Geographic Information Systems 2026-2027

Exercise 2 - QGIS - Explore your first QGIS project

Introduction

In this exercise, you will have an overview of very basic and generic QGIS functions of QGIS interface. You will also learn to identify the different components of the interface of the software and the workflow to manage data and perform analysis.

1. Download and open a QGIS project

To prepare your environment for this first exercise using QGIS, do the following:

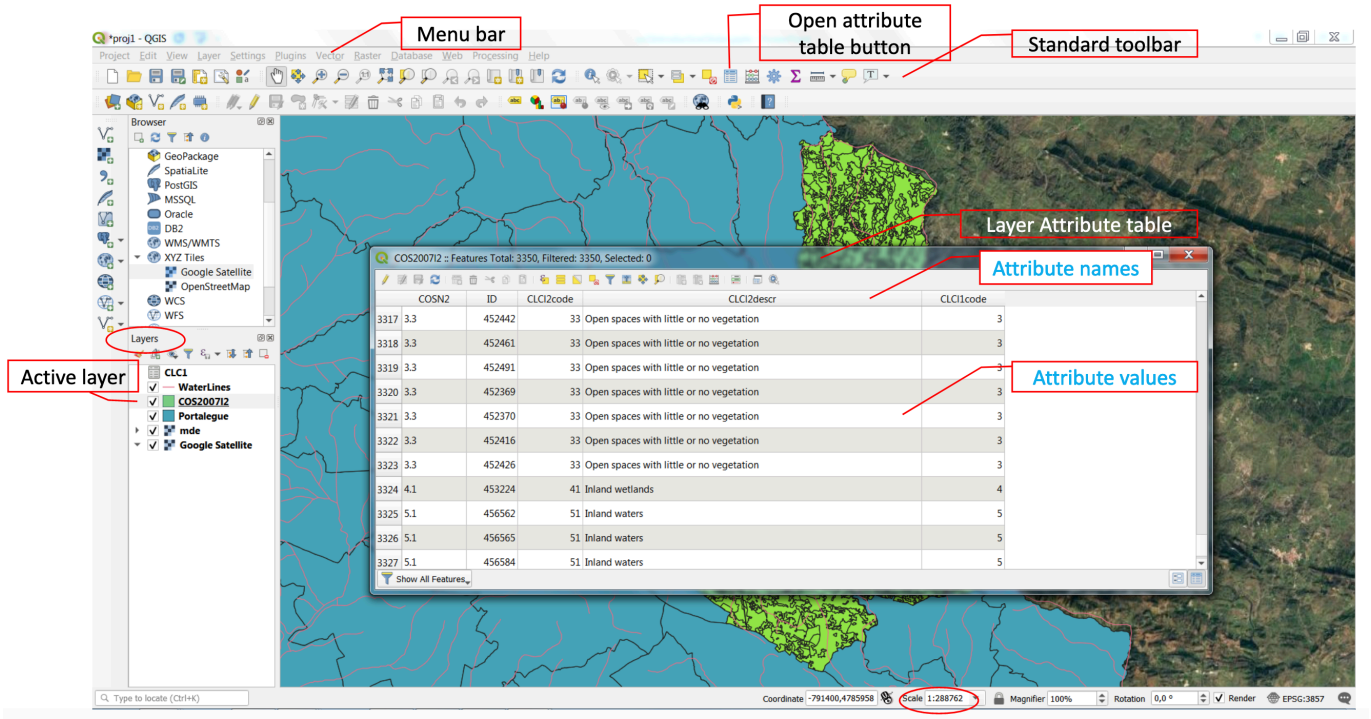
- Create a working folder for your course exercises named `GIS`
- Inside, create a folder for the current exercise named `Ex02`
- Download from Fenix (menu Exercises -> QGIS) the file Ex1CLC.zip for the Exercise 02, to your folder Ex02 (you need to be logged-in in Fenix)
- Unzip the file Ex1CLC.zip. This should create a new folder containing a QGIS project file `CLC.qgz` and a folder `DataIn` containing 3 geographic data sets (files `Waterlines.gpkg`, `Portalegre.gpkg`, `COS2007l2.gpkg`). The file format is gpkg, meaning GeoPackage file format. It also contains a csv table named `CLC1`. The meaning of these datasets is:
    - water streams for Portugal (line features)
    - freguesia (smaller administrative unit in Portugal) of the municipality Portalegre (polygon features)
    - land cover for some freguesias of Portalegre (polygon features)
    - csv table with the classification of some categories of land use
- Create a folder named DataOut in the same folder where already is the folder DataIn
- launch the QGIS project by double-clicking on the file `CLC.qgz`. This should open a new window of QGIS.

2. Get familiar with QGIS 3.28 Interface

2.1. Interface - Terminology

The default interface of QGIS is composed by:

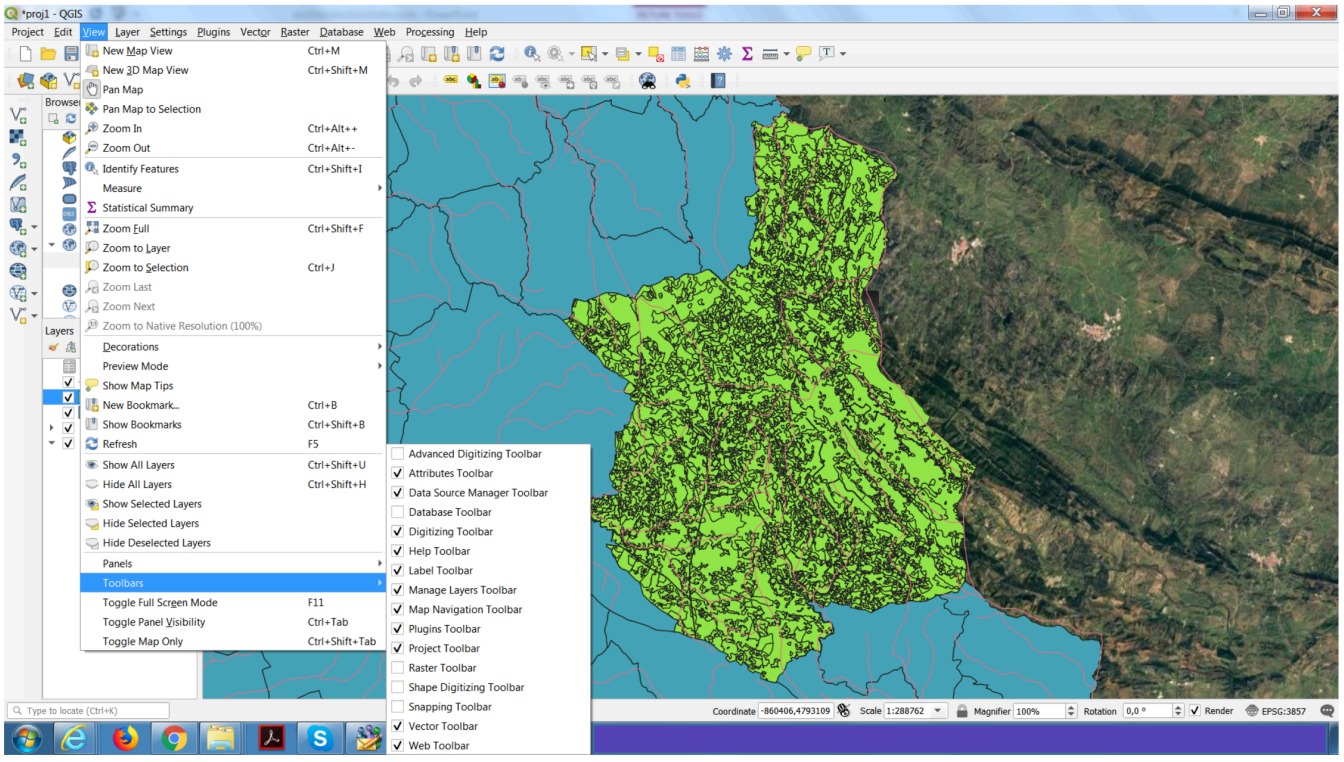
- main menu
- standard toolbar
- main visualization panel
- browser panel - access to data sources
- Layer panel - list of data layers added to the project
- Processing toolbox - right panel with tools



2.2. Interface - Customization

All panels can be rearranged in the window, and resized. Other panels and toolbars can be added. Right-click on a empty area of the toolbar to display a list of available **Panels** and **Toolbars**, and activate or deactivate their display.

In alternative, you can activate/deactivate through the menu *View* → *Panel* or *View* → *Toolbar*



2.3. Interface and language - reset to the original configuration

Sometimes, it is convenient to reset the QGIS interface to the original default settings, including original panels. You can do this by going to the menu *Settings* → *Options* → *System* and select *Reset user interface to default*

settings (restart required).

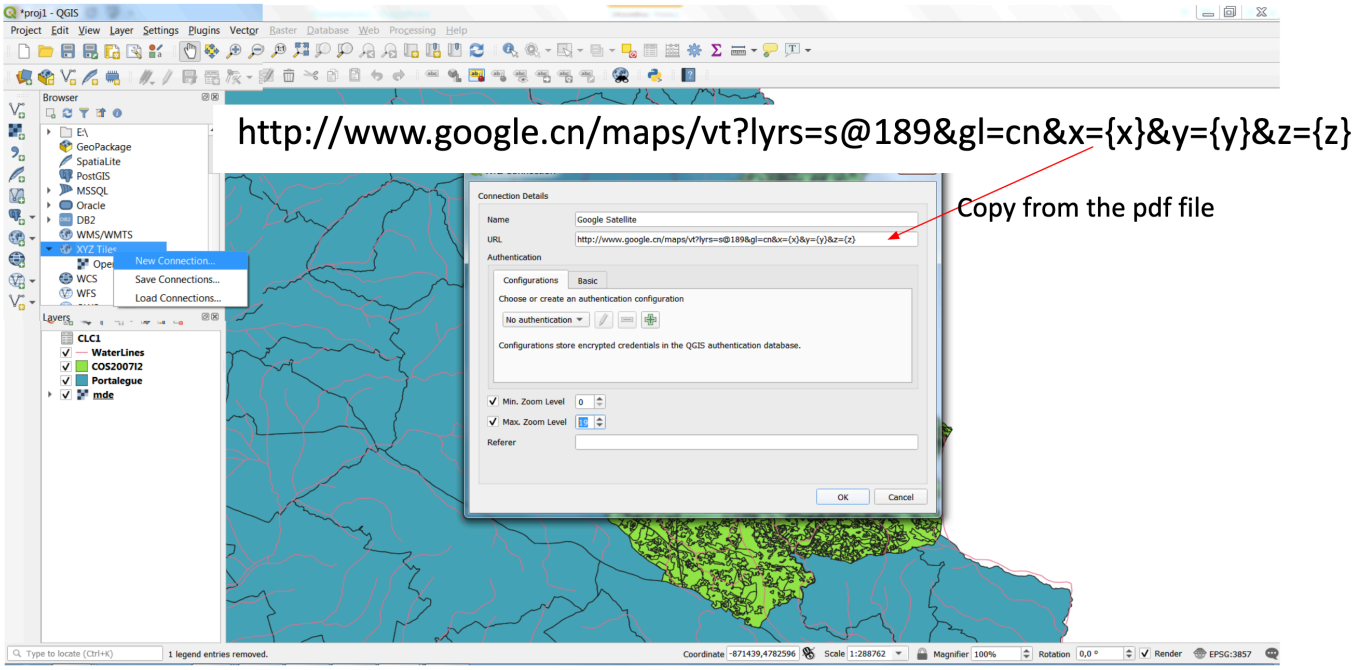
It is also better to use the original english language in QGIS interface. To set QGIS to use english, go to menu *Settings → Options → General*, check the checkbox *Override System Locale* and select `American English` in the *User interface translation*.

2.4. Change basemap

By defaults, QGIS already includes *OpenStreetMap* to be used as a basemap. You can add it to your project selected in the **Browser panel**, *XYZ Tiles* and double-clicking `OpenStreetMap`. Remember to reorder the layers in the **Layers panel**, so that it shows in the back.

You can, however, add other tiled service layers. On the Browse panel, right-click on *XYZ Tyles* to add a new connection (see image). Give it the name `Google Satellite`, and add the URL value:

```
http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}
```



Try additional XYZ tiles, as different backgrounds may fit better your GIS projects:

Service	Connection URL
Google Satellite	http://mt0.google.com/vt/lyrs=s&hl=en&x={x}&y={y}&z={z}
Google Map	https://mt1.google.com/vt/lyrs=r&x={x}&y={y}&z={z}
Bing Satellite	http://ecn.t3.tiles.virtualearth.net/tiles/a{q}.jpeg?g=1
Esri Satellite	https://server.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile/{z}/{y}/{x}
Esri World Topo	https://server.arcgisonline.com/ArcGIS/rest/services/World_Topo_Map/MapServer/tile/{z}/{y}/{x}
CartoDB	https://cartodb-basemaps-a.global.ssl.fastly.net/light_all/{z}/{x}/{y}.png

Service	Connection URL
Russian Topos	http://88.99.52.155/cgi-bin/tapp/tilecache.py/1.0.0/topomapper_v2/%7Bz%7D/%7Bx%7D/%7By%7D.jpg
OpenStreetMap	https://tile.openstreetmap.org/{z}/{x}/{y}.png
GBIF Bird data	https://api.gbif.org/v2/map/occurrence/density/{z}/{x}/{y}@1x.png?taxonKey=212&bin=hex&hexPerTile=30&style=classic-noborder.poly

The last link, for GBIF, serves to demonstrate how you can access different types of data from a web service. The GBIF URL contains the parameter `taxonKey` with the value `212`, which is the identifier code for the taxonomic group **Aves** in GBIF. The map corresponds to the occurrences of birds in GBIF (hotter colors correspond to highest number of records).

If, instead of birds, you want to have a map background for pine trees (genus *Pinus*),you just need to find the ID for it at GBIF, and use it on the URL:

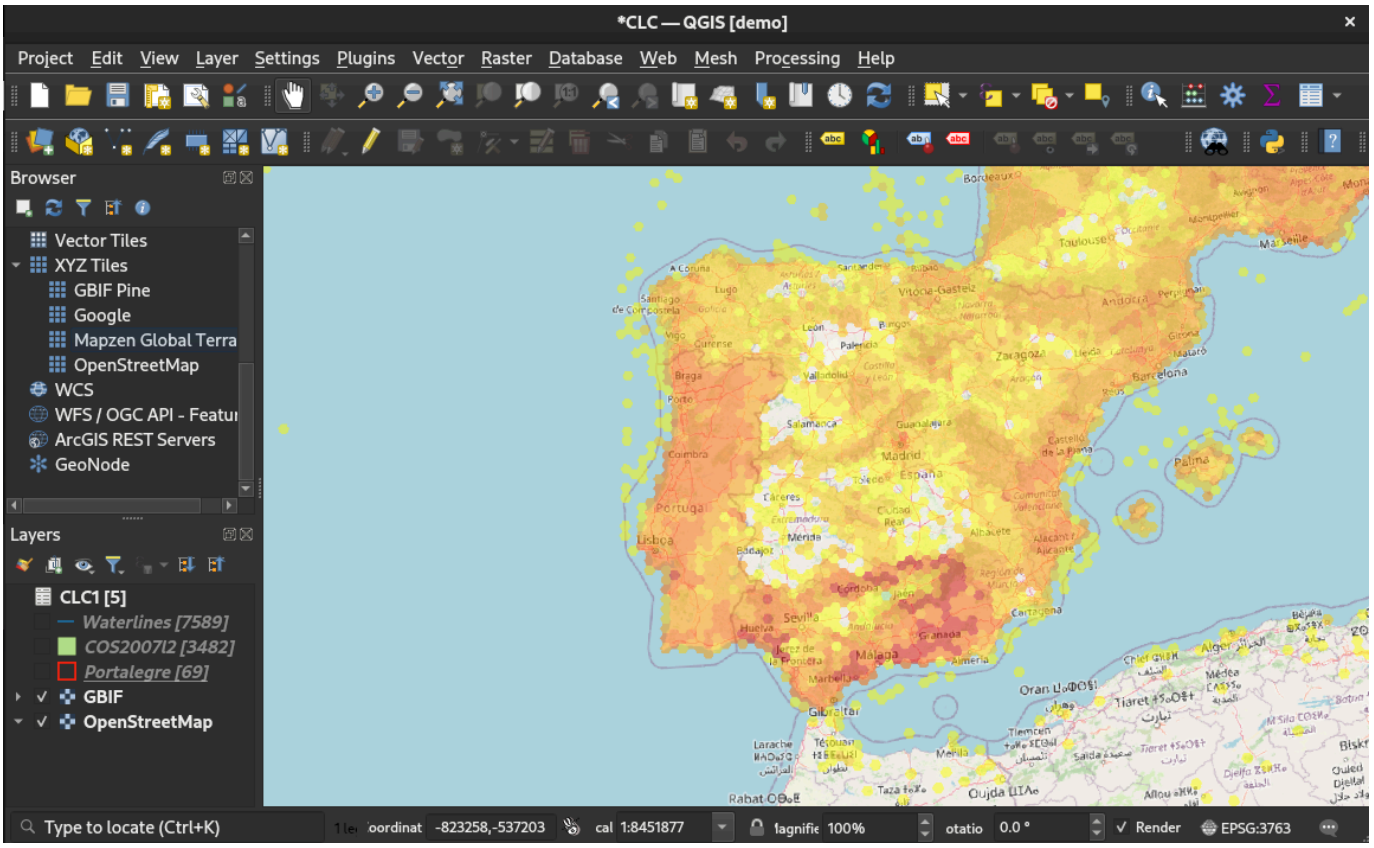
- go to GBIF.ORG and search for *Pinus*
- click on the first result, corresponding to *Pinus* L. This will open a page dedicated to the genus *Pinus*
- notice the URL address in your browser, which is `https://www.gbif.org/species/2684241`. The last figure `2684241` corresponds to the ID for this taxon.
- replace in the URL of above the value of the parameter `taxonKey` with this new value:

```
https://api.gbif.org/v2/map/occurrence/density/{z}/{x}/{y}@1x.png?
taxonKey=2684241&bin=hex&hexPerTile=30&style=classic-noborder.poly
```

You may combine this GBIF map with OpenStreetMap to create an interesting effect:

- Activate both the GBIF map and OpenStreetMap for visualization in the layers panel, but make sure that GBIF is on top of OpenStreetMap
- Increase the transparency of the GBIF layer. Right-click on the name of the layer, open *Properties* → *Transparency* and set a value of 50%

The result should be similar to the following:

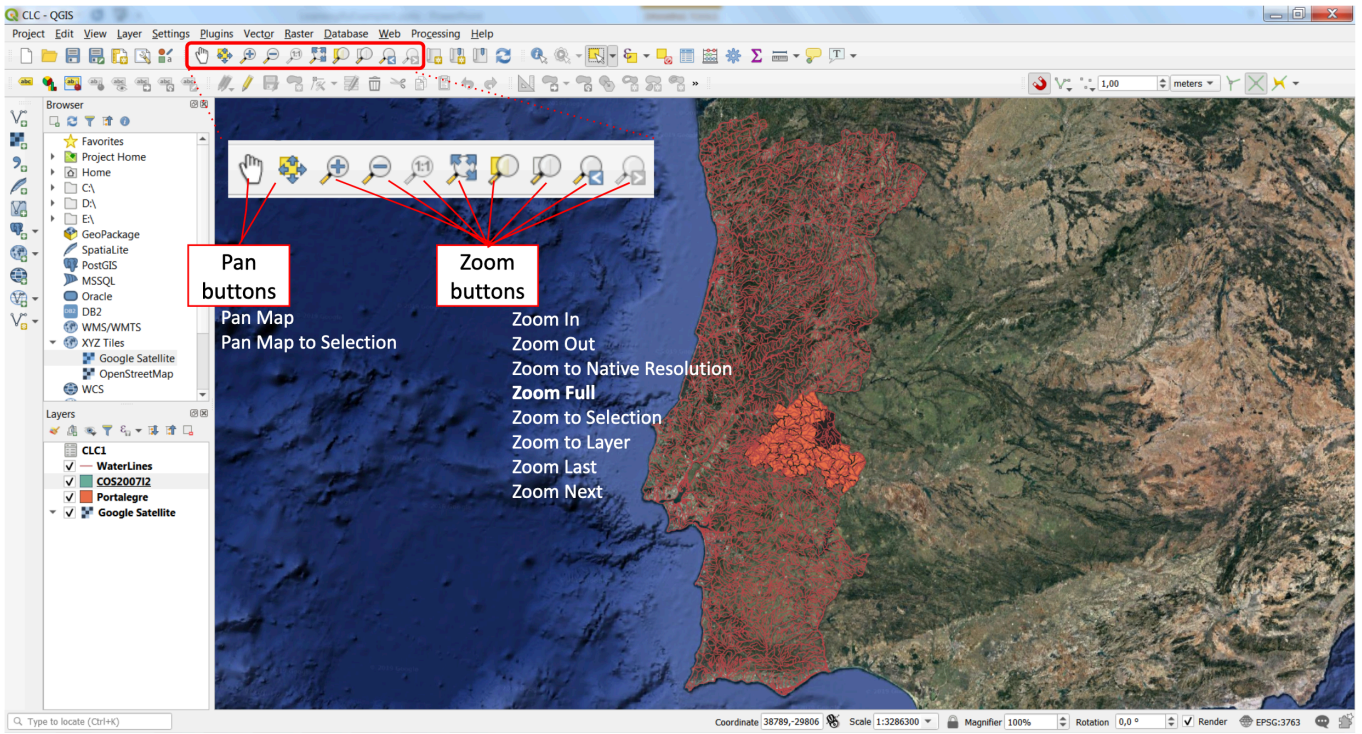


Navigate to your country of origin, and verify the availability of records of pine trees. Does it contain a good coverage? Do pine trees occur in your country, but it is not sufficiently represented in GBIF data?

Check more about GBIF.

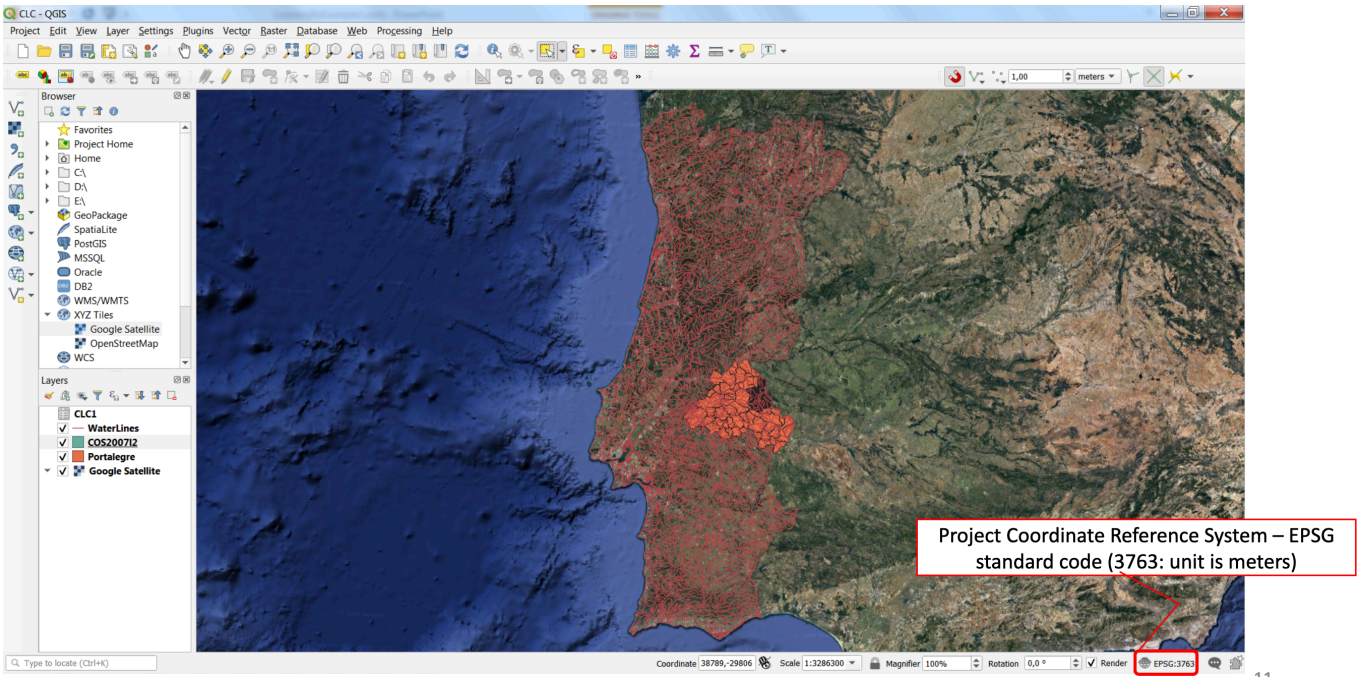
2.5. Zooming and panning

Explore the Zoom and Pane toolbar buttons to navigate and see different detail levels of your spatial data



2.6. Identify project and layer metric units

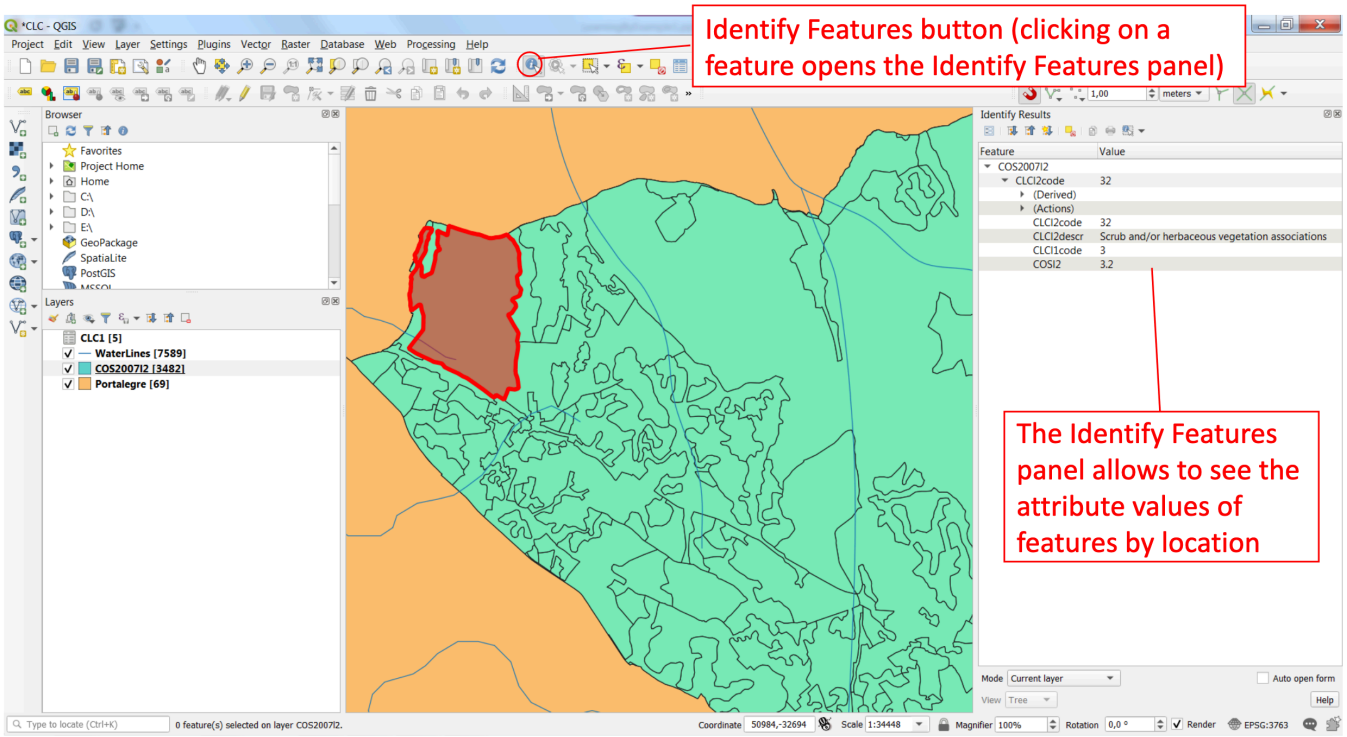
Identify the current project reference system in the bottom right side of the status bar, in the bottom-right corner of your window. Click on the projection to obtain more details about the *coordinate reference system* of the QGIS project. This will tell also if the coordinate system as geographic or metric coordinates.



To obtain the same information for a layer, you will right-click on the layer name (in the Layers panel), and select `Properties` from the context menu. Then, select `Source`.

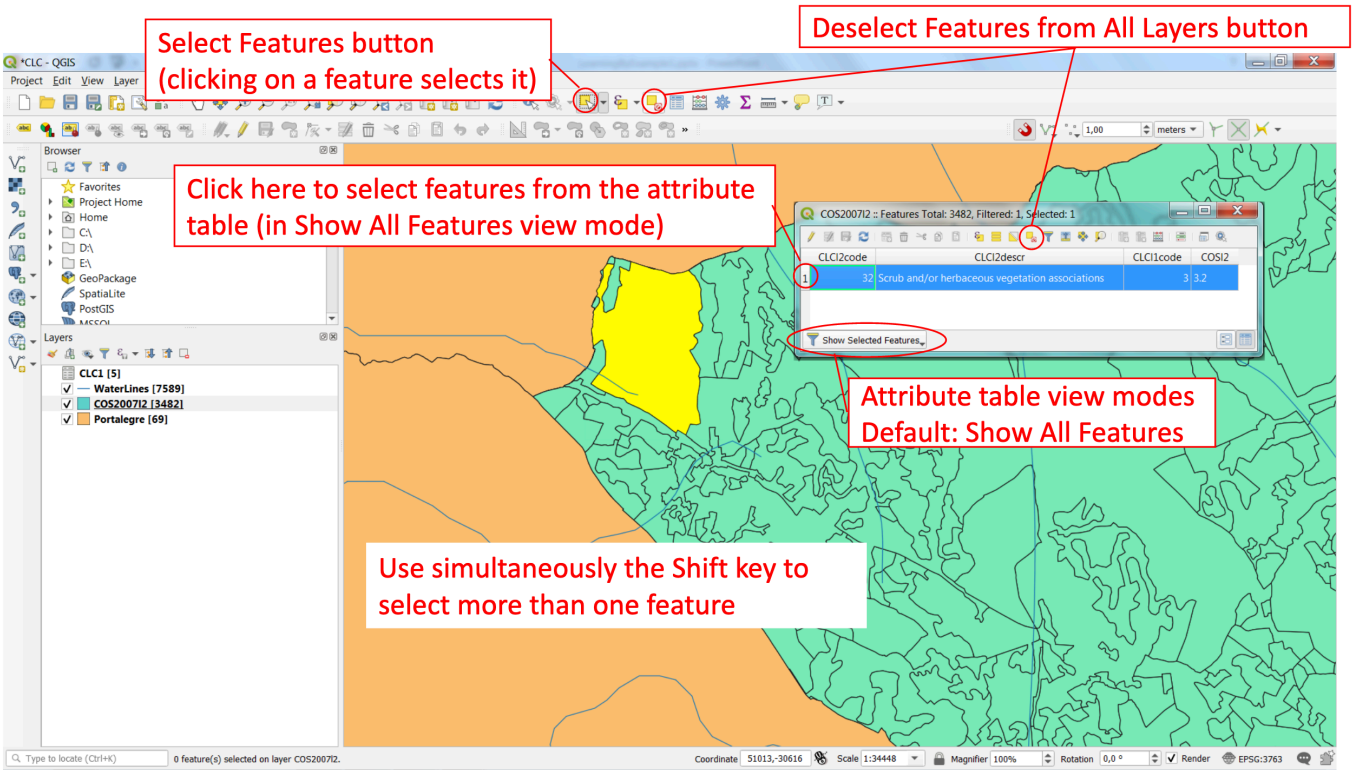
2.7. The Identify Features tool

The Identify tool allows to click on a specific feature, to see the associated attributes.



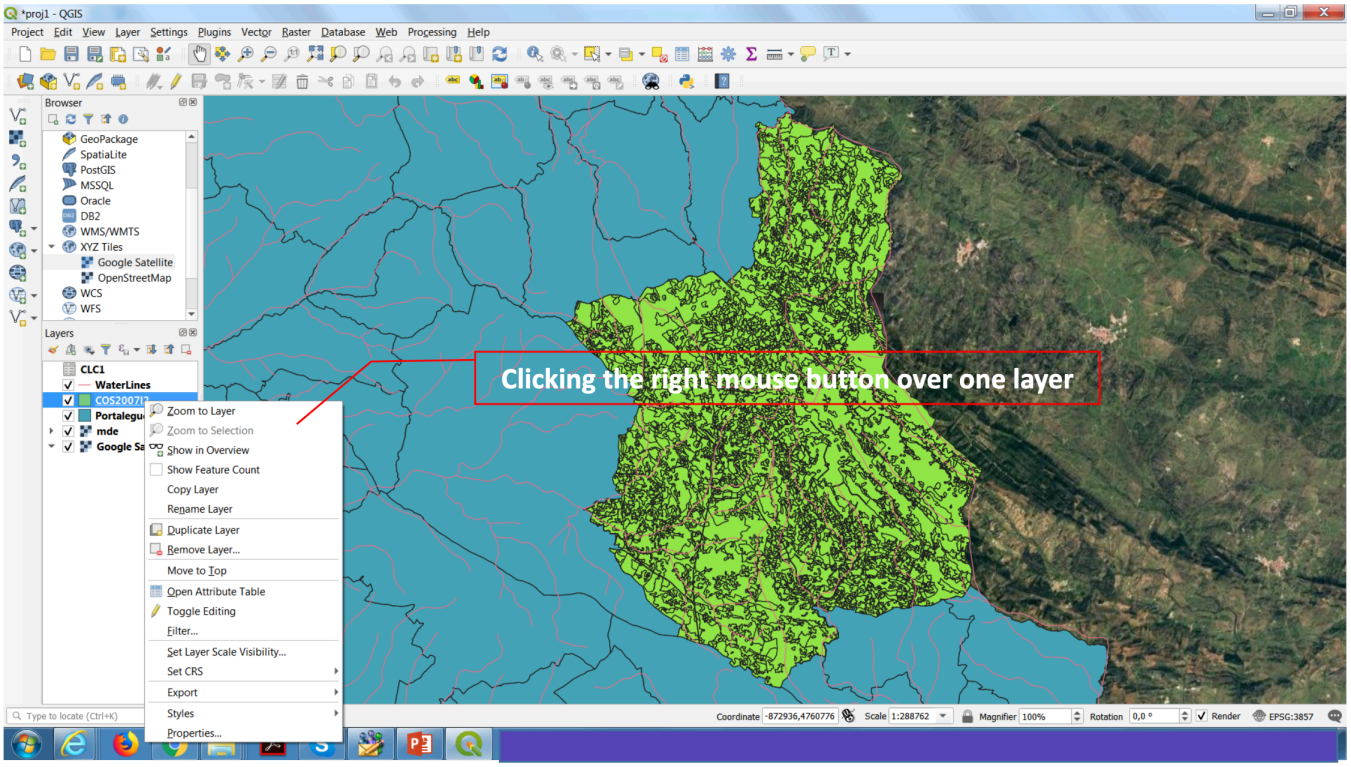
2.8. The Select Features tool

The Select tools allows to select one or more features, on which you can do subsequent operations. Note the *Deselect features* button.



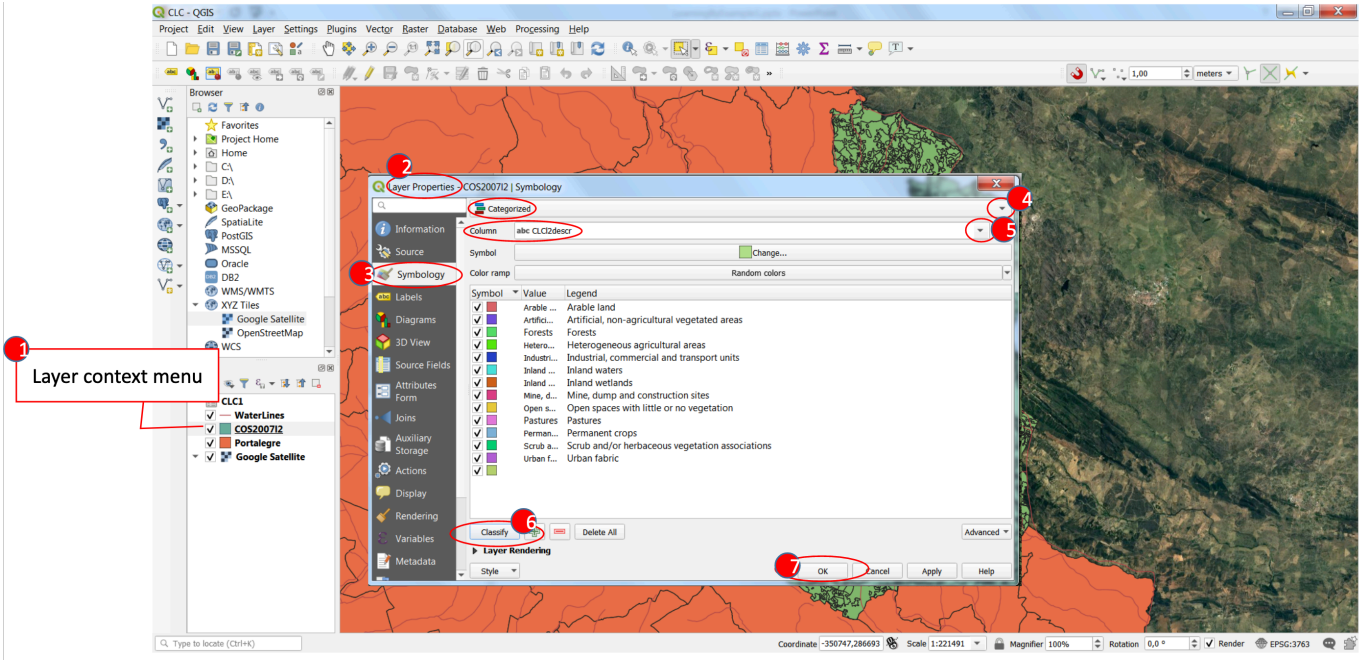
2.9. Context menus

The context menu displays a menu with different options, specific for the item on which it was activated.

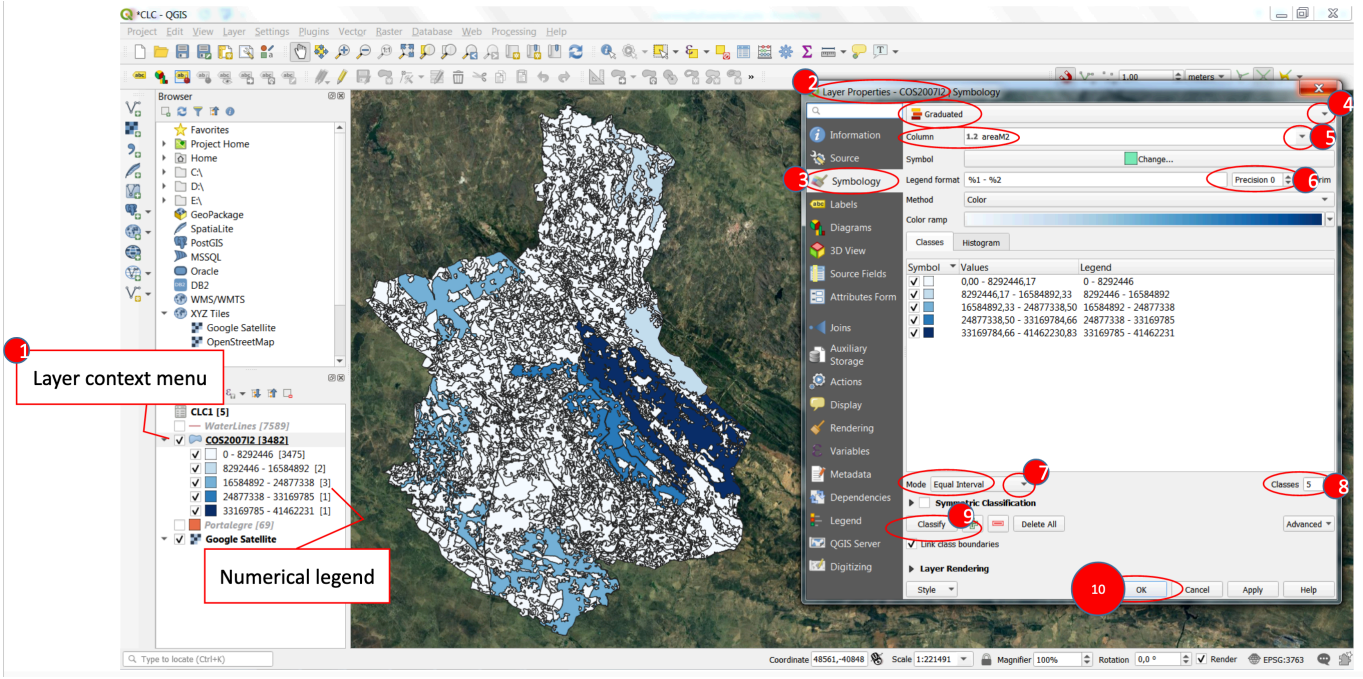


2.10. Create a legend/key

You can create a legend based on the attribute data of a layer. Follow the steps in the image to create a legend for the layer `COS200712`.

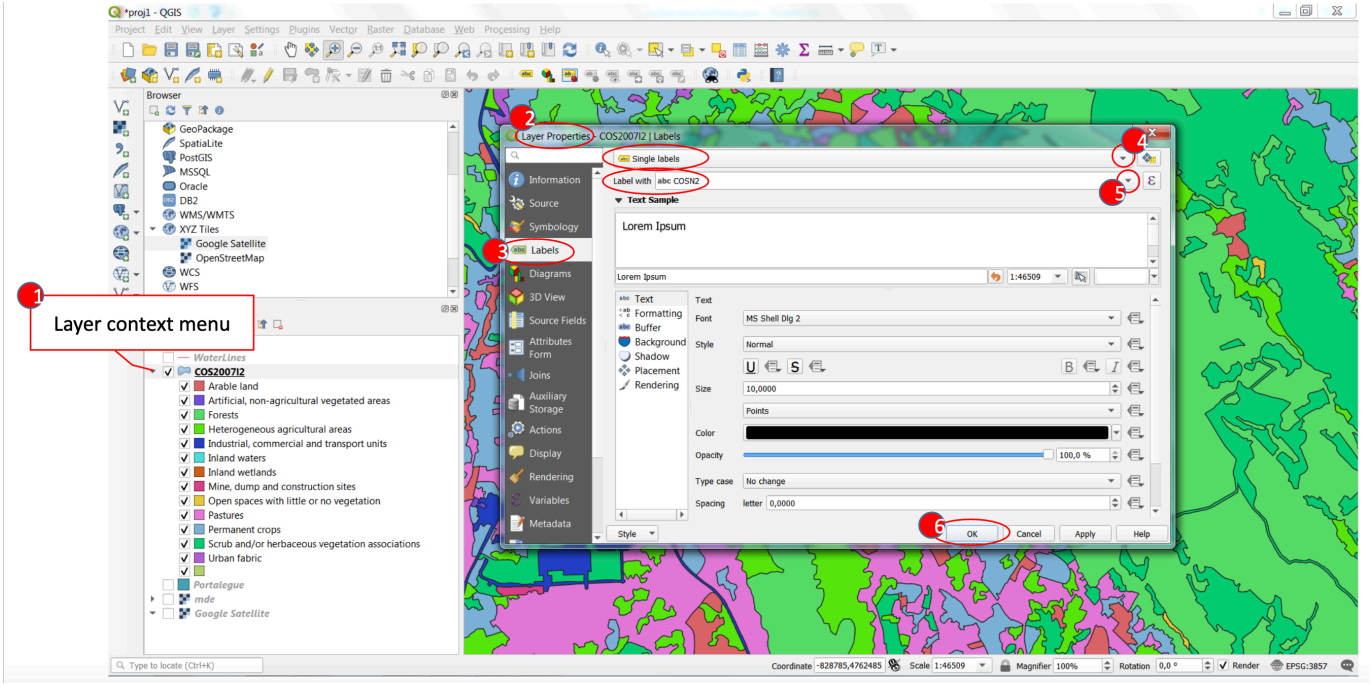


Repeat the procedure on the same layer, but select a numeric attribute.



2.11. Add labels to the spatial features

You can create add labels to the features based on the attribute data of a layer. Follow the steps in the image add labels to the layer `COS200712`.



2.12. Save or Save as

You can save all the changes you made to your project (legend, labels, visible layers and order, etc.). Please note that the files of the geographic layers are not saved inside the project file. Instead, what the project saves is the relative path to the storage location of the geographic files in your disk.

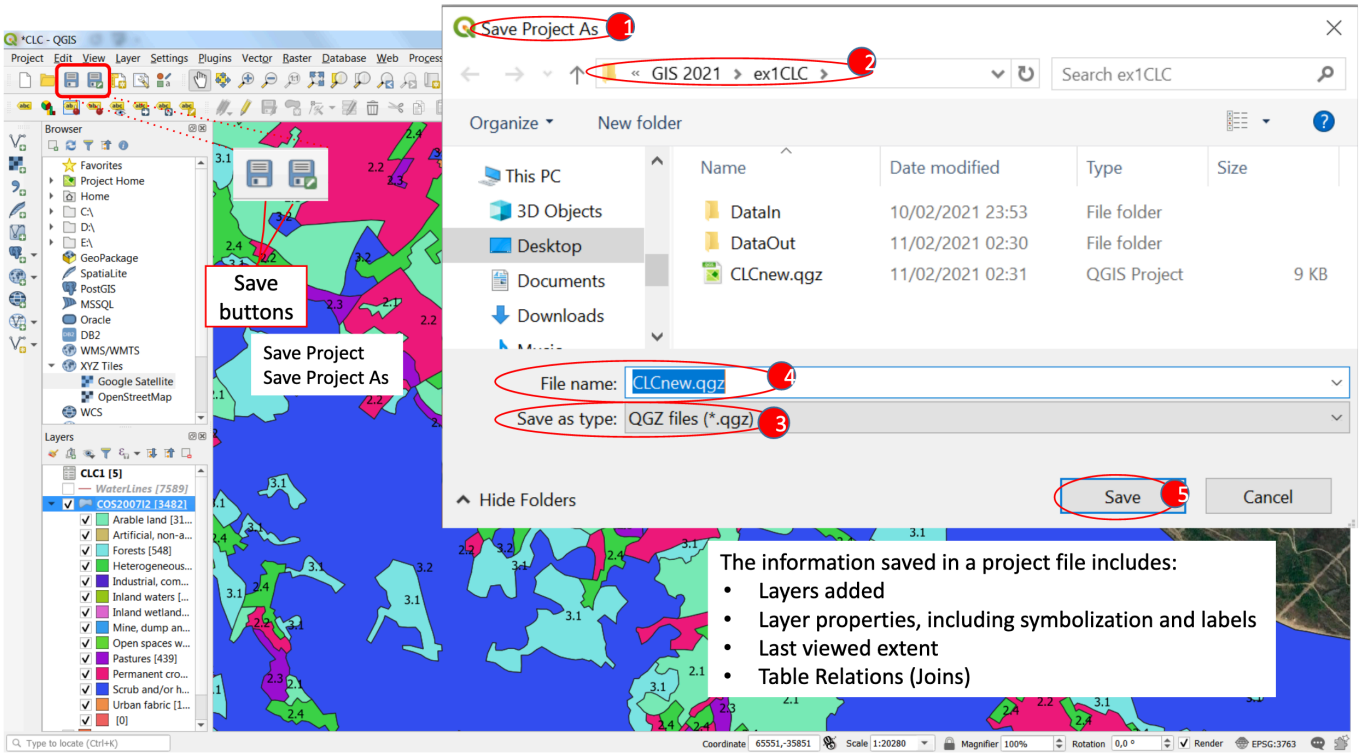
For this reason, it is very important to save the project with the final location of the files, and not to move them, or change the name of the folder where these are stored, after closing the project.

The ideal structure of a QGIS project should be, for the present example:

```
Project item                Description

ex1CLC                      (project folder)
|   CLC.qgz                 (project file)
|
└──DataIn (folder)          (subfolder)
|   |   CLC1.xls            (data file)
|   |   COS200712.gpkg      (data file, geopackage)
|   |   Portalegre.gpkg     (data file, geopackage)
|   |   Waterlines.gpkg     (data file, geopackage)
|   |   ...
|
└──DataOut (folder)
    |   ...
```

You can also save the project with a new name:


Save Project As
GIS 2021 › ex1CLC
Search ex1CLC
Organize
New folder
This PC
3D Objects
Desktop
Documents
Downloads
Name
Date modified
Type
Size
DataIn 10/02/2021 23:53 File folder
DataOut 11/02/2021 02:30 File folder
CLCnew.qgz 11/02/2021 02:31 QGIS Project 9 KB
File name: CLCnew.qgz
Save as type: QGZ files (*.qgz)
Hide Folders
Save
Cancel
Save buttons
Save Project
Save Project As
The information saved in a project file includes:
• Layers added
• Layer properties, including symbolization and labels
• Last viewed extent
• Table Relations (Joins)