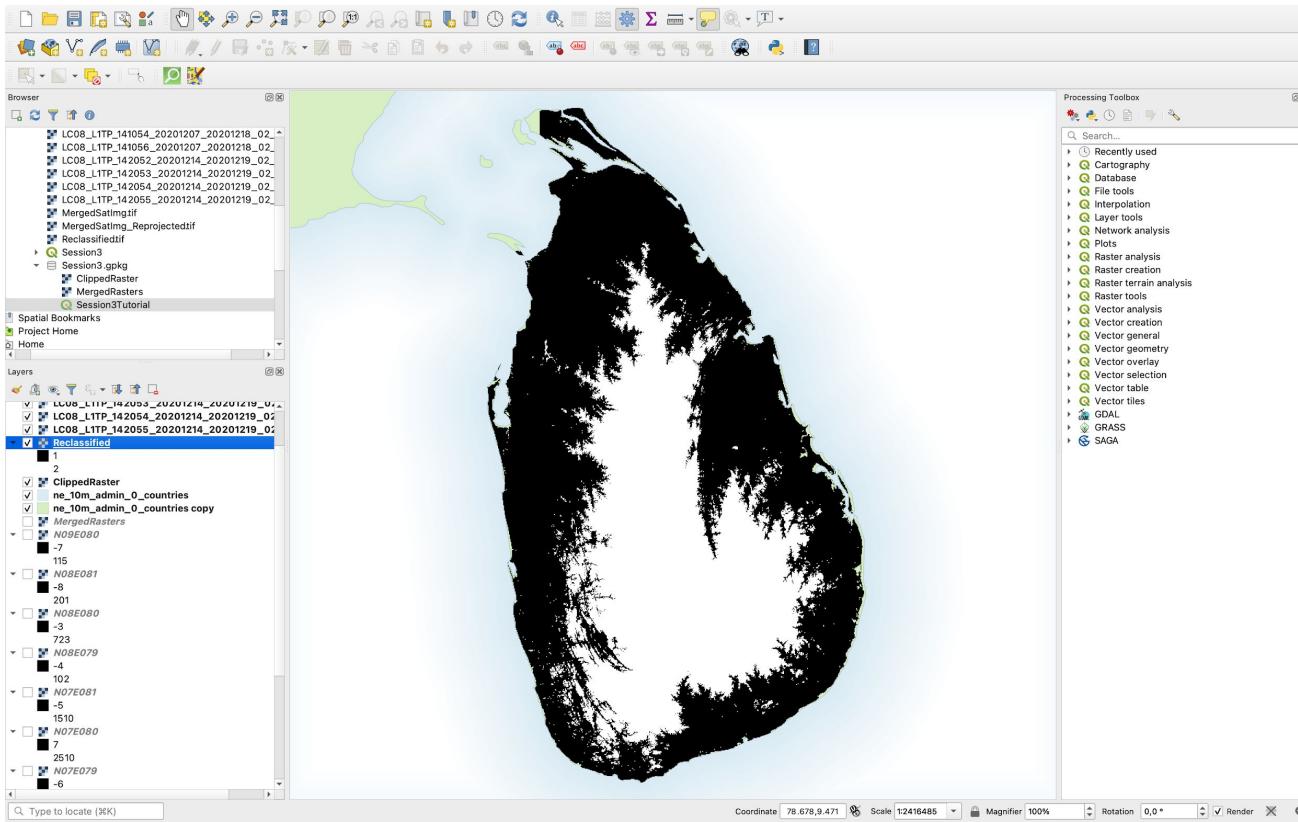
## Simple use case:

You may want to convert the unit. For the SRTM, you could for instance decide you want to convert from meters to cm:

1. In your raster bands menu, select the raster dataset you want. The @1 signals which band you are using. For the SRTM there is only one band so we use **@1**. But you'll notice that the satellite imagery rasters have 4 bands each.
2. Select GeoTIFF format and click on the three dots to select the path where to save the new layer
3. Type in the Expression field:  
**"ClippedRaster@1" \* 100**
4. Click OK → you will get your new raster layer.



# Raster calculations: reclassifying raster cells

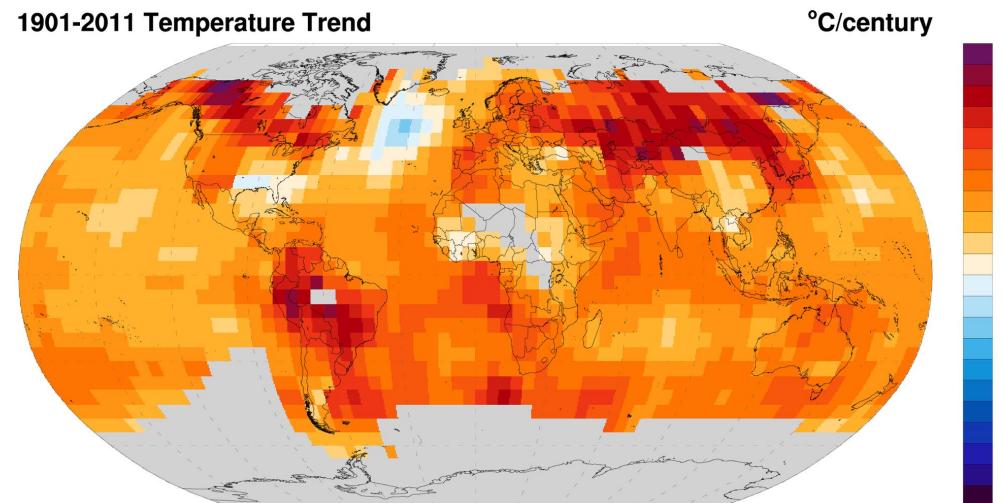


# Raster calculations: Differences

## Possible use case 1:

You have two raster datasets for average temperature in the world in 1901 and 2011 and you're interested in seeing how that evolved. You can simply calculate the difference between those two overlapping layers (as long as their pixels overlap, you will be able to compute this simple difference). The syntax will be:

**“Layer2011@1” - “Layer1901@1”**

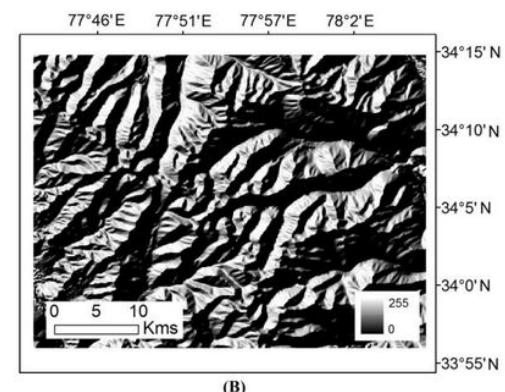
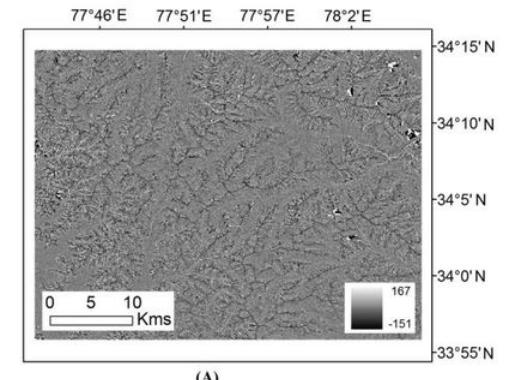


# Raster calculations: Differences

## Possible use case 2:

You have downloaded two elevation datasets covering Nepal, from two different providers that used slightly different methodologies. You want to check if the elevation values they found are matching. You subtract the two layers; it will return a cell value of 0 where the two datasets are identical, and non-null values will indicate a difference in the two rasters.

**Note:** This was actually used to correct SRTM data in Himalaya where the data contained roughly 10% error due to the steep slope in that region. Later missions managed to get more accurate results.



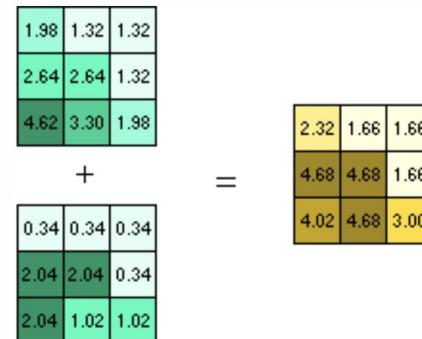
# Raster calculations: cost matrix

In GIS, some tools will produce raster as output. For instance, the **distance matrix** tool takes points as inputs and creates a raster grid where each cell's value is its distance to the nearest point.

This is typically very useful in weighted overlay analysis, where you could calculate the distance to various important facilities and assign them a weight, to combine for instance the distance to schools and to parks into a single score.

## Combining the datasets

The final cost raster is created by adding together the weighted datasets.



Combining the weighted inputs

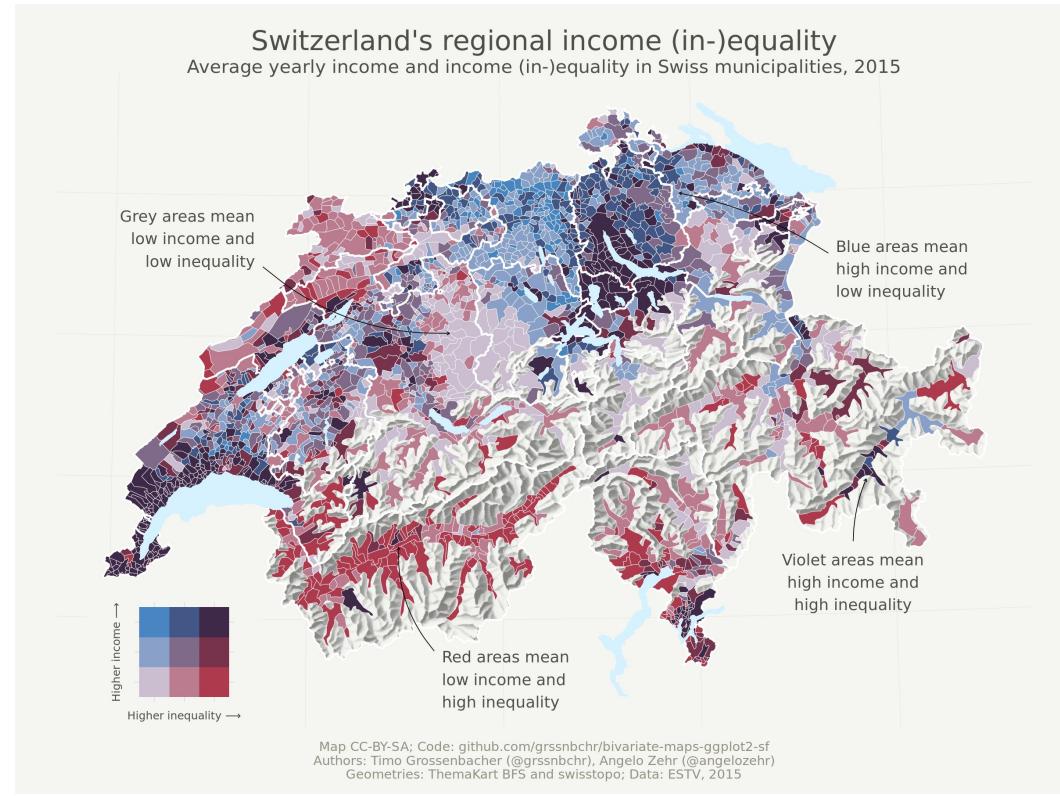
# Bivariate Choropleth

# What is a bivariate choropleth map?

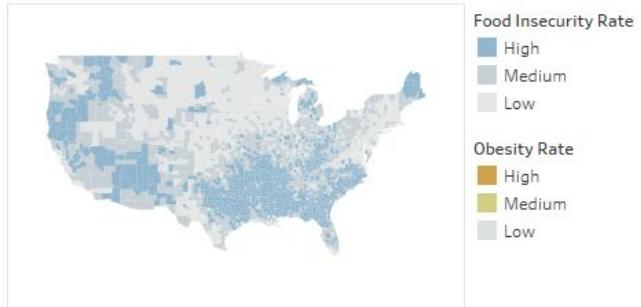
**Bivariate:** simultaneously represents two variables

**Choropleth:** a type of thematic map (map that shows a phenomenon) that represents (colours) data as occurring within bounded areas.

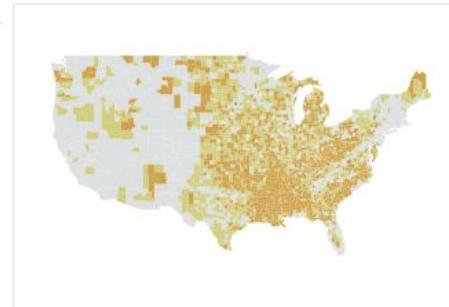
Bivariate choropleth maps use a matrix of carefully chosen complementary colours to simultaneously represent two phenomena and how they relate to each other.



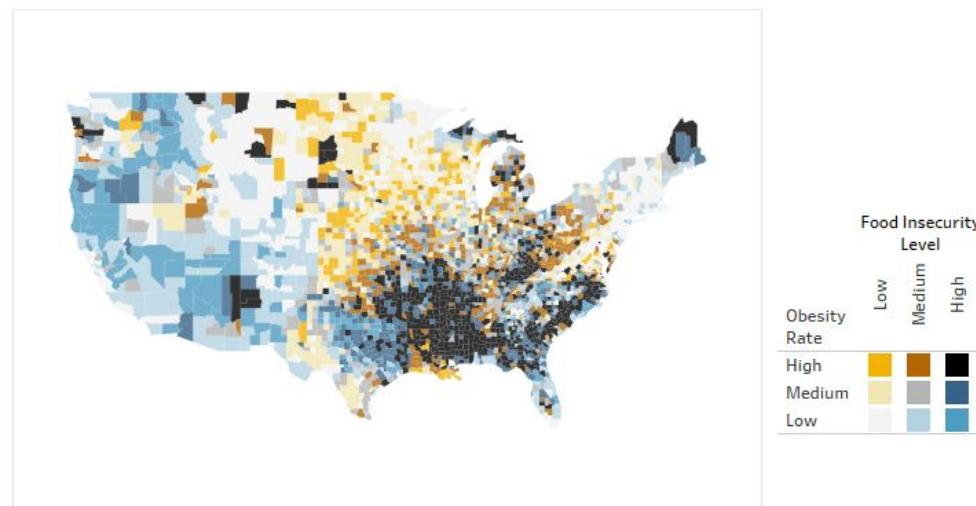
### Food Insecurity Rate



### Obesity Rate



### Food insecurity vs. Obesity



Source: <https://www.tableau.com/about/blog/2018/2/how-make-effective-bivariate-choropleth-maps-tableau-83121>

# Covid cases vs covid casualties in the US

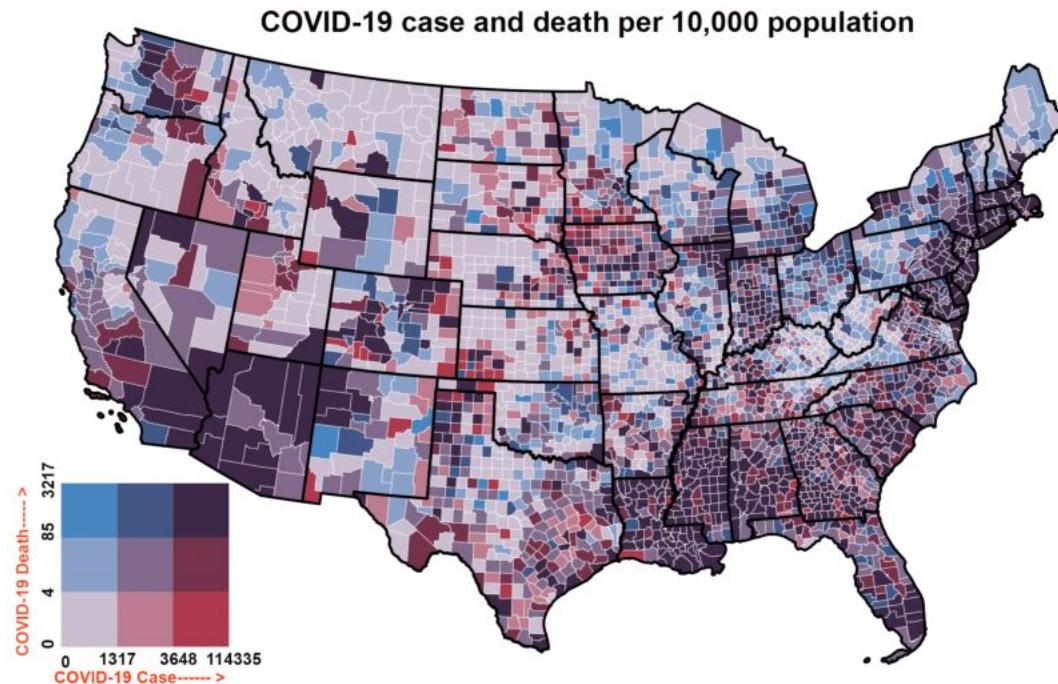
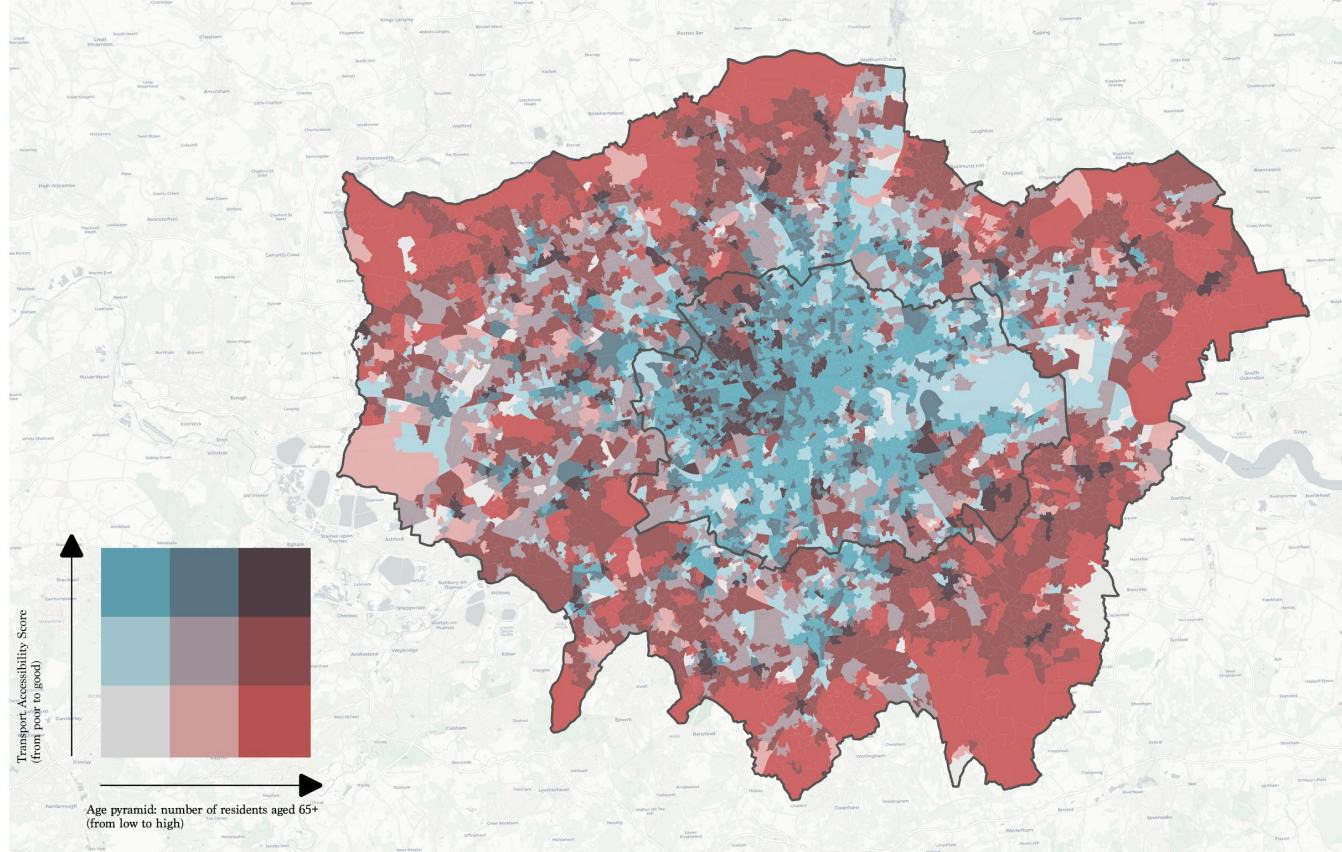


Fig. 2

Transport Accessibility for the 65+ in Greater London:  
Where do the elderly live and how connected are they to public transportation lines?

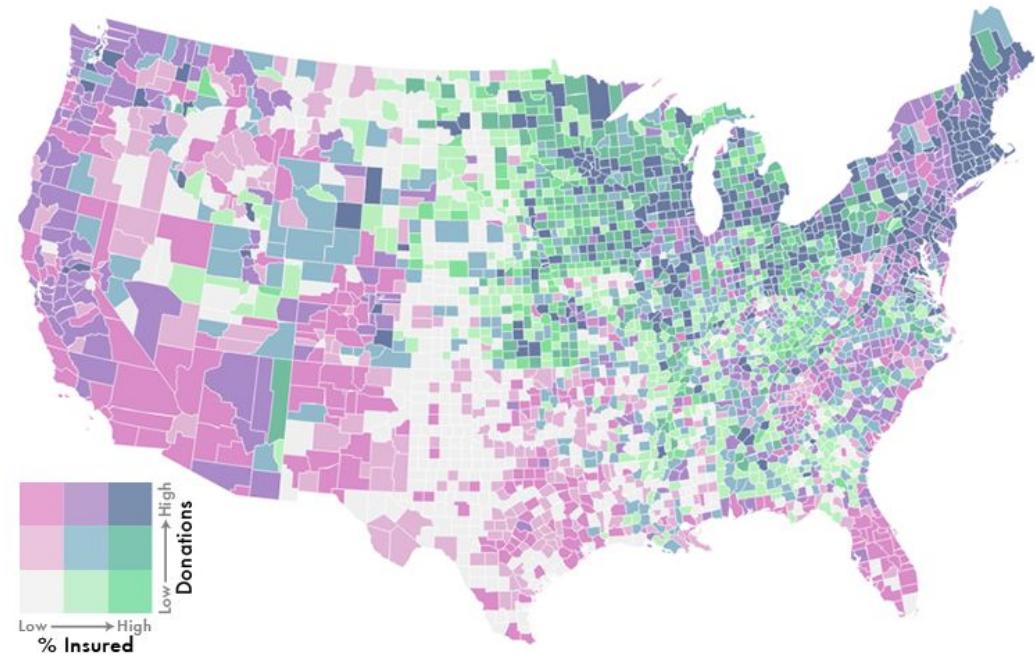


Data Sources: Office for National Statistics, 2016

# Recommended read: Joshua Stevens' guide to bivariate choropleth maps

If you are feeling inspired and want to go further, check out Joshua Stevens' guide and his method for producing state-of-the-art bivariate choropleths.

<https://www.joshuastevens.net/cartography/make-a-bivariate-choropleth-map/>



# Colour palettes

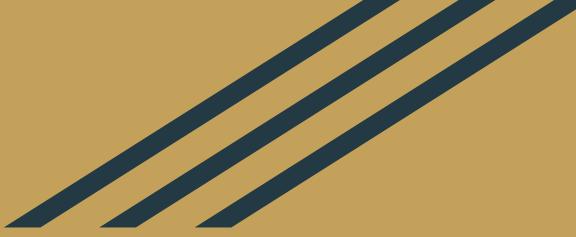
It's Dangerous To Go Alone! Take This.

Mixing colours is difficult; you can use Joshua Stevens' colour codes to create your ramp, and save those ramps for later.

I've made a few sequential bivariate color schemes you're free to use if you'd rather not make one yourself. They were designed for use on light backgrounds.



These example palettes should get you off to a good start.



# Next week

# Homework

- Do the [Session 3 Tutorial](#)
- Start thinking about the final coursework and how you can incorporate some of the new techniques you learnt this term in your analysis.