Creating a simple map with QGIS

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Sources: (Partly) based on the EAMENA-CPF tutorial 'GIS 1', with added information from the QGIS Training Manual and QGIS Tutorials. Updated after useful comments by the first people to take this current tutorial on 25 June 2025.
Version date: 2 July 2025
Duration: ca 1 hour to work through the tutorial without the optional sections + extra time for exploring everything in detail and perfecting your map

QGIS is a free, open-source Geographic Information System. It has a lot of functionalities. In this tutorial we are merely focusing on making a simple map, for example to add to a publication to show where your study places or areas are. For more information on other QGIS functionalities, there are many resources out there such as the QGIS Training Manual, the website QGIS Tutorials, and the tutorials of the EAMENA-CPF project (where you can also find a more extensive version of this current tutorial).

1. QGIS software

You can download QGIS from here: https://qgis.org/download/. This tutorial focuses on a recent version of QGIS 3, and is relevant to all versions of QGIS 3. The screenshots come from the version 3.34.10-Prizren.

Note for those affiliated to Leiden University: If you have a Leiden University-managed laptop, you cannot install the software yourself. Instead, you will need to apply for it through the IT helpdesk portal.

2. Preparing your data

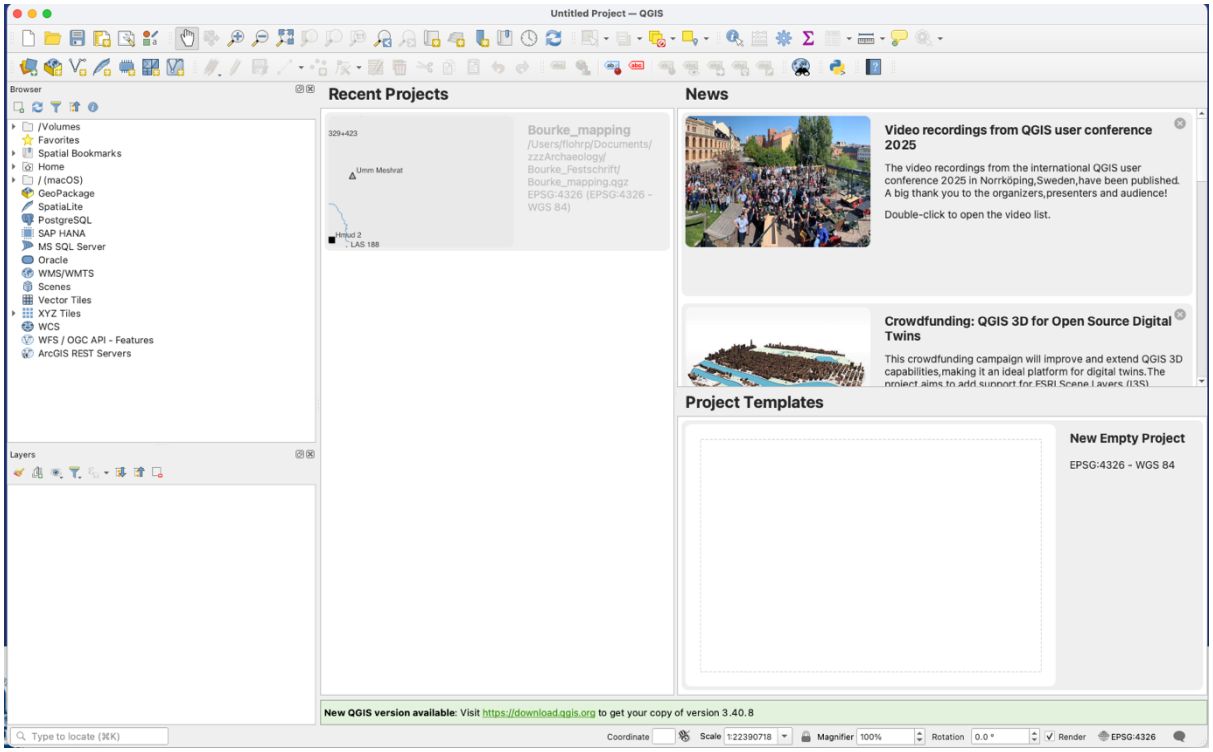
While it is possible to add points or polygons for places in QGIS directly, we follow the assumption that you are wanting to make a map of a set of known places, and for the purpose of this tutorial we will focus on point data. The simplest way is to have a CSV file with at least three columns: place name, X (or E), Y (or N). The coordinates should be in decimal degrees.

We are using the same dataset as for the Leaflet tutorial, paris_museums.csv, shown below and available from the CDS GitHub, but you can choose another CSV dataset if you like.

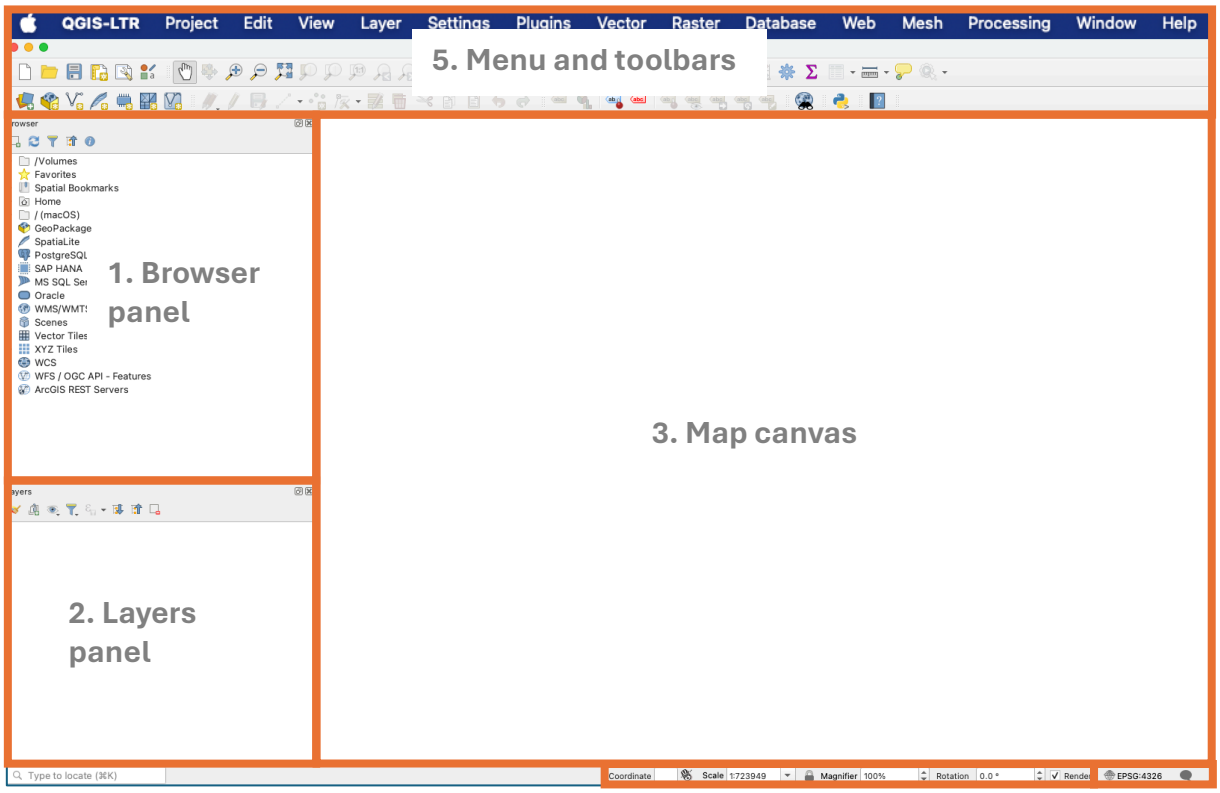
```
latitude, longitude, description
48.860565, 2.33759393, Louvre Museum
48.860032, 2.3265808, Musée d'Orsay
48.85514, 2.31592704, Musée Rodin
48.8608258, 2.35274729, Centre Pompidou
```

3. Getting to know the QGIS interface

If it is the first time you are using QGIS, take some time to familiarize yourself with its layout. It may look somewhat different in your screen, but you will see something like this:



Before navigating further, it is useful to make a new project, by going to Project – New at the top left.



Here you see the following elements:

1. Browser panel: You can use this to navigate through your QGIS database.
2. Layers panel: All the layers in the project. Right-clicking will give you a menu with options.
3. Map canvas: This is where the working map itself will be displayed (but not the print version).
4. Status bar: Information about the current map.
5. Menu and toolbars
6. CRS button: Coordinate Reference System button, you can change here how the data is projected.

4. Saving your project

Before continuing, it is a good idea to save your “Untitled Project”. It is best to use a dedicated folder, as you may end up with a lot of files within one project.

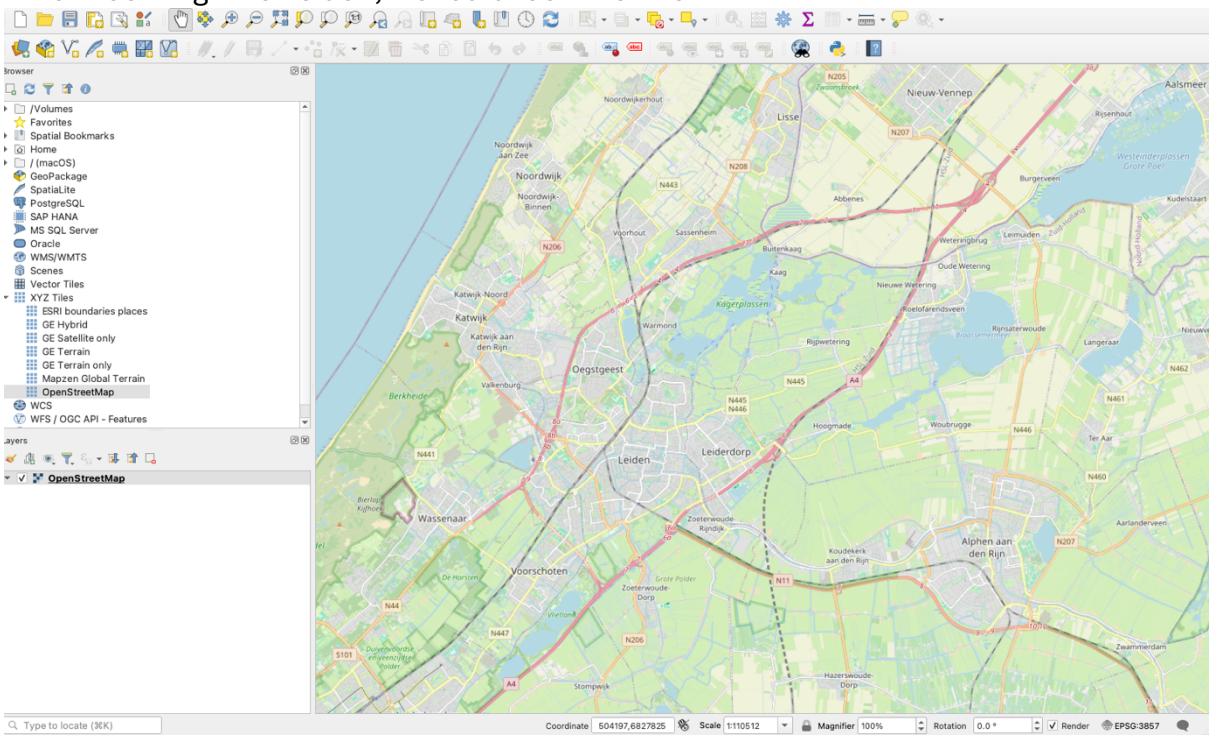
5. Adding basemaps to QGIS

If it is the first time you are using QGIS, you will need to add basemaps to use. There are two different ways: adding basemaps links through XYZ tiles (option 1 below) or using a plugin (option 2 below). While using a plugin is probably the most straightforward and gives you many options, it is good to be aware of how to add the links to your database in case a plugin does not work properly.

Option 1: Adding links to XYZ tiles

- In the browser panel, find and expand “XYZ Tiles”
- If you see “OpenStreetMap”, double-click on it. This will add the open-source dataset OpenStreetMap basemap layer to the Layers Panel and the Map View.

When zooming in to Leiden, it should look like this:



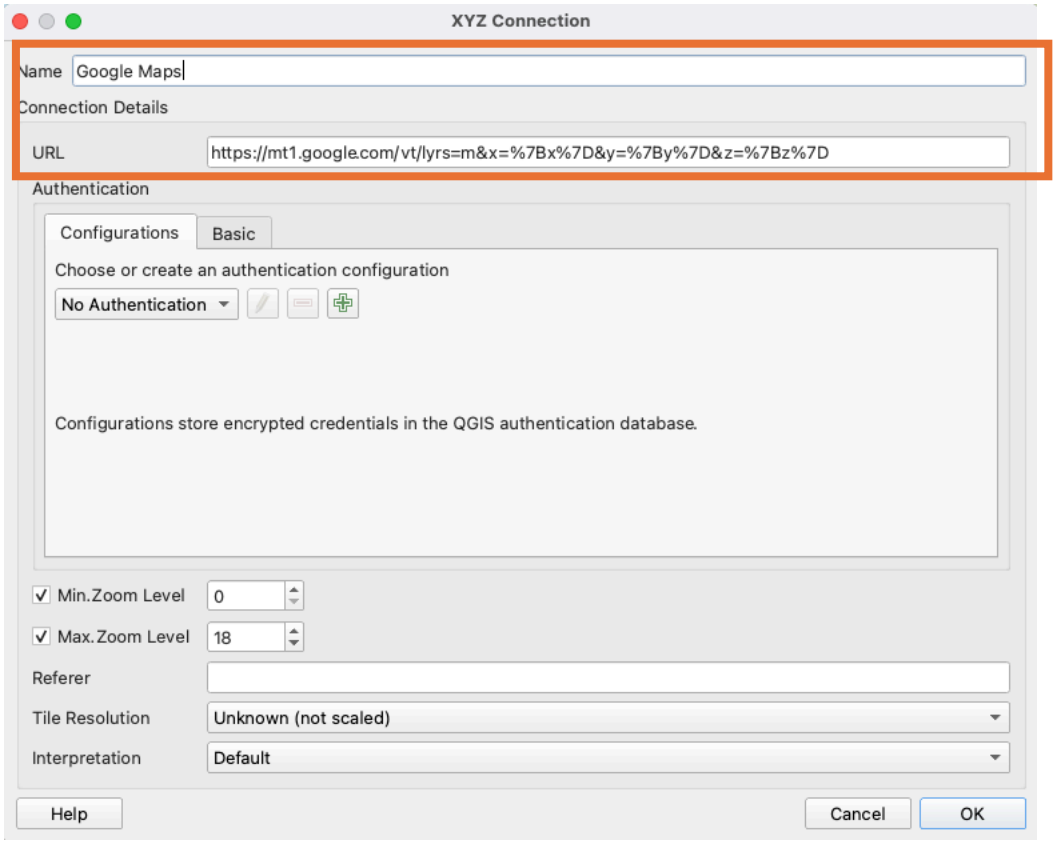
As well as OpenStreetMap, or if you do not have it by default, you can add other basemaps depending on what sort of background you want to use.

- Right-click on “XYZ Tiles” and select “New connection…”
- From the list below, choose the basemap you want, and copy-paste the “Name” and “URL” details into the XYZ connection window and click OK.

Google Maps: https://mt1.google.com/vt/lyrs=m&x=%7Bx%7D&y=%7By%7D&z=%7Bz%7D
Google Earth Satellite: http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}
Google Earth Hybrid: http://mt0.google.com/vt/lyrs=p&hl=en&x={x}&y={y}&z={z}
Google Earth Terrain Hybrid: http://mt0.google.com/vt/lyrs=p&hl=en&x={x}&y={y}&z={z}
Google Earth Terrain: http://mt0.google.com/vt/lyrs=t&hl=en&x={x}&y={y}&z={z}

ESRI Topo World:
http://services.arcgisonline.com/ArcGIS/rest/services/World_Topo_Map/MapServer/tile/%7Bz%7D/%7By%7D/%7Bx%7D
Esri Satellite:
https://server.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile/%7Bz%7D/%7By%7D/%7Bx%7D
Esri Standard:
https://server.arcgisonline.com/ArcGIS/rest/services/World_Street_Map/MapServer/tile/%7Bz%7D/%7By%7D/%7Bx%7D
Esri Terrain:
https://server.arcgisonline.com/ArcGIS/rest/services/World_Terrain_Base/MapServer/tile/%7Bz%7D/%7By%7D/%7Bx%7D
Esri Transportation:
https://server.arcgisonline.com/ArcGIS/rest/services/Reference/World_Transportation/MapServer/tile/%7Bz%7D/%7By%7D/%7Bx%7D

Bing VirtualEarth: http://ecn.t3.tiles.virtualearth.net/tiles/a{q}.jpeg?g=1



You can also find other basemaps by searching online (there are also additional basemap links in the CDS Leaflet tutorial). Do check the reuse conditions carefully, it is normally required, for example, to cite the source if you want to use your map in a publication.

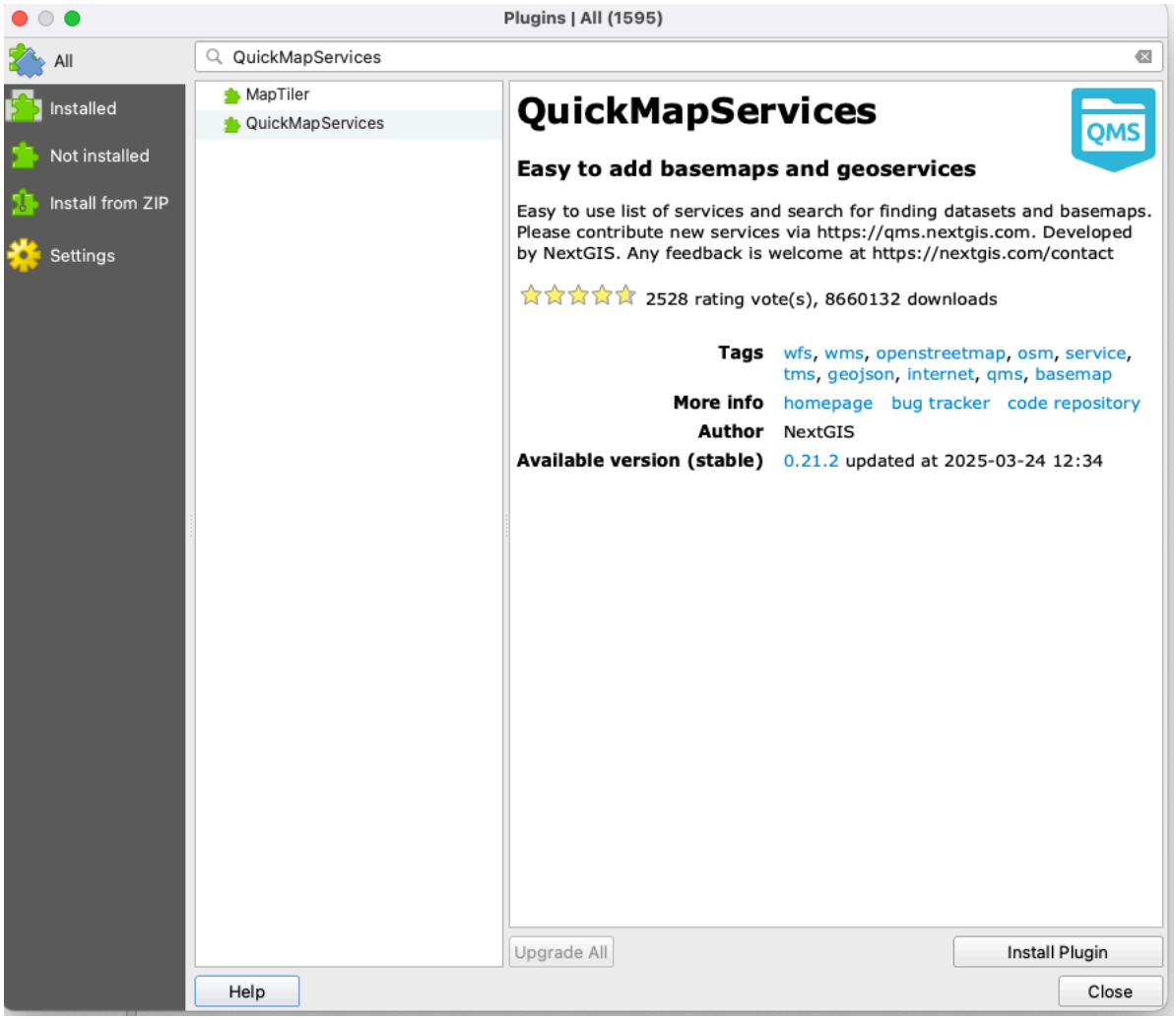
- Double-click on the basemap(s) you want to add to the Layers Panel so that you can use it in your map.

The basemaps will be available throughout all your QGIS projects from ‘XYZ Tiles’, just double-click on them to add them to your current project.

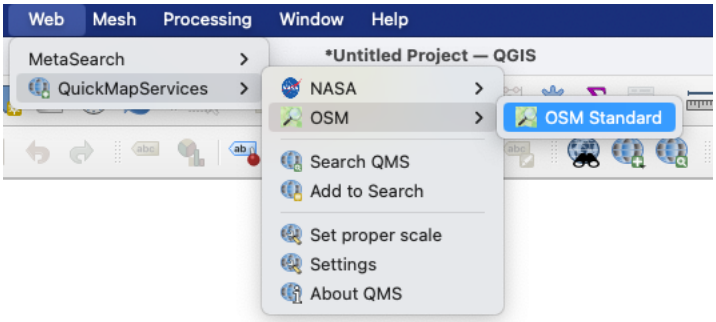
Option 2: Using the QuickMapServices plugin

This is an easy to use plugin that provides access to quite a few different providers of basemaps.

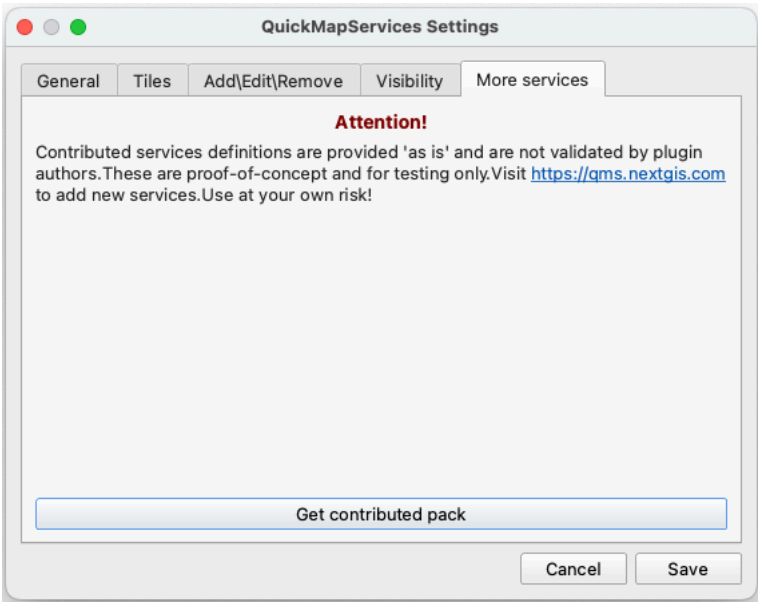
- To install the QuickMapServices plugin (or any other plugin), in the menu at the top, navigate to Plugins > Manage and Install Plugins.
- In the search bar, seach for QuickMapServices (or something more generic like “basemaps” to also find other plugins that may be useful here).



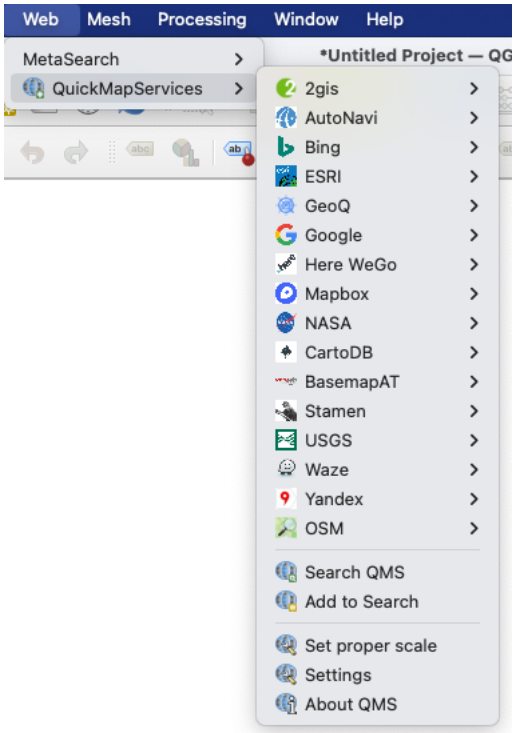
- Click on QuickMapServices and ‘Install Plugin’, and then ‘Close’.
- You can find this plugin in the menu under Web.



- To add the full suite of basemap providers, navigate to Web > QuickMapServices > Settings, and then the More services tab. Click on Get contributed pack.



When navigating to Web > QuickMapServices you will now see the full list of options:



You can find some more information on this, as well as on other plugins, in the QGIS Training Manual tutorial.

6. Download and add vector country data (optional)

Depending on the scale you will work on, it may be relevant to add country borders and other geographic data to your map. When starting out with QGIS, it is handy to have your own 'library' of already downloaded vector (or raster) shapefiles.

- As the data will be downloaded as multiple files (one shapefile alone consists of 6 files that only work if they are all present), it is really only feasible to handle the datasets (and find them back later) if you made dedicated folders for each.

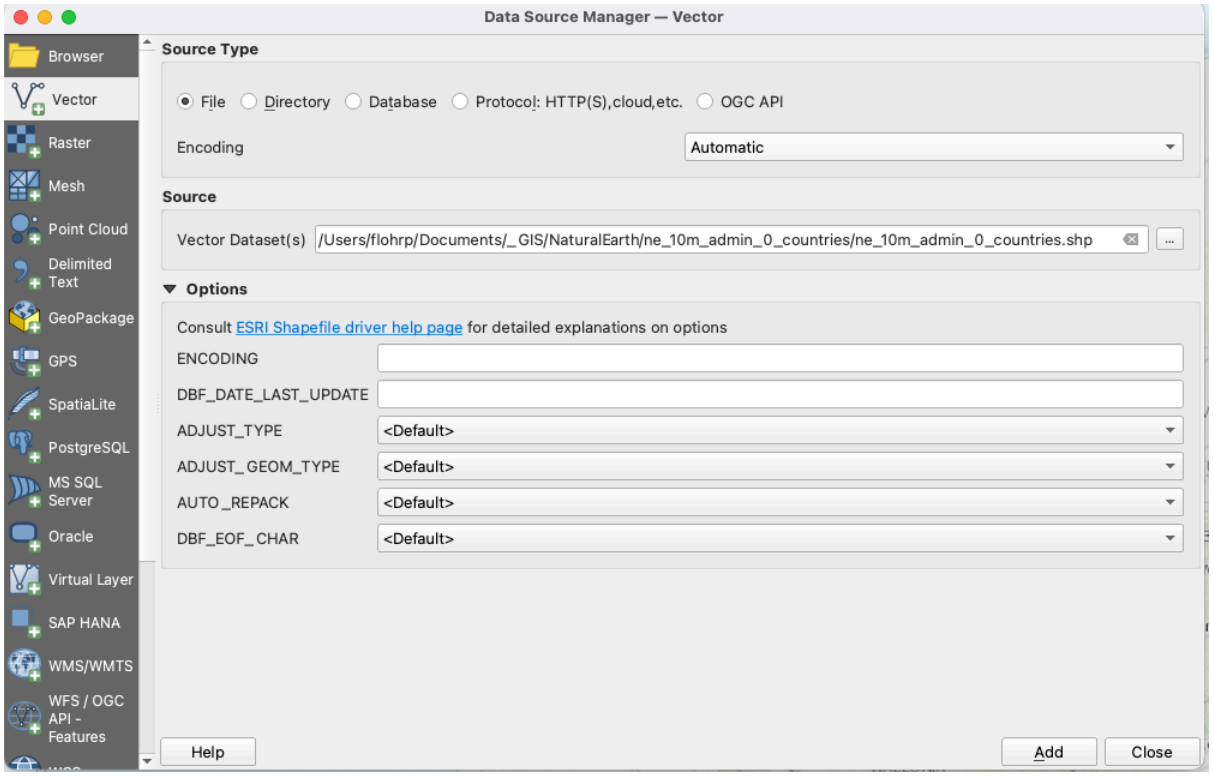
There are various sources:

- https://www.naturalearthdata.com/ for public domain vector and raster data at different scales. The highest quality scale is generally recommended, unless you make a continent-large or global map.
    - Cultural: vector data of country borders, provinces, cities, etc.
        - For country border data, under "Admin 0 – Countries:, click "Download countries".
    - Physical: vector data of land, sea, rivers, etc.
    - Raster: image versions of this data.

  These download as zip files.
- Country outlines: https://gadm.org/
- HydroSheds: Rivers, other water bodies. https://www.hydrosheds.org/
- GSHHG: Rivers, lakes, coastlines. https://www.soest.hawaii.edu/pwessel/gshhg/index.html
- And many more, see for example https://diva-gis.org/data.html

To get these shapefiles into your QGIS project, you can drag and drop them, or:

- go to the Data Source button on the toolbar 
- Vector tab – press the browse [...] button
- Navigate to your NaturalEarth (or other) folder
- Change the file type to "ESRI Shapefile" (or select only the .shp file in the next step)
- Click on the .shp file you want to open
- Click on Add and Close


Data Source Manager — Vector
Browser
Vector
Raster
Mesh
Point Cloud
Delimited Text
GeoPackage
GPS
SpatiaLite
PostgreSQL
MS SQL Server
Oracle
Virtual Layer
SAP HANA
WMS/WMTS
WFS / OGC API - Features
Source Type
File
Directory
Database
Protocol: HTTP(S),cloud,etc.
OGC API
Encoding
Automatic
Source
Vector Dataset(s)
/Users/flohrp/Documents/_GIS/NaturalEarth/ne_10m_admin_0_countries/ne_10m_admin_0_countries.shp
Options
Consult ESRI Shapefile driver help page for detailed explanations on options
ENCODING
DBF_DATE_LAST_UPDATE
ADJUST_TYPE
<Default>
ADJUST_GEOM_TYPE
<Default>
AUTO_REPACK
<Default>
DBF_EOF_CHAR
<Default>
Help
Add
Close

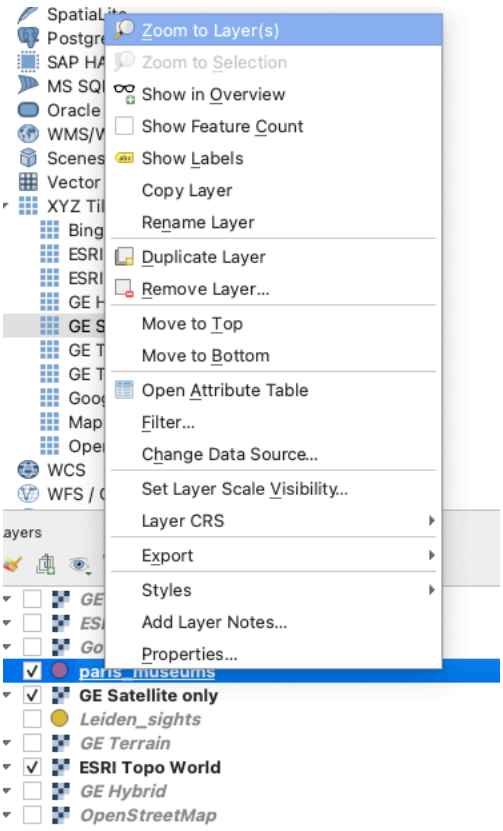
7. Adding your dataset to the map

You are now ready to add your own data (or in this case the dataset we have provided) to the map.

- In the menu, choose Layer – Add Layer – Add Delimited Text Layer
- Click on the three dots [...] to choose the File Name.
- Navigate to your CSV file and click on it.
- Check if the correct columns have been selected for X field and Y field. Change if needed.
    - If no columns are selected and you cannot manually select them, close the window, go to your CSV file and make sure the coordinates are numerical fields.
- Check if the correct geometry is selected. We work with decimal degrees and the geometry should be EPSG:4326 – WGS 84.
- Click on Add, and then Close.

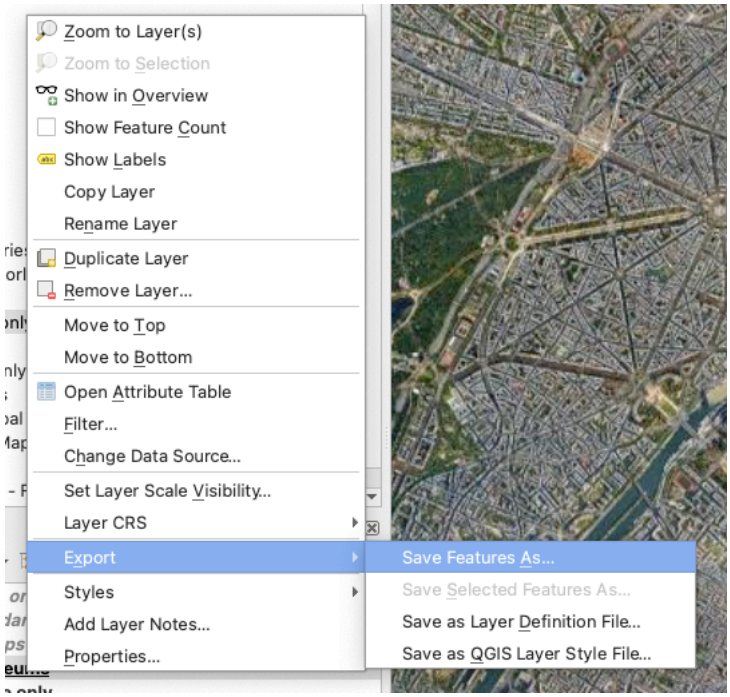
- Right-click on the newly added layer and choose “Zoom to layer”.

You can now see the data points in the map window.

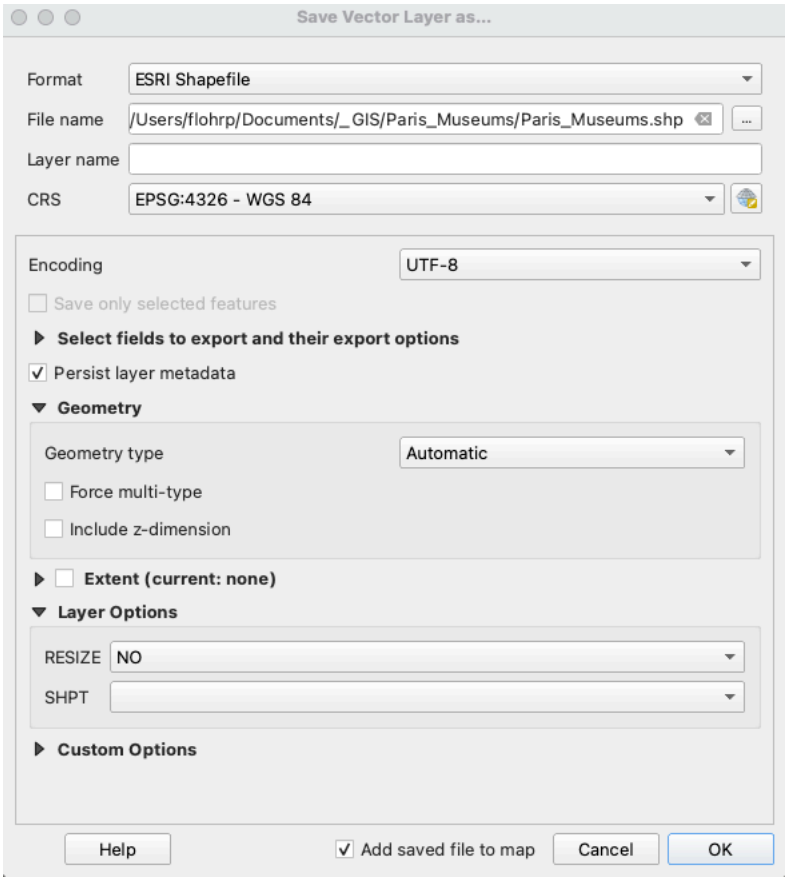


To work with the data, we need to export them first to a shapefile.

- Right-click on the layer, choose Export – Save Feature As…



- Choose, or leave the format as, ESRI Shapefile.
- To choose a file name, click on the three dots (it does *not* work to type directly in the box here).
    - Create a folder (remember that you will create six files at once)
    - Choose a name and click OK
- You can leave the other defaults as they are (make sure the CRS is EPSG:4326 – WGS 84 again) and click on OK.
- You can now close and/or remove the original CSV file from the layers panel.



A note on using shapefiles or geopackages
For our purposes of making a simple map, we are using shapefiles. This was for long, and really still is, *the* file format to use for GIS, and indeed many of the available datasets are shapefiles. However, especially if you want to use GIS more often or for other purposes than making simple maps, consider using the GeoPackage file format.

Shapefile
A widely adopted vector format and de facto standard for GIS, suitable for points, lines, and polygons. It is not a single file, but a collection of files that are (almost) all needed for it to work: .shp, .shx, .dbf, .prj (optional), .sbn/.sbx (optional).

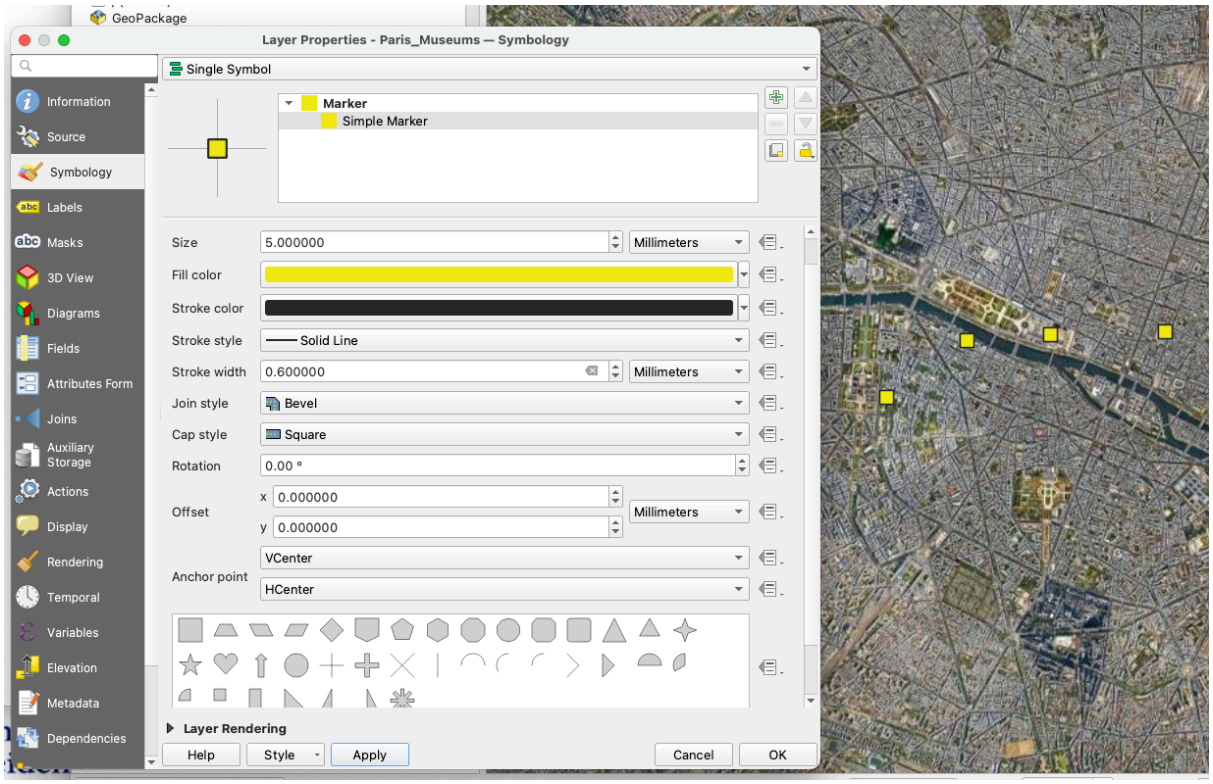
GeoPackage
It is an open standard format which works as an SQLite database. A major advantage is that it is a single file with the extension .gpkg.

Source and further reading: https://mapscaping.com/shapefiles-vs-geopackage/.

8. Changing the appearance of your markers

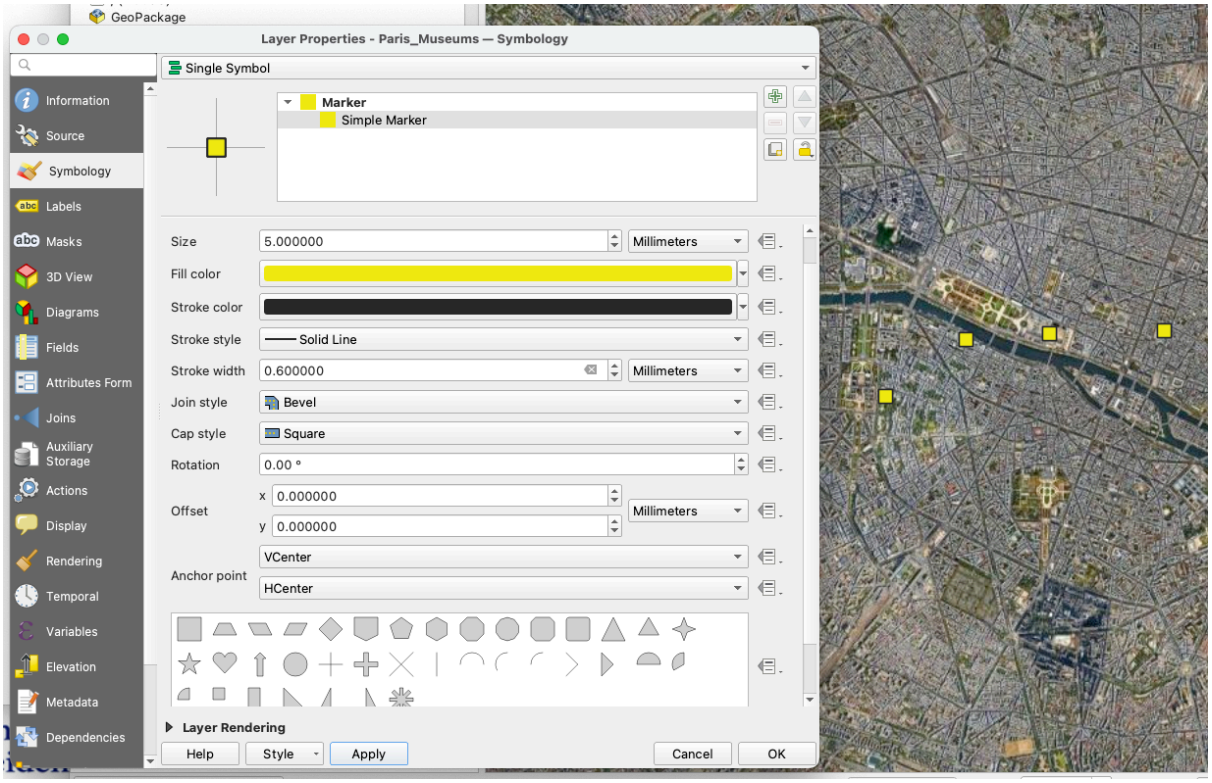
The points are probably not very visible. You can change their appearance.

- Double-click on the layer, or right-click – Properties.
- In Symbology, click on Simple Marker. You can now change the marker size, colour, shape, and so on. Click Apply and when done click OK.



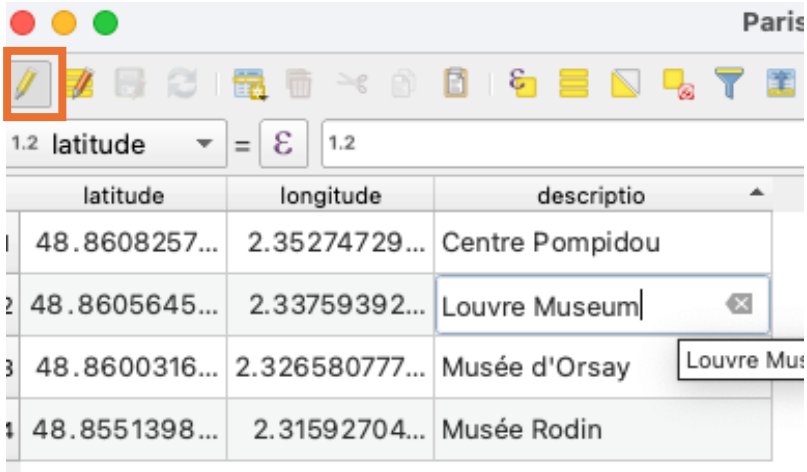
To add **labels**:

- Double click on the layer, or right-click – Properties.
- In Labels, choose Single Labels, and select on which column the value should be based on (in this case ‘description’).
- You can change the font and text size under ‘Text’.
- If the background is busy, it may be worth adding a buffer or background around the text.
- You can also play around with the Placement, especially if you have many points and labels close to each other.
- Click Apply and when done OK.



If you want to change the content of your labels, fortunately you do not have to go back to the CSV file.

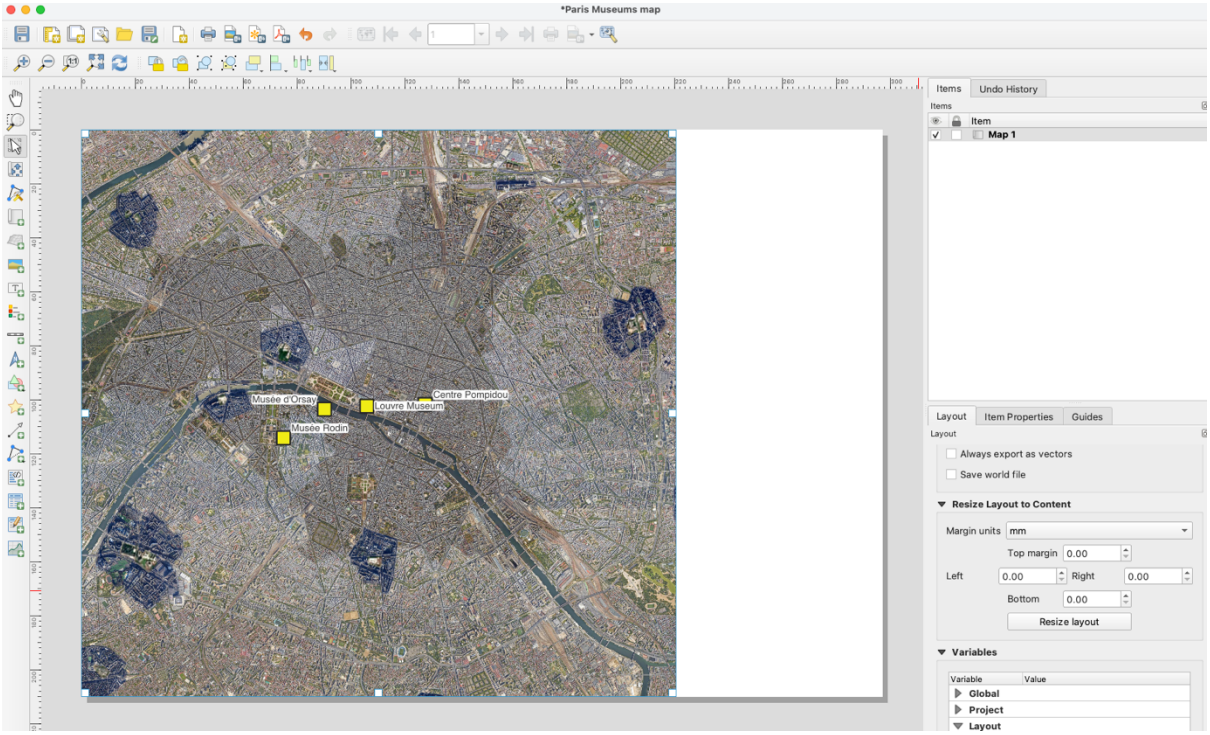
- Right-click on the layer and click on Open Attribute Table.
- By clicking on the pencil, you can edit the values in the table, and even add rows or columns. To make them active, click on the pencil again and save the edits.



9. Preparing the map for export

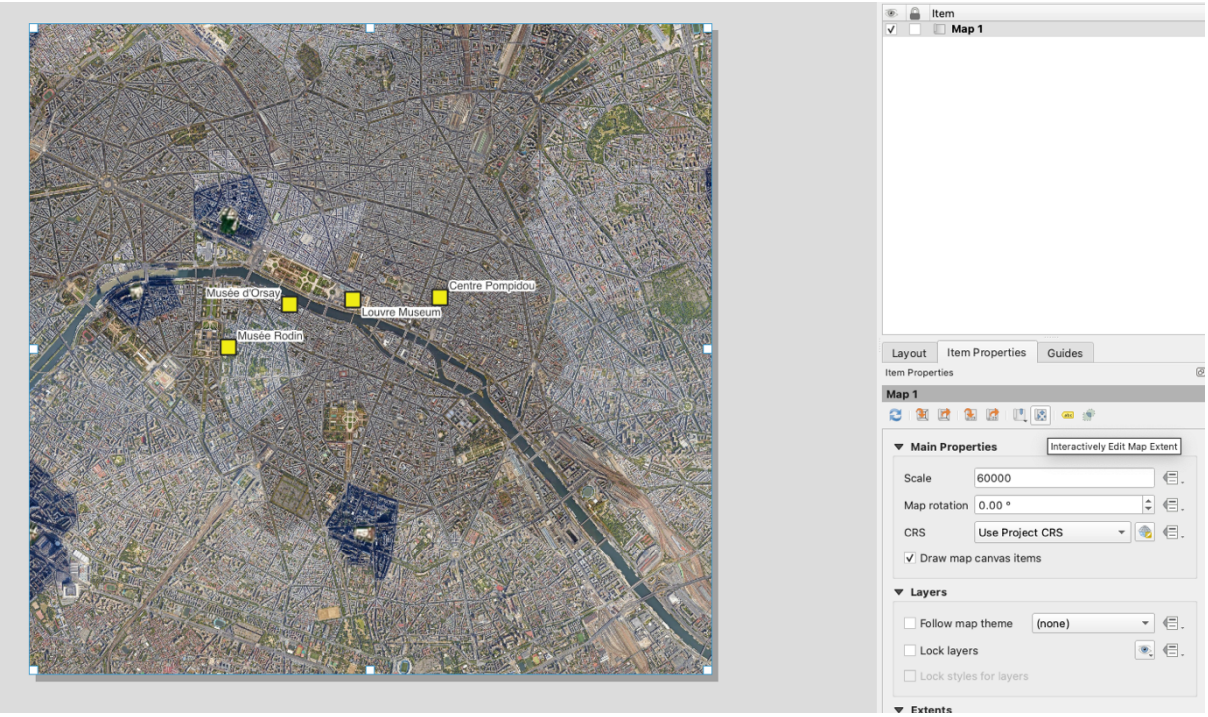
When you are happy with your map, make sure all features that you want on the map are shown, and all others turned off.

- In the menu, navigate to Project – New Print Layout, and enter a title.
- The QGIS Print Layout Manager now opens.
- You can change the print size of the map under Layout – Printer Page Setup.
- To add your map to the canvas here, from the toolbar to the left, choose Add Map 
- Draw the area on the canvas where you want the map. This can be over the whole canvas.
    - If it is not the whole canvas, go to Layout in the lower righthand corner of the screen, scroll down, and click on Resize Layout.



- You can use the Move Item Content button in the left toolbar to move around inside your map.

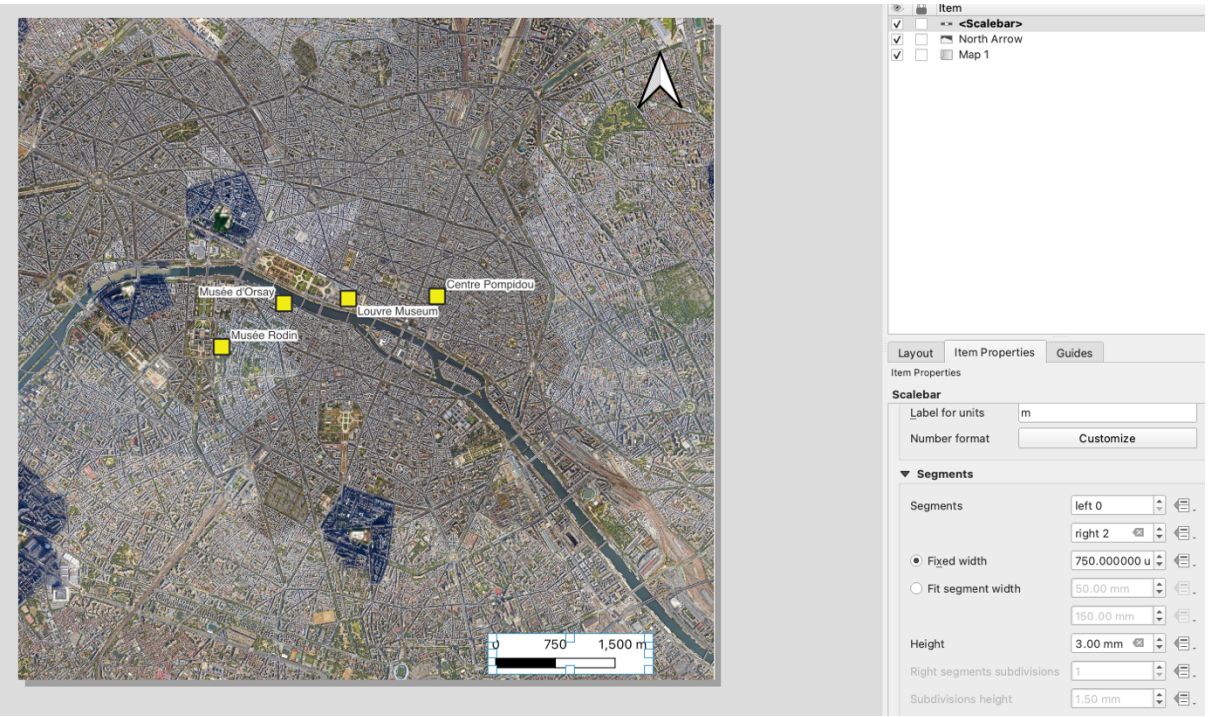
- To zoom in or out, you can use the mouse wheel or use Item Properties (lower righthand corner of the screen), Main Properties – Scale, and adjust the number there until you are happy.



Once you are happy with the map layout and size, you can start to add items.

- To add a **north arrow**, select Add North Arrow from the toolbar on the left.
- Draw a rectangle where you want the north arrow to appear.
- In Item Properties (lower righthand corner) you can adjust the north arrow, or choose a different one.

- To add a **scale bar**, select Add Scale Bar from the toolbar on the left.
- Choose the place on the map canvas.
- You can adjust the scale bar in the Item Properties window.



We have not yet looked into adding different categories onto your map, but if you did add these, adding a legend here will be useful too.

- Once you are happy with the map, export it by clicking on Layout > Export as Image in the menu.
- Choose the folder, file name, and image type, and click on Save.
- Choose the resolution, and if needed (if you did not choose “resize layout” earlier), choose "Crop to content”.

Your map is now ready!
In reality you will now probably see something you want to change... Some things will have to be changed in the original QGIS map, others can be done in the Print Layout Manager.