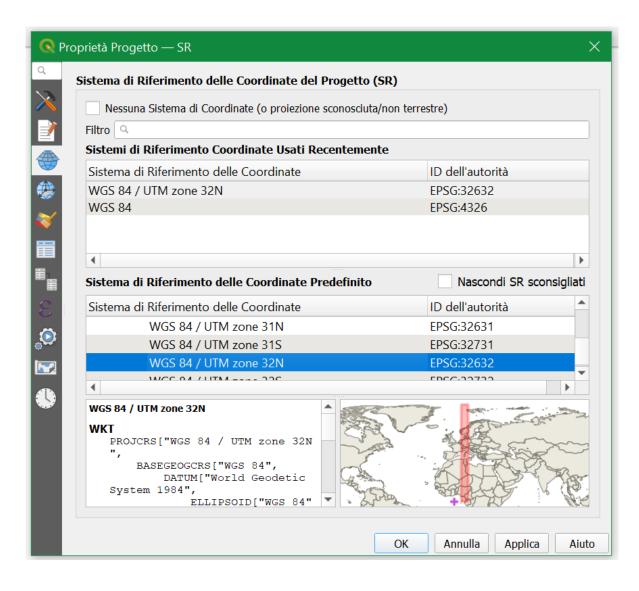
GIS in glaciology - Data sources, processing and use (by A. Citrini, PhD)

Exercise: create the QGIS project of the glacier of interest (Lombardy Region case study)

2020-2021



1. New QGIS project \rightarrow Project \rightarrow Save as

Ex: "Ex_Glaciers"

2. Project → Properties SR "Reference System"

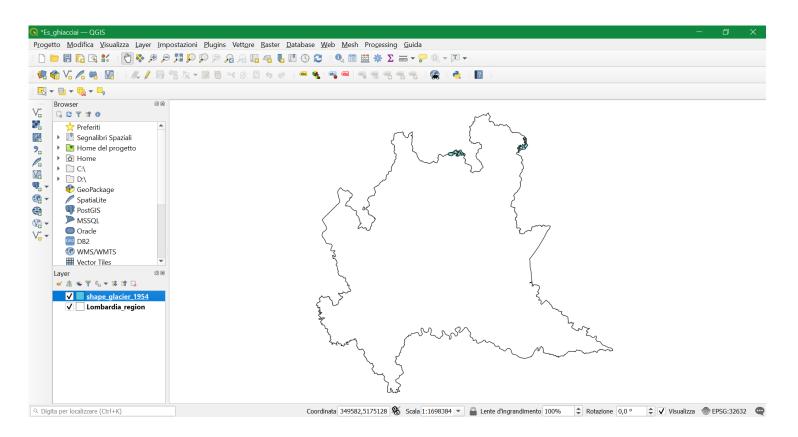
In this case, WGS84/UTM zone 32; EPSG:32632

3. Add the data types inside the folder e.g., "Ex_glaciers";

There are two shapefiles (polygons):

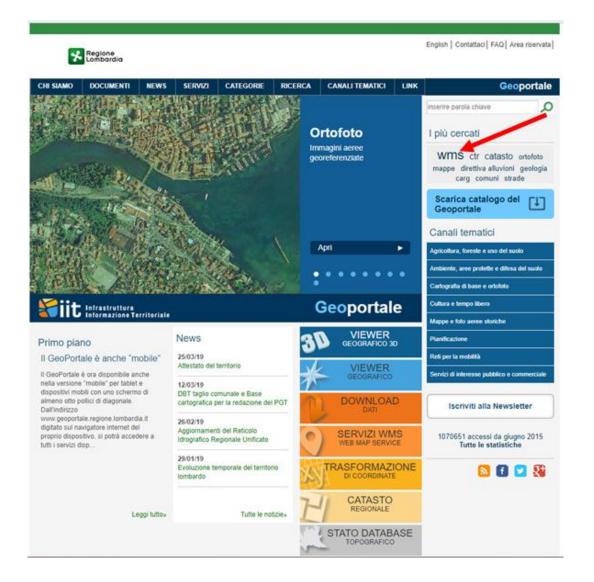
Lombardia_region: limits of the Lombardy Region shape_glacier_1954: the extent of the main Lombardy glaciers (Scerscen and Forni) in 1954

Layer \rightarrow Add Layer Vector (or directly from the quick menu) \rightarrow Browse and insert the two polygon shapefiles (extension .shp).

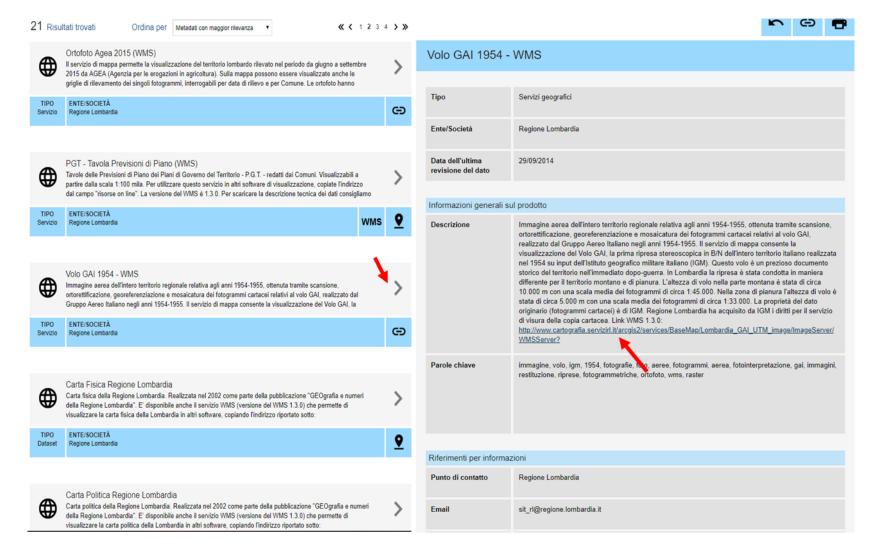


4. Add WMS (Web Map Service) data from the "Geoportal of the Lombardy Region." Go to http://www.geoportale.regione.lombardia.it/ and click on "WMS"

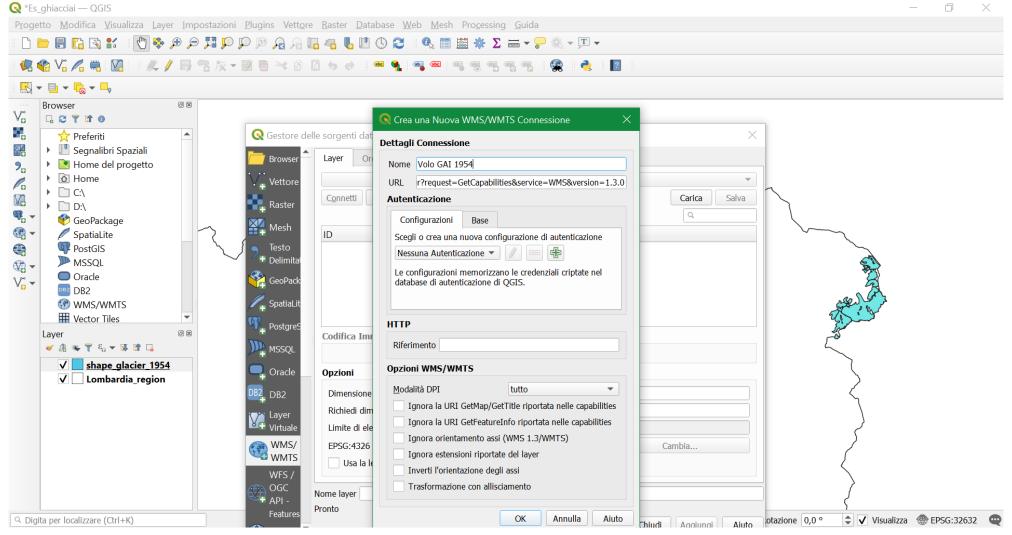
The Geoportal is a website where an enormous amount of geographic, geological, and administrative (e.g., cadastral) data can be found, accessed, and downloaded. Each country has several reference Geoportals, both at the national level and at the regional and more detailed level.



5. Go to the last available page and select "Volo GAI 1954"

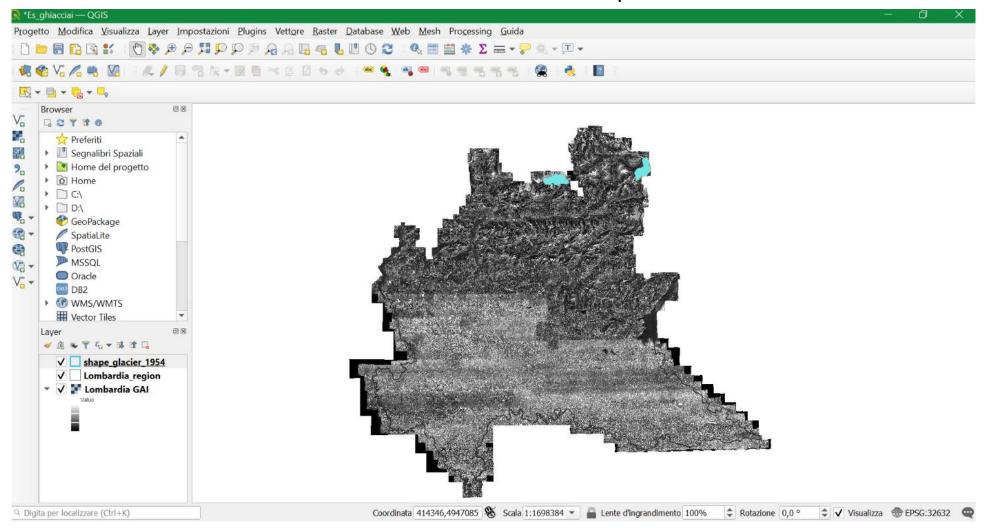


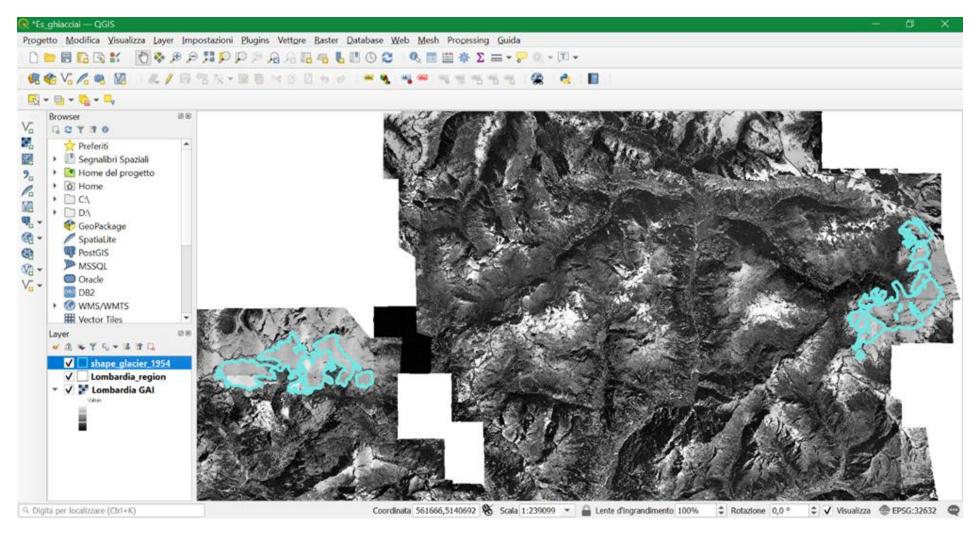
6. Copy the link to the resource



7. Return to the QGIS Project. Layer \rightarrow Add Layer \rightarrow Add Layer WMS/WMTS (or directly from the quick menu) \bigcirc New \bigcirc Enter name (e.g., "Volo GAI 1954") and URL previously copied from the Geoportal \rightarrow Ok \rightarrow Connect \rightarrow Select Layer "Lombardia GAI" \rightarrow Check JPEG \rightarrow Add

8. Allow time for the server to load the map and observe the results

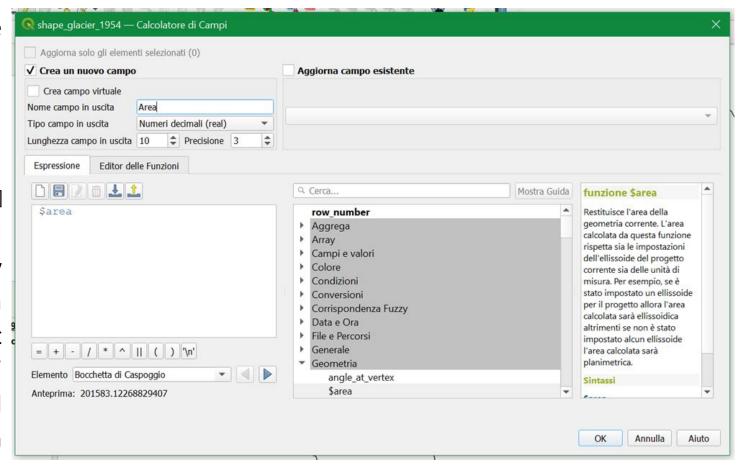




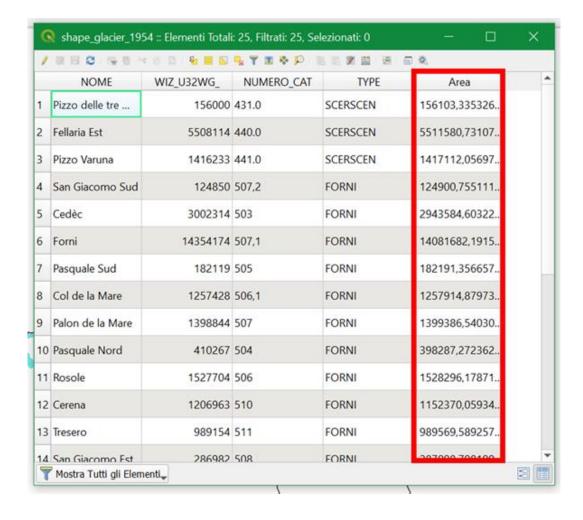
9. Focus on the shapefile "shape_glacier_1954": the shapefile corresponds to the actual size of the two main glaciers in 1954. In the Table of Contents (Layer), right-click on "shape_glacier_1954" \rightarrow Zoom in on the Layer

10. Now we need to add the area value to each element of the shapefile "shape_glacier_1954".

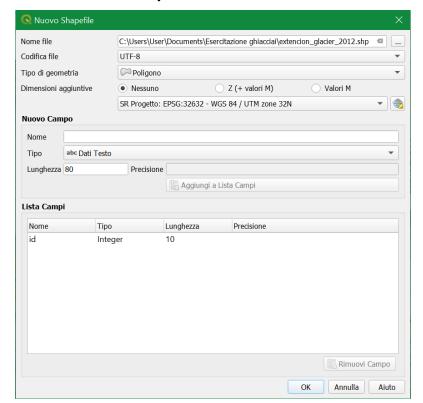
Right-click on Layer ② Open attribute table ② Enable changes (Ctrl+E) → Open Field Calculator (Ctrl+I). Select from the Geometry menu → "\$area" which will calculate the area of each table element. Type in the "Output Field Name" (Area) and "Output Field Type" (Decimal Numbers) → Ok. All calculations will be referenced to the unit of the projection (by default meters → square meters).



11. When the calculation is finished, look at the attribute table of the shapefile in question. A new field has appeared showing the areal values in square meters of each individual element:

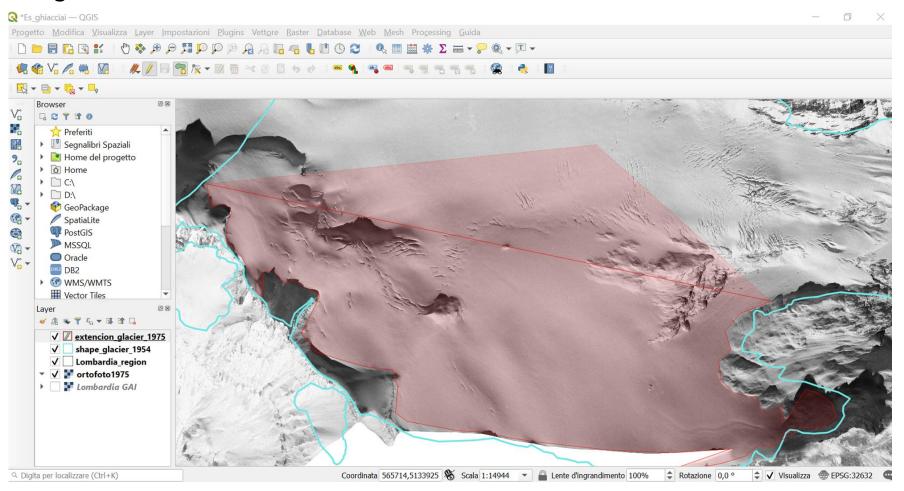


- 12. Add the most recent WMS map "Ortofoto AGEA 2012" (always available on the Lombardy Region Geoportal) in the same way as before (from step 4. to step 8.).
- 13. Layer → Create Vector → New Layer Shapefile... → Enter "File Name" to save it in the project folder (e.g., "extencion_glacier_2012"), "Geometry Type" (Polygon) and make sure the SR reference system is set to EPSG: 32632. → Ok

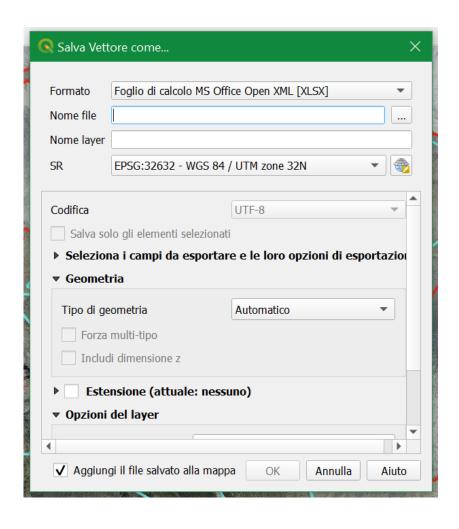


The new Layer is added to the Table of Contents.

14. The extent of alpine glaciers in 2012 needs to be sketched. After selecting the new shapefile in the Table of Contents (Layer) → Enable changes → Add Polygonal Element. By clicking with the cursor and scrolling with the mouse following the shape of the glacier (recognizable by its associated orthophoto) you can recreate its extent. Once you have completed a polygon, you need to right-click to confirm the shape you have created and associate it with a unique ID. Finally, having completed all the different glacier sections, turn off the "Enable Changes" mode and save.



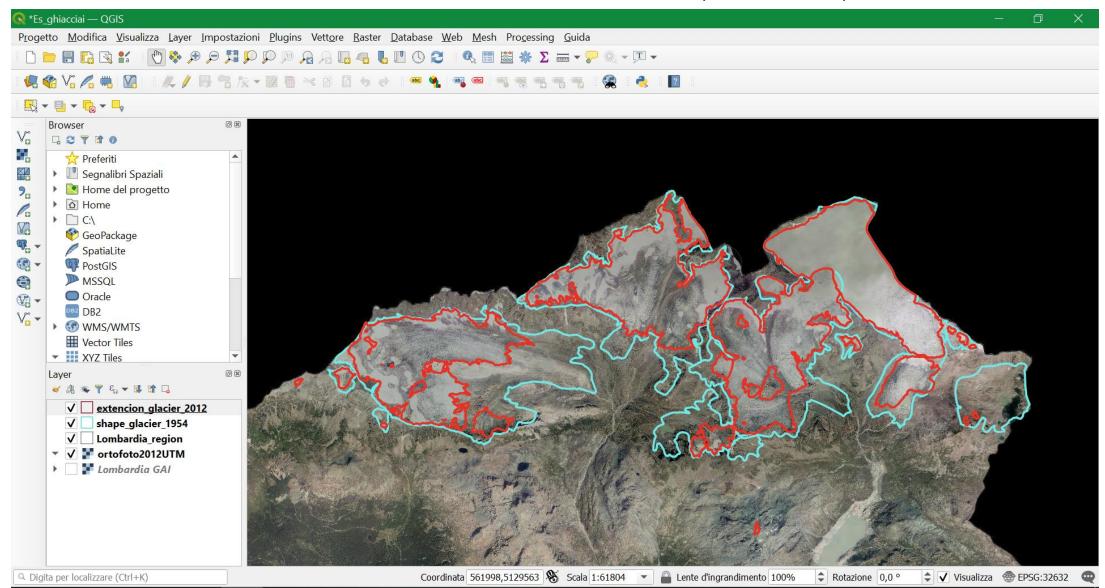
- 15. Enter the field for the area value of the different elements as shown in Step 10.
- 16. To export the attribute table to an .xlsx file, select a shapefile in the Table of Contents (Layer) \rightarrow Right-click \rightarrow Export \rightarrow Save Elements As... \rightarrow Attribute file name and deflag "Add saved file to map" \rightarrow Ok



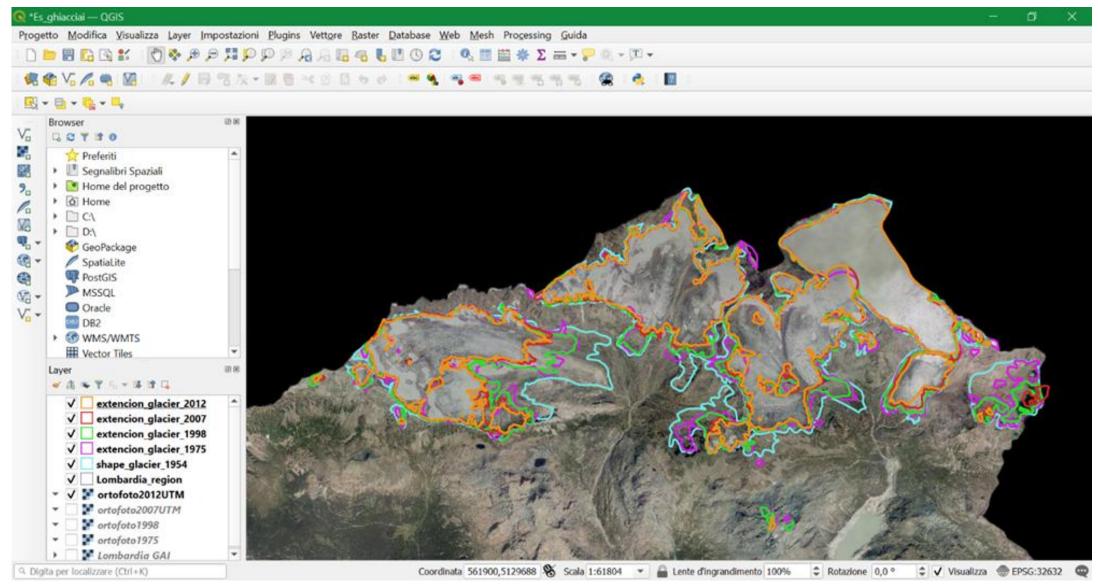
Repeating the same action as in step 16. also for the second shapefile will result in two .xlsx worksheets.

Through these it will be possible to make a comparison of the areas of the Scerscen or Forni glacier polygons and have numerical data of the evolution from 1954 to 2012.

The end result for the Scerscen Glacier will be, for instance, this:



If the same analysis is carried out using all the Orthophotos available on the Geoportal of the Lombardy Region, the result will be this:



Tasks:

- Choose one glacier from the two previously mentioned (Scerscen and Forni);
- After completing the editing of the shapefile for the year 2012, numerically calculate the areal change that occurred between the years (1954-2012) using the duly exported .xlsx sheets;
- Finally, create a map with an appropriate legend and symbology.

To create a paper:

Project → New Print Layout → Add Print Name.

Layout \rightarrow Set Page \rightarrow you can choose the format and orientation of the page.

Through the "Add Object" menu you will be able to insert the basic elements of a thematic map: Map, Legend, North Arrow and Scale Bar.

Play with the right-hand menu to set the specifications of each object inserted in the Print Layout.

Once you have completed editing the Layout \rightarrow Layout \rightarrow Choose the Export option (e.g., Export as PDF...)

Quick example:

