

GIS in Archaeology

02 - Working with QGIS

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based on [Datapolitan-Training/qgis-training](#).

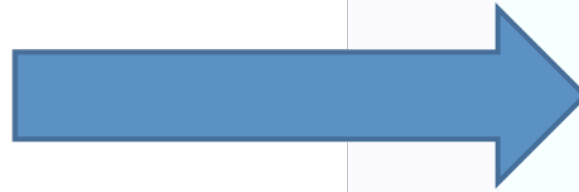
You can download a [pdf of this presentation](#).

Let's Get Started

1. [Click this link](#) and download the file to your desktop
2. Unzip the file
3. [Click this link](#) and download the other file also to your desktop
4. Open QGIS

Layers

**Layers
(Vector Data)**



**Basemap
(Raster Data)**

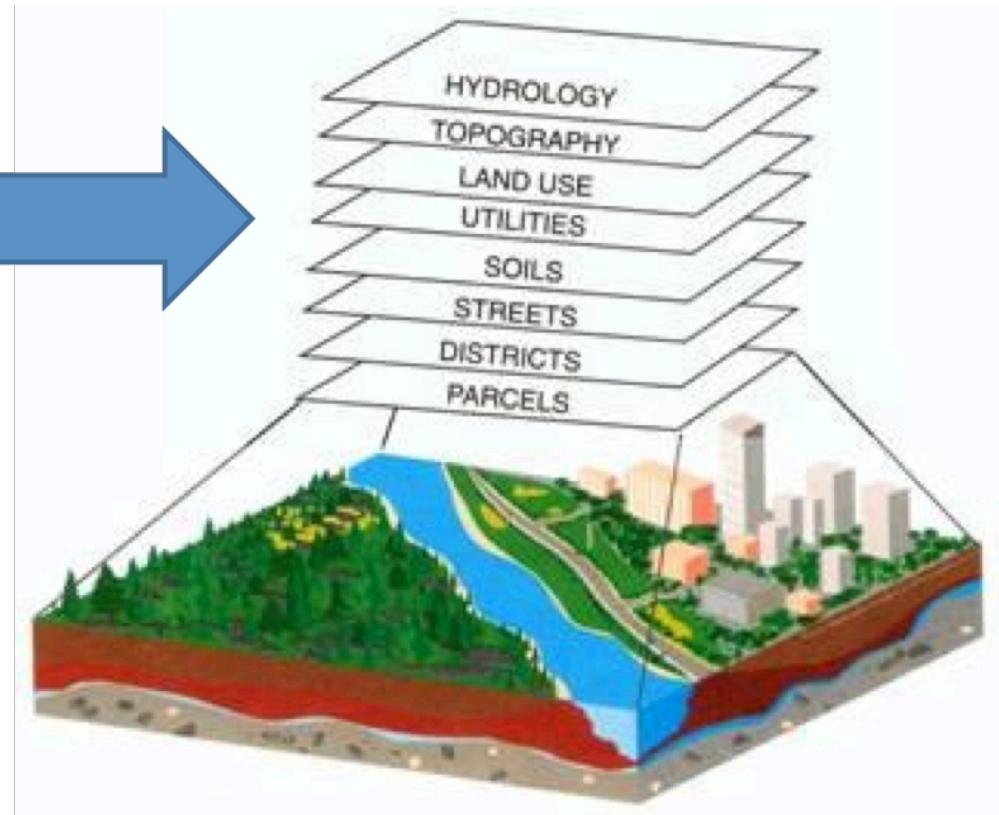
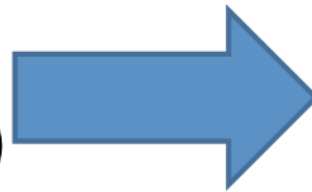


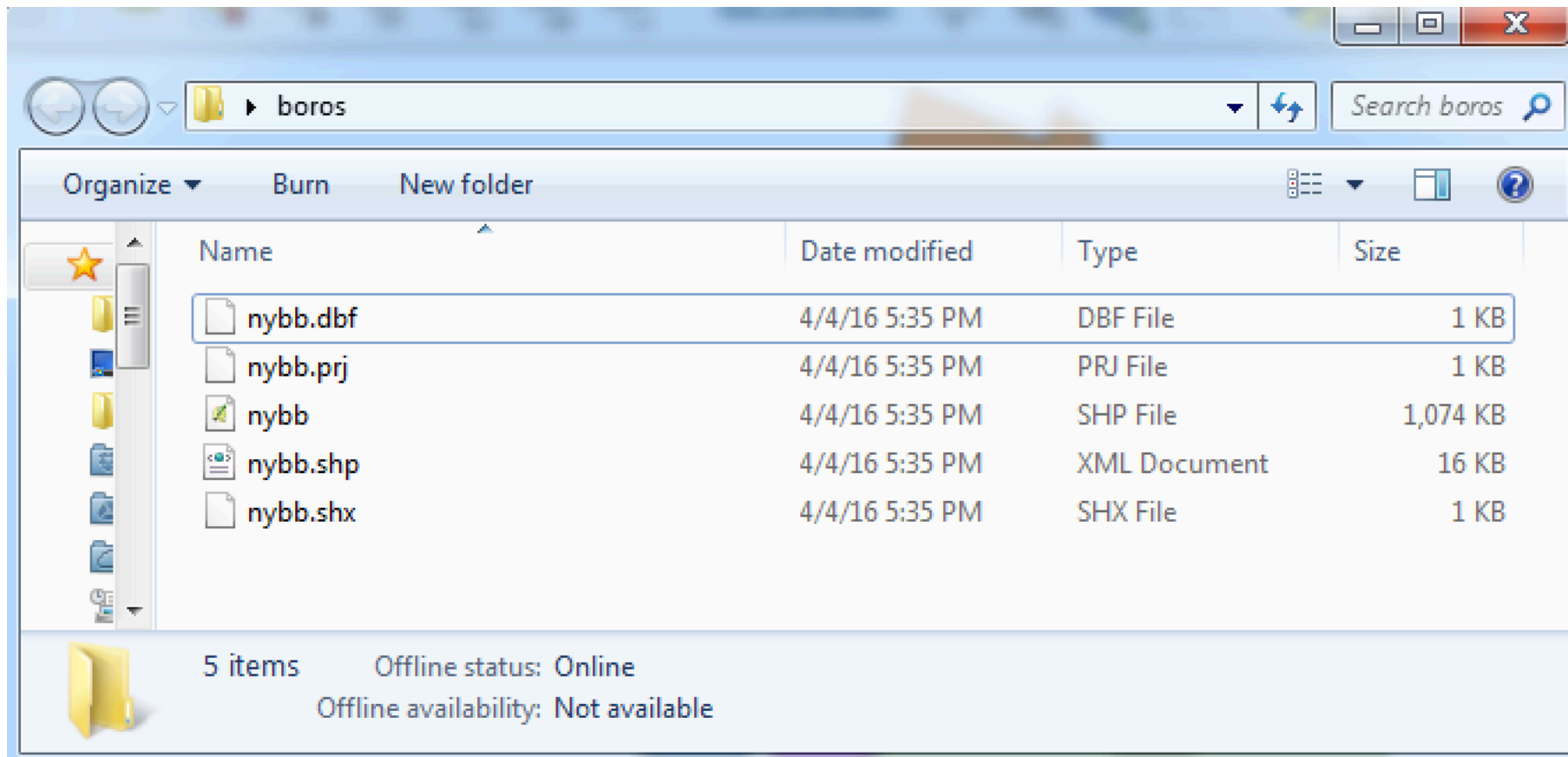
Image Source: <http://www.geocontrolling.com/co-je-gis.htm>

Layer Ordering

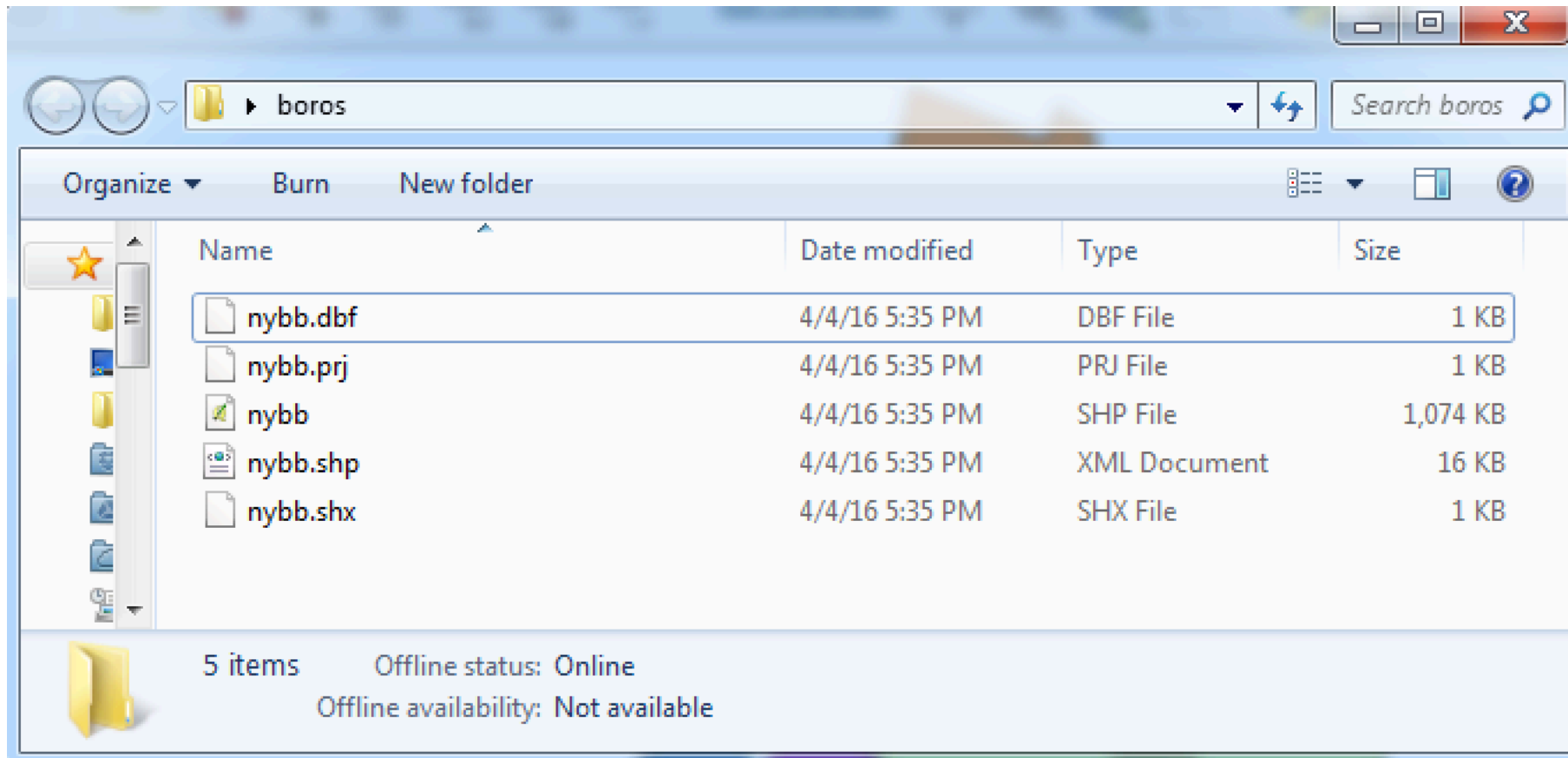
- Layers on top are drawn on top
- Just drag and drop within the Layers Panel to change order
- Try it now

Shapefiles

- Basic file for storing map elements
- Stores spatial data, like points, lines, and polygons
- Multiple files comprise a "shapefile"

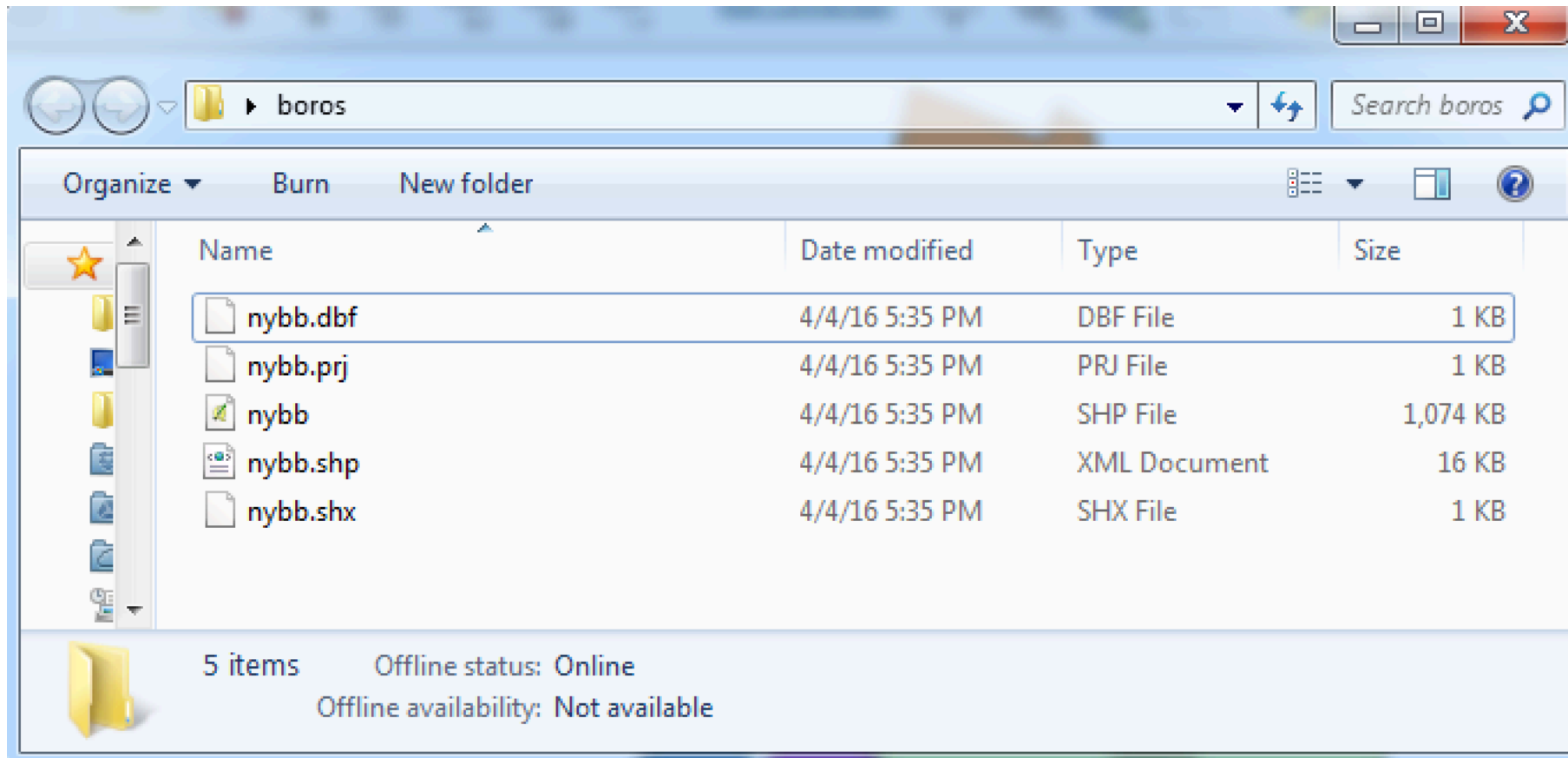


Shapefiles



- .shp—The main file that stores the feature geometry
- .dbf—The dBASE table that stores the attribute information of features

Shapefiles















- .prj—The file that stores the coordinate system information
- .shx—The index file that stores the index of the feature geometry

You might also see

- .cpg—Identifies the character set to be used
- .sbn and .sbx—The files that store the spatial index of the features

Shapefiles

- Have a few limitations
- One geometry type (Point, Line, Polygon) per shapefile
- So sometimes you end up with this:

Name	Size	Type	Modified
 osm_line.dbf	24.7 MB	Document	Feb 4
 osm_line.prj	143 bytes	Unknown	Feb 4
 osm_line.shp	1.5 MB	Unknown	Feb 4
 osm_line.shx	37.1 kB	Unknown	Feb 4
 osm_point.dbf	4.8 MB	Document	Feb 4
 osm_point.prj	143 bytes	Unknown	Feb 4
 osm_point.shp	24.9 kB	Unknown	Feb 4
 osm_point.shx	7.2 kB	Unknown	Feb 4
 osm_polygon.dbf	939.4 kB	Document	Feb 4
 osm_polygon.prj	143 bytes	Unknown	Feb 4
 osm_polygon.shp	4.6 MB	Unknown	Feb 4
 osm_polygon.shx	1.5 kB	Unknown	Feb 4

Overview of GeoPackage

- What is GeoPackage?
 - A data format for geographic information systems (GIS).
 - Platform-independent, open, and standards-based.
 - Uses an SQLite database to store both raster and vector data.
- Key Features:
 - Single file for easy data sharing and use.
 - Efficient, especially for mobile and offline environments.
 - Supports extensions for flexibility (OGC-approved and custom extensions).
- Why Use GeoPackage?
 - Lightweight and portable.
 - Facilitates easy data management and spatial queries.



GeoPackage vs. Shapefiles

1. File Structure:

- **GeoPackage:** Single file (SQLite-based).
- **Shapefile:** Requires multiple files (.shp, .shx, .dbf, etc.).

2. Data Handling:

- **GeoPackage:** Stores both vector and raster data (multiple geometry type per file possible)
- **Shapefile:** Vector data only.

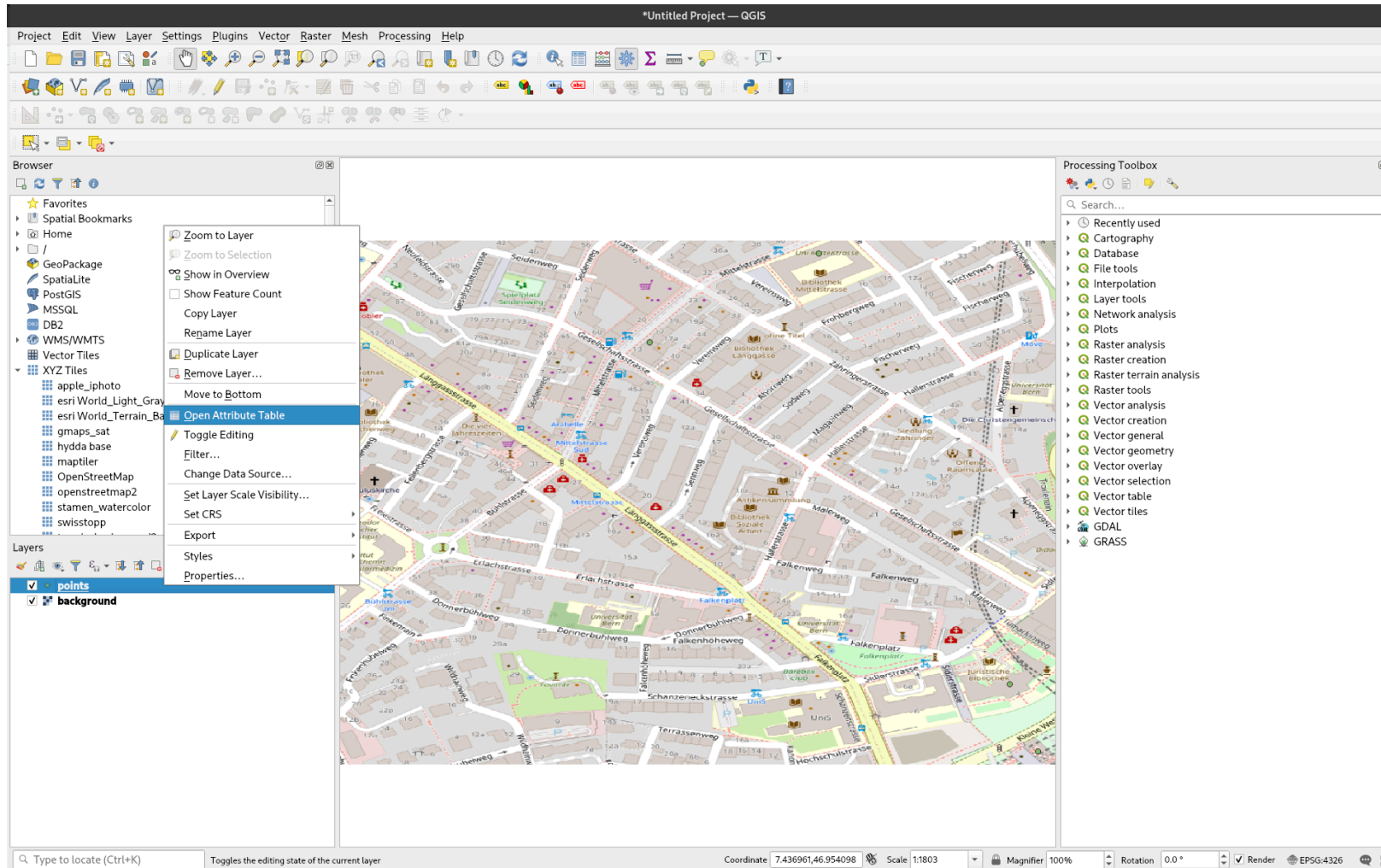
3. Efficiency:

- **GeoPackage:** Compact, better suited for mobile/offline use.
- **Shapefile:** Larger, more fragmented.

4. Attributes:

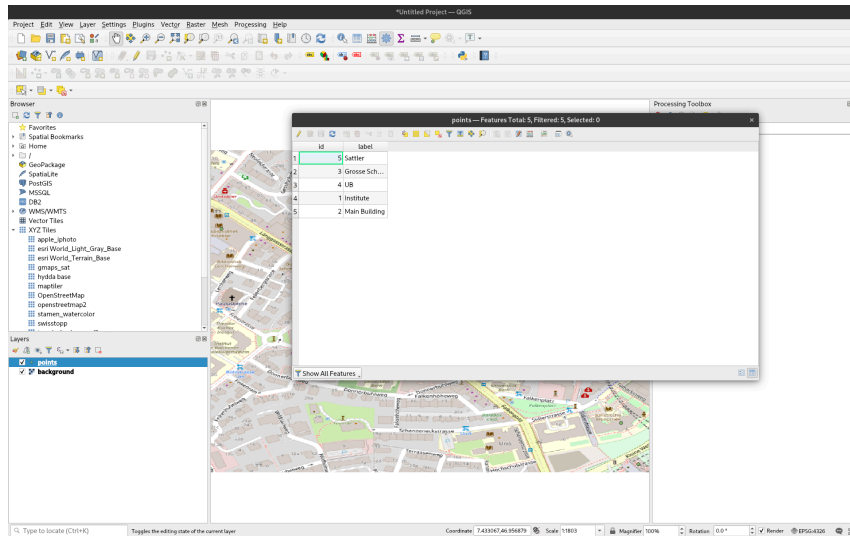
- **GeoPackage:** Supports larger field names and Unicode.
- **Shapefile:** Limited field length and ASCII-only.

Attribute Table (Right click on layer)

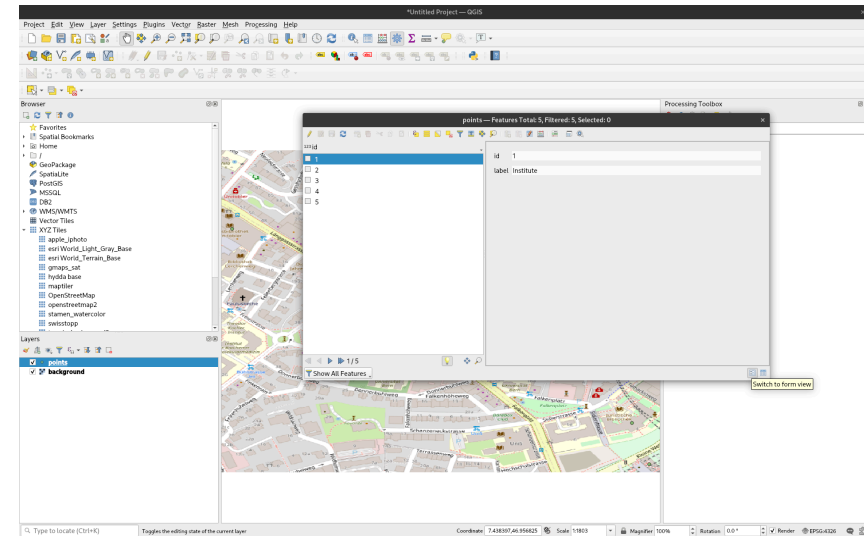


Attribute Table

Table View

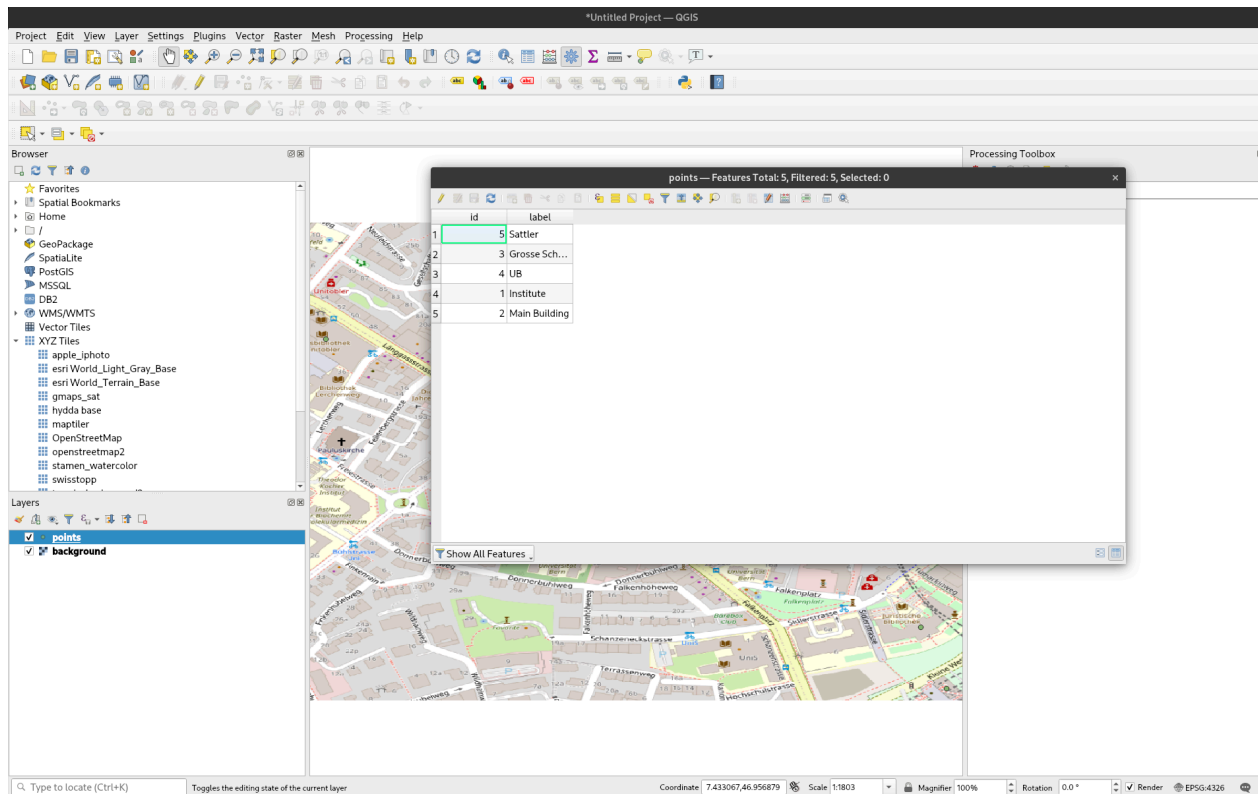


Form View



Shapefiles and Attribute Tables

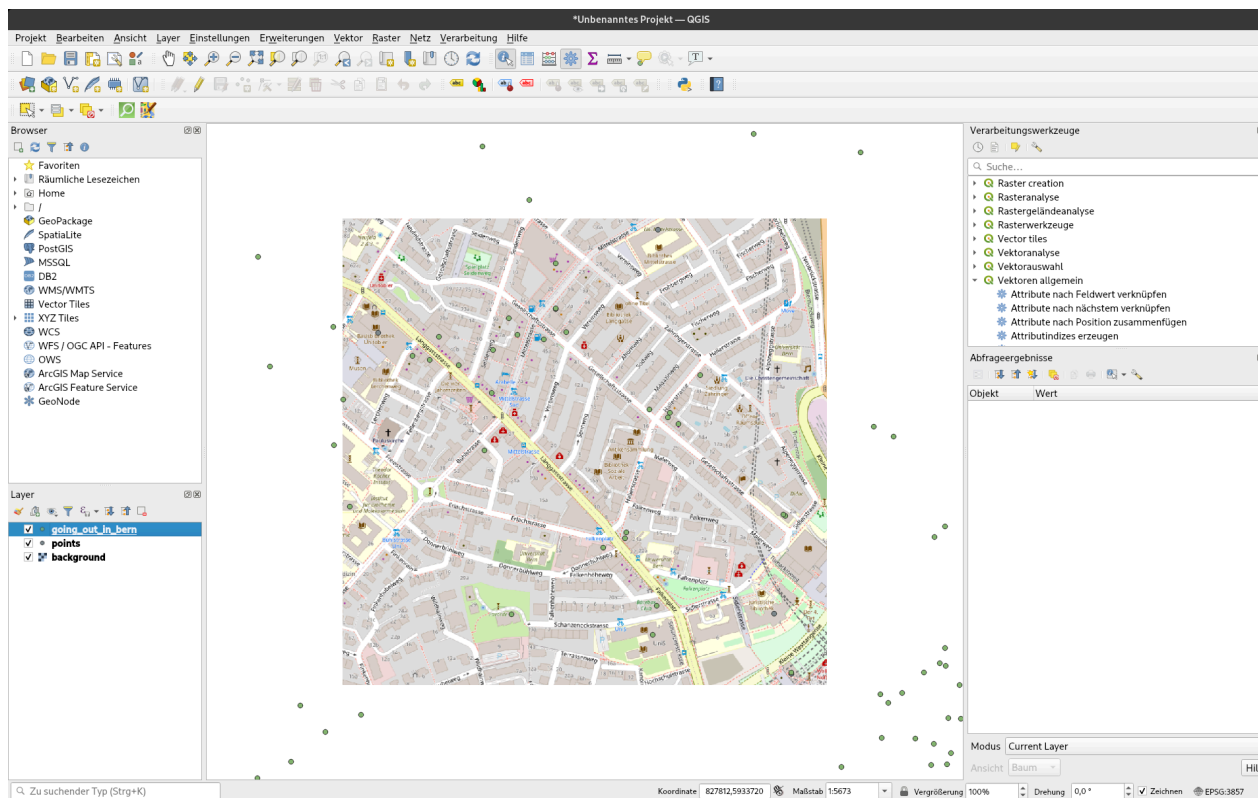
- Column names can only be letters, numbers, and underscores "_"
- Column names can only be ten characters long



Let's add another layer

Going out in Bern

- Download the data to your desktop
- Unzip the file
- Open in QGIS



Going out in Bern

going_out_in_bern — Features Total: 522, Filtered: 522, Selected: 0

	full_id	osm_id	osm_type	amenity	contact_ad	contact_em	contact_fa	contact_ph	name	opening_ho	operator	website	email	phone	alt_name	contact_mo	wheelchair	contact_we	descript
1	n514604437	514604437	node	restaurant	Kasernenst...	info@buen...	NULL	+41 31 3331...	Büner	Mo off, Tu...	Büner Gast...	http://www...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
2	n514604425	514604425	node	restaurant	Kasernenst...	info@resta...	NULL	+41 31 332...	Specht	Mo off, Tu...	Daniel Stet...	http://www...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
3	n537955673	537955673	node	restaurant	Freudenber...	NULL	NULL	NULL	Migros Res...	Mo-Sa 08:0...	Genossens...	https://filia...	NULL	NULL	Migros Res...	NULL	yes	NULL	NULL
4	n537955663	537955663	node	restaurant	NULL	NULL	NULL	+41 31 352...	Strada	Mo-Fr 07:0...	Restaurant ...	NULL	NULL	NULL	NULL	NULL	yes	NULL	NULL
5	n508343505	508343505	node	restaurant	Schwarztor...	info@aeng...	NULL	+41 31 3813...	ängelibeck	Mo-Fr 08:0...	NULL	http://www...	NULL	NULL	ängelibeck ...	NULL	NULL	NULL	NULL
6	n507607982	507607982	node	restaurant	Sonnenhof...	NULL	NULL	+41 31 352...	5 Stagioni	Mo-Sa 11:0...	Vincenzo M...	http://5sta...	NULL	+41 31 352...	NULL	NULL	NULL	NULL	NULL
7	n514596884	514596884	node	restaurant	Spitalacker...	NULL	https://ww...	+41 31 333...	Roseto	NULL	Kaya Demir	http://www...	NULL	NULL	Ristorante ...	NULL	NULL	NULL	NULL
8	n514536836	514536836	node	restaurant	NULL	NULL	NULL	+41 31 9915...	Calabrisella	Tu-Su 09:0...	Hilka Heli...	http://www...	calabrisella...	NULL	NULL	NULL	NULL	NULL	NULL
9	n472439019	472439019	node	restaurant	NULL	NULL	NULL	NULL	Pflaumen G...	NULL	NULL	NULL	NULL	+41 313524...	Restaurant ...	NULL	NULL	NULL	NULL
10	n457113454	457113454	node	restaurant	Monument ...	info@resta...	NULL	+41 31 359...	Schöngrün	Mo-Tu off; ...	NULL	https://ww...	NULL	NULL	Restaurant...	NULL	yes	NULL	NULL
11	n491060929	491060929	node	restaurant	Helvetiapl...	info@stei...	https://ww...	+41 31 3515...	Steinhalle	Mo closed; ...	Lime Conce...	https://ww...	NULL	NULL	Bistro Stein...	NULL	limited	https://stei...	NULL
12	n474362126	474362126	node	restaurant	Thunstrass...	info@pokh...	NULL	+41 31 312...	Pokhara Ne...	Mo 11:30-1...	NULL	http://www...	NULL	+41 31 312...	Pokhara Ne...	NULL	no	NULL	NULL
13	n447293342	447293342	node	restaurant	Zähringerst...	info@seide...	NULL	+41 31 301...	Seidenhof	Mo-Fr 09:0...	Silvana Di C...	http://www...	NULL	NULL	Restaurant ...	NULL	no	NULL	NULL
14	n444434142	444434142	node	restaurant	Schwaneng...	husseini.k...	NULL	+41 31 3114...	Domino	Mo-Th 07:3...	Café Resta...	http://www...	NULL	NULL	Café Resta...	NULL	NULL	NULL	NULL
15	n450670955	450670955	node	restaurant	Turnweg 18...	info@roem...	NULL	+41 31 3310...	Römer	Mo	Alessandro ...	http://www...	NULL	NULL	Ristorante ...	NULL	no	http://www...	NULL
16	n450544536	450544536	node	restaurant	Dammweg ...	kairo@lorr...	NULL	+41 31 330...	Kairo	Mo-Fr 08:3...	NULL	https://ww...	NULL	NULL	Café Kairo	NULL	no	NULL	NULL
17	n587665946	587665946	node	restaurant	NULL	giardino@k...	NULL	+41 31 339...	Giardino	Mo-Su 11:3...	Kongress + ...	http://www...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
18	n583398360	583398360	node	restaurant	Uferweg 4, ...	NULL	NULL	+41 31 332...	Altenberg	Mo-Fr 08:3...	Restaurant ...	NULL	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
19	n598684504	598684504	node	restaurant	Schwaneng...	info@pang...	NULL	+41 31 3116...	Pangäa	Mo-We 09:...	Panimea ...	https://ww...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
20	n598242991	598242991	node	restaurant	Moserstras...	NULL	NULL	+41 31 333...	Del Gusto	NULL	NULL	https://del...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
21	n559232107	559232107	node	restaurant	NULL	info@henri...	NULL	+41 31 307...	Henris	NULL	Genossens...	https://ww...	NULL	NULL	Henris Rest...	NULL	NULL	NULL	NULL
22	n559232004	559232004	node	restaurant	NULL	info@curli...	NULL	+41 31 3319...	Caledonia	NULL	Sportgastr...	http://www...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
23	n559767084	559767084	node	restaurant	Hohgantwe...	NULL	NULL	+41 31 301...	Warteck	Mo-Fr 08:0...	Ramanatha...	NULL	NULL	NULL	Restaurant ...	NULL	limited	NULL	Kegelbahn
24	n559232116	559232116	node	restaurant	NULL	NULL	NULL	NULL	Arena Rest...	NULL	Sportgastr...	http://www...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
25	n550199534	550199534	node	restaurant	Freiestrass...	info@tulsi...	https://ww...	+41 31 508...	tulsi	Mo 11:30-1...	Tulsi GmbH	http://www...	NULL	NULL	Restaurant ...	NULL	limited	http://www...	NULL
26	n547946831	547946831	node	restaurant	NULL	info@camp...	NULL	+41 31 9317...	Campania	Mo-Fr 08:0...	Kathrin Sto...	http://www...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
27	n552765224	552765224	node	restaurant	NULL	NULL	NULL	NULL	Aloha Burger	NULL	NULL	http://www...	NULL	NULL	NULL	NULL	NULL	NULL	NULL
28	n550305631	550305631	node	restaurant	Waldheims...	info@wald...	NULL	+41 31 305...	Waldheim	Tu-Fr 11:00...	NULL	http://www...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
29	n540729997	540729997	node	restaurant	Militärstras...	restaurant...	https://ww...	+41 31 3327...	Lokal	Mo-Tu 9:3...	NULL	http://www...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
30	n540599716	540599716	node	restaurant	Scheibenst...	info@la-do...	NULL	+41 31 3315...	Dolce Vita	Mo-Th 08:...	NULL	http://www...	NULL	NULL	Ristorante ...	NULL	NULL	http://www...	NULL
31	n544581441	544581441	node	restaurant	Galgenfeld...	info@abruz...	https://ww...	+41 31 3310...	Abruzzese	Mo-Fr 10:0...	NULL	http://www...	NULL	NULL	Garage Ha...	NULL	NULL	NULL	NULL
32	n540757176	540757176	node	restaurant	NULL	NULL	NULL	NULL	Migros Res...	Mo-Sa 08:0...	Genossens...	https://filia...	NULL	NULL	Migros Res...	NULL	yes	NULL	NULL
33	n288961804	288961804	node	restaurant	NULL	NULL	NULL	NULL	Zehenderm...	NULL	NULL	http://www...	info@zehe...	+41 31 3015...	Zehendermä...	NULL	yes	NULL	NULL
34	n286879776	286879776	node	restaurant	Gerechtigk...	info@kron...	NULL	+41 31 3121...	Krone	Mo-Fr 09:0...	Krone Bern ...	https://ww...	NULL	NULL	Restaurant ...	NULL	NULL	NULL	NULL
35	n290705146	290705146	node	restaurant	NULL	NULL	NULL	+41 31 992...	Mona Lisa	NULL	NULL	NULL	NULL	NULL	Restaurant ...	NULL	no	NULL	NULL
36	n290704798	290704798	node	restaurant	NULL	NULL	NULL	+41 31 992...	Drei Köpfe	Mo, Fr 09:0...	Tre Pa GmbH	https://www...	NULL	NULL	Ristorante ...	NULL	NULL	NULL	NULL

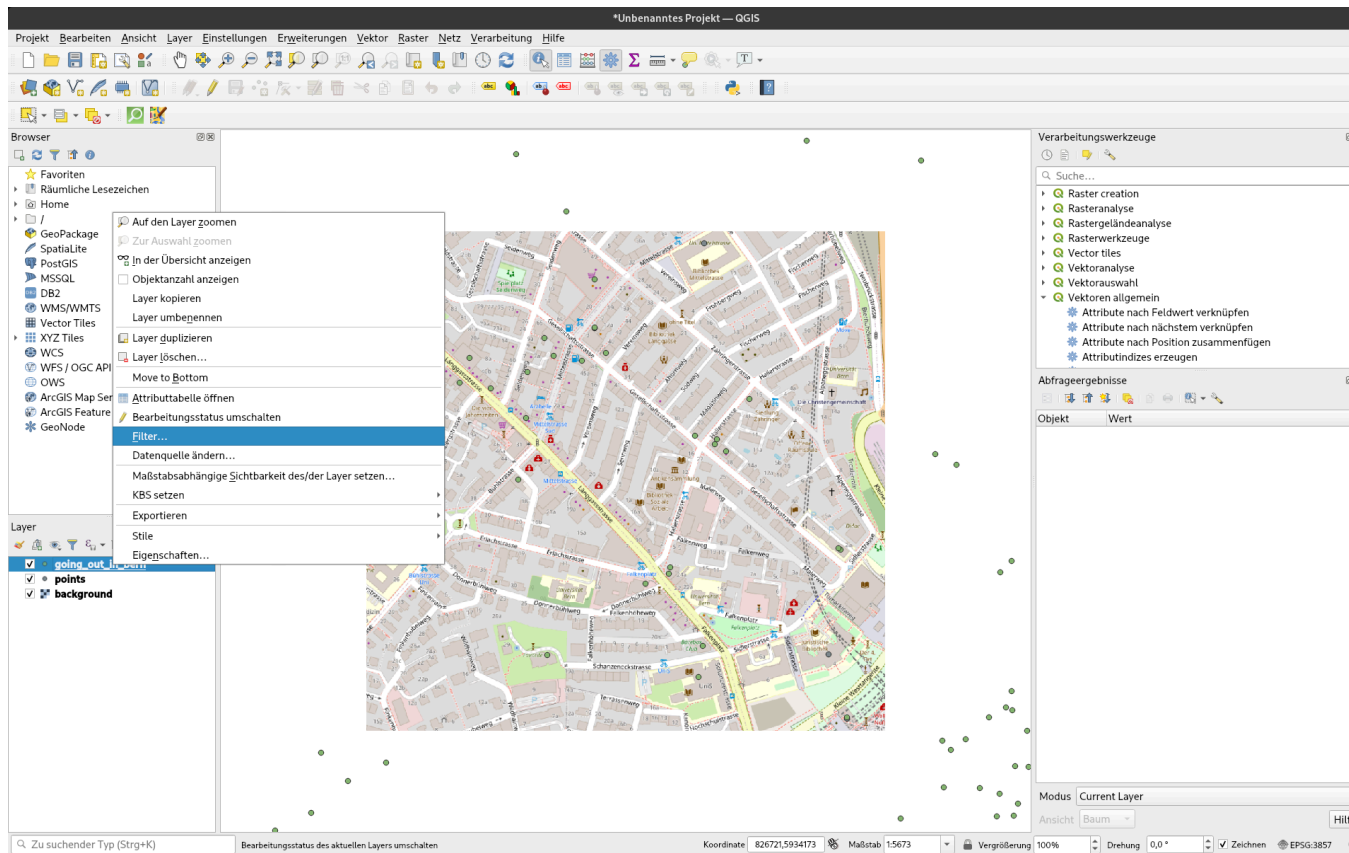
Alle Objekte anzeigen

Filter and Query

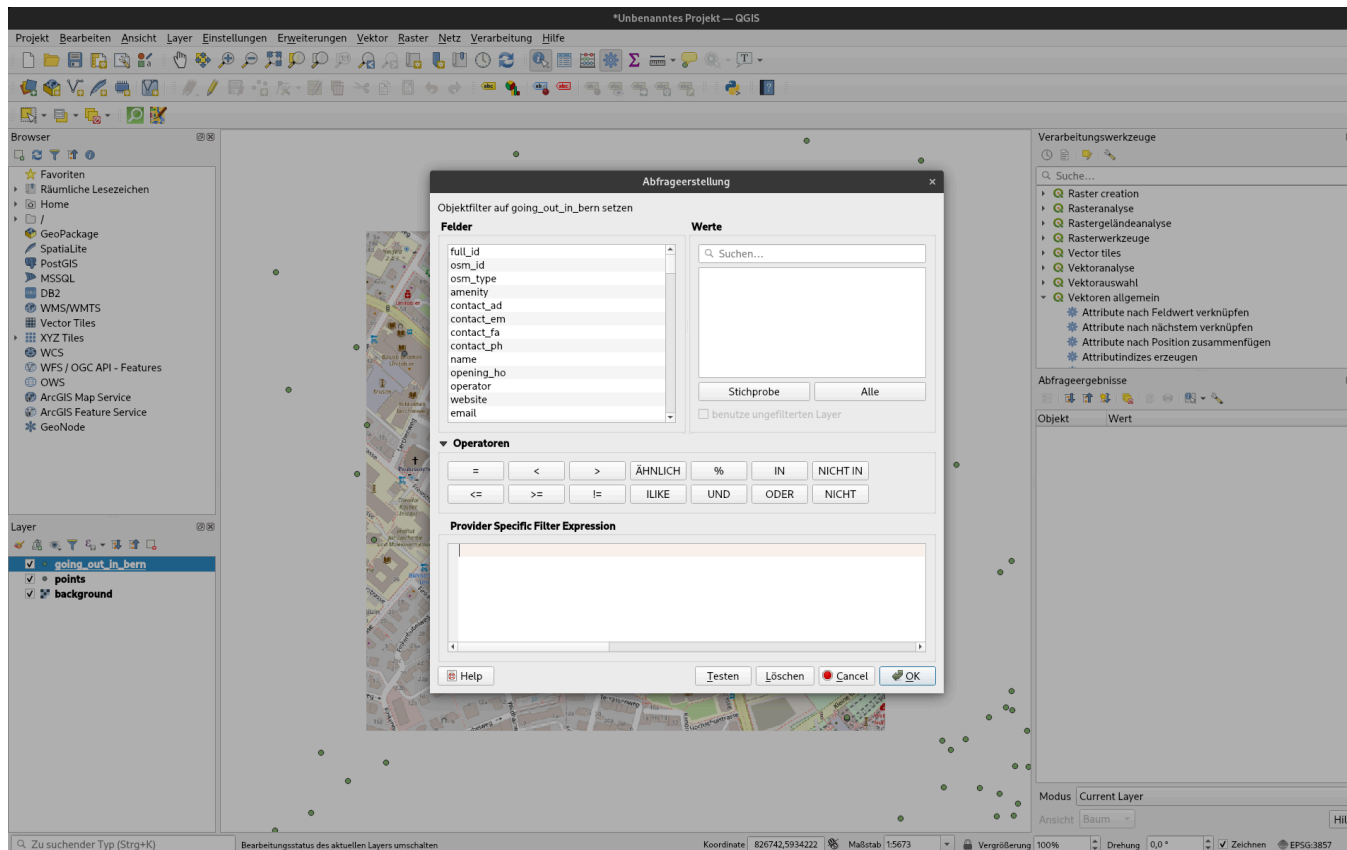
- We can filter the points based on the values in the attribute table

Filter and Query

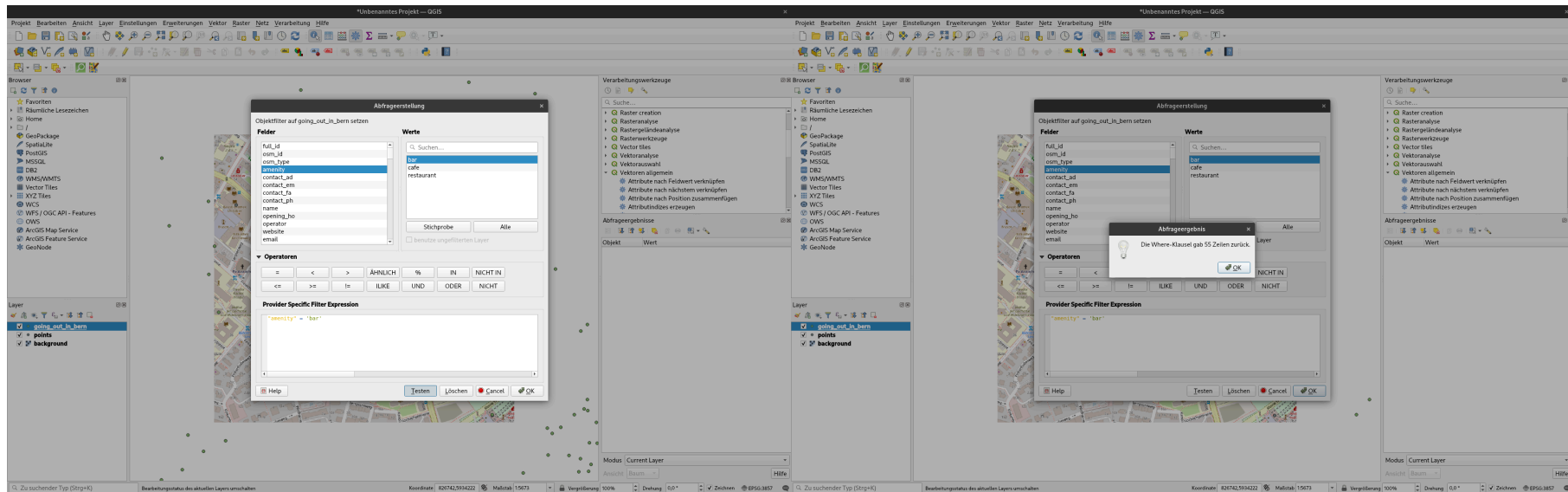
- Right-click on the layer and select "Filter" to open the Query Builder



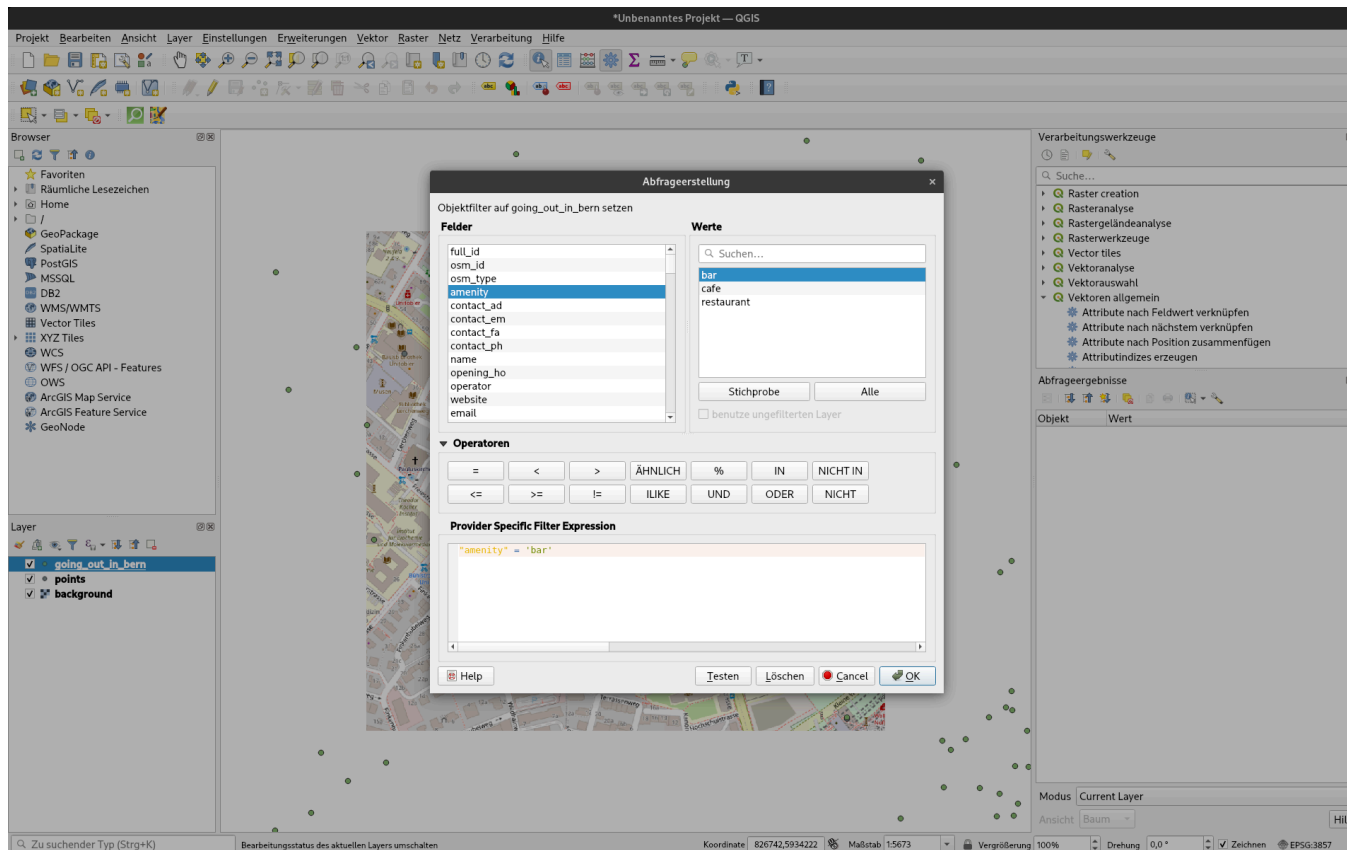
Filter and Query



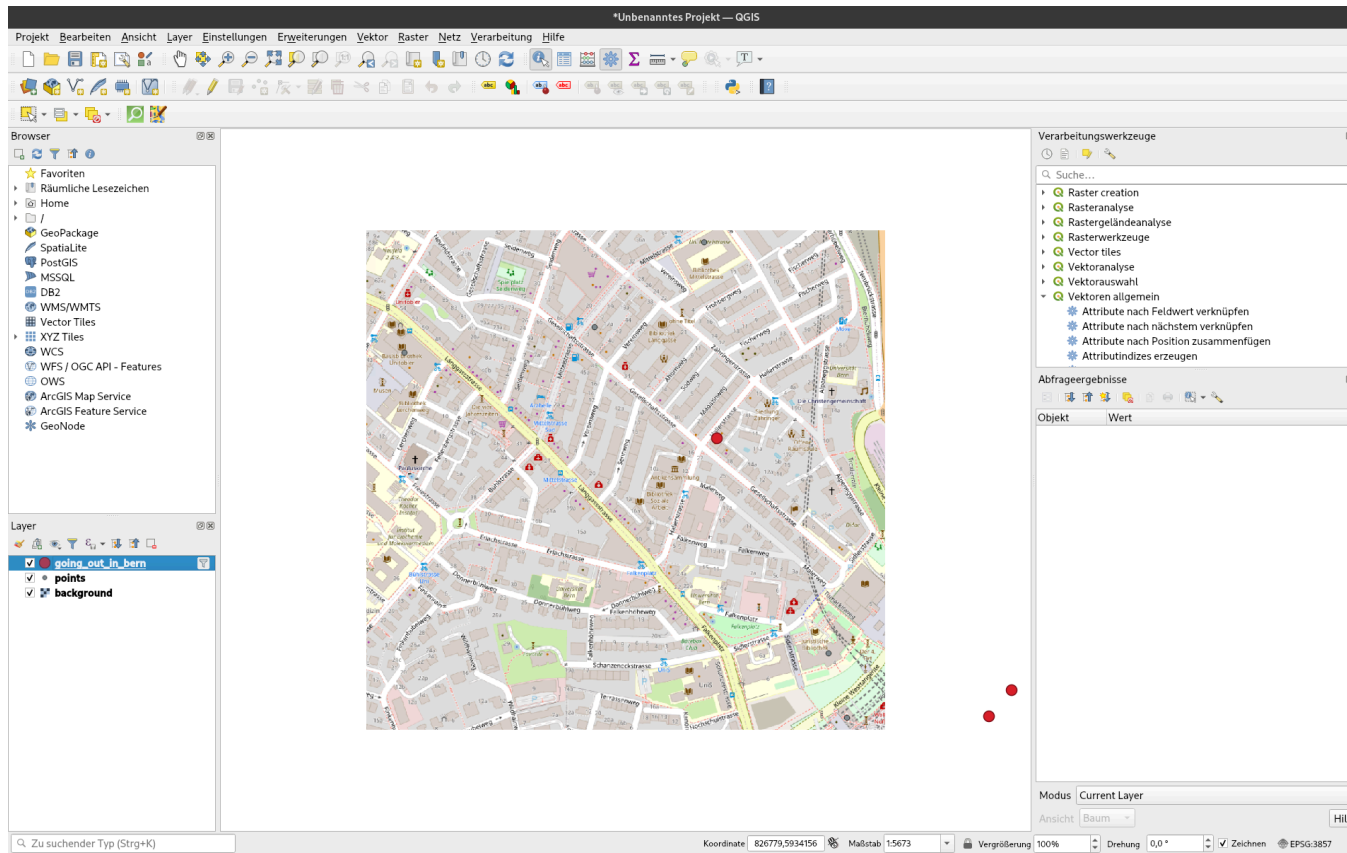
Filter and Query



Filter and Query

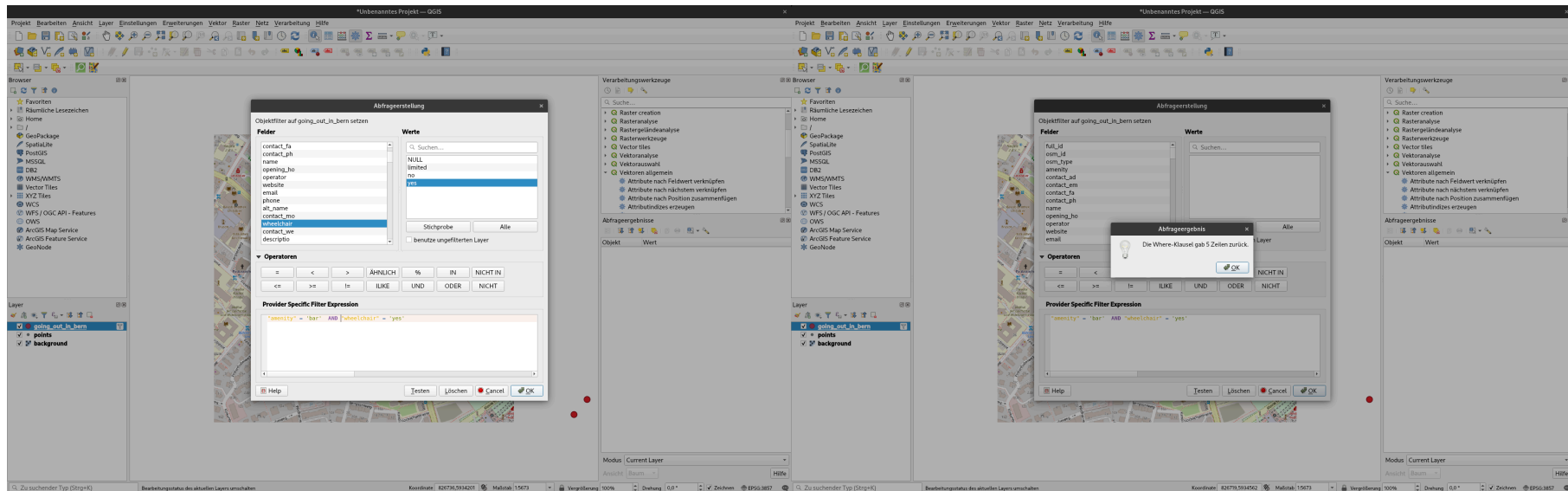


Filter and Query

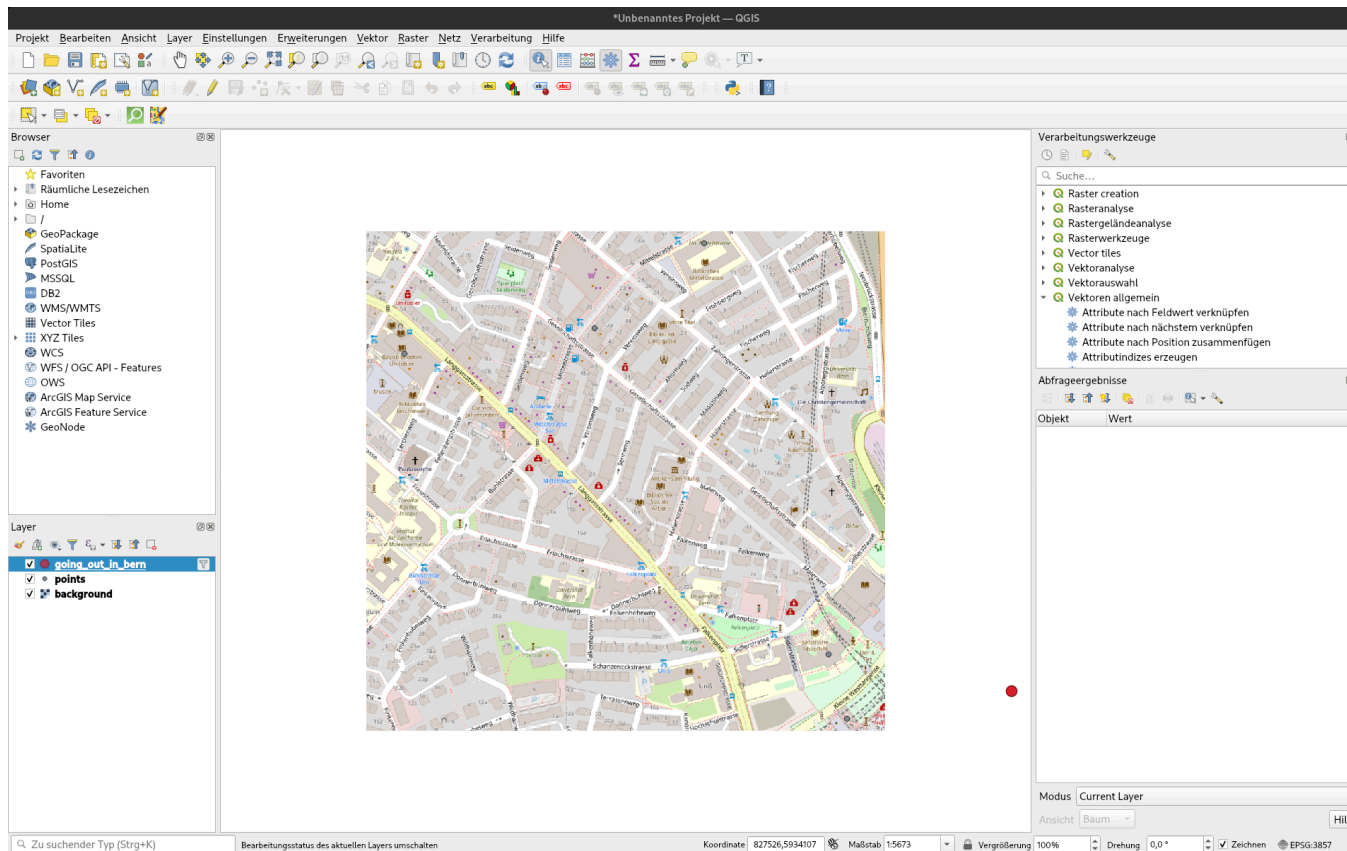


We can also filter by multiple conditions

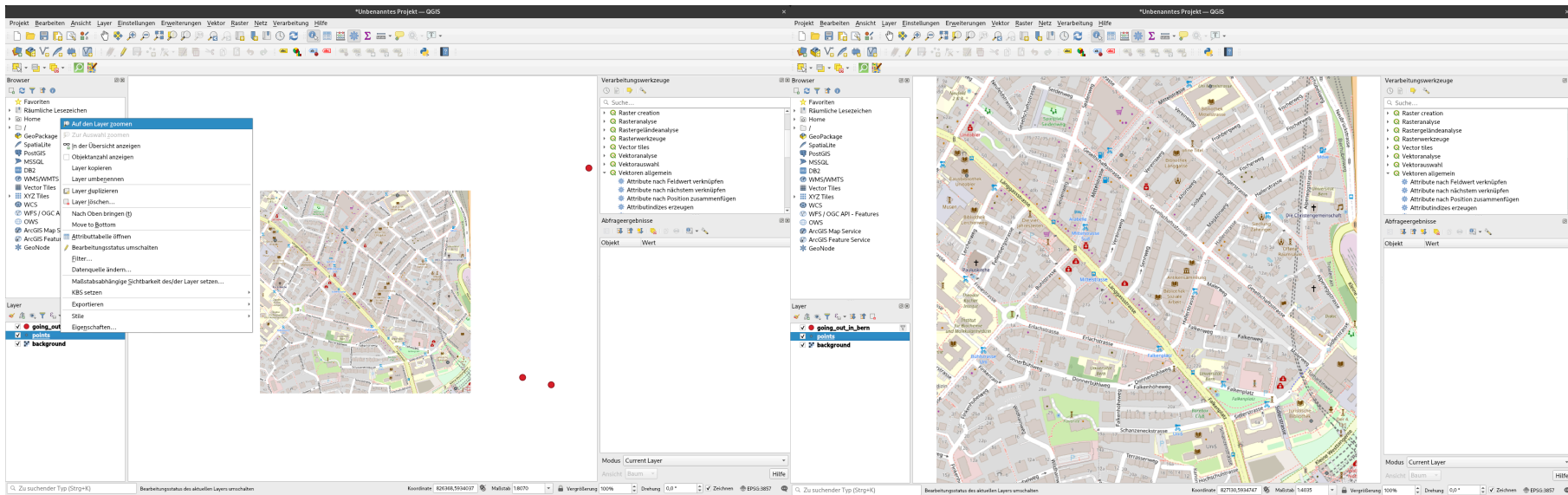
Filter and Query - Multiple Conditions



Filter and Query - Multiple Conditions



Zoom to Layer



Zoom Selection

- Select the zoom on the toolbar



- Draw a box around the area you want to zoom into
- Click the icon to return to the previous map extent

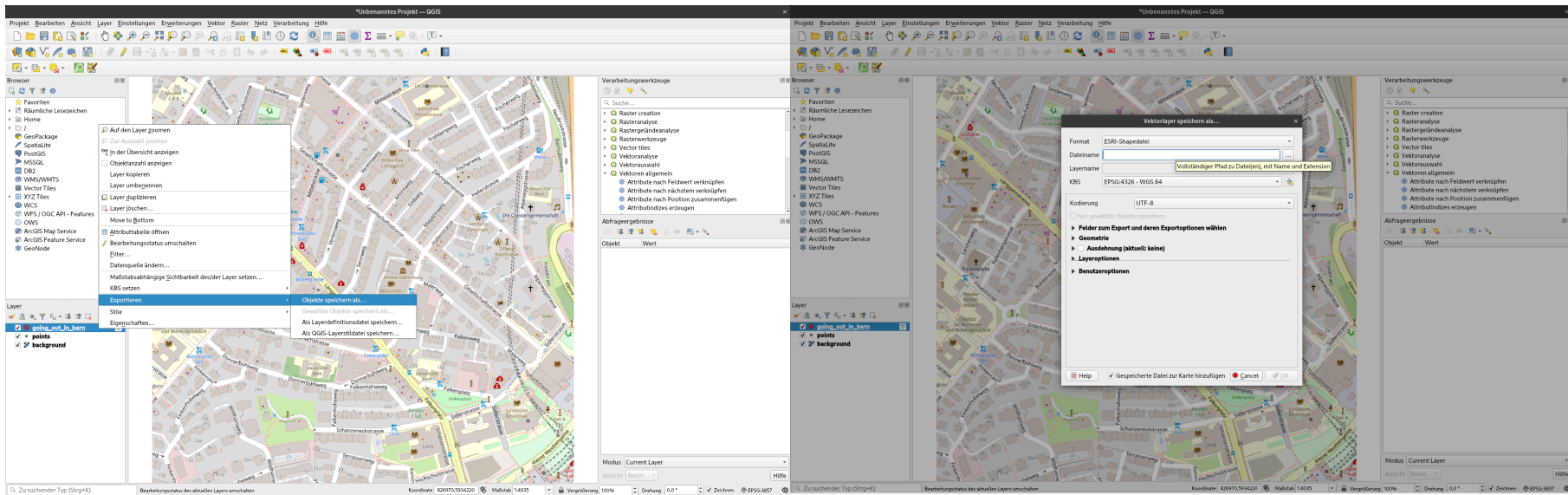


Pan Map

- Select the hand tool to pan around the map



Exporting Data



Your Turn

- Filter according to your own criteria
- Try and find something interesting
- Change the style of the point, either to a different shape, color, or icon
- Export your selection as a new shapefile

CSV-Files

- General (textbased) spreadsheet format
- simple and robust
- human readable (kind of)

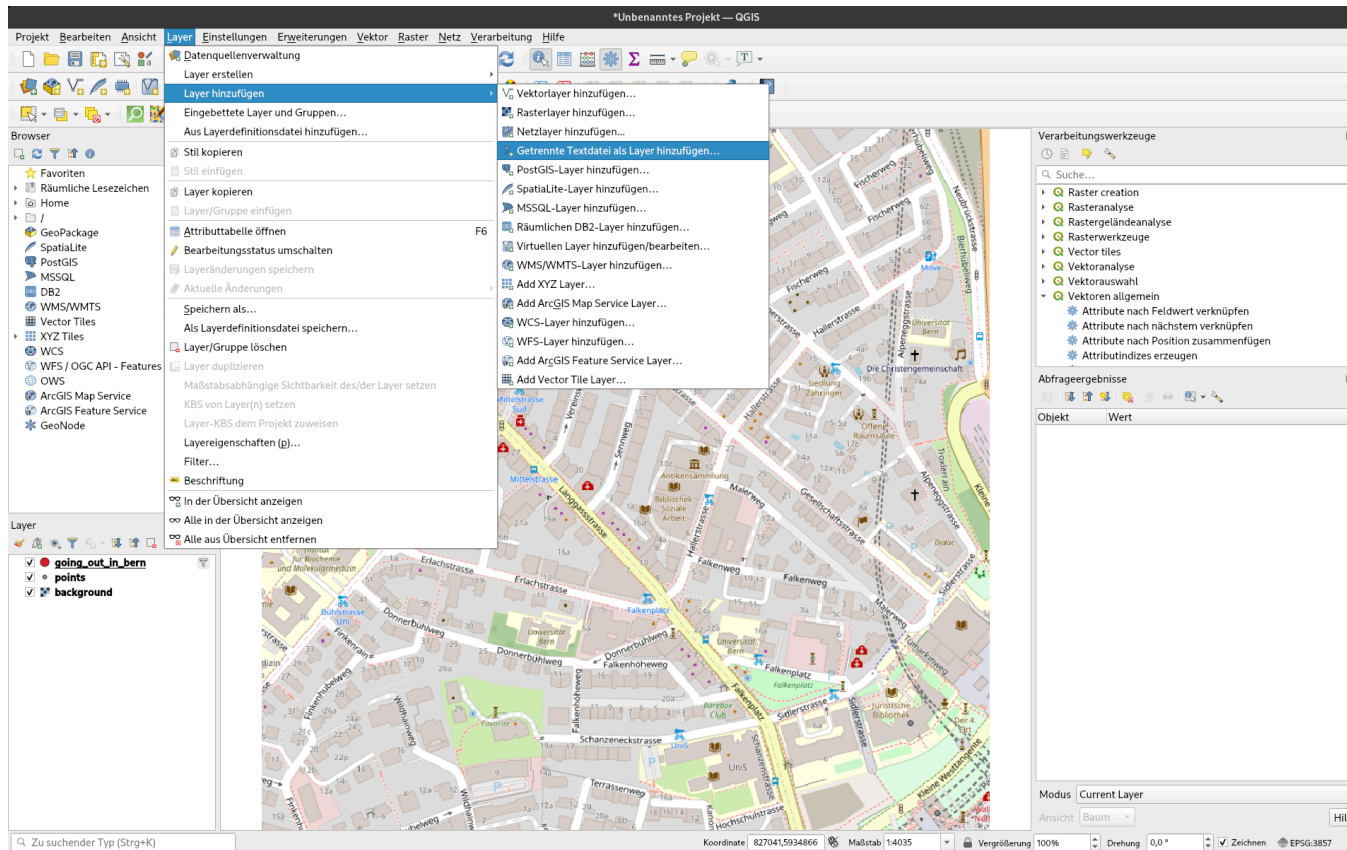
CSV-Files

- Perfect for data exchange between Spreadsheet (Excel) and GIS

The image shows a CSV file named 'bicycle_rent.csv' being viewed in a spreadsheet application. The data is organized into columns with headers: 'id', 'name', 'address', 'opening_hours', 'operator', 'website', 'description', 'layer', 'location', 'contactwebsite', 'kids', 'source', 'name_alt', and 'name'. The rows contain specific data for various bicycle rental stations, such as 'Musterstrasse Velohaupstadt', 'Fahrradstrasse Velohaupstadt', and 'Mittelstrasse Velohaupstadt'. The interface includes a menu bar, a toolbar, and a status bar at the bottom.

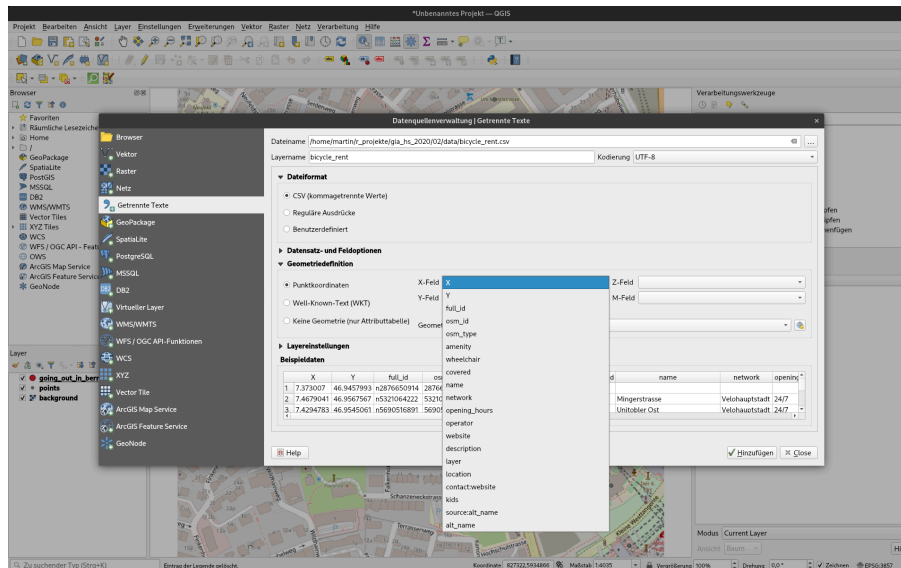
CSV Import - Bicycle Rental

Load Text Layer



CSV Import - Bicycle Rental

Set coordinate columns

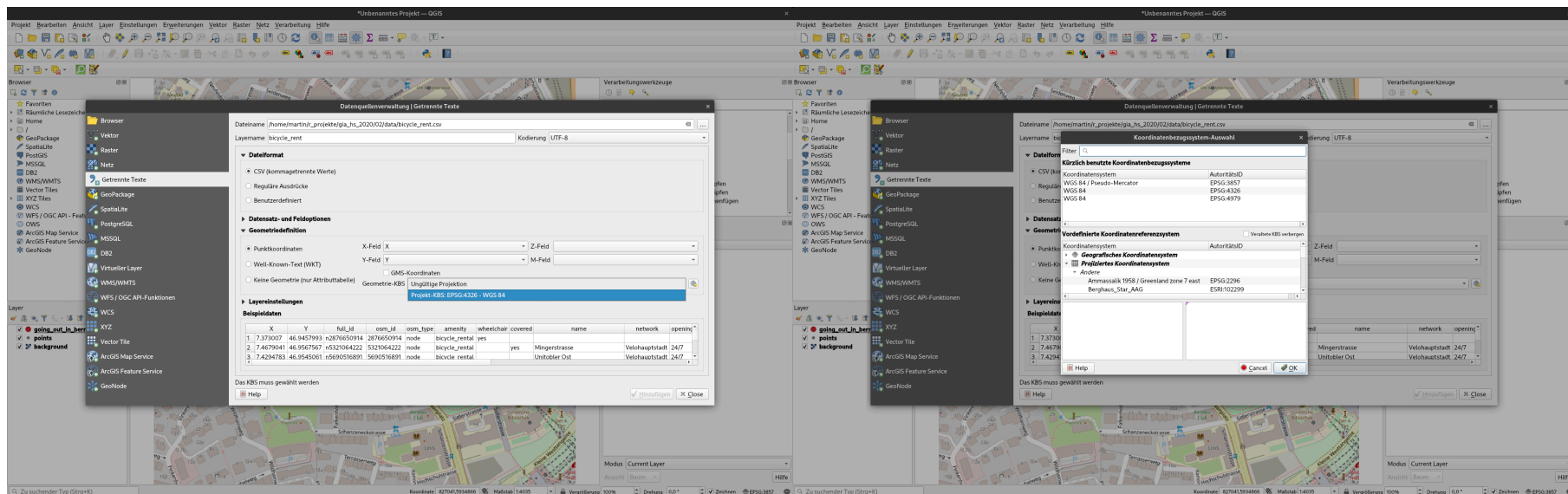


CSV Import - Bicycle Rental

Set coordinate columns

and Coordinate Reference System <- We will explain this in a bit!

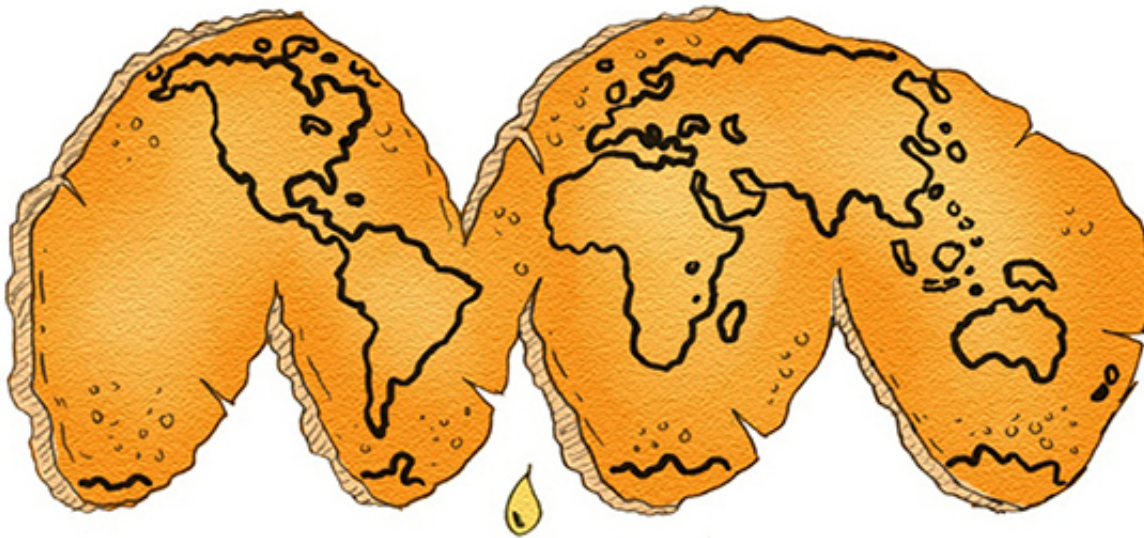
You can also access more detailed Coordinate Reference settings.



So what is a Coordinate Reference System?

Projections

- No one's favorite part of GIS
- But a necessary part of it nonetheless
- Convert points on the 3-dimensional Earth (**latitude** and **longitude**) to x and y coordinates on a 2-dimensional map



Digital Coast Geozone

Projections

- Every projection distorts some part of your map

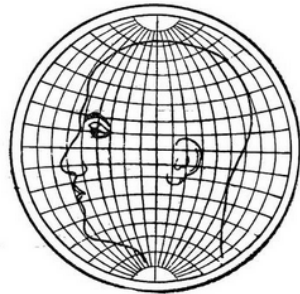


FIG. 42.—Man's head drawn on globular projection.

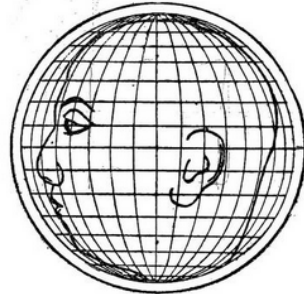


FIG. 43.—Man's head plotted on orthographic projection.

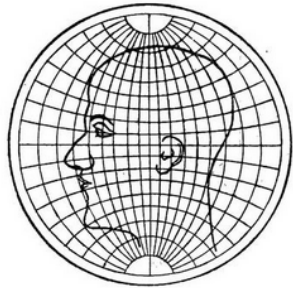


FIG. 44.—Man's head plotted on stereographic projection.

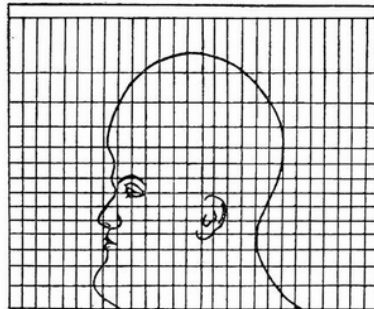
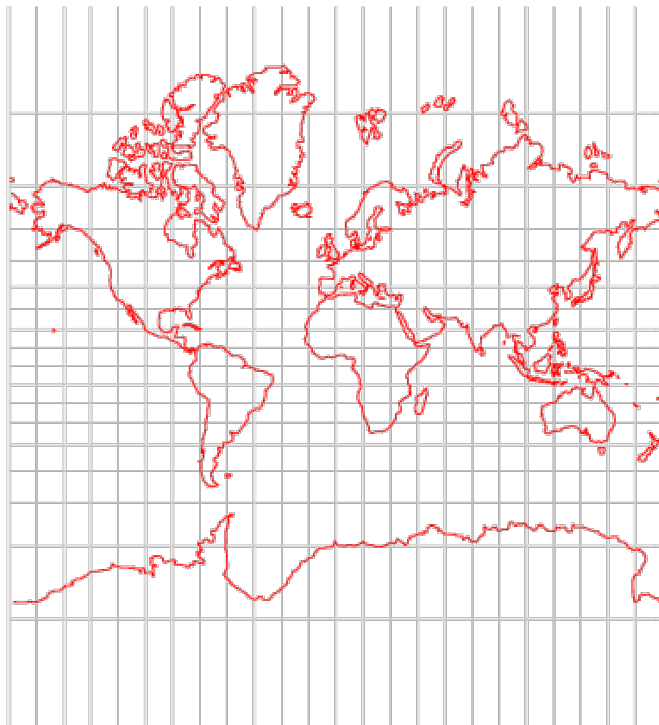


FIG. 45.—Man's head plotted on Mercator projection.

FlowingData

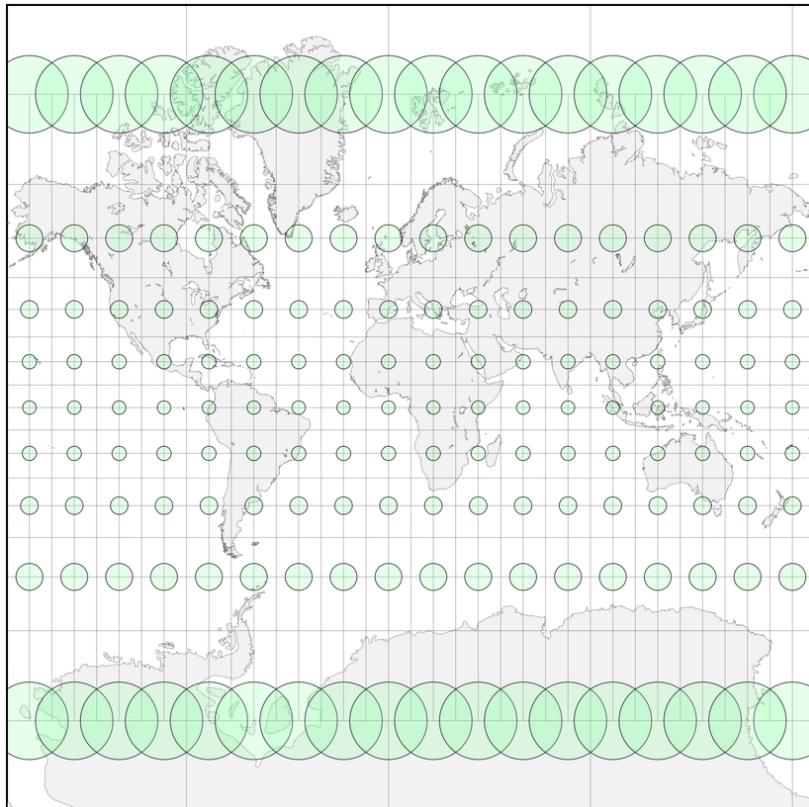
Mercator Projections

- A common map projection
- Makes geometries near poles look bigger than geometries near the equator



Projections Matter

- These circles are all the same size on the globe:

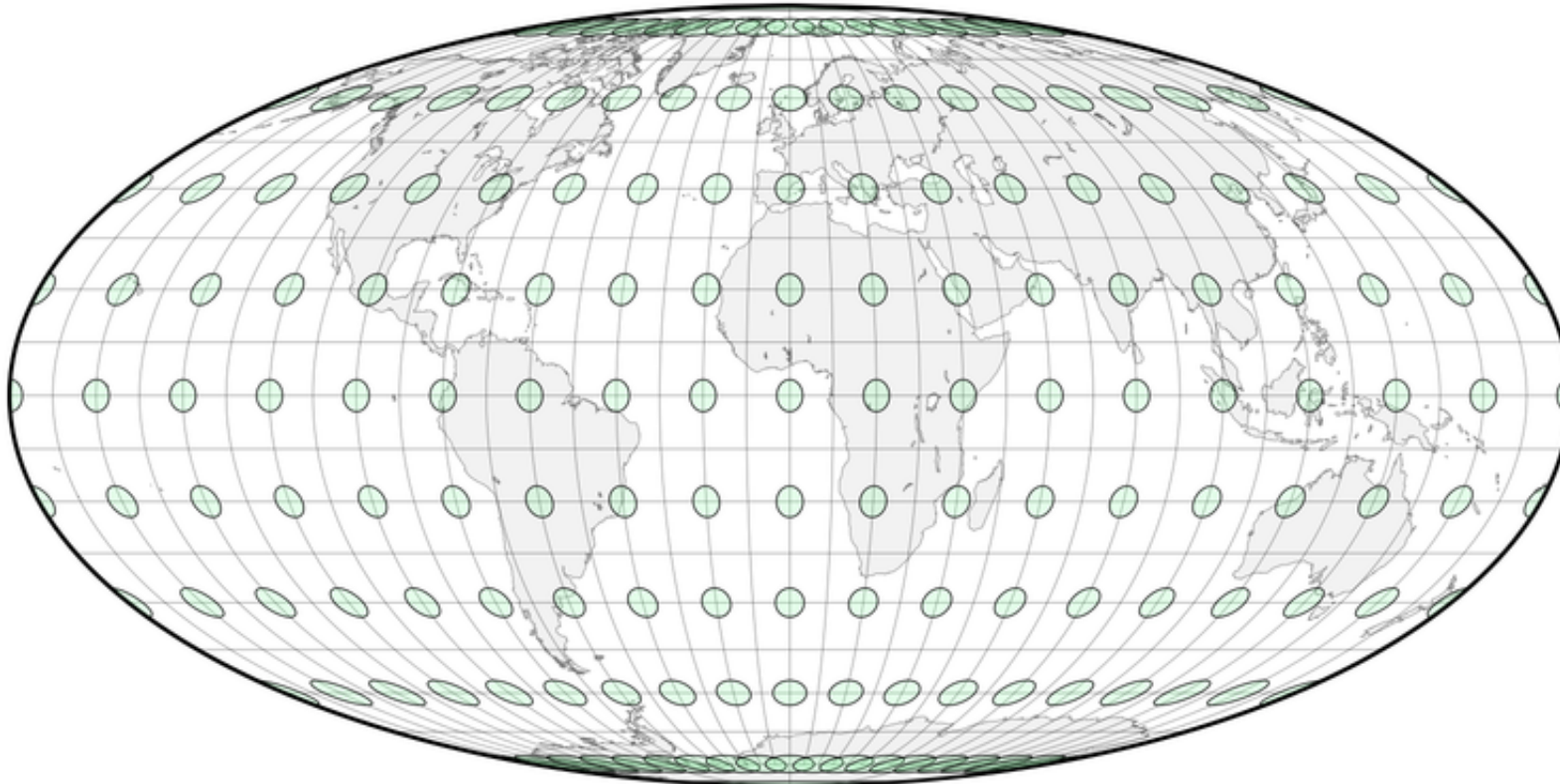


Progonos

- Conformal map projection (Winkeltreu)

Projections Matter

- As are these:

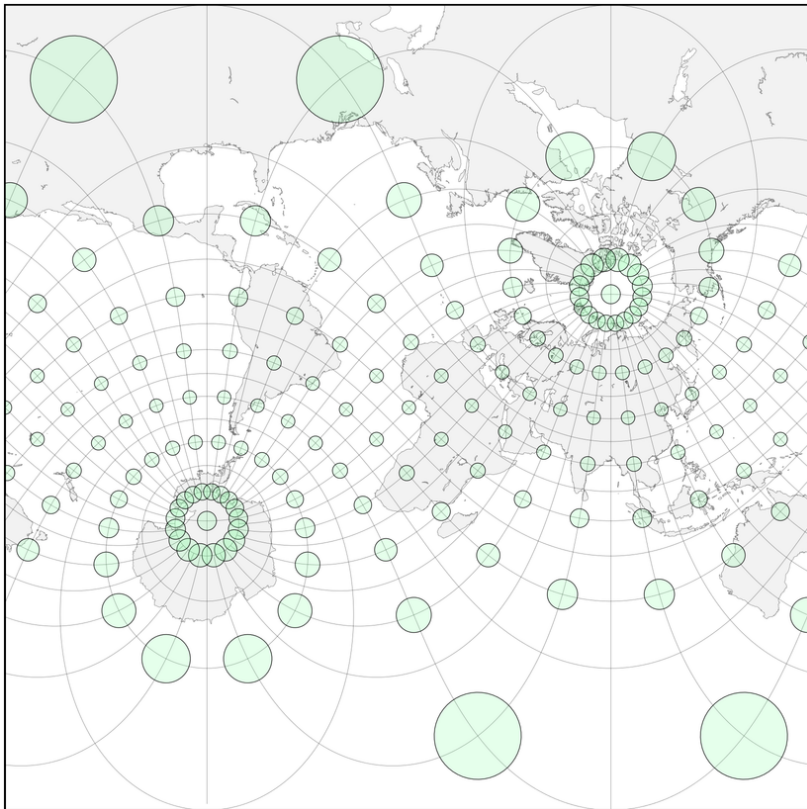


Progonos

- Equal-area projection (Flächentreu)

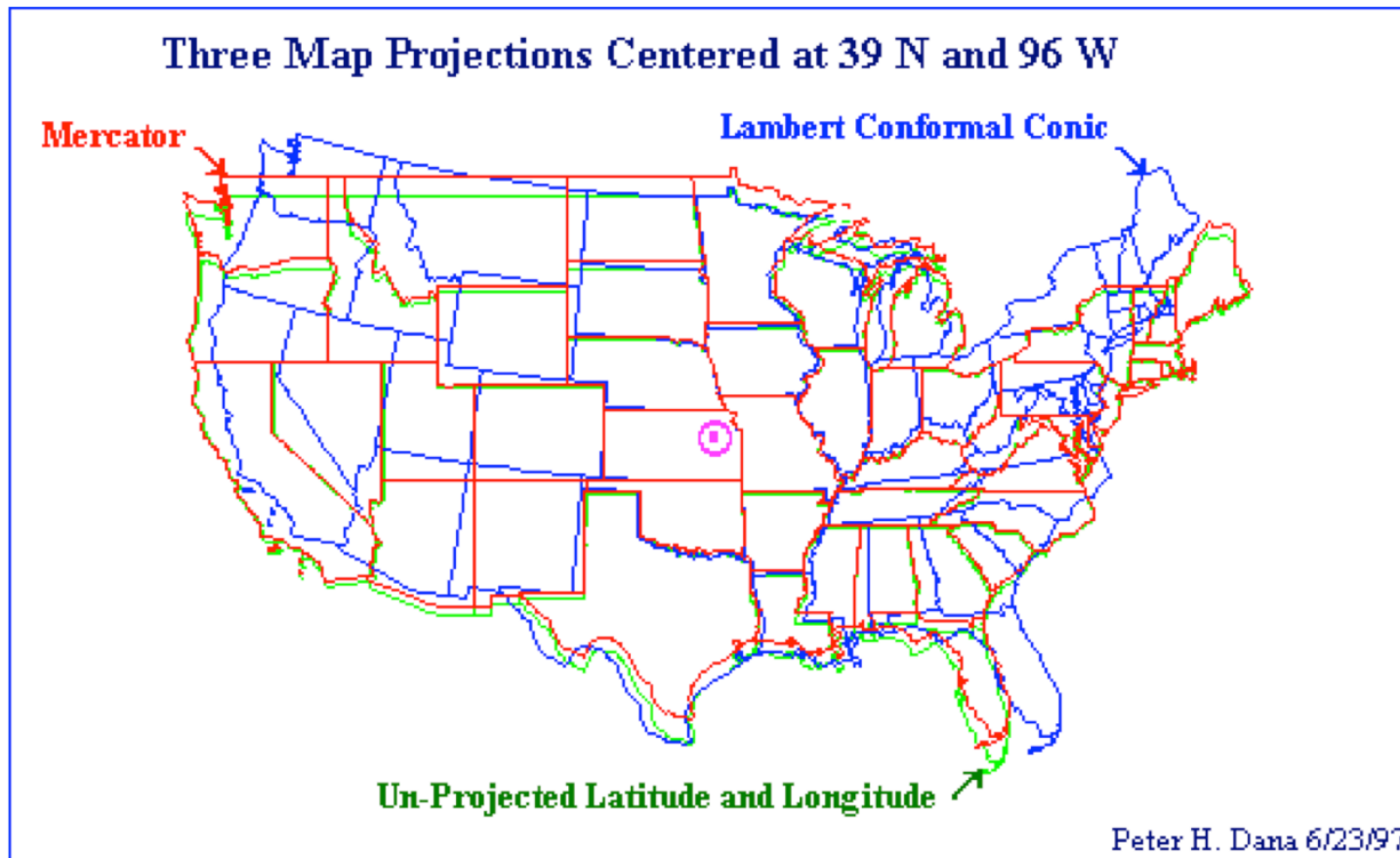
Projections Matter

- And these:



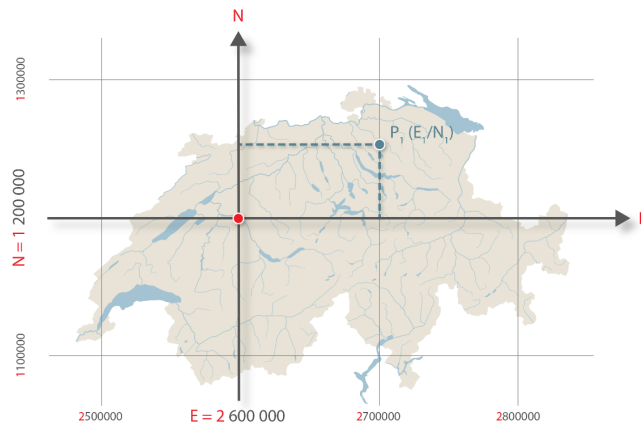
Progonos

Projections Matter



Projections

- For the most part we will work in **WGS 84** (latitude and longitude)
- In Switzerland, we use a more accurate projection **CHTRS95: Swiss Terrestrial Reference System 1995** that is identical with the european system **ETRS89**.
- You might also find 'Schweizer Landeskoordinaten' (CH1903) or Landesvermessung 1903 (LV03)



Source: <https://www.swisstopo.admin.ch/de/wissen-fakten/geodaesie-vermessung/bezugsrahmen/lokal/lv95.html>

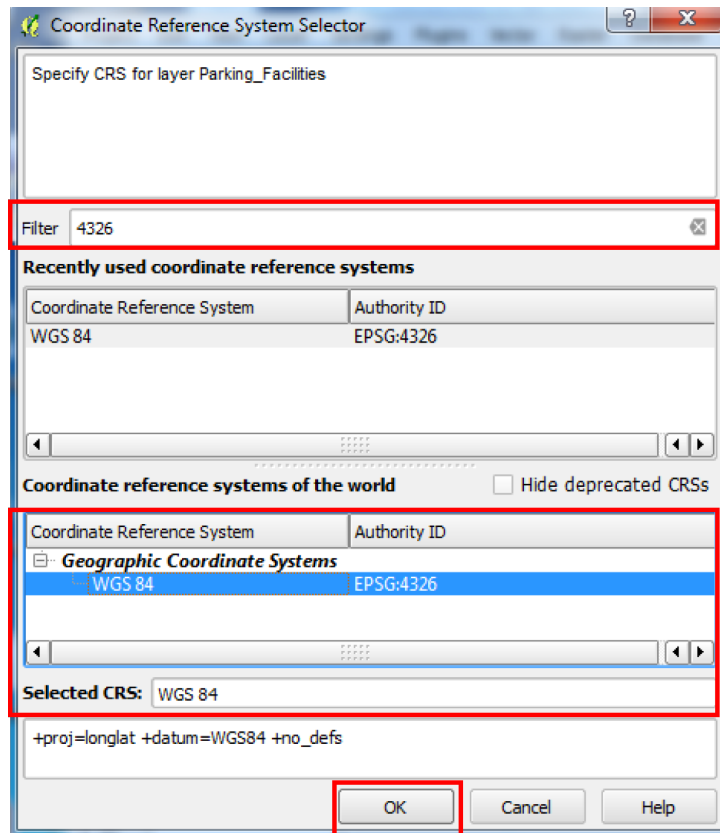
Projections

- Identified by unique IDs (**EPSG**) that make it easier to talk about them
- EPSG: European Petroleum Survey Group Geodesy (it was introduced, because Oil companies were annoyed by the incredible number of different systems)
- WGS 84 is referred to as **EPSG:4326**
- Google Maps and other online sources often uses WGS 84 / Pseudo-Mercator (**EPSG:3857**)
- CHTRS95 is referred to as **EPSG:2056**

Remember these three and you should be set

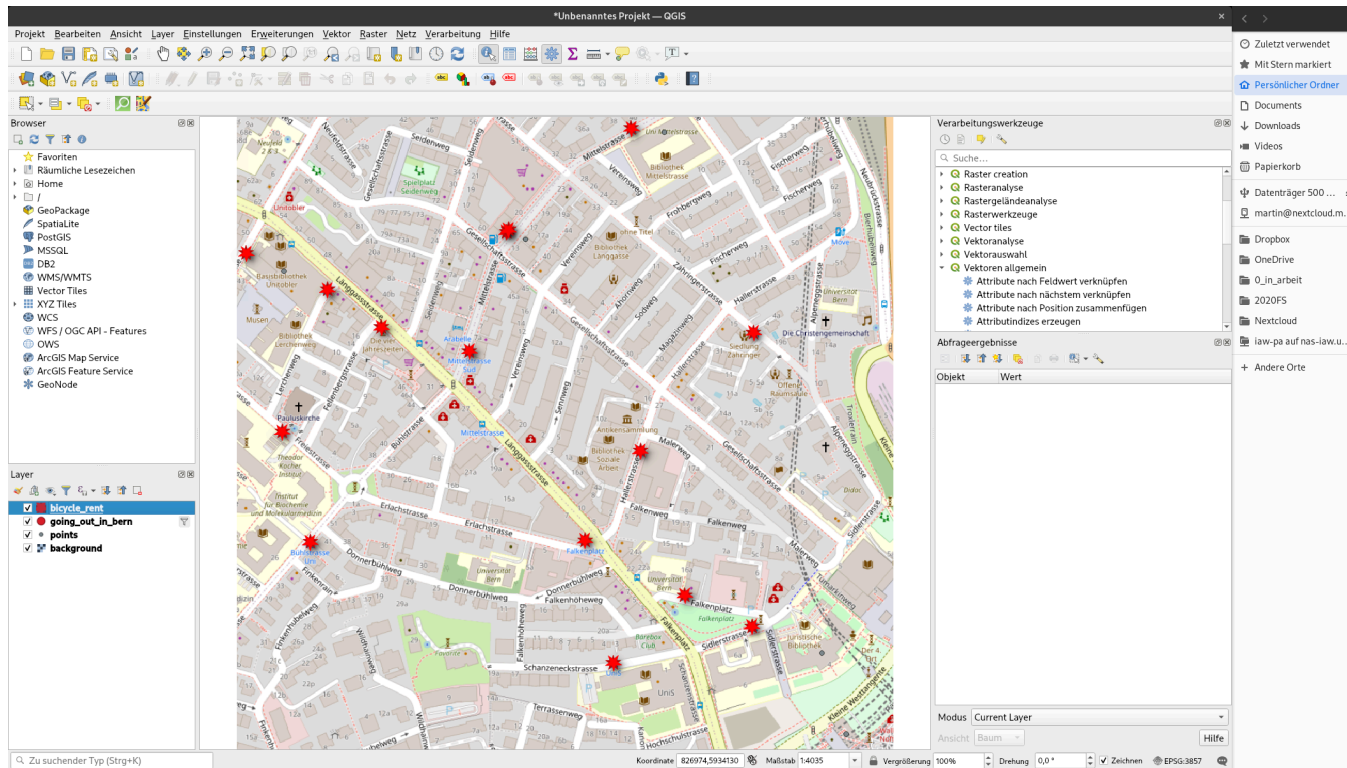
Back to Adding CSV Data

Adding CSV Data



CSV Import - Bicycle Rental

Bicycles added.



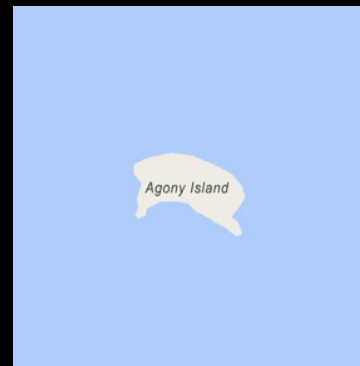
What We've Covered

- Adding, styling, and labeling data in QGIS
- Projections
- Querying features

Homework

- Add the files you can download from the homework page to QGIS (note: the projection epsg is in the filename)
 - background_4326.tif
 - cities_2056.csv
 - lakes_3857.gpkg
- Style as you like
- Send me a screenshot

Any questions?



You might find the course material (including the presentations) at

<https://github.com/BernCoDALab/gia>

You can see the rendered presentations at

<https://berncodalab.github.io/gia>

You can contact me at

martin.hinz@unibe.ch

Source: <https://www.instagram.com/sadtopographies>