

Mapping European Data

with FOSS QGIS 3

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GESIS Data Archive*

*CESSDA Training Day
27-28 November 2019, Cologne*

 [cessda.eu](https://www.cessda.eu)  @CESSDA_Data



Installing QGIS Software

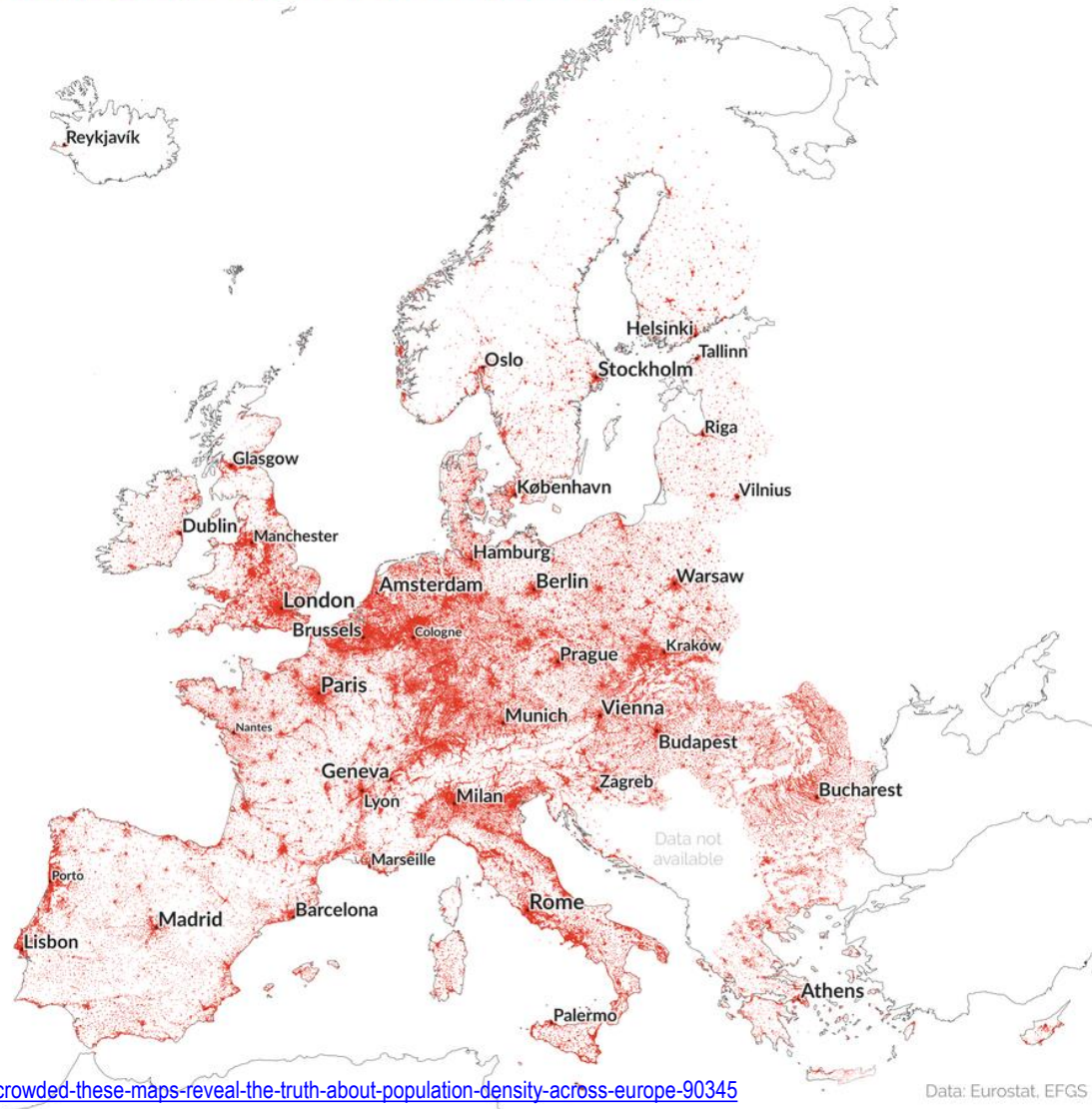
QGIS is a free, open-source geographic information system (GIS) software maintained by volunteer developers.

1. Go to the following website:
<https://qgis.org/en/site/forusers/download.html>
2. Choose the appropriate download for your device (Windows, macOS, or Linux)
3. Select the following standalone installer from OSGeo4W packages:
 - **Long term release repository (most stable)**
 - **QGIS Standalone Installer Version 3.4**
4. Download the installer, and follow the instructions (if the program asks about installing data, chose “not”).

Why do Social Scientists map?

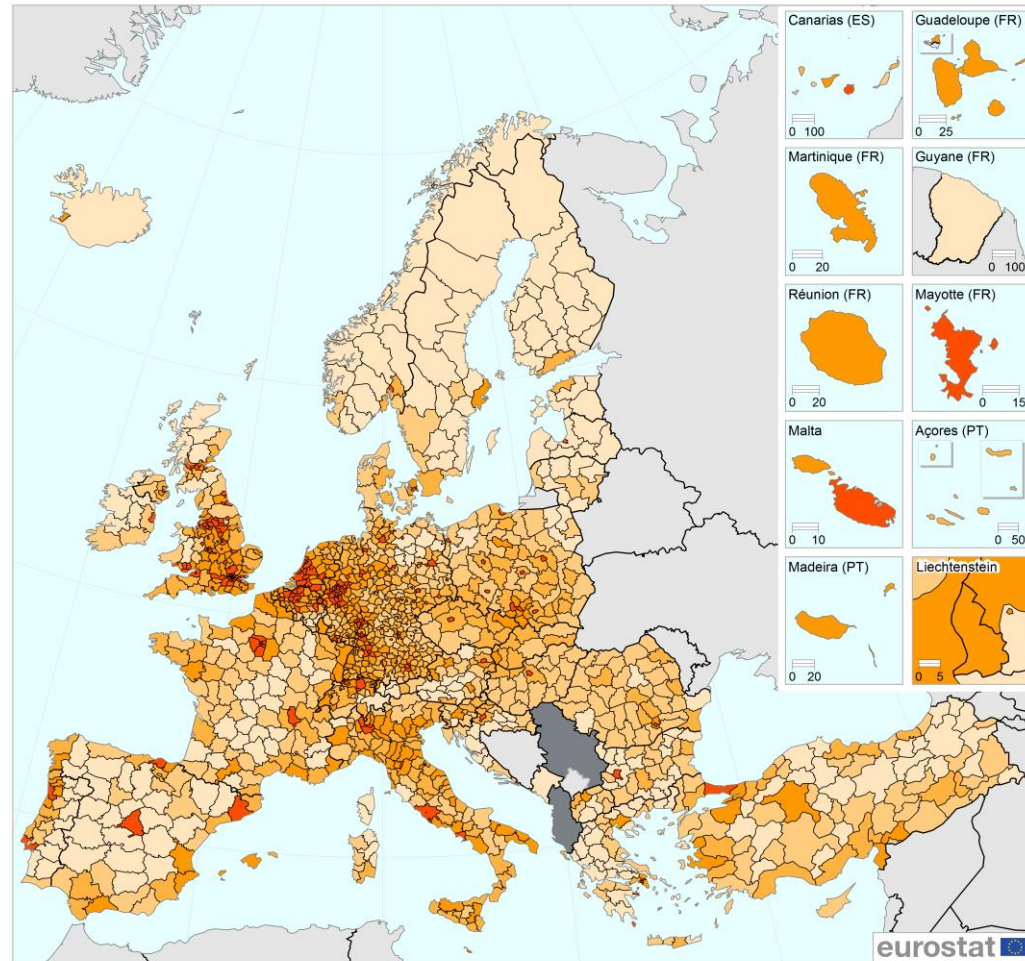
POPULATION DENSITY IN EUROPE

Areas with 250 people or more, per sq. km.



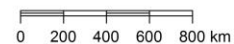
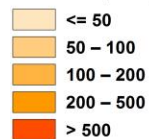
Why do Social Scientists map?

Population density by NUTS3 regions, 2015



Administrative Boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — IMAGE, 4/04/2017

Inhabitants per square km



How crowded is your region? Eurostat (2017)

<https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20170406-1>

How can we map? [Qgis.org](https://qgis.org)



3.10.0
3.4.13 LTR

DISCOVER QGIS

FOR USERS

GET INVOLVED

DOCUMENTATION

Search

English

Time until freeze 2020-01-17 12:00:00 UTC 50d 16h 31m
Time until packaging 2020-02-21 12:00:00 UTC 85d 16h 31m
Time until next pointrelease 2019-11-29 12:00:00 UTC 1d 16h 31m

QGIS

A Free and Open Source Geographic Information System

QGIS 3.10 A Coruña
has been released!

New release: 3.10!
Get the [installer](#) or [packages](#) for your Operating System!

Create, edit, visualise, analyse and publish geospatial information on Windows, Mac, Linux, BSD (Android coming soon)

For your desktop, server, in your web browser and as developer libraries

Download Now

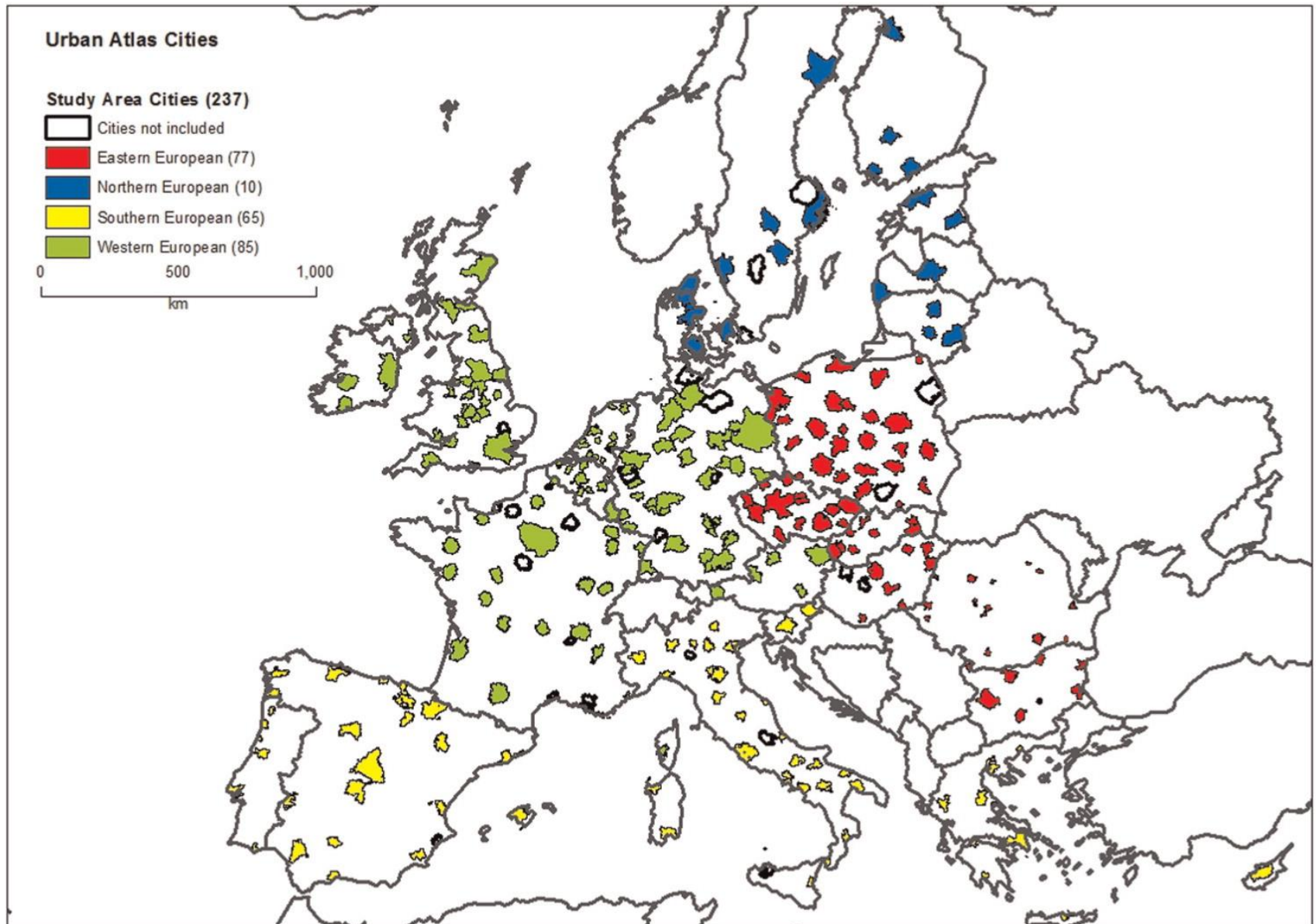
Support QGIS

Today: four QGIS exercises

- A. Europe: Urbanisation patterns in 2018
- B. Germany: Mapping hospital locations
- C. Spatial analysis (Geoprocessing) : Buffers
- D. Geoprocessing : Spatial “linking” with Overlays

Determinants of urban sprawl in European cities

Oueslati, Alvanides, Garrod (2015) <https://doi.org/10.1177/0042098015577773>



A. Urbanisation patterns 2018

red:cities, orange:towns, yellow:rural



Sources of European geo-data



eurostat
Statistics Explained

Tutorials | log in

English



NAVIGATION ▾

ONLINE PUBLICATIONS ▾

TOOLS ▾

Geographical information system of the Commission (GISCO)

This article presents GISCO, the 'Geographical information system of the Commission', a permanent service of Eurostat that answers the needs of Eurostat and the European Commission for geographical information at the level of the European Union (EU), its Member States and regions. The GISCO database contains core geographical data for all of Europe such as administrative boundaries (see Map 2), but also thematic geospatial information, for instance population grid data (see Map 4).

Full article 

What is GISCO?

Which data can you find in the GISCO database?

What is GIS and how can it be applied?

Direct access to



Other articles



Database



Dedicated section



Publications

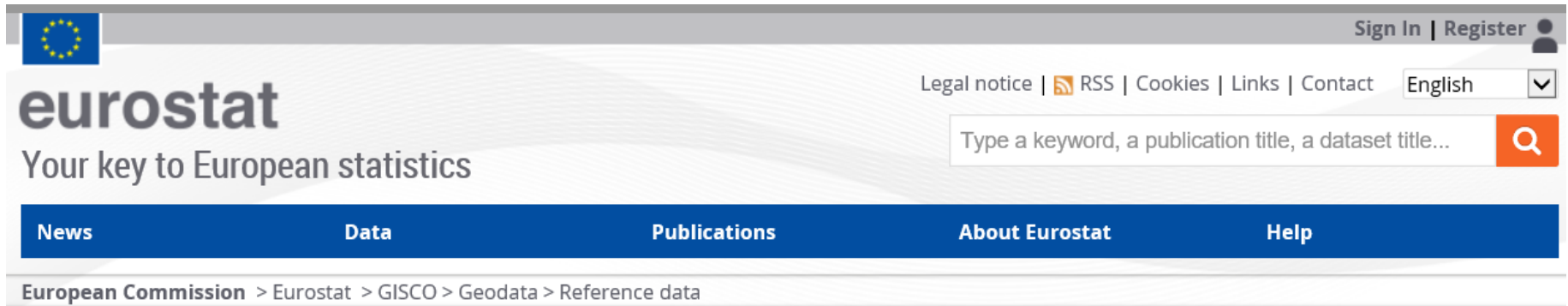


Legislation



Visualisations

Sources of European geo-data



The screenshot shows the top section of the Eurostat website. On the left is the Eurostat logo with the tagline "Your key to European statistics". On the right, there are links for "Sign In | Register", "Legal notice | RSS | Cookies | Links | Contact", and a language dropdown menu set to "English". Below these is a search bar with the placeholder text "Type a keyword, a publication title, a dataset title..." and a magnifying glass icon. A dark blue navigation bar contains the following menu items: "News", "Data", "Publications", "About Eurostat", and "Help". Below the navigation bar is a breadcrumb trail: "European Commission > Eurostat > GISCO > Geodata > Reference data".

GISCO: GEOGRAPHICAL INFORMATION AND MAPS

Overview

▼ Geodata

▼ GISCO activities

Frequently asked questions (FAQ)

REFERENCE DATA

General Copyright

Eurostat's general copyright notice and licence policy is applicable and can be consulted in the [Policies section](#). Please also be aware of the European Commission's [general conditions](#).

Moreover, there are specific provisions applicable to some of the following datasets available for downloading. The download and usage of these data is subject to their acceptance. Please see the respective section for more details:


- ▶ [Administrative Units / Statistical Units](#)
- ▶ [Population distribution / Demography](#)
- ▶ [Transport Networks](#)
- ▶ [Land Cover](#)
- ▶ [Elevation \(DEM\)](#)

Geodata available:

<https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data>

e.g. Administrative units: NUTS

<https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data>

Sign In | Register

Legal notice | RSS | Cookies | Links | Contact English

[News](#) [Data](#) [Publications](#) [About Eurostat](#) [Help](#)

[European Commission](#) > [Eurostat](#) > [GISCO](#) > [Geodata](#) > [Reference data](#) > [Administrative Units / Statistical Units](#) > [NUTS](#)

GISCO: GEOGRAPHICAL INFORMATION AND MAPS

- Overview
- ▼ Geodata
- ▼ GISCO activities
- Frequently asked questions (FAQ)

NUTS

Please be aware that there are specific [download provisions](#) for the datasets shown below which must be respected. The download and usage of these data is subject to their acceptance.

Access to the datasets is additionally provided via the [GISCO data distribution REST API](#) which includes data in different projections.

Administrative or Statistical unit	Version date	Scale	File format to download					API
			SHP	TopoJSON	geoJSON	GDB	SVG	
NUTS 2016	14/03/2019	1:1 Million	ZIP	ZIP	ZIP	ZIP	ZIP	
		1:3 Million	ZIP	ZIP	ZIP	ZIP	ZIP	
		1:10 Million	ZIP	ZIP	ZIP	ZIP	ZIP	
		1:20 Million	ZIP	ZIP	ZIP	ZIP	ZIP	
		1:60 Million	ZIP	ZIP	ZIP	ZIP	ZIP	

Case study: Degree of Urbanisation

<https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data>

Geodata available:

Administrative units / Statistical units:

- NUTS 2016
- NUTS 2013
- NUTS 2010
- NUTS 2006
- NUTS 2003

- Urban audit 2018
- Urban audit 2011-2014
- Urban audit 2004
- Urban audit 2001

- Countries 2016
- Countries 2013
- Countries 2010
- Countries 2006
- Countries 2001

- Census centroids 2011

- Census units 2011

- Communes 2013

- Communal centroids 2010
- Communal centroids 2006

- Local Administrative Units (LAU) 2018
- Local Administrative Units (LAU) 2017

Population Distribution / Demography:

- GEOSTAT 1 km² Population grid
- Urban Clusters
- Degree of Urbanisation

Transport networks:

- Airports
- Ports

Land cover:

- Land Use /Cover Area frame Statistical Survey (LUCAS)
- Corine Land Cover (CLC)
- Urban Morphological Zones (UMZ)

Elevation (DEM):

- EU DEM (DD)
- EU DEM (LAEA)

- Aspect
- Slope
- Coloured Relief
- Hillshade

- Hydrography (LAEA)
- Hydrography (ETRS1989)

- RMS

1. Download the 2018 file **DGURBA-2018-01M-SH.zip**

<https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data>

Degree of Urbanisation (DEGURBA)

Please be aware that there are specific [download provisions](#) for the datasets shown below which must be respected. The download and usage of these data is subject to their acceptance.

Degree of Urbanisation	Scale	Feature type	Format	Period	Coordinate reference system	Version date	Files to download
2018	1:1 million	Polygon	Shapefile	2018	ETRS89	06/11/2019	DGURBA-2018-01M-SH.zip
2014	1:1 million	Polygon/Point	Personal GDB	2014	ETRS89	19/12/2016	DGURBA_2014.zip
	1:1 million	Polygon/Point	Shapefile	2014	ETRS89	19/12/2016	DGURBA_2014_SH.zip
2001	1:3 million	Polygon	Personal GDB	2001	ETRS89	19/10/2007	DGUR_03M_2001.zip
	1:3 million	Polygon	Shapefile	2001	ETRS89	19/10/2007	DGUR_03M_2001_SH.zip
	1:10 million	Polygon	Personal GDB	2001	ETRS89	19/10/2007	DGUR_10M_2001.zip
	1:10 million	Polygon	Shapefile	2001	ETRS89	19/10/2007	DGUR_10M_2001_SH.zip
	1:20 million	Polygon	Personal GDB	2001	ETRS89	19/10/2007	DGUR_20M_2001.zip
	1:20 million	Polygon	Shapefile	2001	ETRS89	19/10/2007	DGUR_20M_2001_SH.zip









2. Uncompress the zipped file (e.g. Windows right-click & “Extract all...”) **Check out the Metadata.pdf/xml**

DGURBA-2018-01M-SH

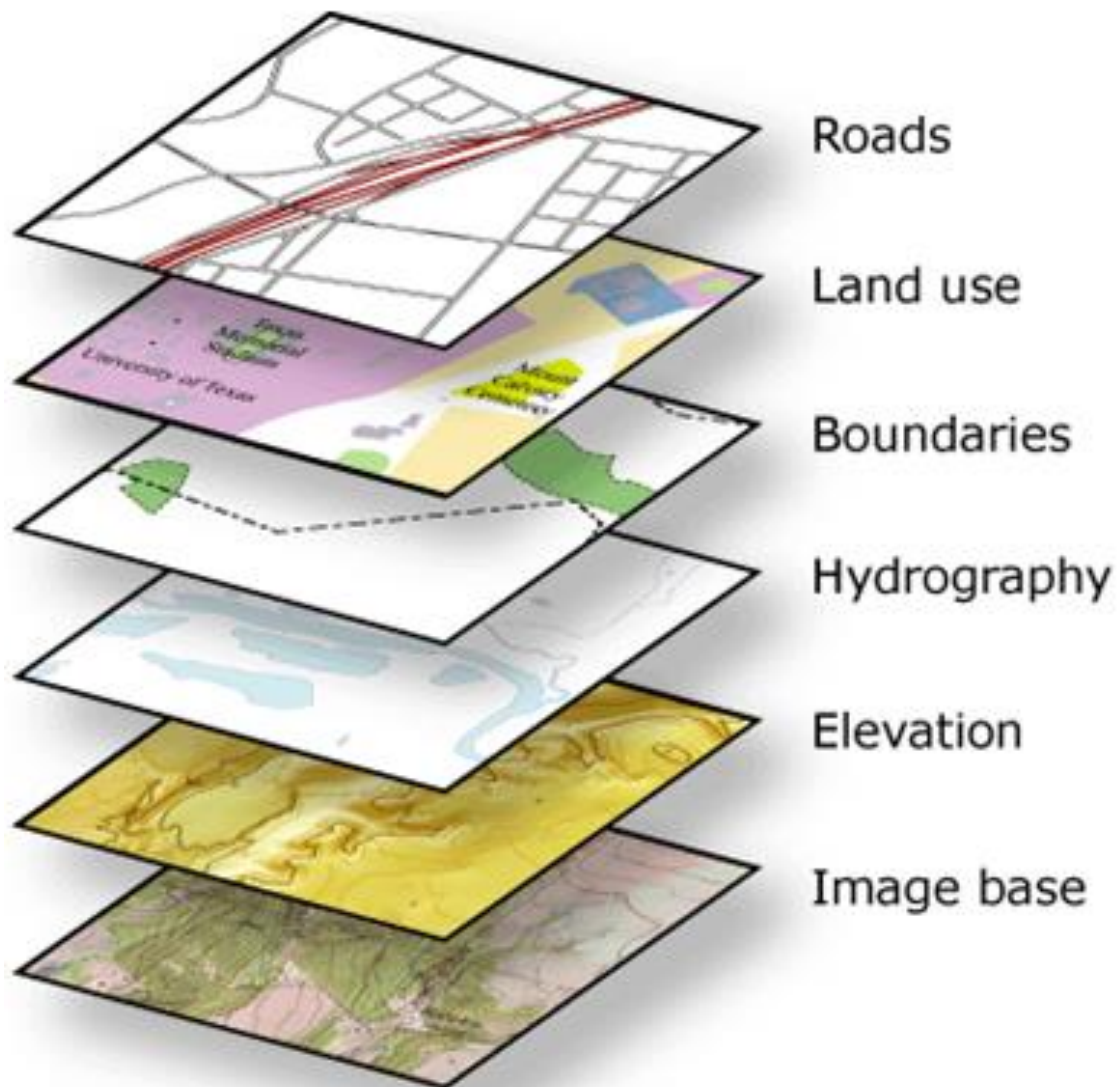
Share View

« 2019_11 CESSDA Training Days Q... » DGURBA-2018-01M-SH

Search DGURBA-2018-01M-SH

Name	Date modified	Type	Size
 DGURBA_2018_01M.CPG	27/11/2019 ...	CPG File	1 KB
 DGURBA_2018_01M.dbf	27/11/2019 ...	DBF File	204,700 KB
 DGURBA_2018_01M.prj	27/11/2019 ...	PRJ File	1 KB
 DGURBA_2018_01M.shp	27/11/2019 ...	SHP File	47,273 KB
 DGURBA_2018_01M.shp.xml	27/11/2019 ...	XML Document	2 KB
 DGURBA_2018_01M.shx	27/11/2019 ...	SHX File	802 KB
 DGURBA_2018_Metadata.pdf	27/11/2019 ...	PDF Document	10 KB
 DGURBA_2018_Metadata.xml	27/11/2019 ...	XML Document	18 KB

“Layers” of geographical data



GISCO Functioning: Layers of geo-referenced information

Source: Eurostat

[https://ec.europa.eu/eurostat/statistics-explained/index.php/Geographical_information_system_of_the_Commission_\(GISCO\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Geographical_information_system_of_the_Commission_(GISCO))

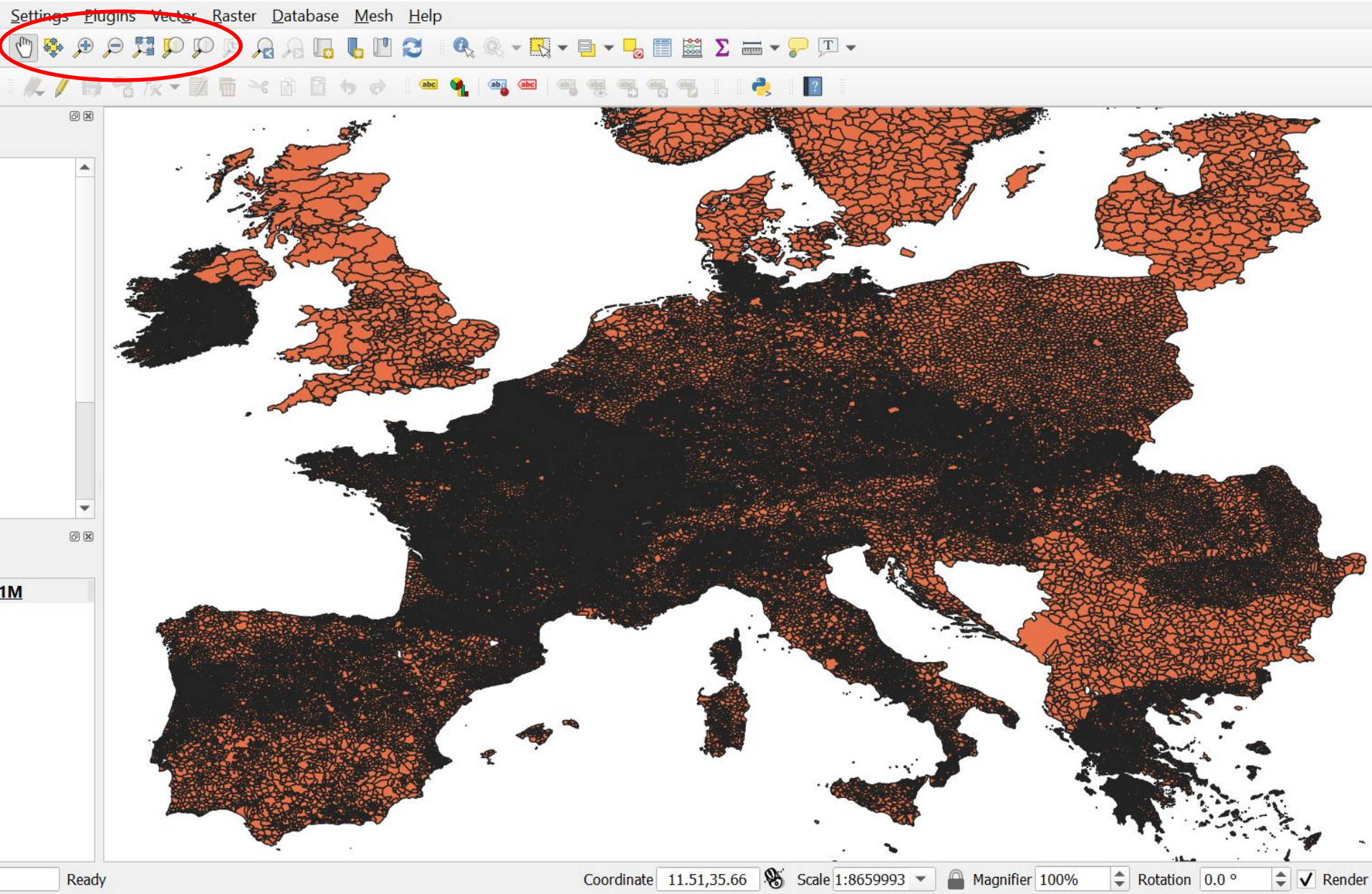
3. In QGIS main menu: Layer > Add Layer > Add Vector Layer... > Open the .SHP File

The screenshot shows the QGIS interface with the following elements:

- QGIS Main Menu:** The 'Layer' menu is circled in red.
- Data Source Manager | Vector:** A dialog box with 'Source Type' set to 'File' and 'Encoding' set to 'UTF-8'. The 'Source' field is empty.
- Open OGR Supported Vector Dataset(s):** A file browser window showing a directory with several files. The file 'DGURBA_2018_01M.shp' is selected and circled in red.

Name	Date modified	Type	Size
DGURBA_2018_01M.CPG	27/11/2019 ...	CPG File	1 KB
DGURBA_2018_01M.dbf	27/11/2019 ...	DBF File	204,700 KB
DGURBA_2018_01M.prj	27/11/2019 ...	PRJ File	1 KB
DGURBA_2018_01M.shp	27/11/2019 ...	SHP File	47,273 KB
DGURBA_2018_01M.shp.xml	27/11/2019 ...	XML Docum...	2 KB
DGURBA_2018_01M.shx	27/11/2019 ...	SHX File	802 KB
DGURBA_2018_01M.shx	27/11/2019 ...	SHX File	10 KB

4. Use the pan and zoom buttons



5. Main menu: Layer > Open Attribute Table...

DGURBA_2018_01M :: Features Total: 102600, Filtered: 102600, Selected: 0

LEN	NUTS	NSI_CODE	SHAPE_AREA	GISCO_ID	LAT_NAT	LAU_LATIN	DGURBA	COASTAL
33965	AT113	10413	0.00217483024...	AT_10413	Sankt Michael i...	Sankt Michael i...	3 No	
29918	AT113	10414	0.00211164376...	AT_10414	Stegersbach	Stegersbach	3 No	
7793...	AT113	10423	2.04045207483...	AT_10423	Tschanigraben	Tschanigraben	3 No	
79656	AT111	10827	0.00110841174...	AT_10827	Weingraben	Weingraben	3 No	
10168	AT124	32501	0.00875004038...	AT_32501	Allentsteig	Allentsteig	3 No	
36547	CZ052	573451	0.00114642188...	CZ_573451	Sběř		3 No	
57618	SK022	513989	0.00169036100...	SK_513989	Dolné Vestenice	Dolné Vestenice	3 No	
94658	SK022	513997	0.01045549138...	SK_513997	Handlová	Handlová	2 No	
33377	SK022	514004	0.00226304717...	SK_514004	Horná Ves	Horná Ves	3 No	
121	SK022	514012	0.00121791524...	SK_514012	Horné Vestenice	Horné Vestenice	3 No	

Show All Features

5. Layer > Layer Properties > **Symbology**

Select **Categorized** and Value **DGURBA**

Change Color ramp to **Spectral** and **Classify**

The screenshot shows the 'Layer Properties - DGURBA_2018_01M | Symbology' dialog box. The 'Symbology' tab is active, and the 'Categorized' symbology type is selected. The 'Value' field is set to '123 DGURBA'. The 'Color ramp' dropdown menu is open, showing various color ramps, with 'Spectral' highlighted. The 'Classify' button is also visible.

Layer Properties - DGURBA_2018_01M | Symbology

Information
Source
Symbology
Labels
Diagrams
3D View
Fields
Attributes Form
Joins
Auxiliary Storage
Actions
Display
Rendering
Variables
Metadata
Dependencies
Legend

Categorized

Value: 123 DGURBA

Symbol: [Color Ramp]

Color ramp: [Color Ramp]

Symbol

- [Red]
- [Orange]
- [Yellow]
- [Green]
- [Blue]

Invert Color Ramp
 Random Color Ramp

- Blues
- Greens
- Greys
- Magma
- RdGy
- Reds
- Spectral**
- Viridis

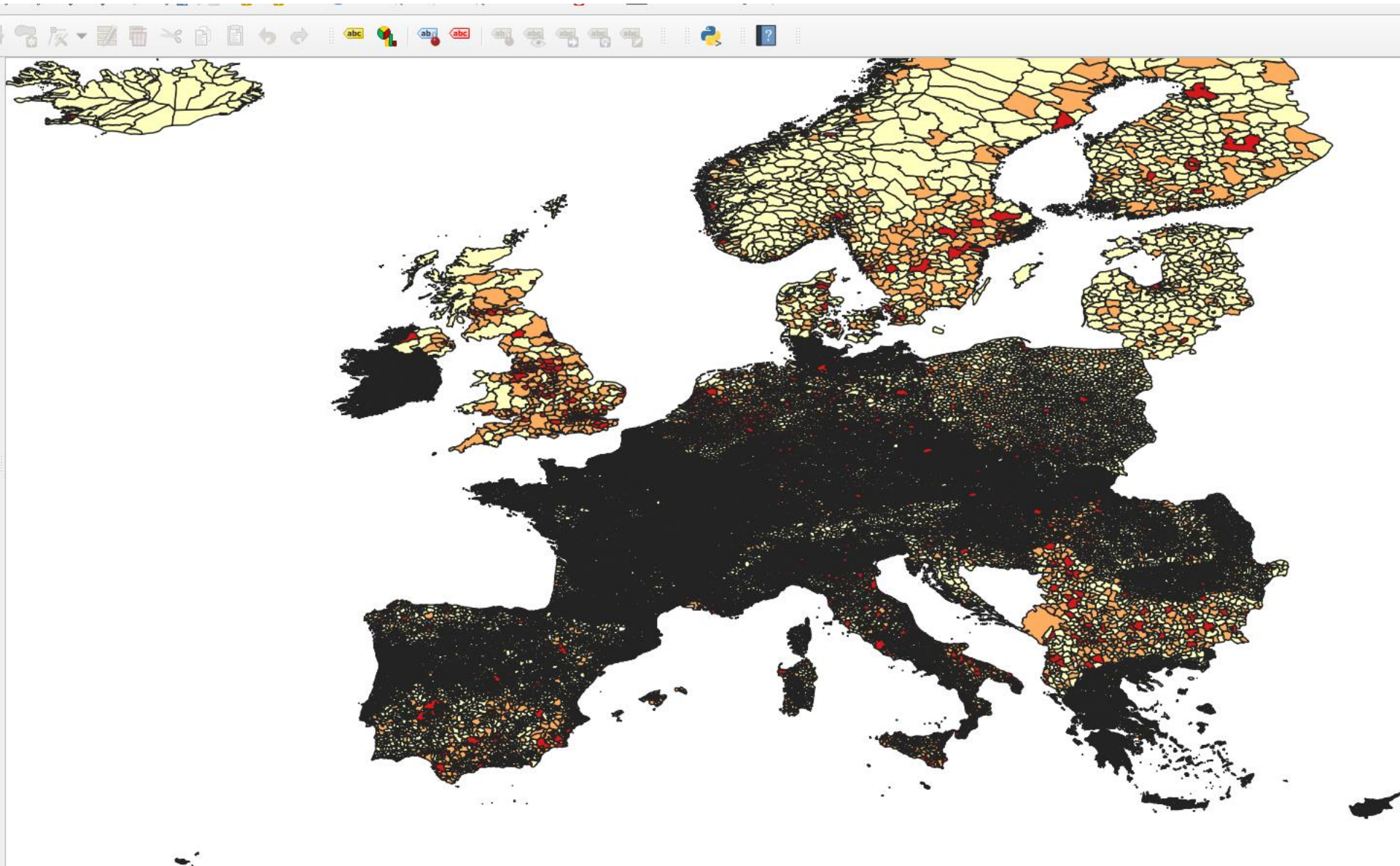
All Color Ramps
Create New Color Ramp...
Edit Color Ramp...
Save Color Ramp...

Classify

Advanced

OK Cancel Apply Help

Still not very appealing 😞



6. Layer > Layer Properties > **Symbology**

Select **Symbol** and Configure Symbol

Simple Fill > change Stroke Color to **Transparent**

The screenshot shows the QGIS interface with the Layer Properties dialog for the layer '123 DGURBA'. The 'Symbology' tab is selected. The 'Symbol Settings' dialog is open, showing the 'Simple fill' symbol type. The 'Stroke color' is set to a transparent checkerboard pattern, indicating it is set to be transparent.

Symbol	Value	Legend
✓	1	1
✓	2	2
✓	3	3
✓	9	9
✓	<i>all other values</i>	

Symbol Settings

Fill: Simple fill

Symbol layer type: Simple fill

Fill color:

Fill style: Solid

Stroke color:

Stroke width: 0.260000 Millimeters

Stroke style: Solid Line

Join style: Bevel

OK Cancel Help

7. While on the Symbology menu, also
Untick Symbols 9 and “all other values”
Edit Legend 1,2,3 to: Cities, Towns, Rural

Layer Properties - DGURBA_2018_01M | Symbology

Information
Source
Symbology
Labels
Diagrams
3D View
Source Fields
Attributes Form
Joins
Auxiliary Storage
Actions
Display
Rendering
Variables
Metadata
Dependencies

Categorized

Column: 123 DGURBA

Symbol: Change...

Color ramp

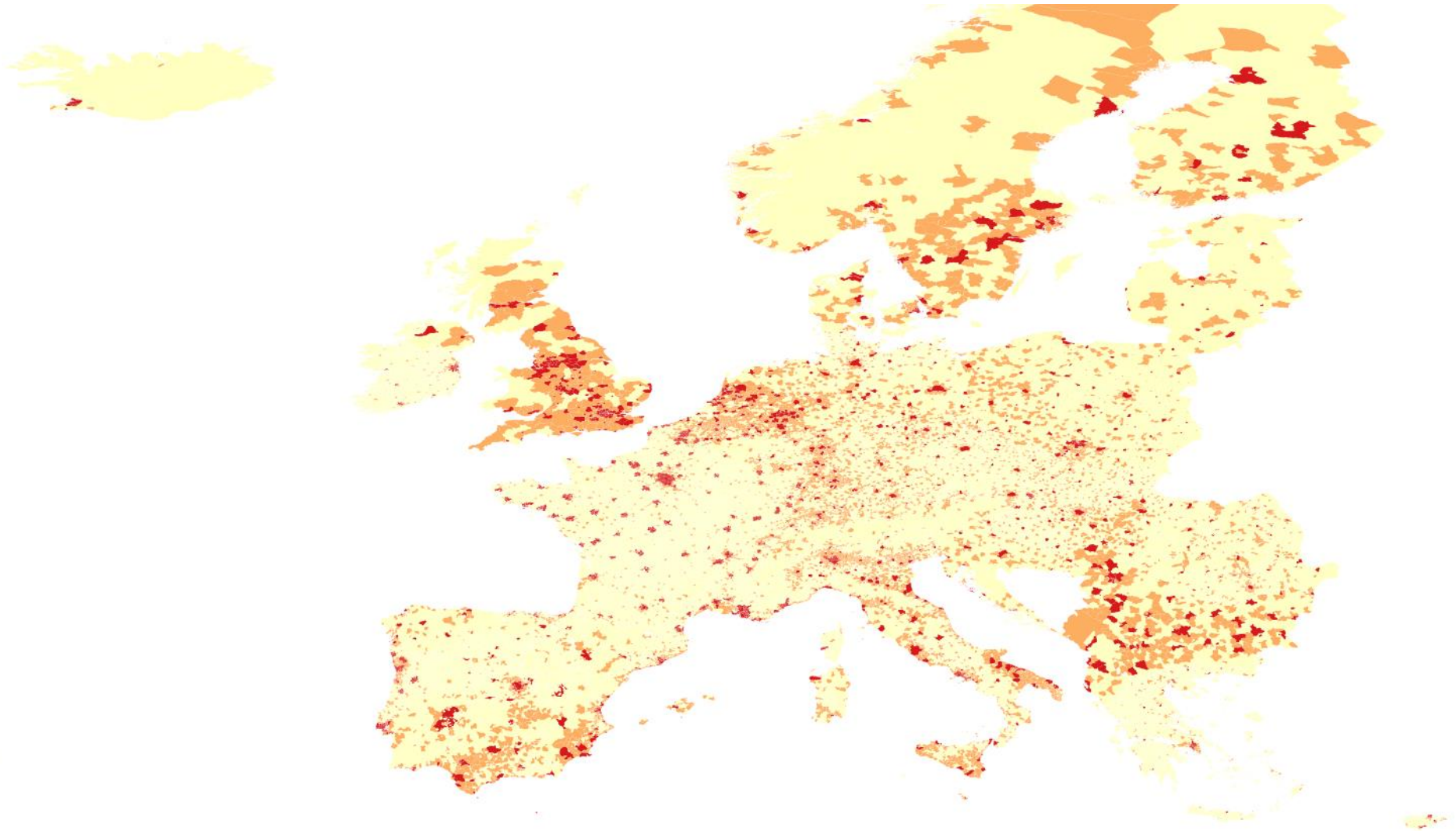
Symbol	Value	Legend
<input checked="" type="checkbox"/>	1	Cities
<input checked="" type="checkbox"/>	2	Towns
<input checked="" type="checkbox"/>	3	Rural
<input type="checkbox"/>	9	
<input type="checkbox"/>	all other values	

Classify + - Delete All Advanced

Layer Rendering

Style OK Cancel Apply Help

Almost there, but a bit “squashed”?



8. Main menu Project > Properties

Select CRS > in Filter type in “EPSG 5669”

and select it from the **Coordinate Reference System** list

Project Properties | CRS

Project Coordinate Reference System (CRS)

No projection (or unknown/non-Earth projection)

Filter

Recently used coordinate reference systems

Coordinate Reference System	Authority ID
RD/83 / 3-degree Gauss-Kruger zone 5 (E-N)	EPSG:5669

Coordinate reference systems of the world Hide deprecated CRSs

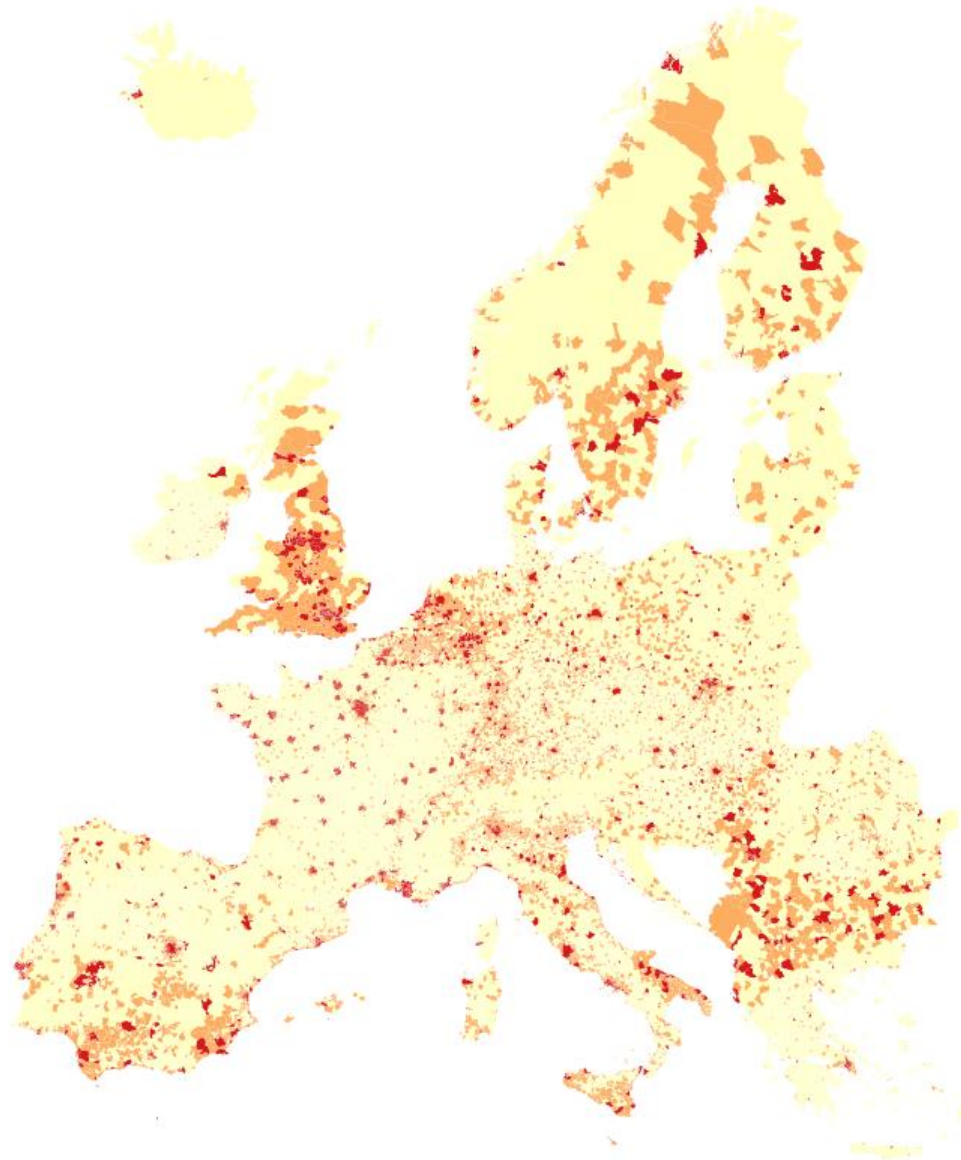
Coordinate Reference System	Authority ID
▼ <i>Transverse Mercator</i>	
RD/83 / 3-degree Gauss-Kruger zone...	EPSG:5669

RD/83 / 3-degree Gauss-Kruger zone 5 (E-N)

WKT
PROJCRS["RD/83 / 3-degree Gauss-

▼ **Datum Transformations**

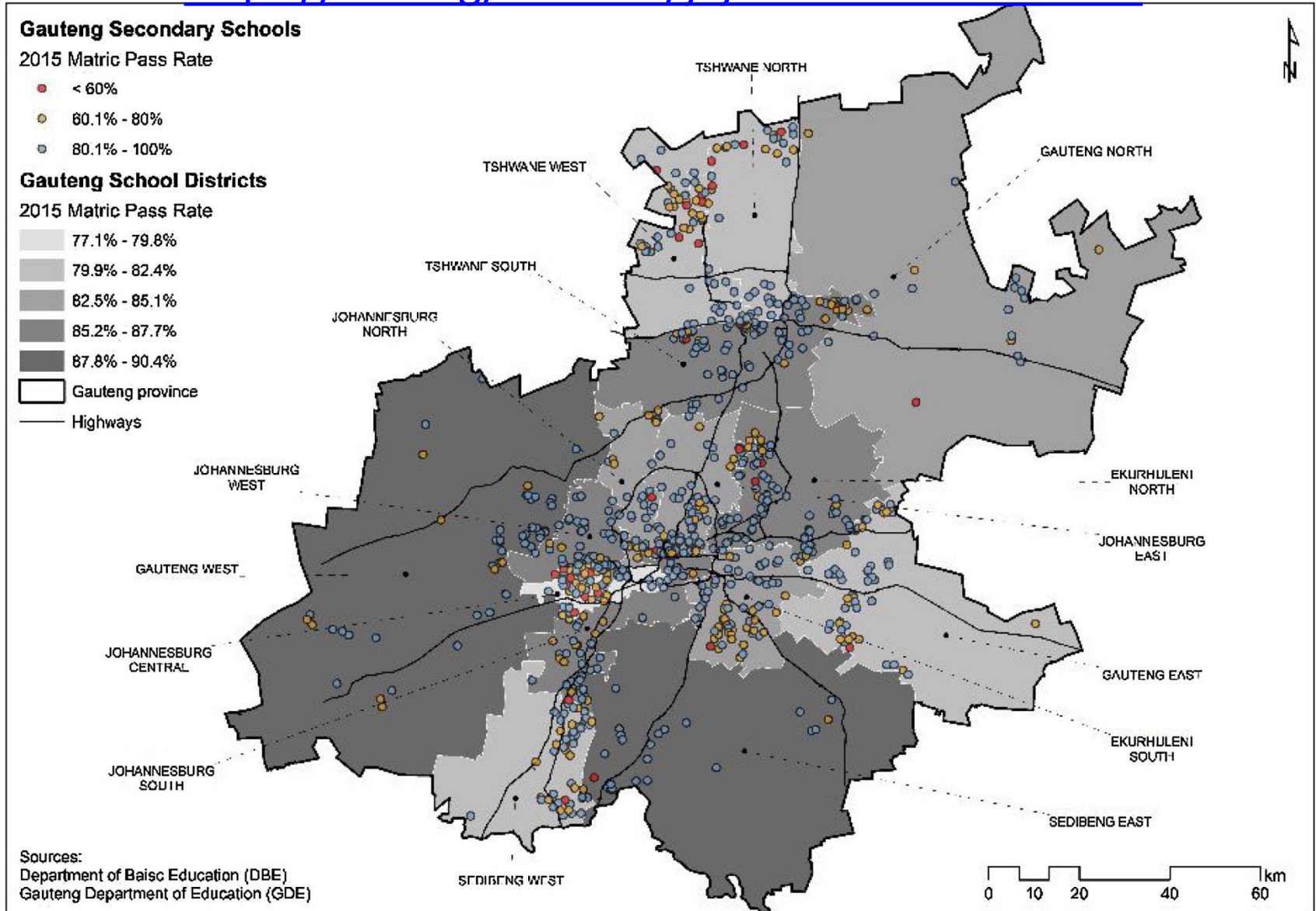
Part A. Congratulations! Now save your
“project”: main menu **Project** > **Save as...**



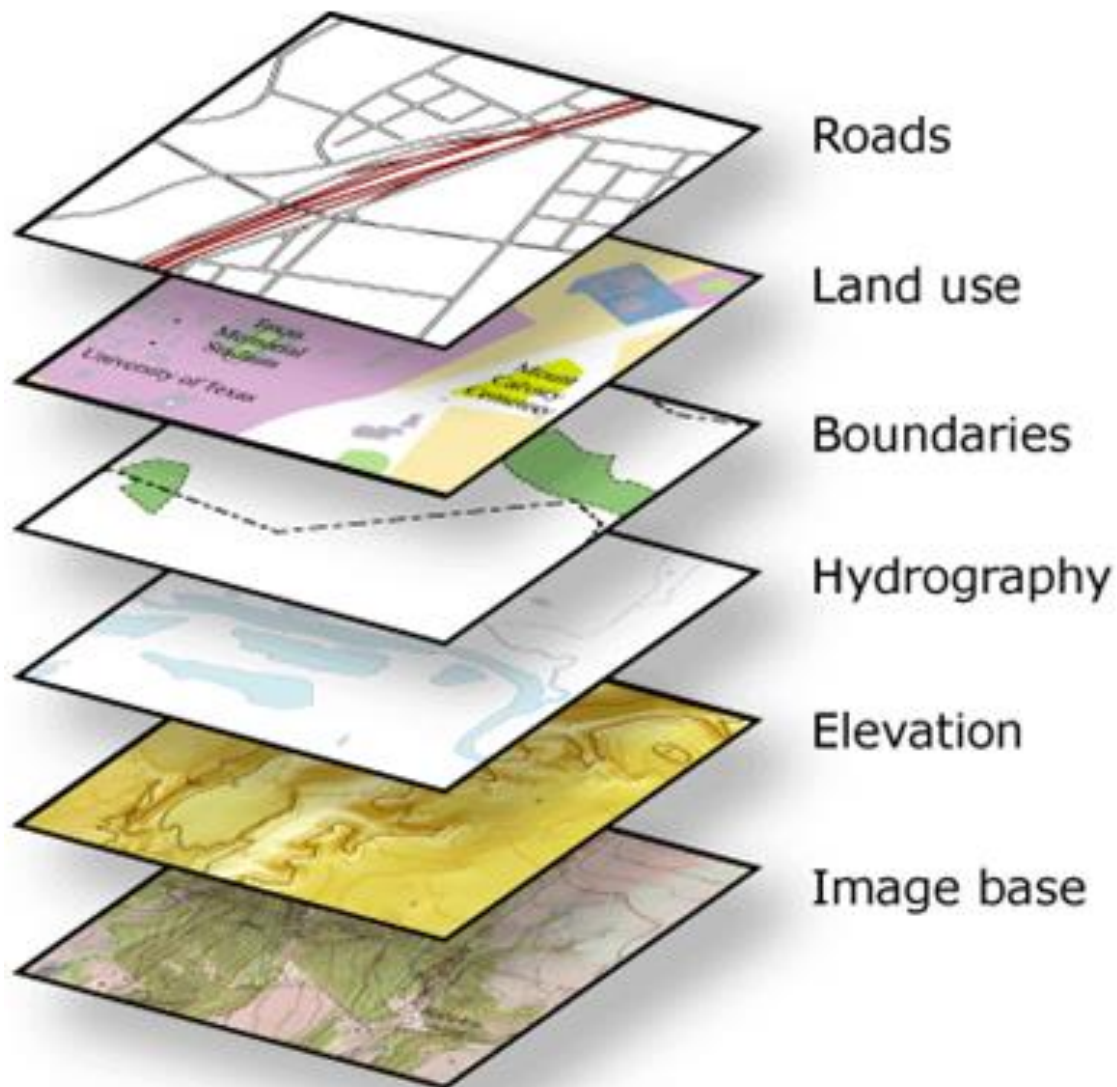
Children's travel to school in South Africa

de Kadt, van Heerden Richter, Alvanides (2019)

<https://doi.org/10.1016/j.ijedudev.2019.04.007>



“Layers” of geographical data



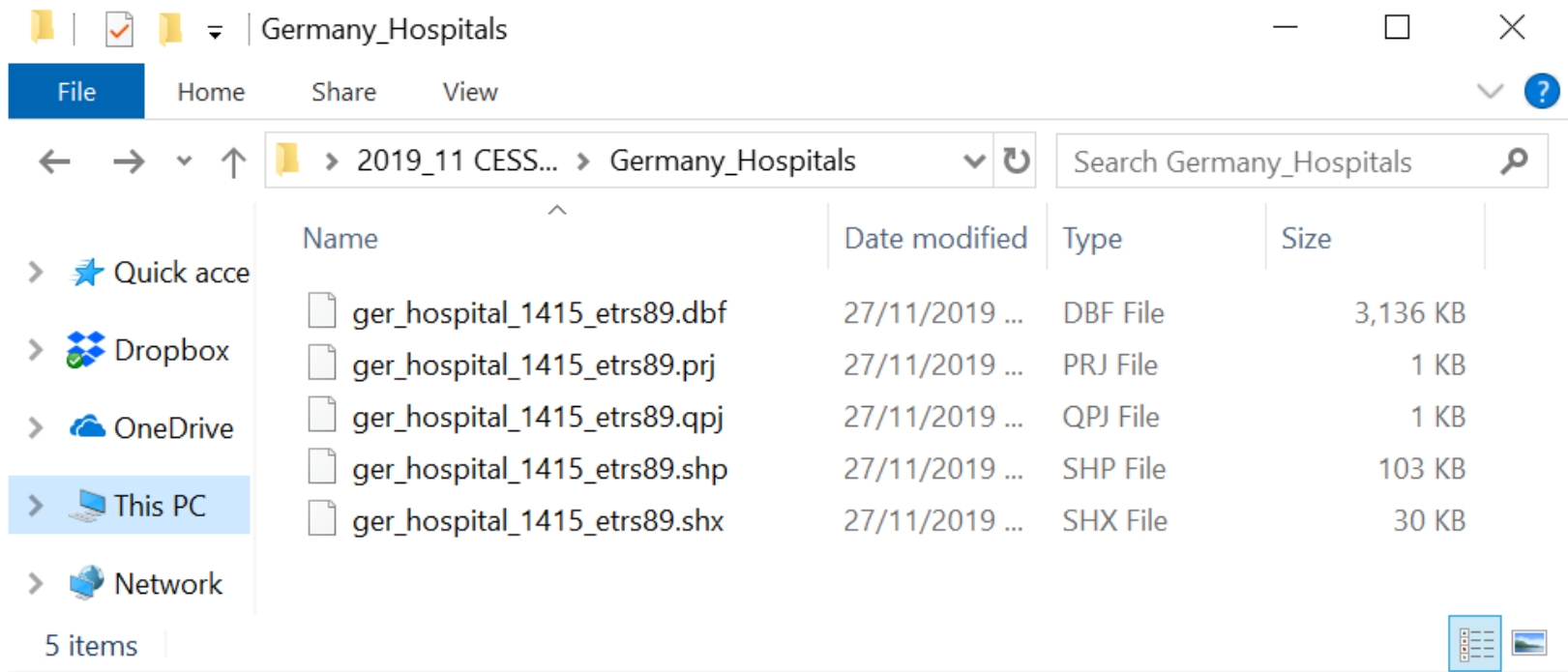
GISCO Functioning: Layers of geo-referenced information

Source: Eurostat

[https://ec.europa.eu/eurostat/statistics-explained/index.php/Geographical_information_system_of_the_Commission_\(GISCO\)](https://ec.europa.eu/eurostat/statistics-explained/index.php/Geographical_information_system_of_the_Commission_(GISCO))

B. Germany: Mapping hospitals

- Download the zipped file from the following link:
<https://tinyurl.com/rtrqptj>
- Uncompress the zipped file as you did earlier (e.g. Windows right-click & “Extract all...”)



3. In QGIS main menu: Layer > Add Layer > Add Vector Layer... > Open the .SHP File

The screenshot displays the QGIS software interface. The 'Layer' menu in the top menu bar is circled in red. The 'Data Source Manager | Vector' dialog is open, showing the 'Source Type' as 'File' and the 'Encoding' as 'UTF-8'. Below this, the 'Open OGR Supported Vector Dataset(s)' window is open, showing a file explorer view of the 'Germany_Hospitals' folder. The file 'ger_hospital_1415_etr89.shp' is selected and circled in red. The 'File name' field at the bottom of the file explorer contains 'ger_hospital_1415_etr89.shp'.

QGIS project - QGIS

Project Edit View **Layer** Settings Plugins Vector Raster Database Web Mesh Processing Help

Browser

- ★ Favorites
- ▶ Spatial Bookmarks
- ▶ Project Home
- ▶ Home
- ▶ C:\
- ▶ I:\
- ▶ Y:\
- GeoPackage
- SpatialLite
- PostGIS
- MSSQL
- Oracle
- DB2
- WMS/WMTS
- XYZ Tiles

Layers

- ✓ DGURBA_2018_01M
 - ✓ Cities
 - ✓ Towns
 - ✓ Rural
 - 9

Data Source Manager | Vector

Source Type

File Directory Database Protocol: HTTP(S), cloud, etc.

Encoding UTF-8

Source

Vector Dataset(s)

Open OGR Supported Vector Dataset(s)

2019_11 CESSDA Traini... Germany_Hospitals

Organise New folder

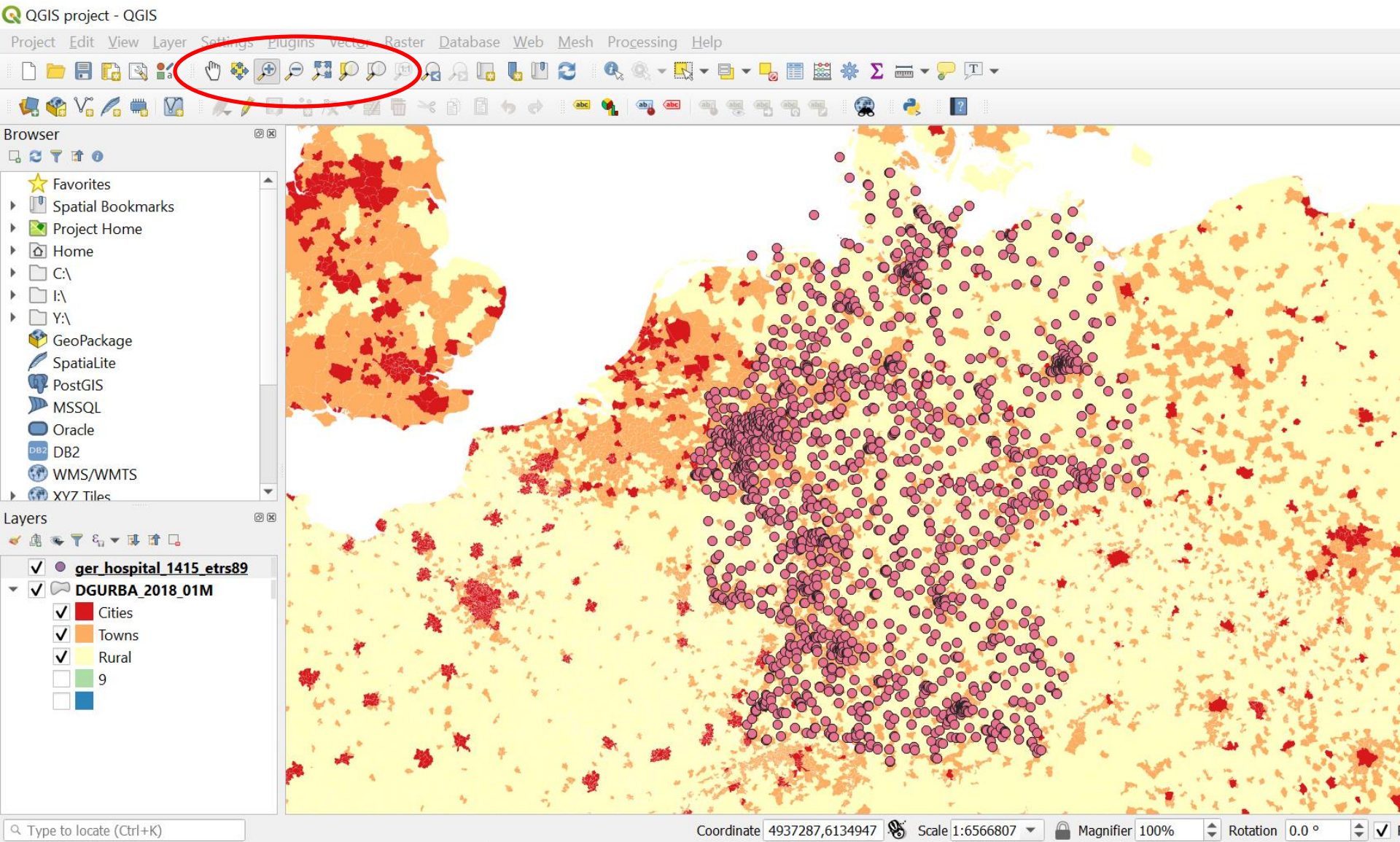
Name	Date modified	Type
ger_hospital_1415_etr89.dbf	27/11/2019 ...	DBF File
ger_hospital_1415_etr89.prj	27/11/2019 ...	PRJ File
ger_hospital_1415_etr89.qpj	27/11/2019 ...	QPJ File
ger_hospital_1415_etr89.shp	27/11/2019 ...	SHP File
ger_hospital_1415_etr89.shx	27/11/2019 ...	SHX File

File name: ger_hospital_1415_etr89.shp All files (*)

Open

Coordinate 1049441,5398097 Scale :29695911 Magnifier 100% Rotation 0.0 °

4. Use the pan and zoom buttons



5. Main menu: Layer > Open Attribute Table...

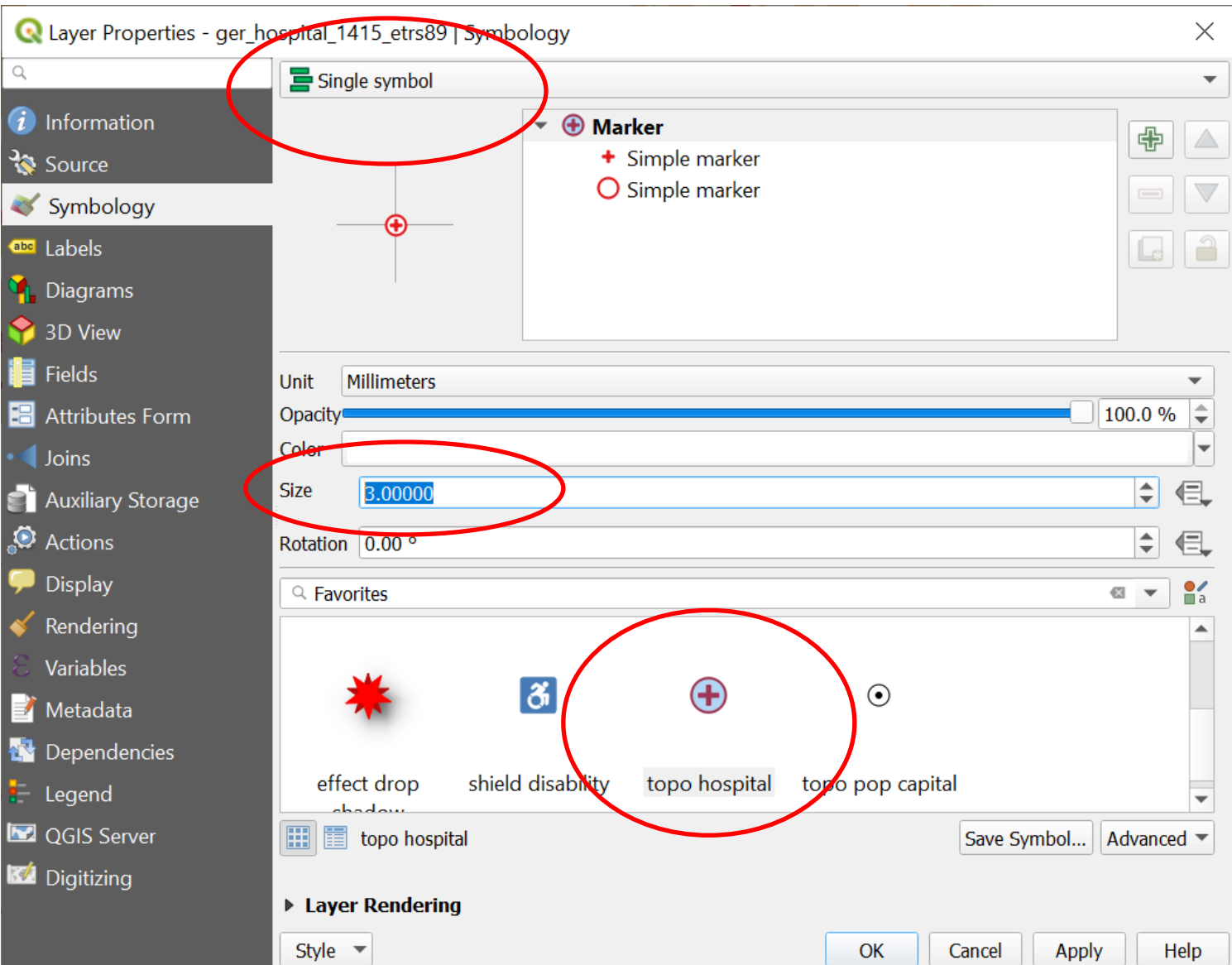
ger_hospital_1415_etr89 :: Features Total: 3773, Filtered: 3773, Selected: 0



	locationid	year	hospital_n	bland	kreis	ags	total_beds	x_coord	y_coord
1	x4179313y2755910	2014	Privatklinik in der Zarten	8	315	08315052	351	4179313.209689...	2755910.32765...
2	x4169868y2820614	2014	MediClin Klinik an der Lindenhöhe für ...	8	317	08317096	70	4169868.755080...	2820614.96681...
3	x4169851y3104027	2015	St. Martinus-Hospital	5	966	05966024	468	4169851.952349...	3104027.71376...
4	x4170117y2986125	2014	Heilig-Geist-Hospital Bingen am Rhein	7	339	07339005	155	4170117.700379...	2986125.27394...
5	x4169868y2820614	2015	MediClin Klinik an der Lindenhöhe für ...	8	317	08317096	66	4169868.755080...	2820614.96681...
6	x4170130y3176577	2014	St. Marien-Hospital	5	915	05915000	495	4170130.441120...	3176577.91679...
7	x4170117y2986125	2015	Heilig-Geist-Hospital Bingen am Rhein	7	339	07339005	138	4170117.700379...	2986125.27394...
8	x4170687y3175473	2014	Ev. Krankenhaus	5	915	05915000	423	4170687.404730...	3175473.54602...
9	x4170130y3176577	2015	St. Marien-Hospital	5	915	05915000	477	4170130.441120...	3176577.91679...
10	x4170870y3194791	2014	St. Josef-Stift Orthopädisches Zentrum...	5	570	05570040	302	4170870.367769...	3194791.08858...
11	x4170687y3175473	2015	Ev. Krankenhaus	5	915	05915000	403	4170687.404730...	3175473.54602...
12	x4171352y2763698	2014	Friedrich-Husemann-Klinik	8	315	08315020	14	4171352.480059...	2763698.82517...

Show All Features

6. Layer > Layer Properties > Symbology (Single symbol) Change symbol to “topo hospital” and Size to 3.0



7. Change the hospital symbol to blue

The screenshot displays a GIS application interface. On the left, there is a 'Browser' panel with a tree view of folders and files, including 'Spatial Bookmarks', 'Project Home', 'Home', 'C:\', 'Y:\', 'GeoPackage', 'SpatiaLite', 'PostGIS', 'MSSQL', 'Oracle', 'DB2', 'WMS/WMTS', 'XYZ Tiles', and 'WCS'. Below the browser is a 'Layers' panel with a list of layers: 'ger_hospital_1415_etr89' (checked), 'DGURBA_2018_01M' (checked), 'Cities' (checked), 'Towns' (checked), 'Rural' (checked), '9' (unchecked), and an empty layer (unchecked). The main map area shows a geographical view of Germany with a yellow and orange background representing administrative boundaries. Numerous blue circular symbols with a white cross inside are scattered across the map, representing hospital locations. The bottom status bar shows the coordinate '5102349,5290615', a scale of '1:5966955', and a magnifier set to '100%'.

8. Layer > Layer Properties > Symbology > Graduated Value to “total_beds” and Color ramp to Blues

Layer Properties - ger_hospital_1415_etr89 | Symbology

Graduated

Value: 123 total_beds

Symbol: [Symbol]

Legend format: %1 - %2 Precision 0 Trim

Method: Color

Color ramp: [Color ramp]

Classes Histogram

Symbol	Values	Legend
✓ [Symbol]	1.00 - 91.00	1 - 91
✓ [Symbol]	91.00 - 209.00	91 - 209
✓ [Symbol]	209.00 - 331.20	209 - 331
✓ [Symbol]	331.20 - 489.60	331 - 490
✓ [Symbol]	489.60 - 655.00	490 - 655

Mode: Equal Count (Quantile) Classes: 5

Classify [Add] [Remove] Delete All

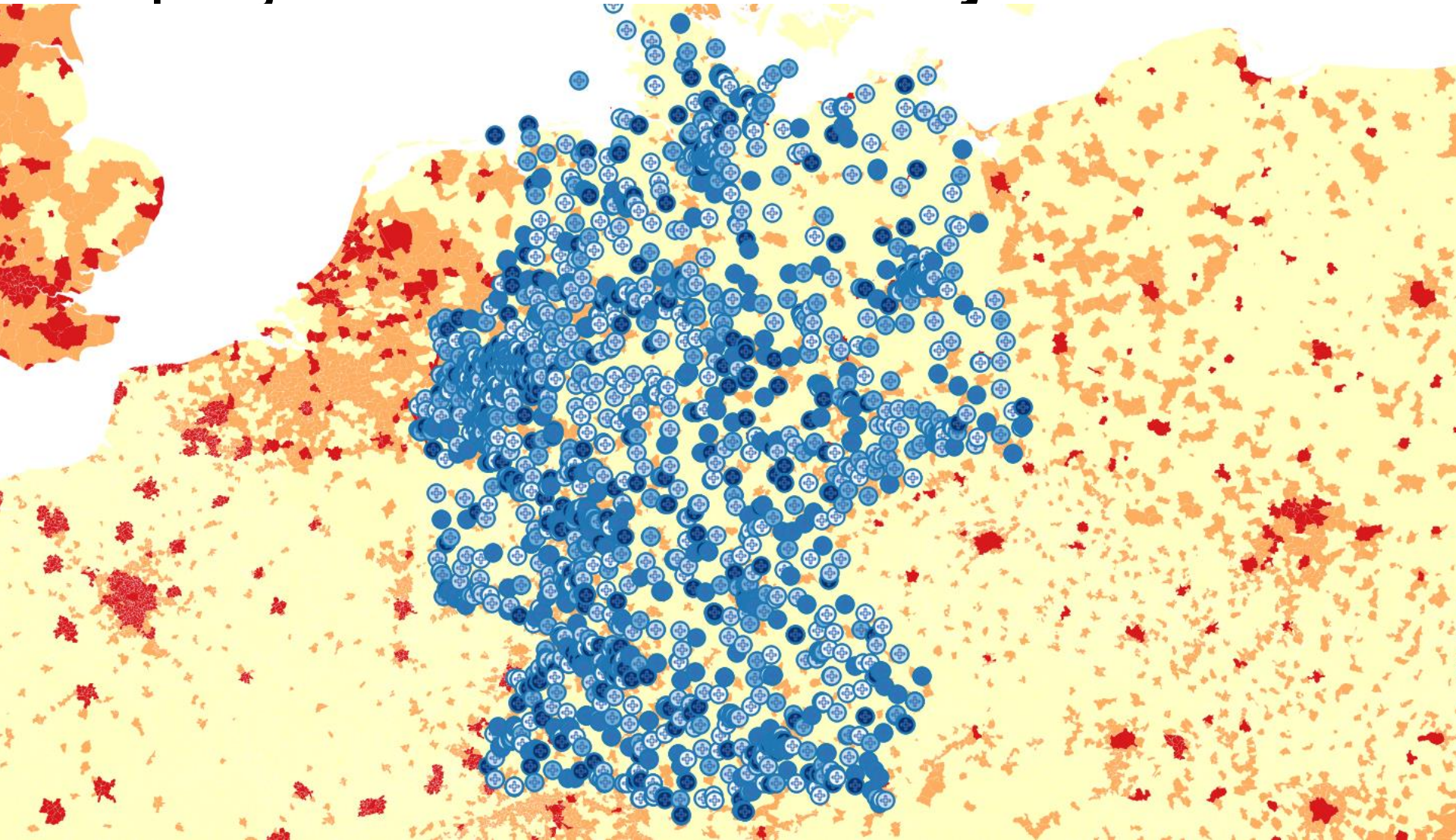
Link class boundaries

Layer Rendering

Style

OK Cancel Apply Help

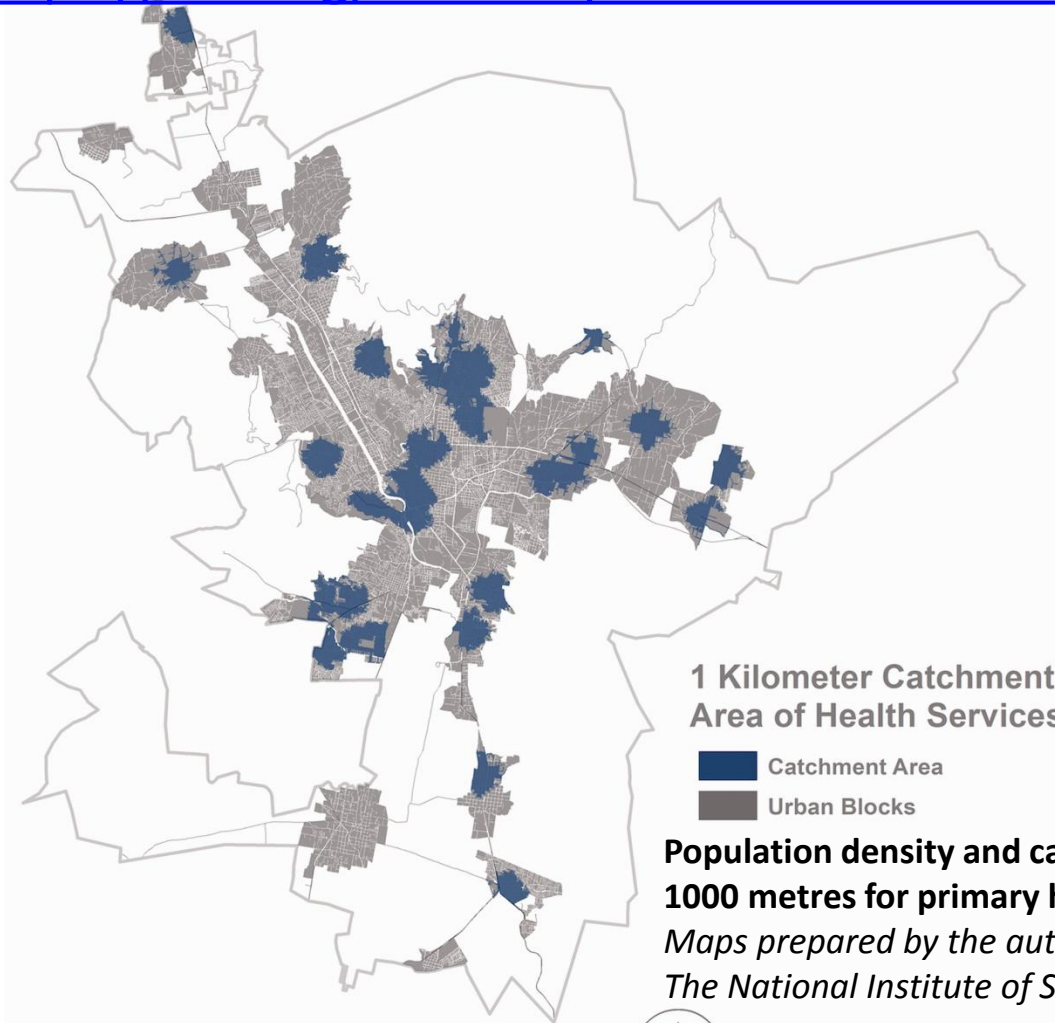
Part B. Congratulations! Now save your
“project”: main menu **Project > Save**



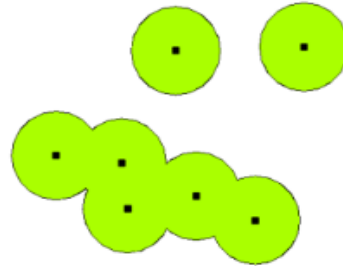
Spatial segregation and urban form in Mexican cities

Garnica-Monroy & Alvanides (2019)

<https://doi.org/10.1177/2399808319856629>



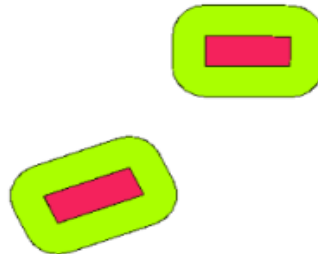
C. Geoprocessing: *Buffers* or “Catchment areas” or “Zones of influence”



A buffer zone around vector points.



A buffer zone around vector polylines.

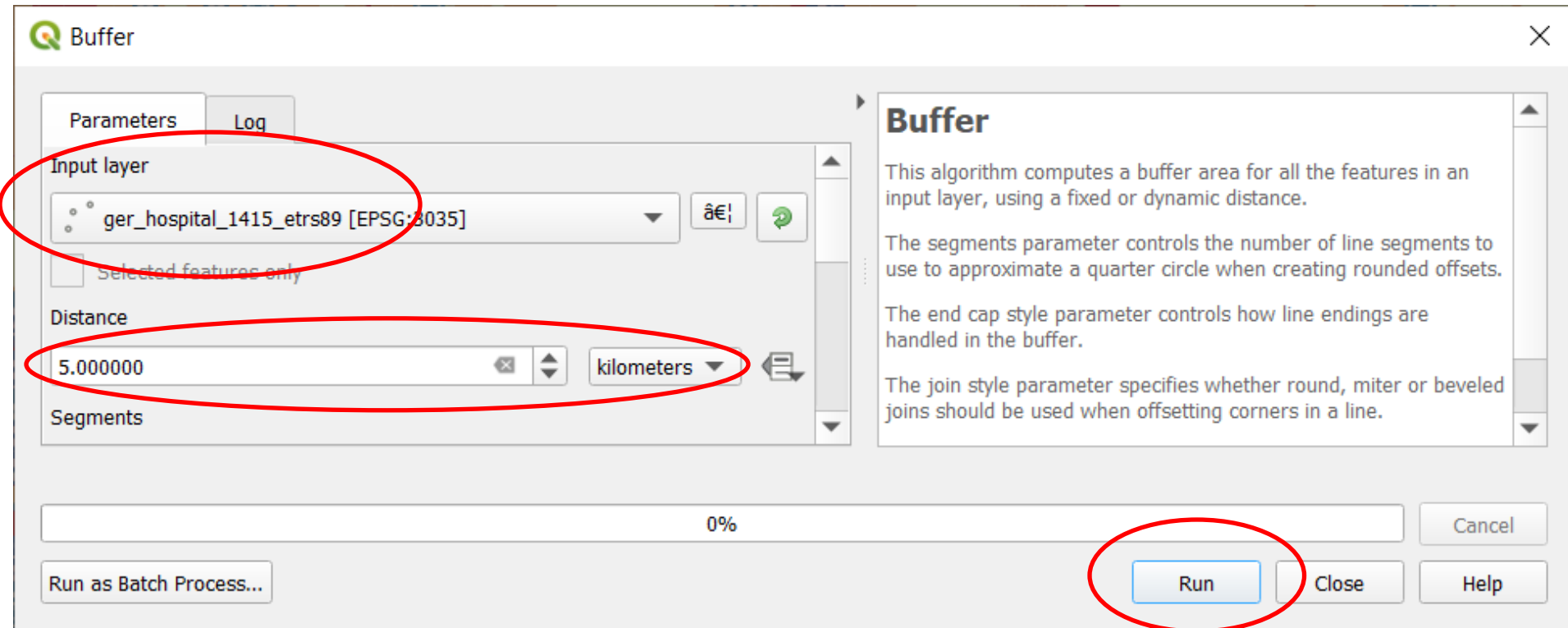


A buffer zone around vector polylines.

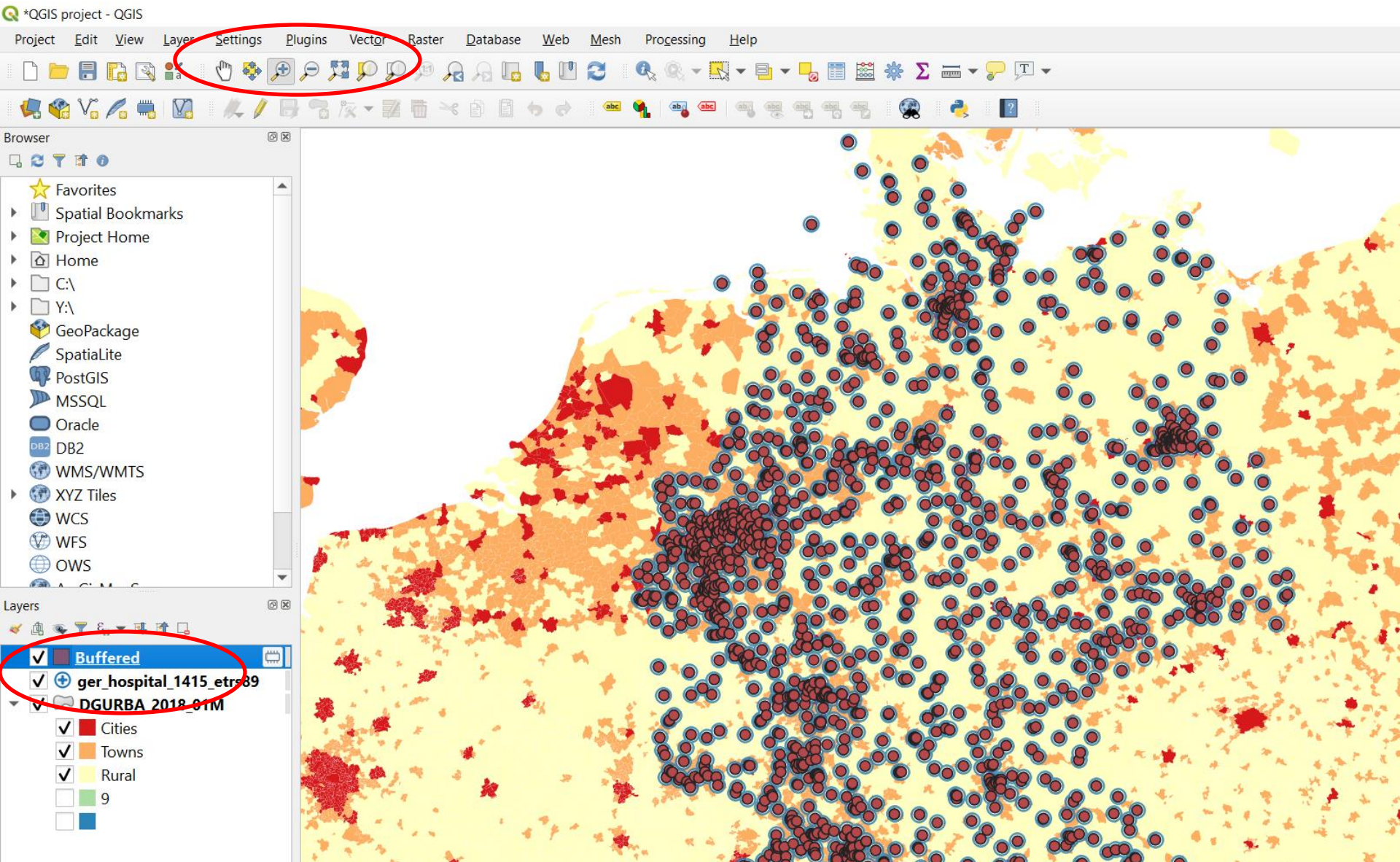
Documentation for QGIS:

https://docs.qgis.org/3.4/en/docs/gentle_gis_introduction/vector_spatial_analysis_buffers.html

1. QGIS main menu: Vector > Geoprocessing tools...
 - > **Buffer** > Input layer : **ger_hospital_1415_etr89**
 - Change **Distance to 5 Kilometers** and Run



2. Use the pan and zoom buttons



3. Move the Hospitals layer to the top

The image shows the QGIS desktop environment. The main map area displays a geographic map with a background of yellow and orange areas, overlaid with numerous red circular markers, each containing a white cross. The 'Layers' panel on the left side of the interface is visible, showing a list of layers. The layer 'ger_hospital_1415_etrs89' is selected and highlighted with a red oval. Below it, the 'Buffered' layer is also visible. The 'Browser' panel on the left shows various file and data sources. The top menu bar includes Project, Edit, View, Layer, Settings, Plugins, Vector, Raster, Database, Web, Mesh, Processing, and Help. The toolbar below the menu bar contains various icons for map navigation and editing.

QGIS project - QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help

Browser

- ★ Favorites
- ▶ Spatial Bookmarks
- ▶ Project Home
- ▶ Home
- ▶ C:\
- ▶ Y:\
- GeoPackage
- Spatialite
- PostGIS
- MSSQL
- Oracle
- DB2
- WMS/WMTS
- ▶ XYZ Tiles
- WCS
- WFS
- OWS

Layers

- ger_hospital_1415_etrs89**
- Buffered**
- ~~DGURBA_2018_01M~~
 - Cities
 - Towns
 - Rural
 - 9
 -

4. QGIS main menu: Vector > Geoprocessing tools... > **Buffer** > Input layer : **ger_hospital_1415_etr89** **Distance to 5 Kilometers** and tick **Dissolve result**

The screenshot shows the QGIS Buffer dialog box with the following settings:

- Input layer:** ger_hospital_1415_etr89 [EPSG:3035] (circled in red)
- Distance:** 5.000000 kilometers
- Segments:** 5
- End cap style:** Round
- Join style:** Round
- Miter limit:** 2.000000
- Dissolve result** (circled in red)

The dialog box also includes a "Log" tab, a "Run as Batch Process..." button, and "Run", "Close", and "Cancel" buttons at the bottom. The "Run" button is circled in red.

On the right side of the dialog, there is a "Buffer" section with the following text:

Buffer

This algorithm computes a buffer area for all the features in an input layer, using a fixed or dynamic distance.

The segments parameter controls the number of line segments to use to approximate a quarter circle when creating rounded offsets.

The end cap style parameter controls how line endings are handled in the buffer.

The join style parameter specifies whether round, miter or beveled joins should be used when offsetting corners in a line.

The miter limit parameter is only applicable for miter join styles, and controls the maximum distance from the offset curve to use when creating a mitered join.

Below the dialog box, there is a diagram illustrating the buffer process. It shows three green circles representing the input features. The left side shows the circles with their individual buffers, and the right side shows the circles with their buffers dissolved into a single continuous area.

5. Change Symbology of “Buffered” Fill to Transparent & Stroke width 1

The screenshot shows the 'Layer Properties - Buffered | Symbology' dialog box. The 'Symbology' tab is active, and the 'Single symbol' is selected. The 'Fill' category is expanded, and 'Simple fill' is selected. The 'Symbol layer type' is 'Simple fill'. The 'Fill color' is set to a transparent checkerboard pattern. The 'Fill style' is 'Solid'. The 'Stroke color' is black. The 'Stroke width' is 1.000000 millimeters. The 'Stroke style' is 'Solid Line'. The 'Layer Rendering' section is partially visible at the bottom.

Layer Properties - Buffered | Symbology

Single symbol

Fill

- Simple fill

Symbol layer type: Simple fill

Fill color: [Transparent checkerboard pattern]

Fill style: Solid

Stroke color: [Black]

Stroke width: 1.000000 Millimeters

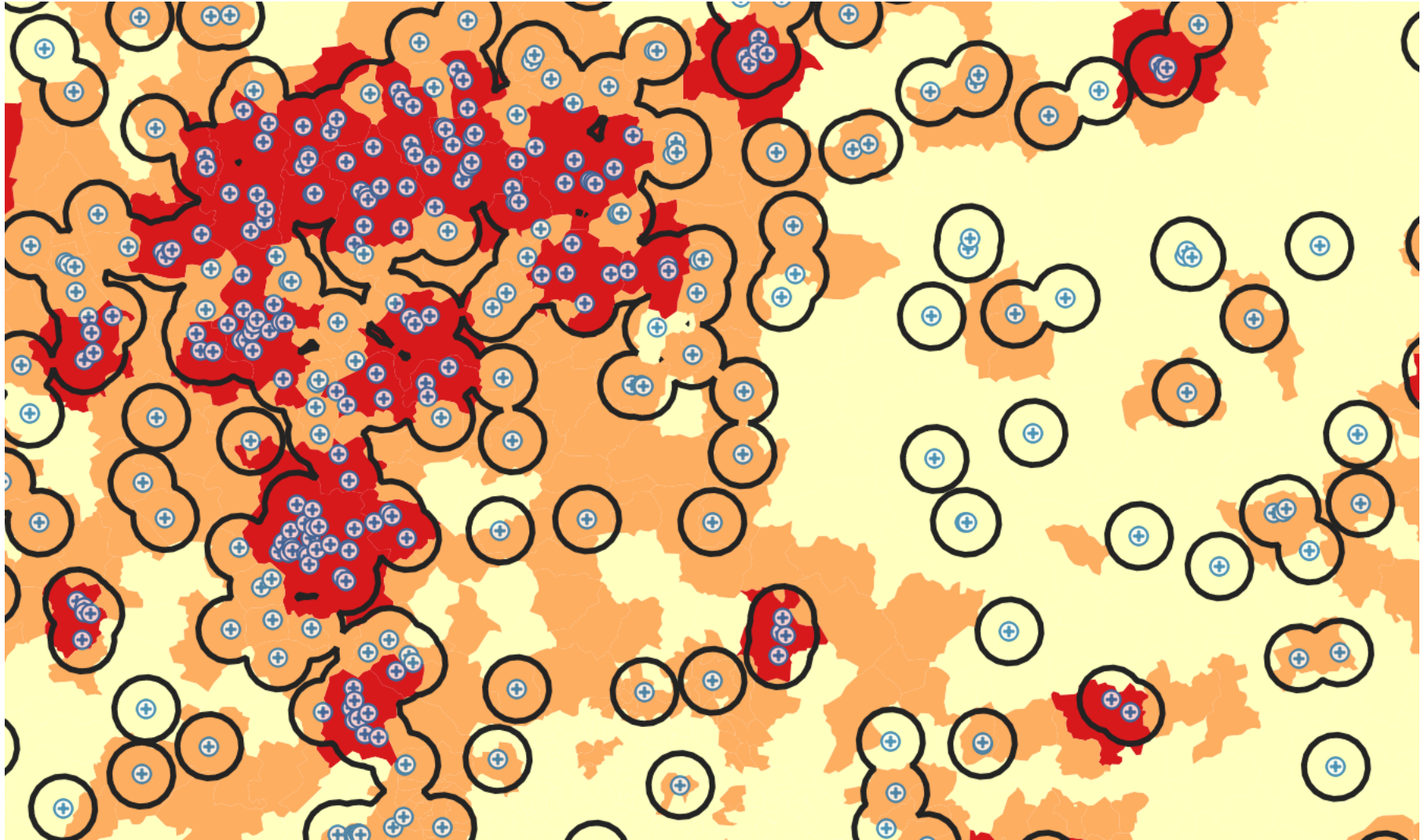
Stroke style: Solid Line

Layer Rendering

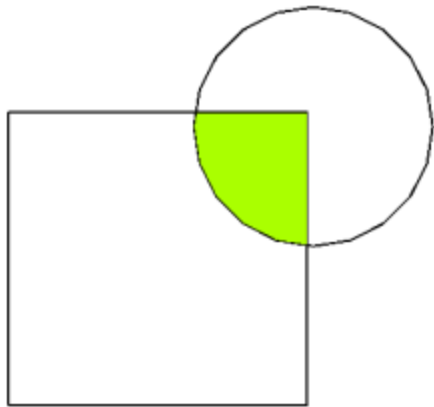
Style

OK Cancel Apply Help

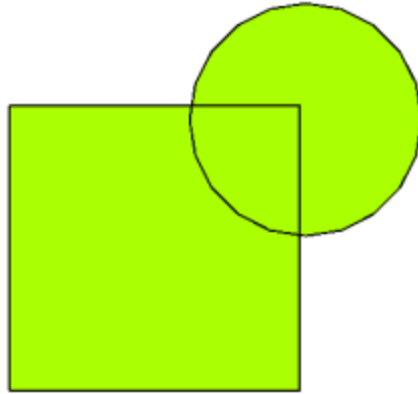
Part C. Congratulations! Now save your
“project”: main menu **Project > Save**



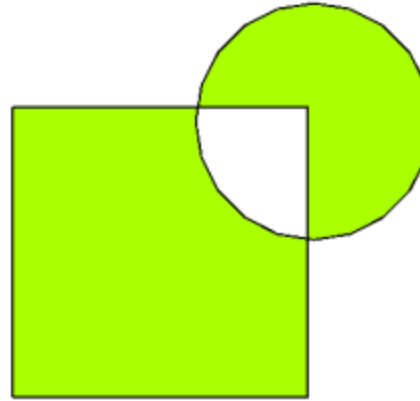
D. Spatial “linking” with Layer overlays



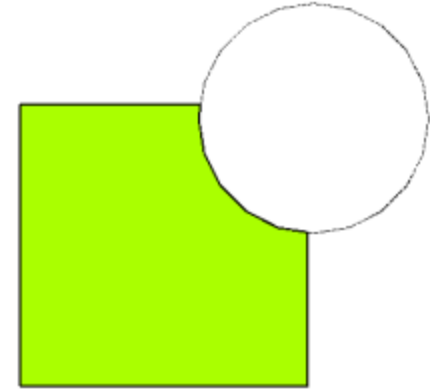
Intersection



Union



Symmetrical Difference



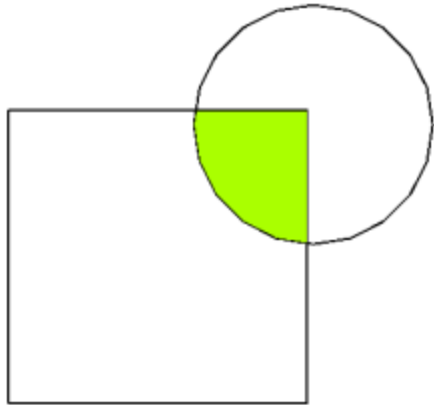
Difference

Intersection: The output layer contains all areas where both layers overlap (intersect).

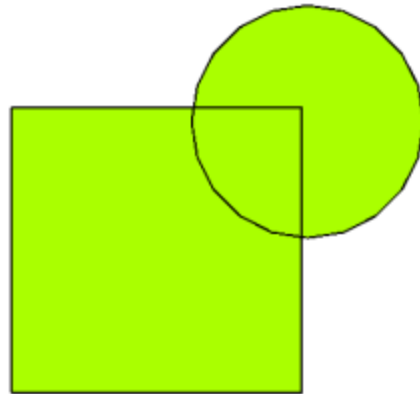
Documentation for QGIS:

https://docs.qgis.org/3.4/en/docs/gentle_gis_introduction/vector_spatial_analysis_buffers.html

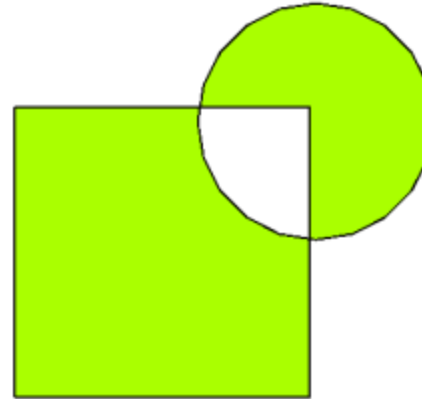
D. Spatial “linking” with Layer overlays



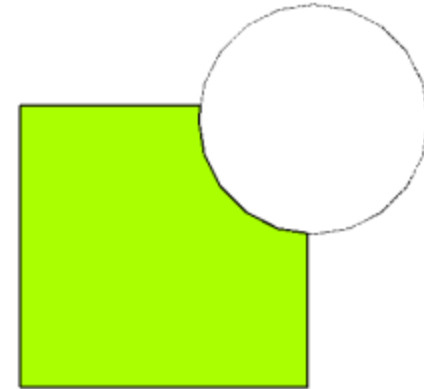
Intersection



Union



Symmetrical Difference



Difference

ger_hospital_1415_etr89 :: Features Total: 3773, Filtered: 3773, Selected: 0

	locationid	year	hospital_n	bland	kreis	ags	total_beds	x_coord	y_coord
1	x4331896y3386563	2015	Kath. Kinderkrankenhaus Wilhelmstift	2	0	02000000	158	4331896.401829...	3386563.62271...
2	x4332019y3346472	2014	Krankenhaus Salzhausen	3	353	03353030	428	4332019.612590...	3346472.44360...
3	x4332580y3468797	2014	Tagesklinik für Allergie und Hautkrankh...	1	2	01002000	2	4332580.534930...	3468797.50993...
4	x4332580y3468797	2015	Tagesklinik für Allergie und Hautkrankh...	1	2	01002000	1	4332580.534930...	3468797.50993...
5	x4332558y2799779	2014	Kreisspitalstiftung Weißenhorn Stiftung...	9	775	09775164	85	4332558.563409...	2799779.48042...

Show All Features

Documentation for QGIS:

https://docs.qgis.org/3.4/en/docs/gentle_gis_introduction/vector_spatial_analysis_buffers.html

1. Vector > Geoprocessing tool > **Intersection**

Input layer: ger_hospital_1415_etr89 (points)

Overlay layer : DGURBA_2018_01M (polygons)

Intersection

This algorithm extracts the overlapping portions of features in the Input and Overlay layers. Features in the output Intersection layer are assigned the attributes of the overlapping features from both the Input and Overlay layers.

Parameters | Log

Input layer
ger_hospital_1415_etr89 [EPSG:3035]

Selected features only

Overlay layer
DGURBA_2018_01M [ESRI:37201]

Selected features only

Input fields to keep (leave empty to keep all fields) [optional]
0 elements selected

Overlay fields to keep (leave empty to keep all fields) [optional]
0 elements selected

► **Advanced parameters**

Intersection
[Create temporary layer]

Open output file after running algorithm

0%

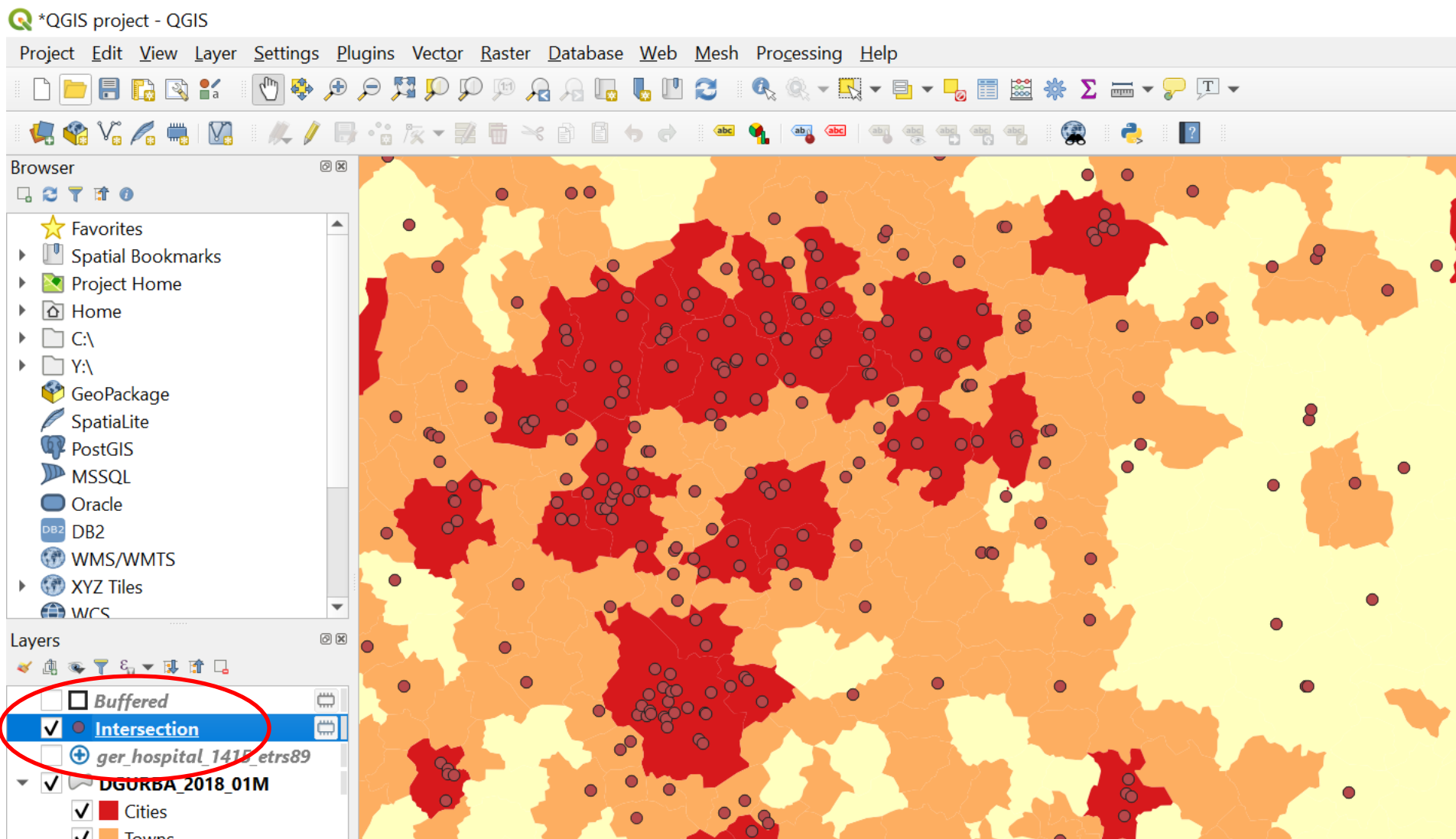
Run as Batch Process...

Run Close Help

Not much has happened? a new Layer!

*QGIS project - QGIS

Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help



The screenshot displays the QGIS desktop environment. The main map area shows a geographic region with a color-coded overlay, likely representing a risk or suitability index, with red indicating higher values and orange/yellow indicating lower values. Numerous small grey circular markers are scattered across the map. On the left side, the 'Layers' panel is visible, listing several layers. The 'Intersection' layer, represented by a red circle icon, is selected and highlighted with a red circle. Other layers include 'Buffered', 'ger_hospital_1411_etr89', 'DGURBA_2018_01M', 'Cities', and 'Towne'. The 'Browser' panel on the left shows a file system tree with folders like 'Spatial Bookmarks', 'Project Home', 'Home', 'C:\', and 'Y:\', along with various data sources like 'GeoPackage', 'SpatialLite', 'PostGIS', 'MSSQL', 'Oracle', 'DB2', 'WMS/WMTS', 'XYZ Tiles', and 'WCS'.

Browser

- ★ Favorites
- ▶ Spatial Bookmarks
- ▶ Project Home
- ▶ Home
- ▶ C:\
- ▶ Y:\
- GeoPackage
- SpatialLite
- PostGIS
- MSSQL
- Oracle
- DB2
- WMS/WMTS
- ▶ XYZ Tiles
- WCS

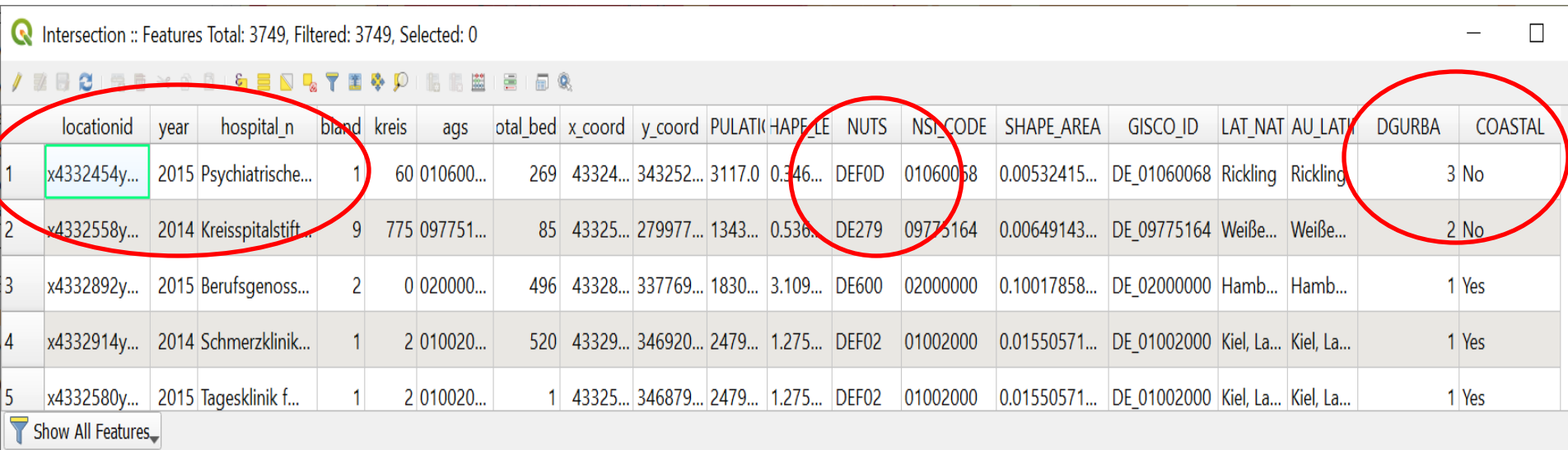
Layers

- Buffered
- Intersection
- ger_hospital_1411_etr89
- ▶ DGURBA_2018_01M
 - Cities
 - Towne

2. Right click on **Intersection Layer**

> Open Attribute Table

Intersection :: Features Total: 3749, Filtered: 3749, Selected: 0



The screenshot shows a GIS attribute table with 19 columns and 5 rows. Red circles highlight the 'locationid' column, the 'NUTS' column, and the 'DGURBA' and 'COASTAL' columns. The first row is highlighted in green.

	locationid	year	hospital_n	blaud	kreis	ags	otal_bed	x_coord	y_coord	PULATIK	HAPELE	NUTS	NSL_CODE	SHAPE_AREA	GISCO_ID	LAT_NAT	AU_LATI	DGURBA	COASTAL
1	x4332454y...	2015	Psychiatrische...	1	60	010600...	269	43324...	343252...	3117.0	0.346...	DEF0D	01060068	0.00532415...	DE_01060068	Rickling	Rickling	3	No
2	x4332558y...	2014	Kreisspitalstift...	9	775	097751...	85	43325...	279977...	1343...	0.536...	DE279	09775164	0.00649143...	DE_09775164	Weiße...	Weiße...	2	No
3	x4332892y...	2015	Berufsgenoss...	2	0	020000...	496	43328...	337769...	1830...	3.109...	DE600	02000000	0.10017858...	DE_02000000	Hamb...	Hamb...	1	Yes
4	x4332914y...	2014	Schmerzklinik...	1	2	010020...	520	43329...	346920...	2479...	1.275...	DEF02	01002000	0.01550571...	DE_01002000	Kiel, La...	Kiel, La...	1	Yes
5	x4332580y...	2015	Tagesklinik f...	1	2	010020...	1	43325...	346879...	2479...	1.275...	DEF02	01002000	0.01550571...	DE_01002000	Kiel, La...	Kiel, La...	1	Yes

Show All Features

3. Exporting the Layer attribute table

Right click on Layer name

> Export

> Save Features as...

Format

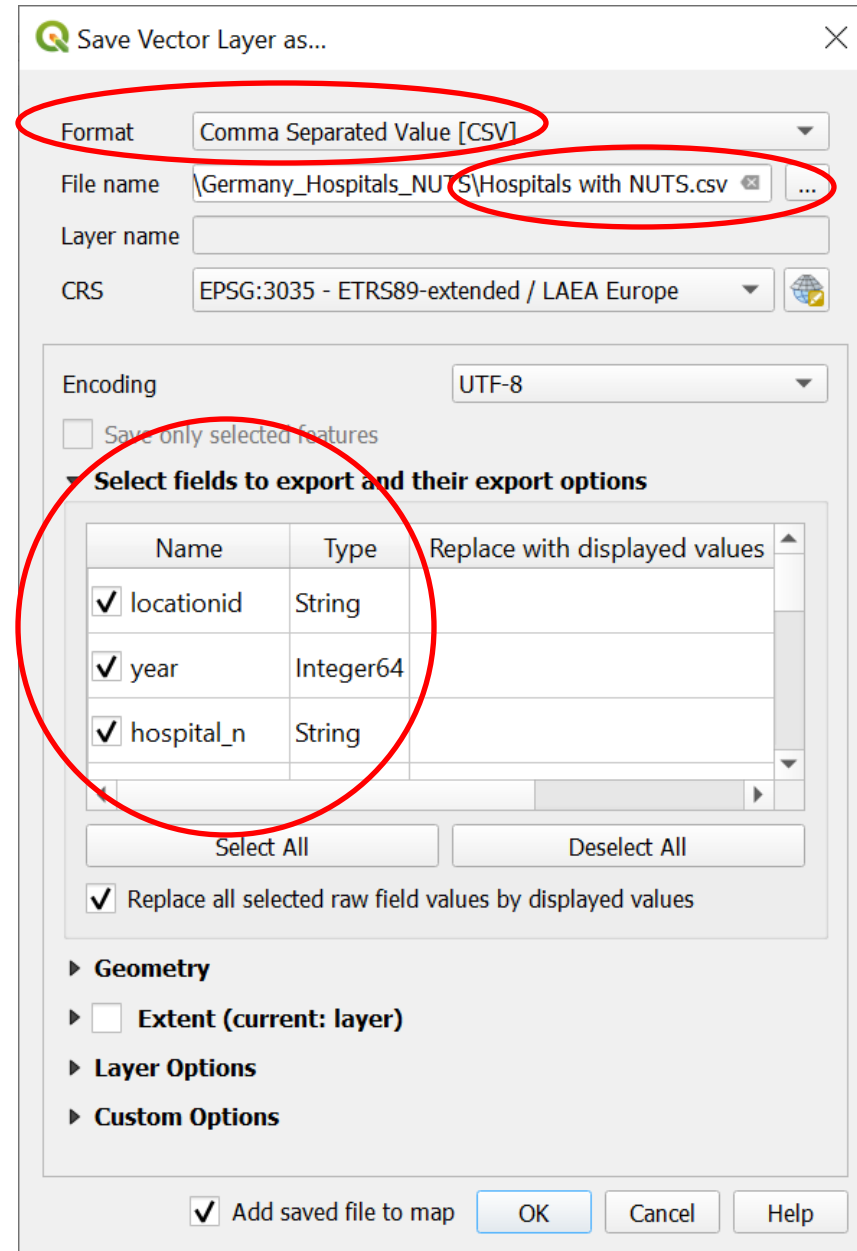
Comma Separated Values (CSV)

Filename

<something meaningful>

Optional

Select fields to export...



4. Symbology > Categorized and Value DGURBA

Change Color ramp to **Spectral** and **Classify**

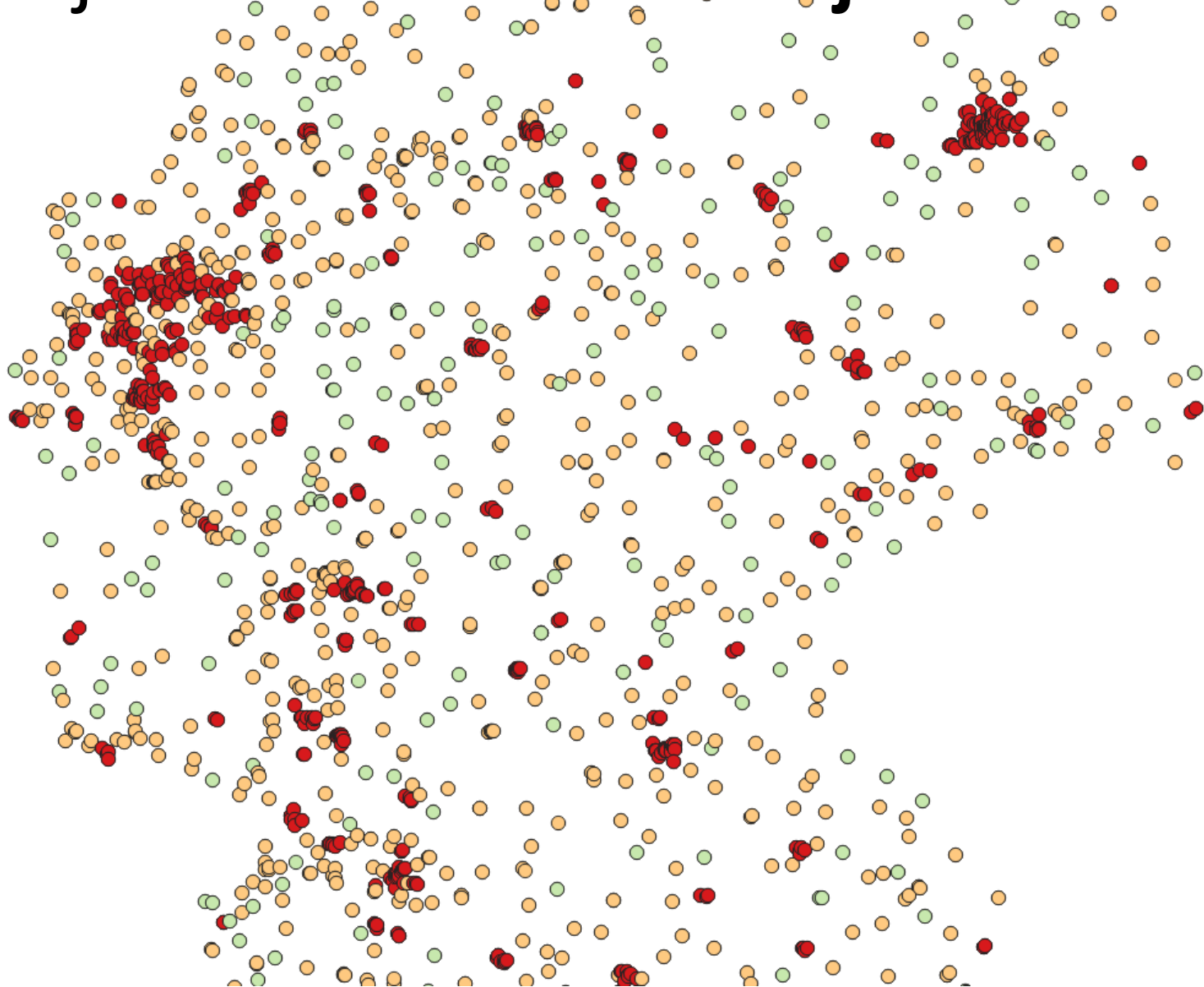
Also change the Legend: **Cities, Towns, Rural**

The screenshot shows the 'Layer Properties - Intersection | Symbology' dialog box. The 'Symbology' tab is selected in the left sidebar. The 'Categorized' method is chosen, with a value of '123 DGURBA'. The 'Color ramp' is set to 'Spectral'. A legend table is visible with the following entries:

Symbol	Value	Legend
<input checked="" type="checkbox"/>	1	Cities
<input checked="" type="checkbox"/>	2	Towns
<input checked="" type="checkbox"/>	3	Rural
<input type="checkbox"/>		<i>all other values</i>

At the bottom of the dialog, there are buttons for 'Classify', 'Delete All', and 'Advanced'. The 'Layer Rendering' section is partially visible at the bottom.

Part D. Congratulations! Now save your
“project”: main menu **Project > Save**



What we learned today

- Some sources of European data
- Downloading & mapping areal data (e.g. NUTS)
- Mapping point data (hospital locations in Germany)
- Basic Spatial Analysis (Geoprocessing)
 - Buffering (zones of influence)
 - Spatial “linking” with Overlays
- Exporting Layer attributes as a CSV table

Additional information & Acknowledgements

- QGIS documents 18! languages <https://docs.qgis.org/3.4>
- A comprehensive QGIS book: <https://locatepress.com/dq3>
- Introduction to GIS (9th edition)
<https://www.baruch.cuny.edu/confluence/display/geoportal/GIS+Practicum>

My research and list of publications

<https://www.gesis.org/en/institute/staff/person/S.Alvanides>

*Acknowledgement: Hospital data provided by
Anne-Kathrin Stroppe, GESIS Data Archive (DAS)*

<https://www.gesis.org/en/institute/staff/person/Anne-Kathrin.Stroppe>