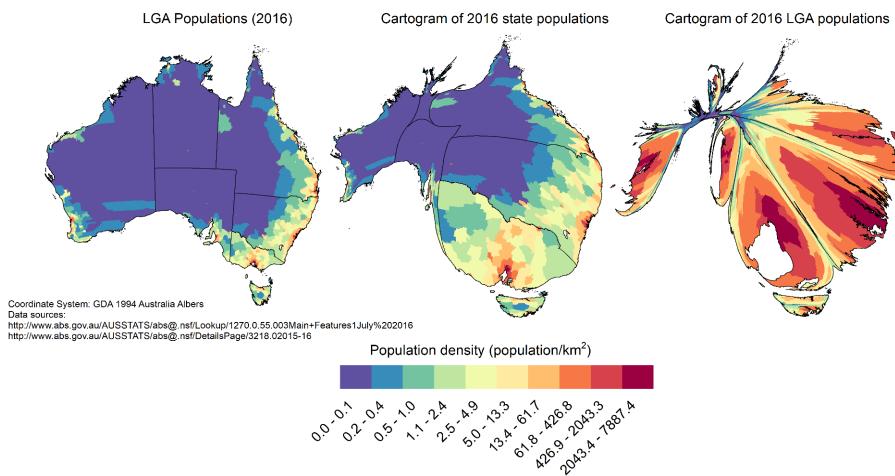


# EXERCISE 8

## “Thematic Map Types”



Winter Semester 2024/2025

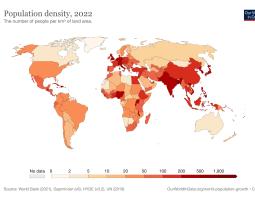
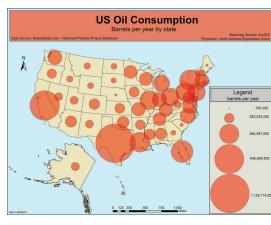
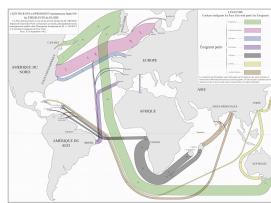
### 1. Aims of this exercise:

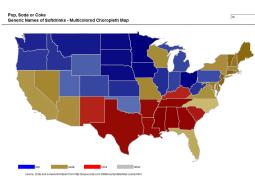
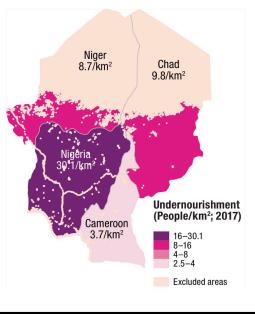
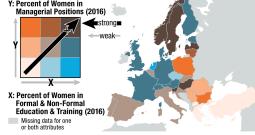
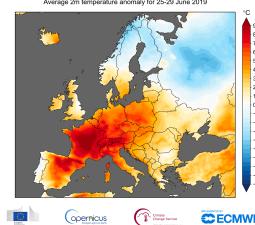
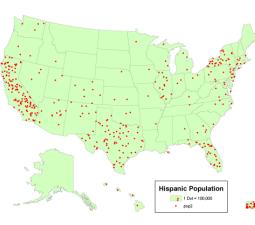
We will continue exploring Thematic Map types during this meeting, building upon what we learned in previous exercises. This part of the course will teach students how to create thematic maps using different data types.

Students will use QGIS and ArcGIS for this exercise, allowing them to choose which software they are most comfortable with. By the end of these sessions, students will gain valuable experience in producing thematic maps and effectively visualising data in a spatial context using their preferred GIS tool.

### Thematic Map Types

The type of data we are working on will influence how we visualise it on thematic maps. For example, like vegetation types, categorical data often leads to maps with different colours or patterns for each category. The specific data type guides us in selecting the best thematic map style to effectively convey the information at hand.

Thematic Map	Data Types	(Possible) Visual Variable	Example
Choropleth Map	Quantitative	Colour value	 A world map showing population density by country. The legend ranges from 'No data' to 1,000 people per square kilometer, with intermediate values at 2, 5, 10, 20, 50, 100, 200, 500. Darker shades of orange and red indicate higher population density.
Proportional Symbol Map	Quantitative	Size	 A map of the United States where states are represented by circles of varying sizes. The size of each circle corresponds to the annual oil consumption in barrels per state. A legend on the right shows consumption levels from 0 to over 1 billion barrels per year, with intermediate values at 500,000, 1,000,000, and 5,000,000.
Flow Map	Qualitative (nominal), Quantitative	Size, colour hue, colour value	 A global map showing the flow of oil between countries. The thickness of the lines represents the volume of oil traded, and the color of the lines indicates the type of oil product (e.g., Crude oil, Diesel fuel, Jet fuel, etc.). A legend on the left provides a key for these categories.

Nominal Map	Qualitative (nominal)	Colour hue, texture, orientation	
Dasymetric Map	Quantitative	Colour hue, colour value	
Bivariate Map	Quantitative	Colour hue, colour value	
Cartogram	Quantitative	Colour hue, colour value	
Diagram Map	Qualitative (nominal), Quantitative	Location, size, colour hue, colour value	
Isoline Map	Quantitative	Colour hue, colour value	
Dot Density Map	Quantitative	Shape, colour hue, colour value	

Source: [https://thempe.github.io/thempe/07\\_map\\_types.html](https://thempe.github.io/thempe/07_map_types.html)

## 2. The references used for this exercise:

These pages from ESRI are helpful for you:

<https://pro.arcgis.com/en/pro-app/latest/help/mapping/layer-properties/symbolization.htm>

<https://pro.arcgis.com/en/pro-app/latest/help/mapping/layer-properties/symbolize-feature-layers.htm>

Please have a look at this page to find more about ArcGIS Pro Documentation:

<https://learn.arcgis.com/en/gallery/>

QGIS references:

[https://docs.qgis.org/3.28/en/docs/training\\_manual/index.html](https://docs.qgis.org/3.28/en/docs/training_manual/index.html)

[https://mltconsecol.github.io/QGIS-Tutorial/QGIS-Tutorial/Treglia\\_QGIS\\_Tutorial\\_3\\_0.pdf](https://mltconsecol.github.io/QGIS-Tutorial/QGIS-Tutorial/Treglia_QGIS_Tutorial_3_0.pdf)

<https://github.com/uwcrtlab/MappingSDGsTechnicalSupplement/> (QGIS)

## 3. The data for this meeting:

### a. Part 1: Working on ArcGIS

- i. Provided data “NYC\_statistics”: *exercise5\_dataexploration\_shp*
- ii. Data from the internet. Download data from various sources! Here is the list of the sources:
  - Raster download: <https://earthexplorer.usgs.gov/>
  - Geoda data and lab: <https://geodacenter.github.io/data-and-lab/> ★
  - OSM data download: <https://overpass-turbo.eu/> ★
  - Europe data download:  
<https://mapcuzin.com/free-europe-arcgis-maps-shapefiles.htm>
  - Geocommons: <http://geocommons.com/search.html>
  - Geofabrik: <https://download.geofabrik.de/>
  - GADM: <https://gadm.org/maps.html>
  - Statistisches Bundesamt:  
[https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Energie/Erzeugung/\\_inhalt.html](https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Energie/Erzeugung/_inhalt.html)

- Regionaldatenbank Deutschland:  
<https://www.regionalstatistik.de/genesis/online/logon>
- UN Data: <https://unstats.un.org/sdgs/daportal/database> ★  
If you use the data from the UN, you can follow this tutorial on how to pre-process the data:  
<https://github.com/uwcrtlab/MappingSDGsTechnicalSupplement/>

b. **Part 2: Working on QGIS**

- i. Provided data “NYC\_statistics”: *exercise5\_dataexploration\_shp*
- ii. Data from the internet. You can see the list above for downloading data from various sources.

4. **What we will do in this meeting:**

**Part 1: Working on ArcGIS**

- a. Open the provided data “NYC\_statistics”: *exercise5\_dataexploration\_shp*
- b. Analyse what you want to visualise from the **attribute table** and what **thematic map types** suit the data
- c. Create one thematic map from the provided data; you can choose any thematic map type
- d. Take a screenshot of the maps as the exercise results
- e. Download data from the internet
- f. Create one thematic map with the data you downloaded
- g. Take a screenshot of the map as the exercise result

**Part 2: Working on QGIS**

- h. Open the provided data “NYC\_statistics”: *exercise5\_dataexploration\_shp*
- i. Analyse what you want to visualise from the **attribute table** and what **thematic map types** suit the data
- j. Create one thematic map from the provided data; you can choose any thematic map type
- k. Take a screenshot of the maps as the exercise results
- l. Download data from the internet
- m. Create one thematic map with the data you downloaded
- n. Take a screenshot of the map as the exercise result

## 5. Expected outputs:

- a. Screenshots of the project in ArcGIS Pro for **Part 1** result:
  - i. The **first** thematic map on ArcGIS with the provided data (*Result 1*)
  - ii. The **second** thematic map on ArcGIS with data from the internet (*Result 2*)
- b. Screenshots of the project in QGIS for **Part 2** result:
  - i. The **first** thematic map on QGIS with the provided data (*Result 3*)
  - ii. The **second** thematic map on QGIS with data from the internet (*Result 4*)

## 6. Tutorial:

In this tutorial, you will see some emojis which have different meanings:

👉 **Pro-tip:** suggestions to experience the best for your exercise

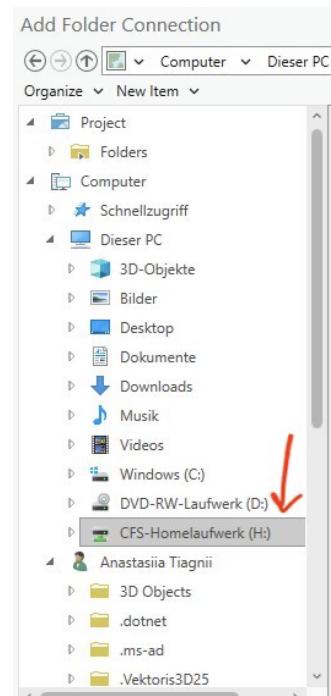
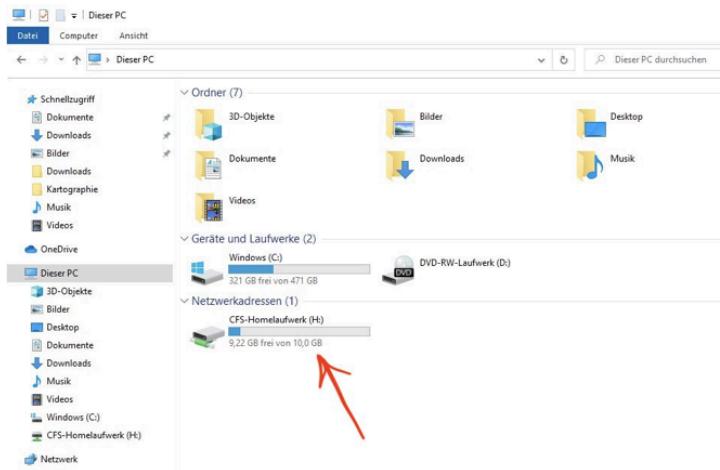
📝 **Notes:** information on the data or steps you need to know

⚠ **Steps:** how to do important steps in detail

📁 **Result:** the outcomes or results of the current exercise

⚠ **Make sure to properly save your project when you are working in class** ⚠

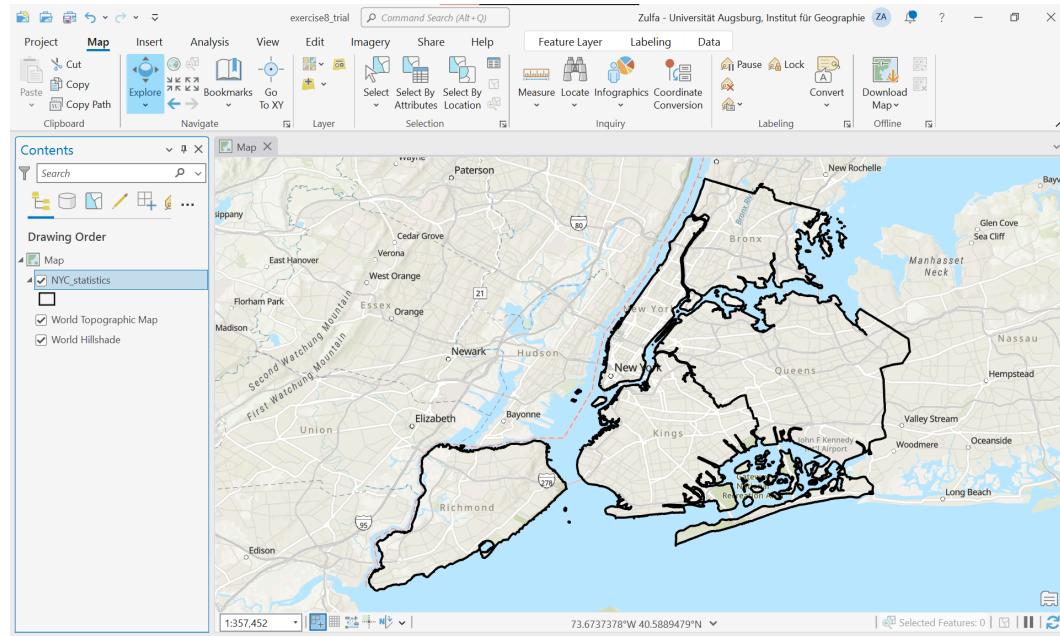
- Pay attention to the folder structure
- Use "**Home-Laufwerk**"! Otherwise, it will be deleted daily
- **Save and check by reopening** your project
- Always **save** the project in progress because ArcGIS Pro can shutdown unexpectedly



This is the tutorial for today's exercise:

## Part 1: Working on ArcGIS

1. Open the provided data "NYC\_statistics": `exercise5_dataexploration_shp`



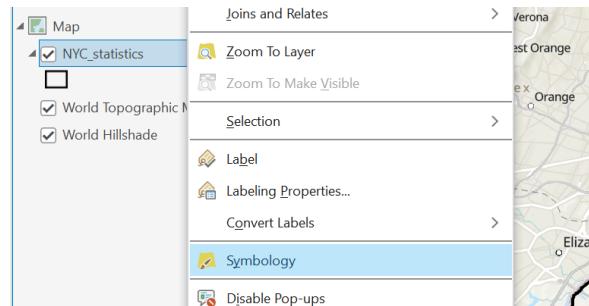
2. Analyse what you want to visualise from the **attribute table** and what **thematic map types** suit the data.

FID	Shape *	boroname	SUM_FID	SUM_UNEMP_	SUM_cartod	SUM_withss	SUM_withso	SUM_withpu	SUM_strugg	SUM_profes	SUM_popune	SUM_poptot	SUM_
1	Polygon	Bronx	154923	47.677202	155262	54264	113654	36038	330538	9329	89734	1386364	
2	Polygon	Brooklyn	764940	77.110269	765700	71698	207264	43615	529074	36662	126874	2512740	
3	Polygon	Manhattan	41328	26.13277	41616	41854	164135	20937	239362	86229	80426	1596735	
4	Polygon	Queens	1149294	63.61809	1149962	36783	201359	24043	427156	30948	113582	2235008	
5	Polygon	Staten Island	234210	8.013408	234321	7778	48400	4988	59122	5819	16450	468374	

 **Notes:** The layer of "NYC\_statistics" is already simplified to five boroughs (Bronx, Brooklyn, Manhattan, Queens, and Staten Island), so you can see that in every field started with "SUM" (for example: "SUM\_UNEMP\_RATE") as the result of "dissolve" geoprocessing. You can check what data is included here:

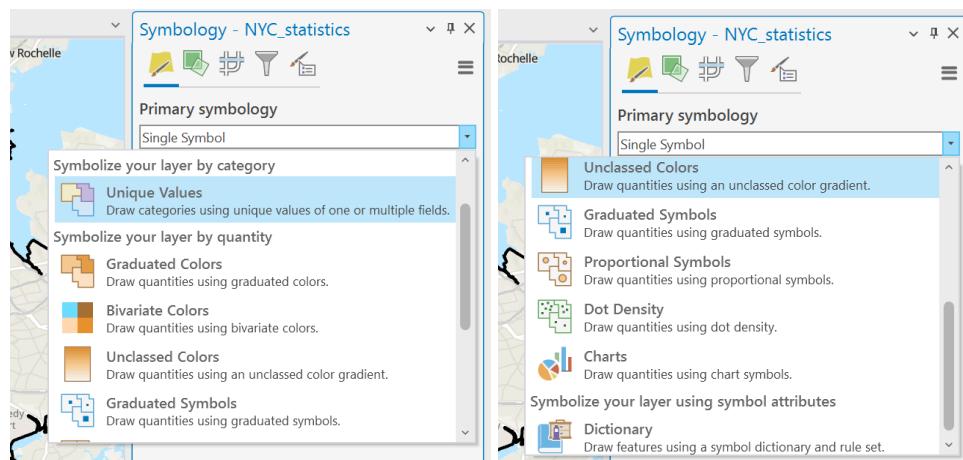
[https://geodacenter.github.io/data-and-lab//NYC\\_Trait\\_ACS2008\\_12/](https://geodacenter.github.io/data-and-lab//NYC_Trait_ACS2008_12/)

3. Create one thematic map from the provided data; you can choose any thematic map type. Basically, you can play with the symbology on ArcGIS.



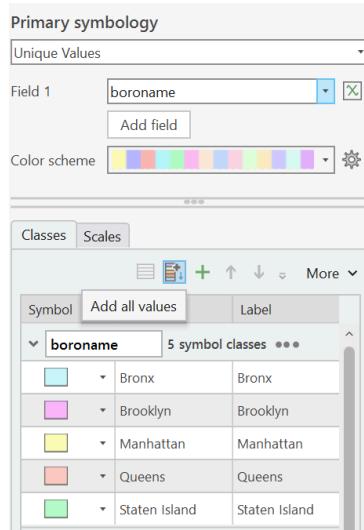
**⚠ Steps:** Go to the “Catalog” pane → right-click on “NYC\_statistics” → choose “Symbology”

4. In the Symbology, you can see that we choose different symbolisations. Each symbolisation allows us to create a specific thematic map type.



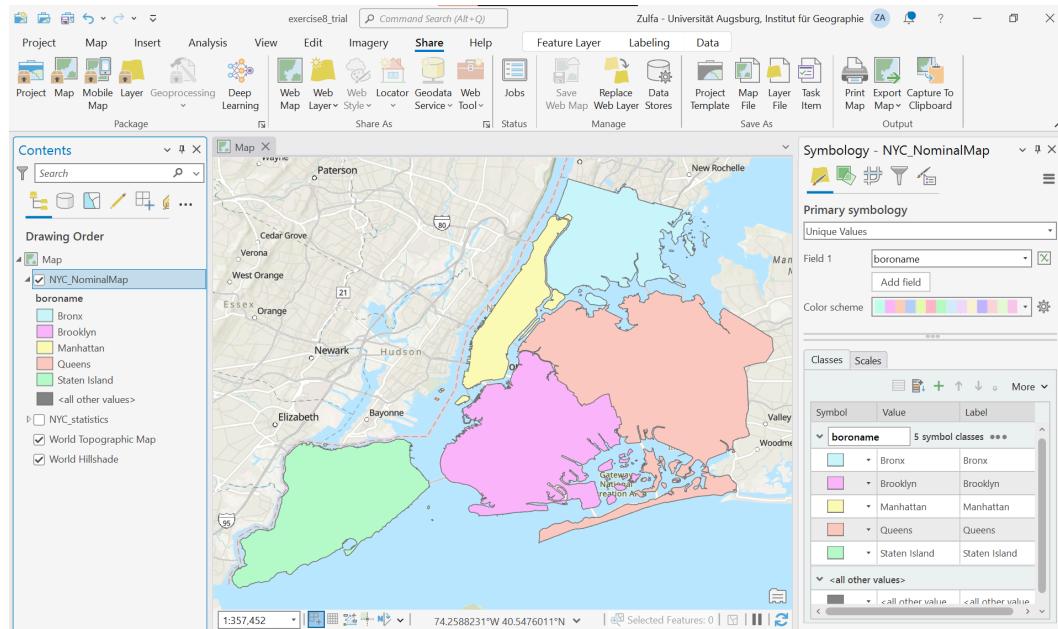
**👍 Pro-tip:** You can export the “NYC\_statistics” as a new thematic map based on the symbolisation. For example, symbolise the qualitative data and export the layer as “NYC\_NominalMap”. So, you can have different layers of different thematic map types.

## 5. This is how you create a nominal map:



**⚠ Steps:** On the “Symbology” window, select “Unique Values” → choose “boroname” as Field 1 → choose “Color Scheme” and use colour hue as the *visual variable* to differentiate each Borough Name (*data type: Nominal*) → click “Add all values” to add all borough names from “boroname” field

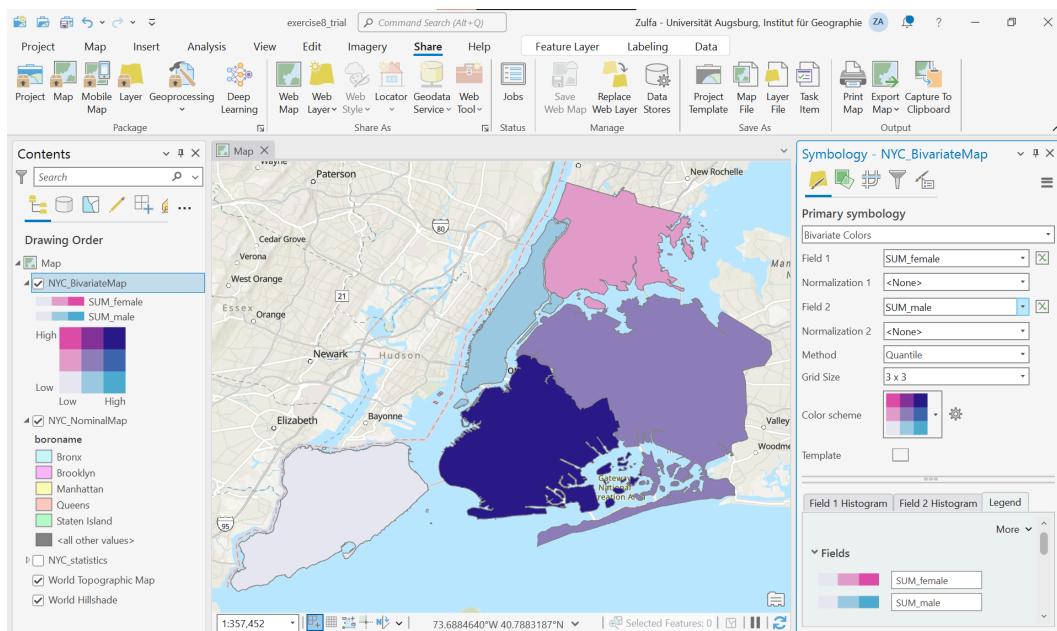
## 6. Take a screenshot of this map as the exercise result



**📝 Notes:** use a different field other than the example above, please create different map types (for example: Choropleth or Proportional Symbol maps) for higher score! Do not forget to “Enable Labelling”

**📁 Result 1:** Take a screenshot of your Thematic Map with The Provided Data on ArcGIS

7. (Optional) To create a new map, export the layer and symbolise with different symbology like this example:



8. After creating one thematic map with the provided data, please download data from the internet.
9. Create one thematic map with the data you downloaded. Just follow the previous instructions to make your own map. You can also explore other possibilities of creating different thematic map types on ArcGIS.
10. Take a screenshot of the thematic map as the exercise result.

 **Result 2: Take a screenshot of your Thematic Map with The Downloaded Data on ArcGIS**

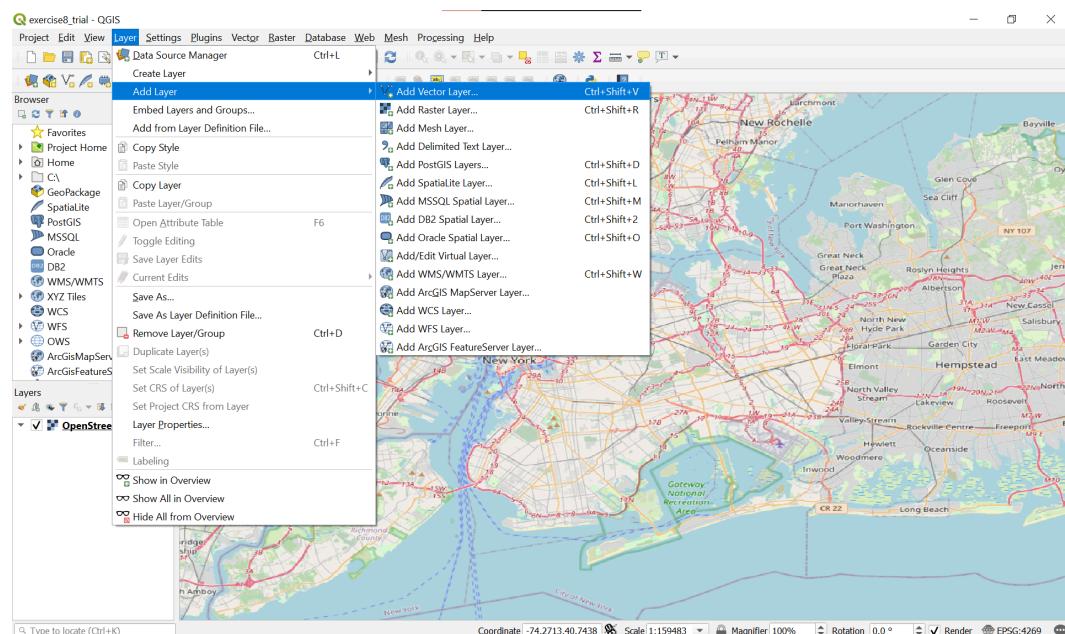
## Part 2: Working on QGIS

11. Open QGIS, and you can familiarise yourself with the QGIS environment first.

Here is the **tutorial**:

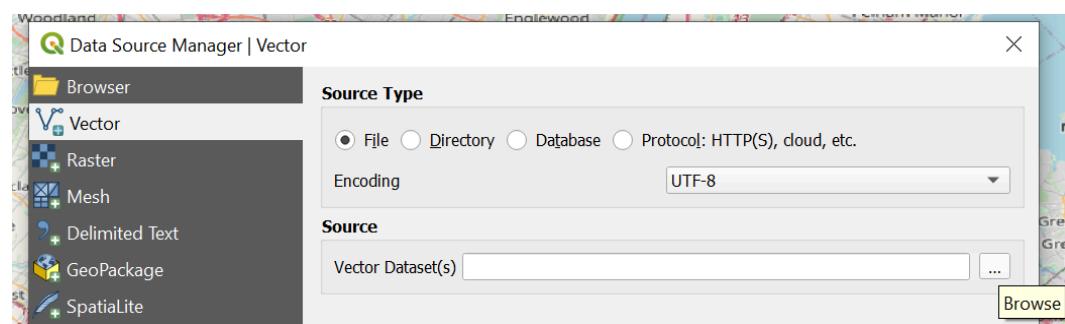
[https://docs.qgis.org/3.28/en/docs/server\\_manual/index.html](https://docs.qgis.org/3.28/en/docs/server_manual/index.html)

12. Add the shapefile to QGIS



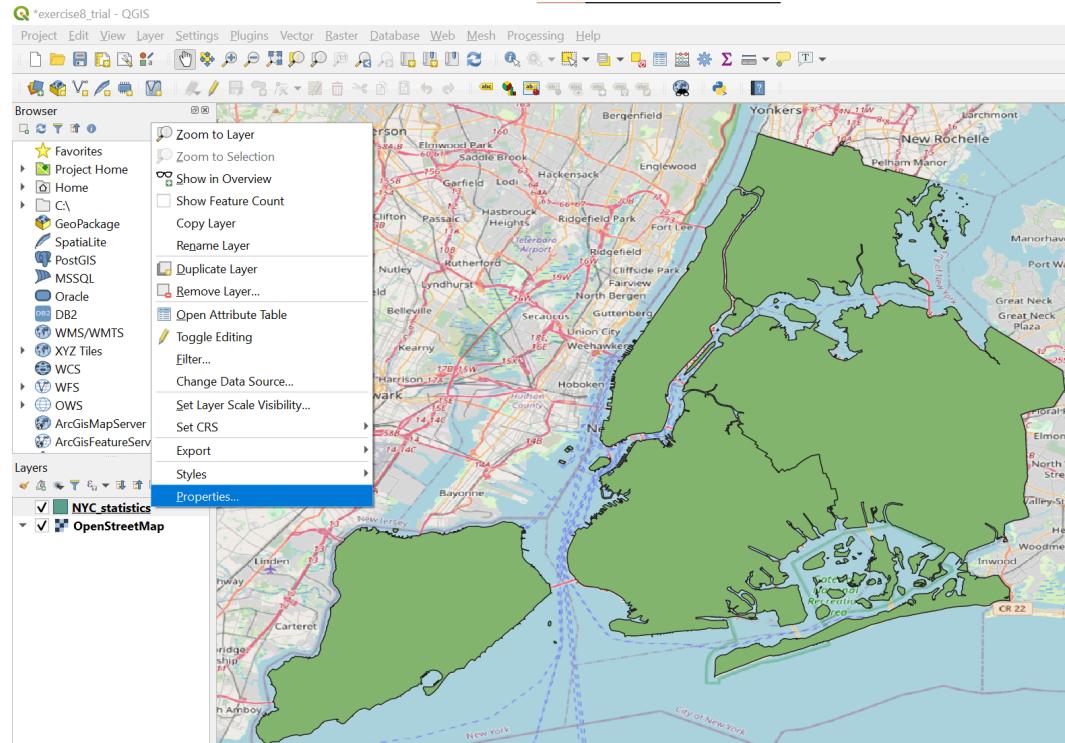
⚠️ **Steps:** On the “Layer”, select “Add Layer” → choose “Add Vector Layer” because the shapefile is a vector file

13. In the dialogue window, you will see this:

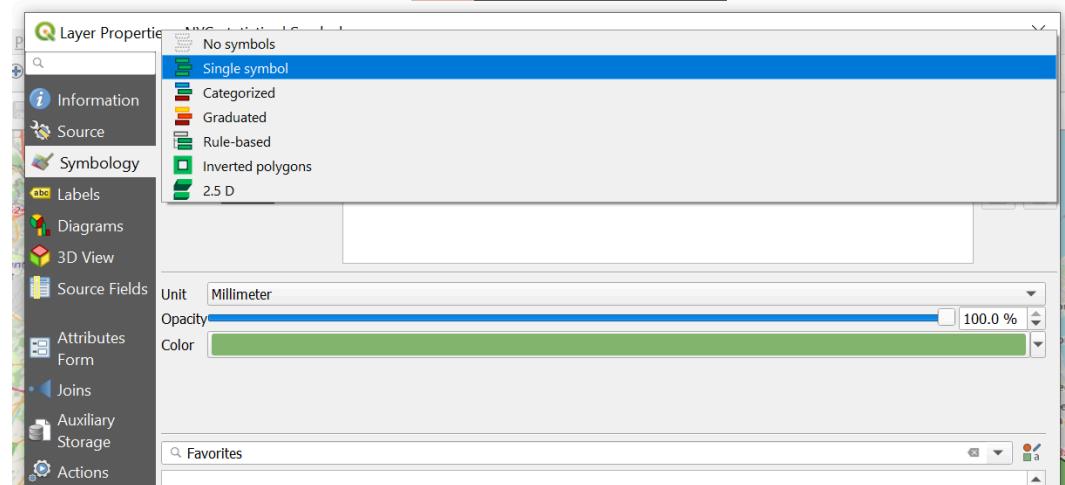


⚠️ **Steps:** On the lower-right, select “Browse” → choose the “NYC\_statistics” file in your file directory

14. Then, to symbolise the layer, go to “Properties”

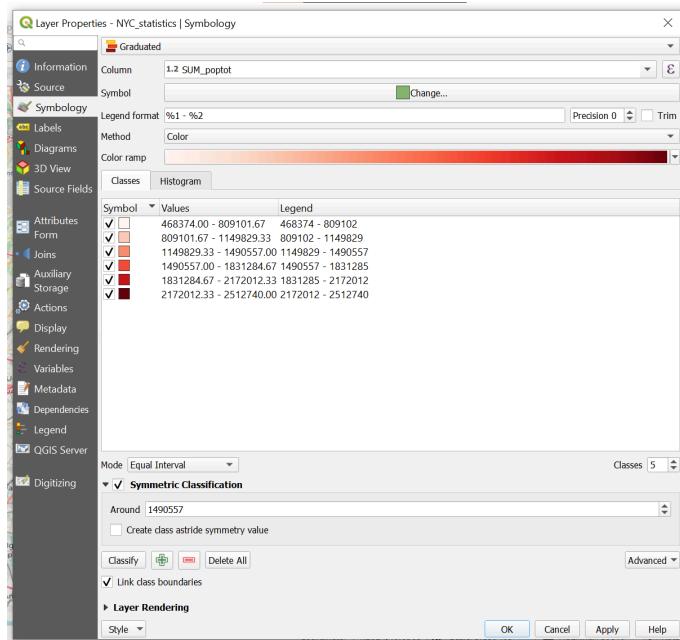


15. When you are in the “Layer Properties” window, choose “Symbology” and click “Single Symbol” on the top. Then, you will see your options:



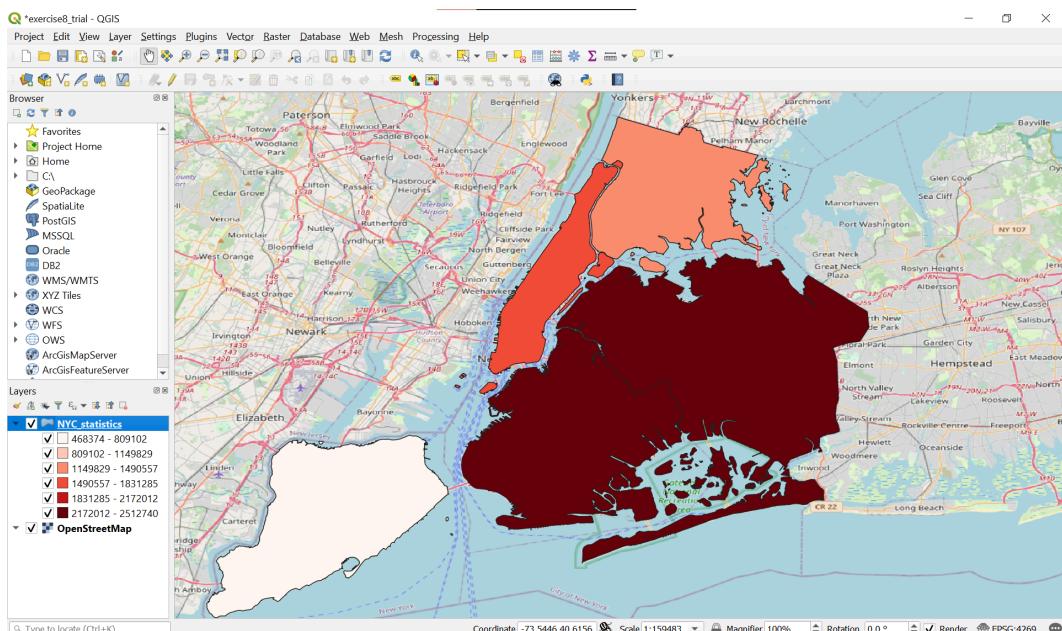
16. Create a thematic map!

For example, this is the tutorial to create a **choropleth map**:



⚠️ **Steps:** Choose “Graduated” → choose “SUM\_poptot” on the Column to visualise the total population of each borough in New York City → choose the most appropriate **Color ramp** for your data → click “Classify” → choose “Equal Interval” as the classification method → click “OK” to apply the symbolisation

## 17. This is how a choropleth map on QGIS will look:

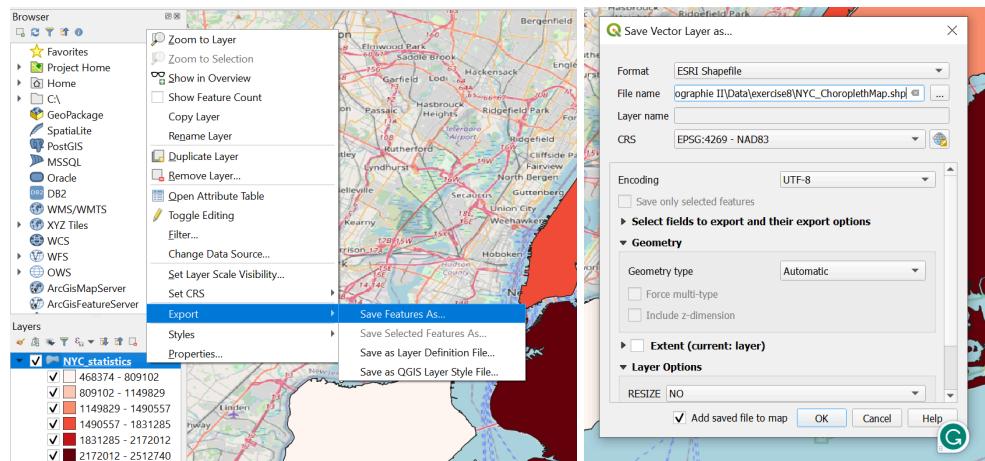


**Notes:** use a different column other than the example above, please **create different map types** (for example: Dasymetric or Proportional Symbol maps) **for higher score!** Do not forget to "**Enable Labelling**"

18. Take a screenshot of this map on QGIS as the exercise result

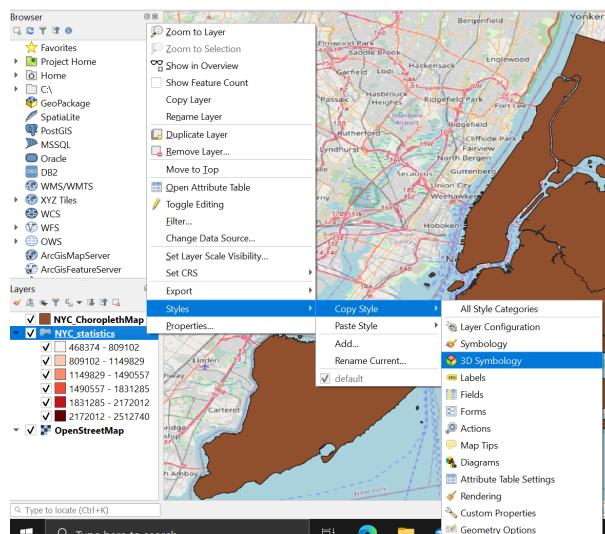
**Result 3: Take a screenshot of your Thematic Map with The Provided Data on QGIS**

19. **(Optional)** You can **export the feature** to create a new choropleth map layer to work with a new thematic map.



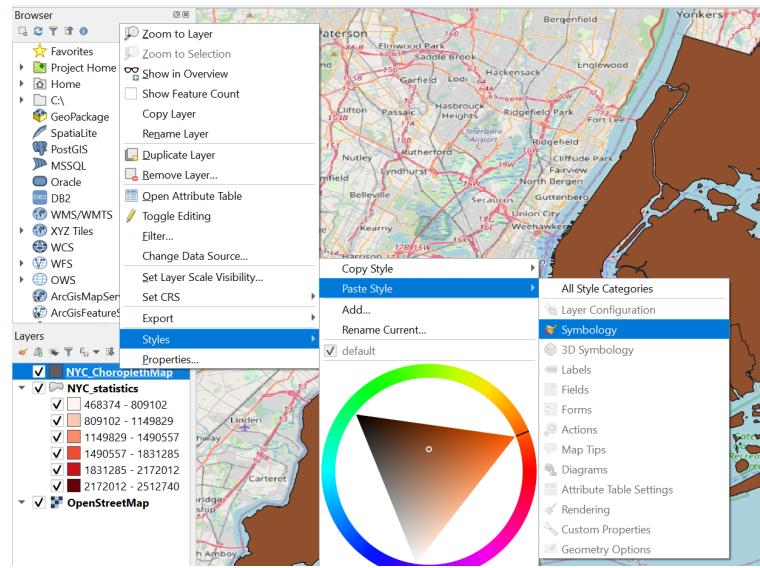
**Steps:** Right-click on the "NYC\_statistics" layer → choose "Export" → then "Save Features As ..." → on the dialogue window, choose "ESRI Shapefile" or "GeoJSON" as the file format → write the file name → click "OK"

20. **(Optional)** In the new layer, the style is set by default. So, you can **copy the style** of the layer you symbolised before.



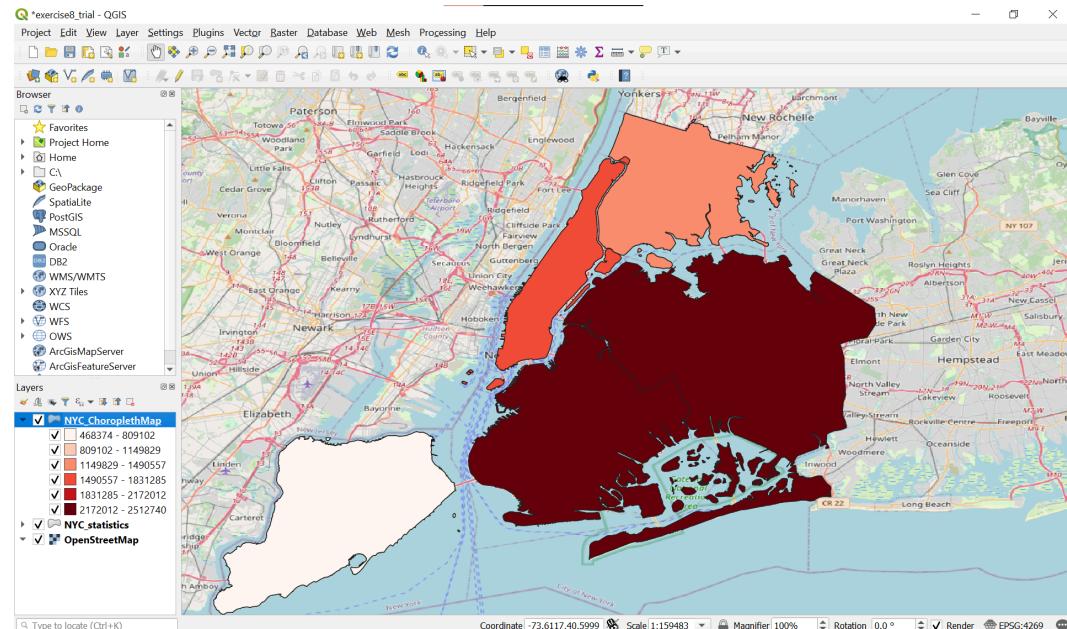
**Steps:** Right-click on the "NYC\_statistics" layer → choose "Styles" → then "Copy Style" → click "Symbology"

## 21. (Optional) Paste the style to your new layer



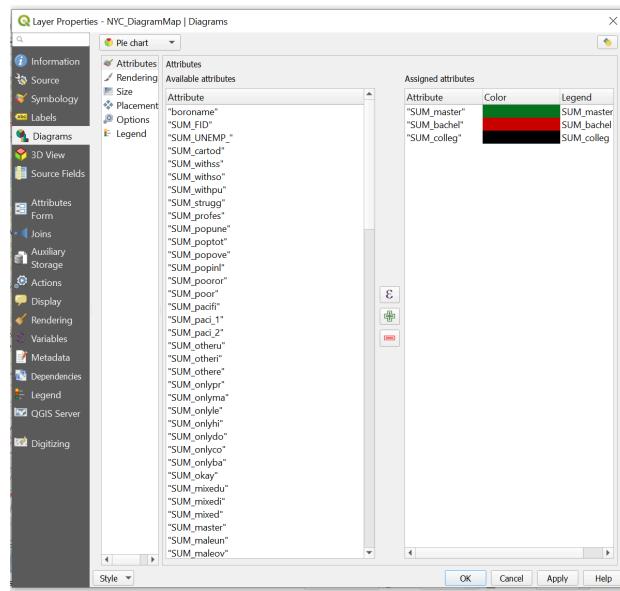
**⚠ Steps:** Right-click on the “NYC\_ChoroplethMap” layer → choose “Styles” → then “Paste Style” → click “Symbology”

## 22. (Optional) This is the choropleth map layer you have as a result:



**👍 Pro-tip:** You can export the “NYC\_statistics” as a new thematic map based on the symbolisation. For example, symbolise the qualitative data and export the layer as “NYC\_NominalMap”. So, you can have different layers of different thematic map types.

**23. (Optional)** Next, you can **explore all the possibilities** of making a **different thematic map type**. Here is the tutorial to create a **diagram map**:

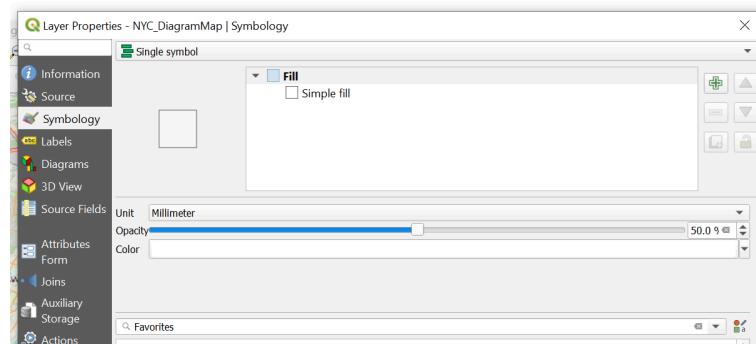


**⚠ Steps:** Right-click on the “NYC\_DiagramMap” layer → choose the “Diagrams” tab → then on the upper part, choose “Pie Chart” → on the “Available attributes” list, choose “SUM\_master”, “SUM\_bachel”, “SUM\_colleg” as the data we want to include in the diagrams → click “+” button in the middle → you can change the colour of each attribute by double clicking “Color” of each attribute → click “OK”

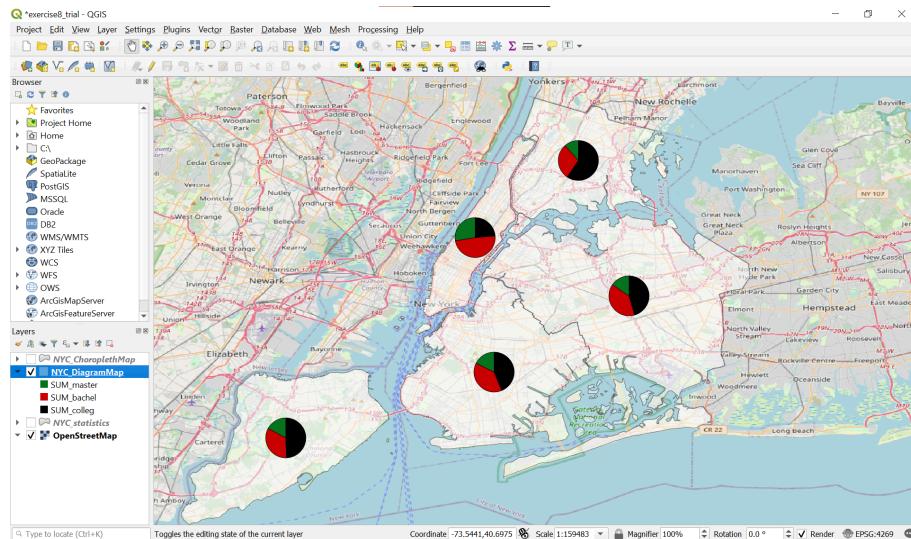
**💡 Notes:** use the different attributes other than the example above!

Do not forget to “**Enable Labelling**”

**24. (Optional)** You can also change the background colour opacity on the “Symbology” tab:



25. (Optional) This is the diagram map as the next result:



26. Take a screenshot of this map as the exercise result

27. After creating one thematic map with the provided data, please download data from the internet.

28. Create one thematic map with the data you downloaded. Just follow the previous instructions to make your own map. You can also explore other possibilities of creating other thematic map types on QGIS.

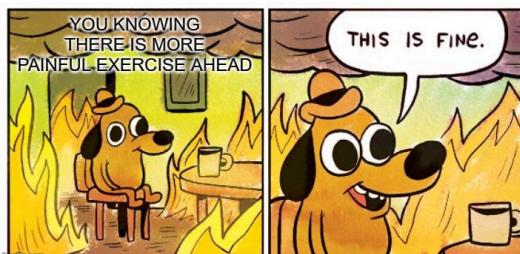
29. Take a screenshot of the thematic map as the exercise result.

**Result 4:** Take a screenshot of your Thematic Map with The Downloaded Data on QGIS

This is the end of the tutorial! Congratulations! 🎉

Add your results of today's exercise to the file:

"Abgabe Dokumentations-Vorlage\_Geoinformationssysteme & Kartographie II\_Ihre Name\_Ihre Gruppe" file. Attach the PDF files to the document at the end of the course.



See you next week!!! 🌟