Geographic Information Systems 2022-2023

Exercise 3 - QGIS - Perform you first analysis with QGIS 3.22

Introduction

The goals of these exercise are:

- To create a geographic data set (gds), in a folder named DataOut, representing locations from the gds COS2007l2 that simultaneously verify the following requirements:

  - have a water stream within a distance less than or equal to 1 km
  - have a 1st level of the CLC (Corine Land Cover project) classification as "Agricultural areas" or "Forest and semi natural areas"

- To calculate:

  - The areas of "Agriculture" or "Forest and semi natural areas", in ha
  - The areas per administrative region "freguesia" of "Agriculture" or "Forest and semi natural areas", in ha.

You will be guided through the exercise with visuals representing the actions to take.

What do you need:

For this exercise, you should use the same project as saved in the final of the exercise 02. It includes:

- the input data for the exercise 01, also available from Fenix → SIGeo → Exercises → ArcGIS Pro → ex1CLC.zip. It contains three spatial layers, and a csv table:

  - gds COS2007l2 (geometry: polygons) – land coverage according to the 2nd level classification of the project CORINE Land Cover
  - gds WaterLines (geometry: lines) – waterlines (rivers but not only)
  - gds Portalegre (geometry: polygons) – administrative boundaries (freguesias)
  - table CLC1 (table) – the 1st level classification of the project CORINE Land Cover
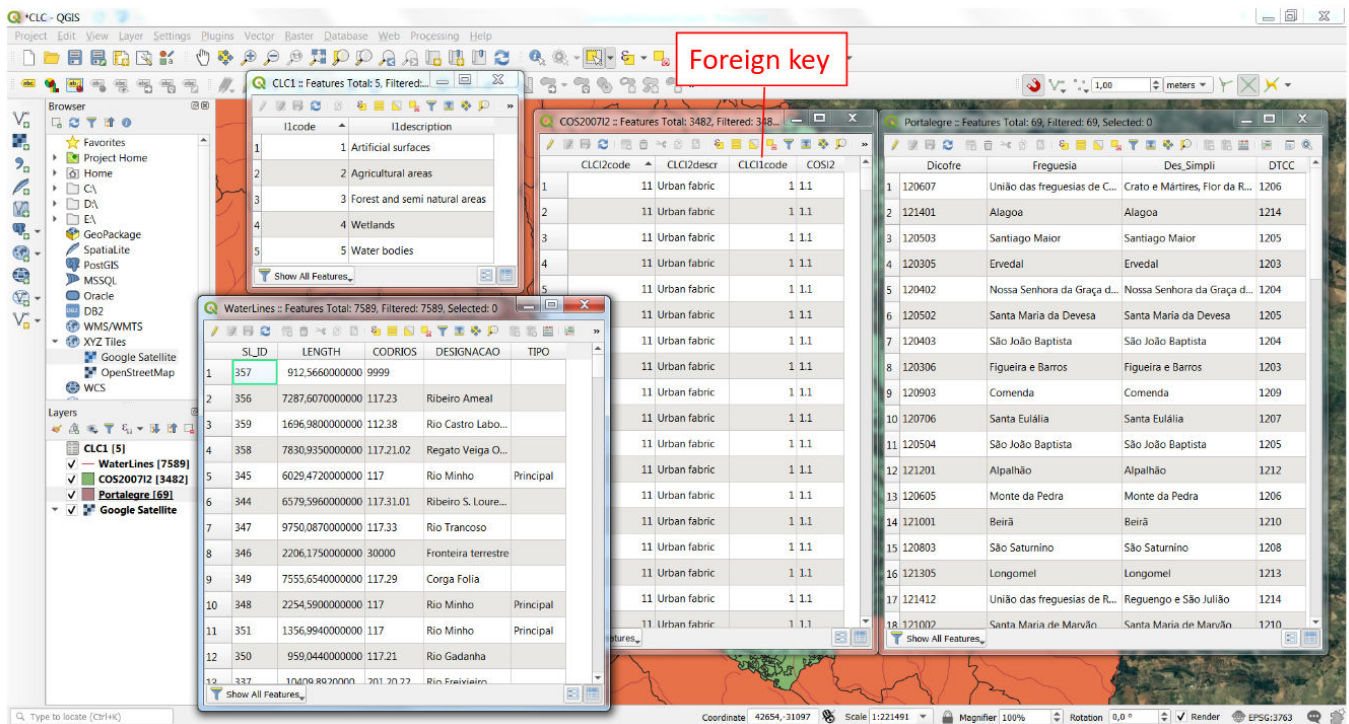
Expected output

You should prepare your environment to save the output layers, using the Catalog Pane:

- create a folder under "DataOut"
- create a new geopackage inside the new folder named "ex03_out.gpkg". This geopackage will store new layers. Details on how to create the geopackage later in the exercise.

Requirements

You will use QGIS 3.22 to perform this exercise. You should have performed before Exercise 02, about the introduction to QGIS interface.

You should also be able to use QGIS documentation to, search, learn and solve questions on how to use the tools. The documentation is available, either from the **Help** of the software, or online.

Quality control

You are required to make quality assessment steps through out the workflow. This involves:

- check the if the results of each spatial operation make sense.
  - this may require additional calculations by hand, for example, to cross-check area values in square meters with hectares
  - spatial operations may results in outdated data in the attribute tables of the outputted gds. This requires review, clean and update these tables
- ensure that data inputs and data outputs are correctly managed
  - imported datasets do not contain errors (in the attribute values)
  - file names are correctly spelled and file location is the expected (cross-check using the file explorer of your system)
 - the project is frequently saved, and can be closed and open without issues

Task 1 - Create a geographic data set (gds) in a folder named DataOut representing locations from the gds COS2007l2 that simultaneously verify the following requirements:

**A. There is a waterline within a distance less than or equal to 1 km**

B. The 1st level of the CLC (Corine Land Cover project) classification is "Agricultural areas" or "Forest and semi natural areas"

One solution:

1. Clip the gds **Waterlines** (7589 lines), in order to reduce these data to the **COS2007l2** polygon layer (only 62 lines):
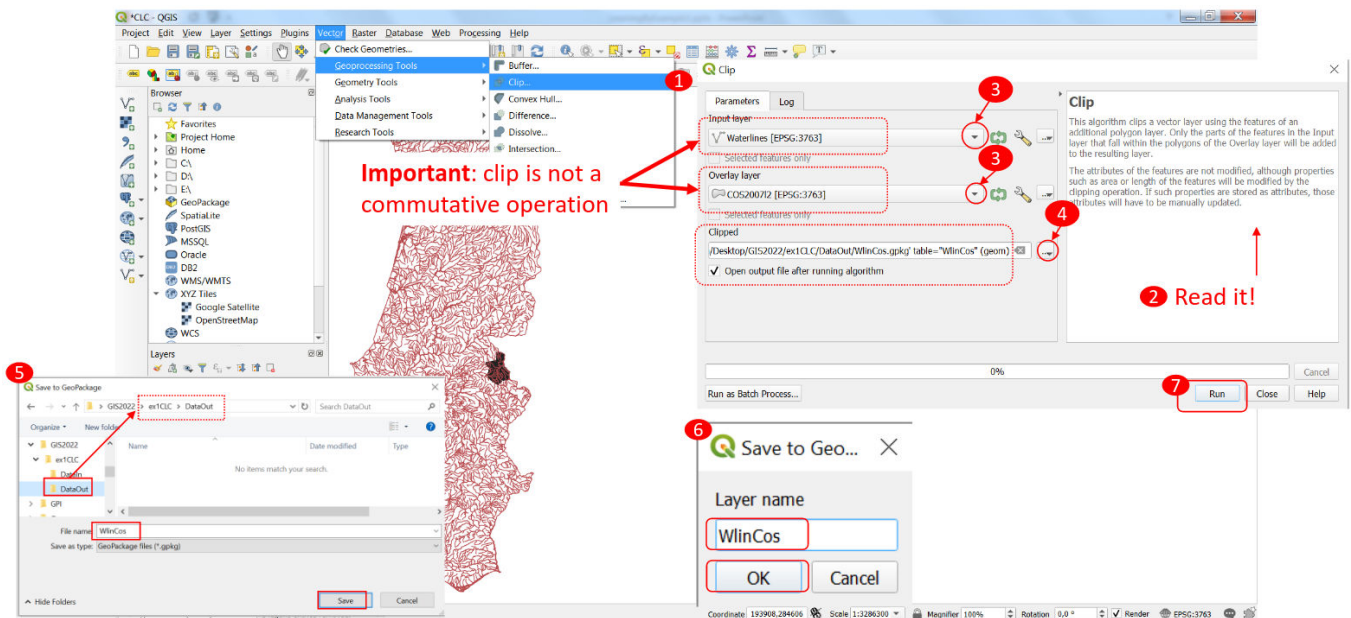
After performing the operation, there are some issues related to not valid or outdated data:
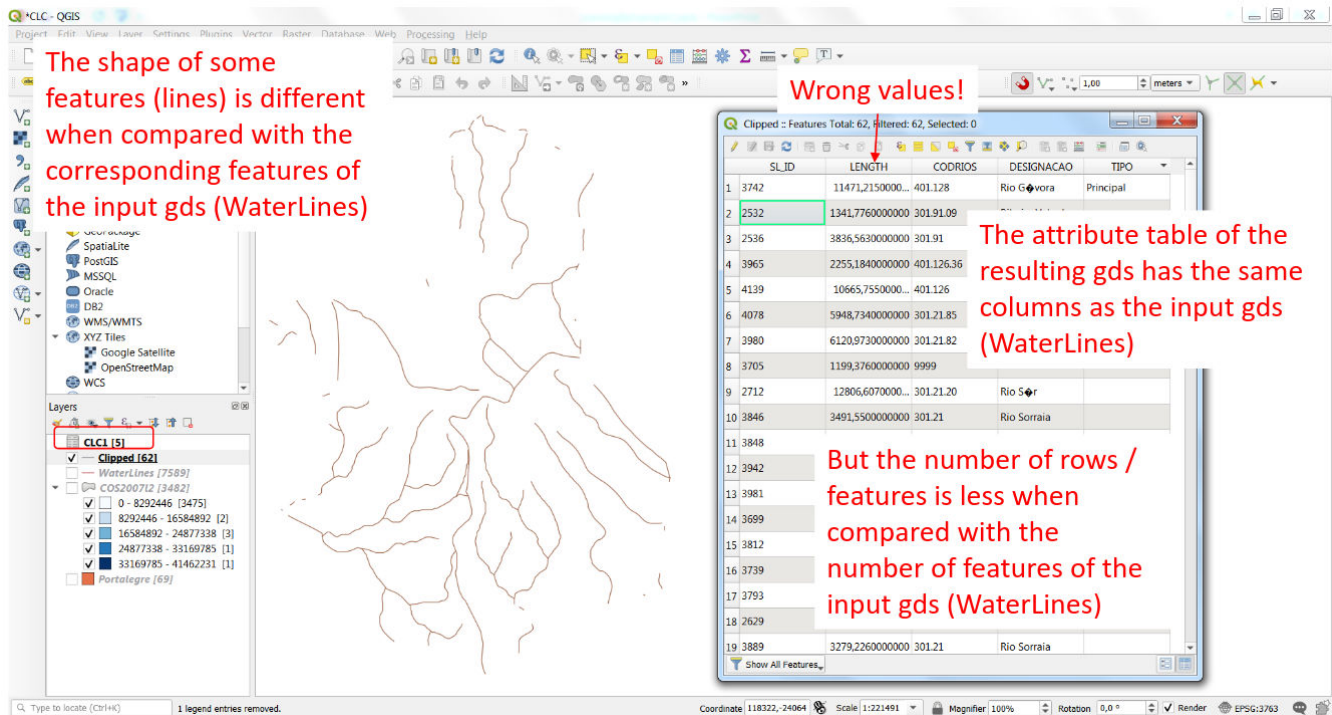
To fix the problems:

- Open the attribute table of the gds WlinCos
- Delete the attribute LENGTH of the gds WlinCos
    - Use the Toggle Edit Mode button of the attribute table toolbar
    - Use the Delete field button of the attribute table toolbar ...
    - Use the Toggle Edit Mode button and save the **data updates**
- Create a new attribute of the clipped gds with **data type** *decimal number (real)*, name it `lengthKm` and fill it with every feature length (unit Km)
- Use Field Calculator and from the Geometry subset of functions, select `$length`, to build the expression:

```
$length / 1000
```

- Save the data updates
- Save your QGIS project
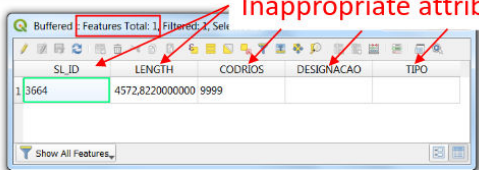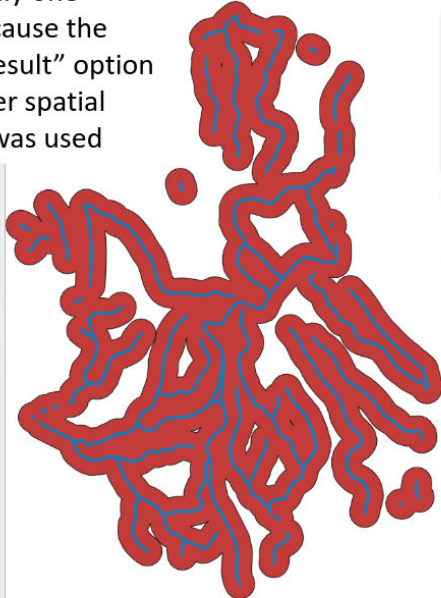
This is the visual sequence of operations:
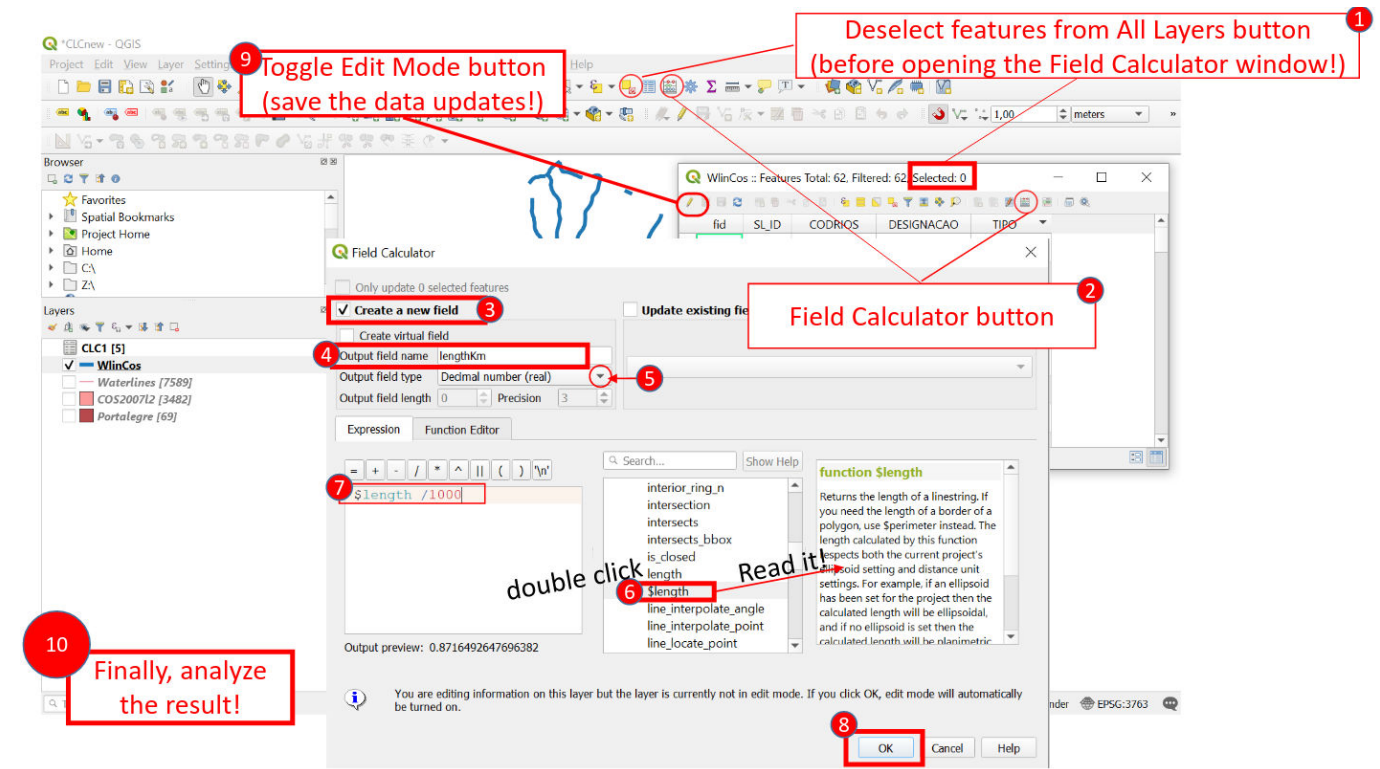
Analyze the results:
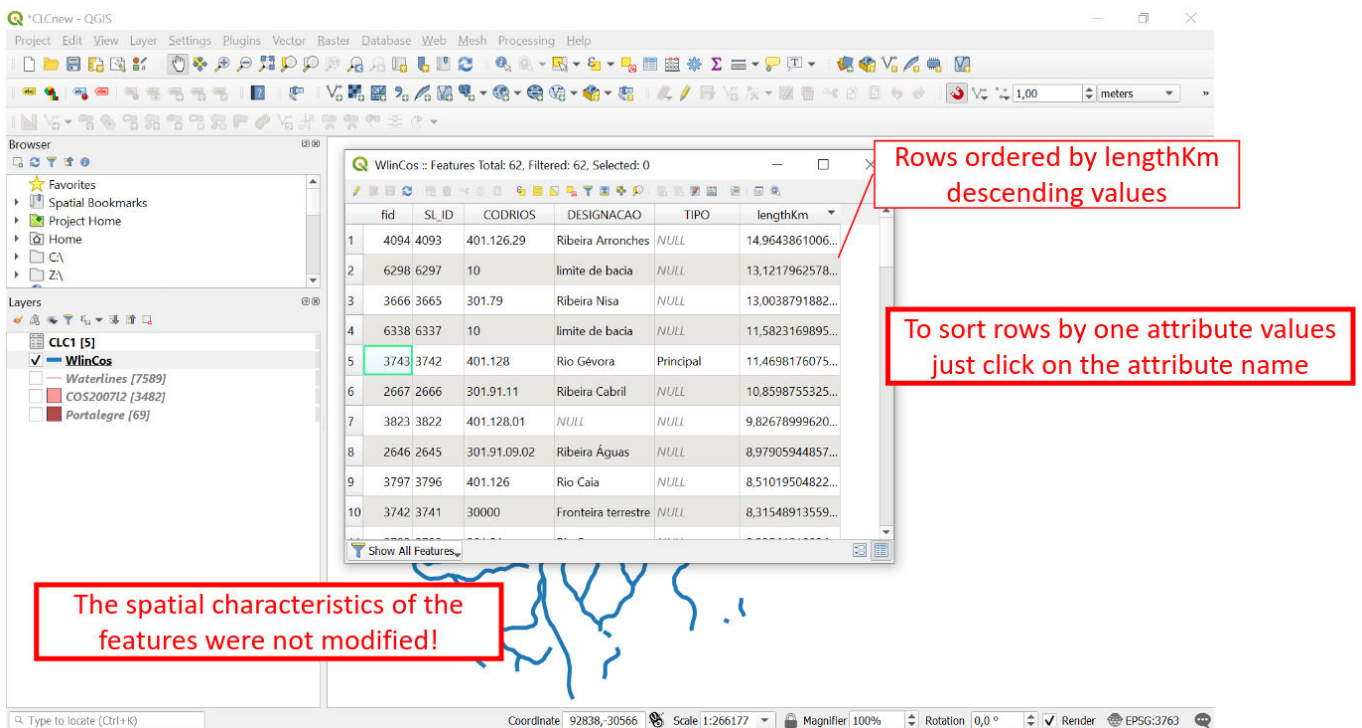
2. To find out *regions within a distance less than or equal to 1 km from the clipped waterlines* (layer **WlinCos**)

To do this operation, we will use the **Buffer** spatial operation:

Analyze the results:

Fix the issues:

- Delete attributes: "SL_ID", "LENGTH", "CODRIOS", "DESIGNACAO", "TIPO" and "lengthKm"
- Toggle Editing Mode on
- Use the Delete Field button ...
- Toggle Editing Mode off and save the data updates
- Save your QGIS project

3. Find the regions from **COS2007I2** that are within a distance less than or equal to 1 km from the clipped waterlines:
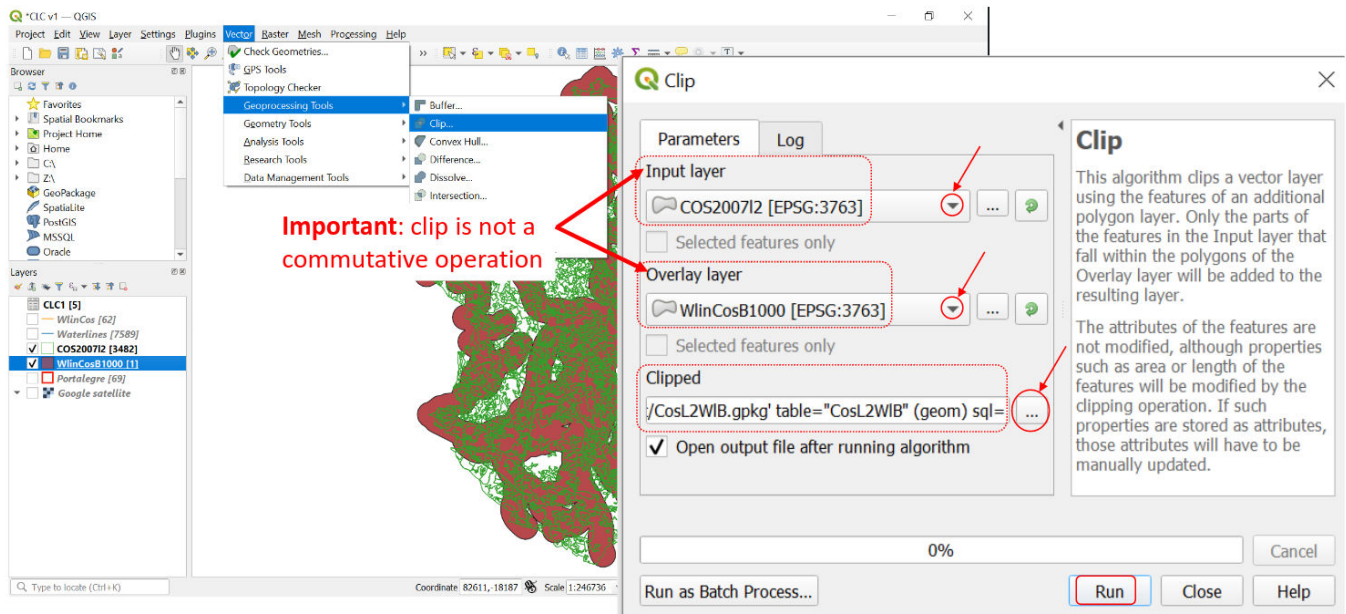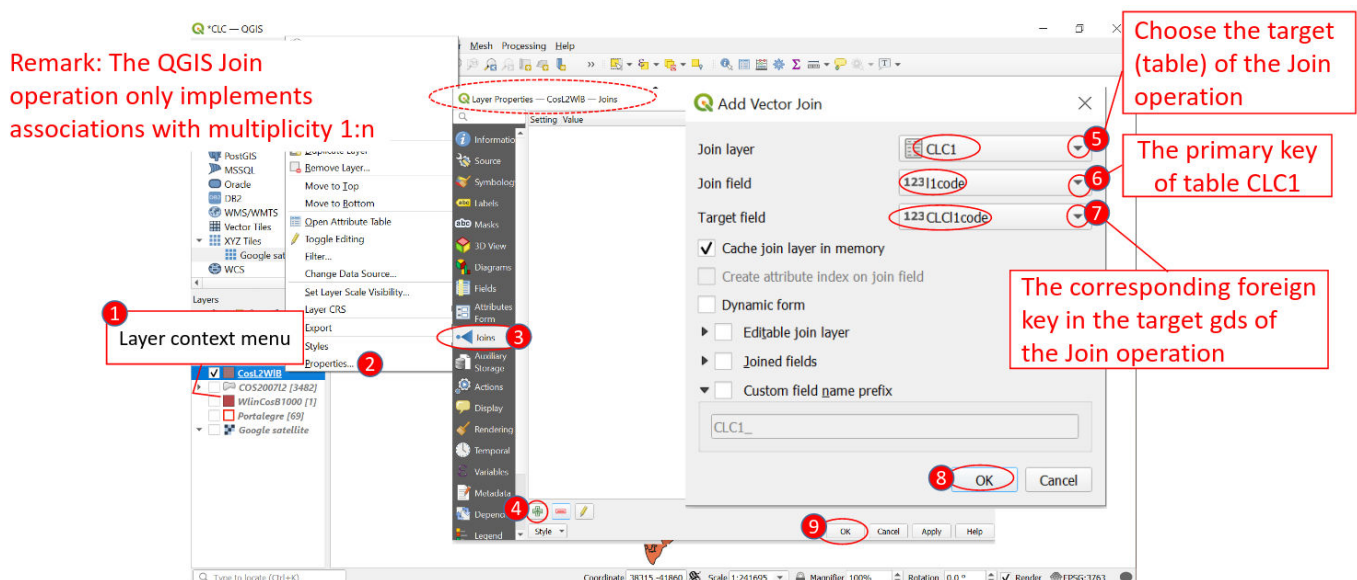
You need to perform additional verifications or changes:

- Verify if the attributes of gds CosL2WlB must be fixed
- In the gds CosL2WlB, create a new attribute named `areaM2` containing the area of each polygon, setting as unit **m2**, and datatype: *Whole number (integer)*
    - Use the tool Field Calculator for this operation
- In the gds CosL2WlB create a new attribute named `areaHa` containing also the area of each polygon, setting as unit **ha**, and datatype: real
    - Use the tool Field Calculator and the expression `areaM2 / 10 ^ 4`
- In the gds CosL2WlB create a new attribute named `perimKm` containing the perimeter each polygon, setting as unit **km**,« and datatype: real
    - Use the tool Field Calculator fro this operation
- Save your data (gds CosL2WlB) and the QGIS project

4. Perform a **join** operation to append the 1st level of the CORINE Land Cover (table **CLC1.csv**) to the **CosL2WlB** layer

Use the **Join** function, available on the Properties panel, opened via context menu of the layer:

Verify in the attribute table that the fields of the CLC1 table were appended:

5. On layer **CosL2WlB** , select the polygons classified as **"Agricultural areas" or "Forest and semi natural areas"** using the **l1description** attribute

Use the **Select By Expression** tool (available on the Map tab) and logical conditions (logical operators: AND, OR)

Analyze the results:

6. Save the previously selected polygon as a new gds:

- Use the option fom the the context menu of the layer to save the selection as **AgricForInWlB1000**. Since a selection is active, only the selected features will be included in the export;

- Save your QGIS project.

Task 2 - Calculate:

A. The areas of "Agriculture" or "Forest and semi natural areas", in ha

B. The areas per administrative region "freguesia" of "Agriculture" or "Forest and semi natural areas", in ha
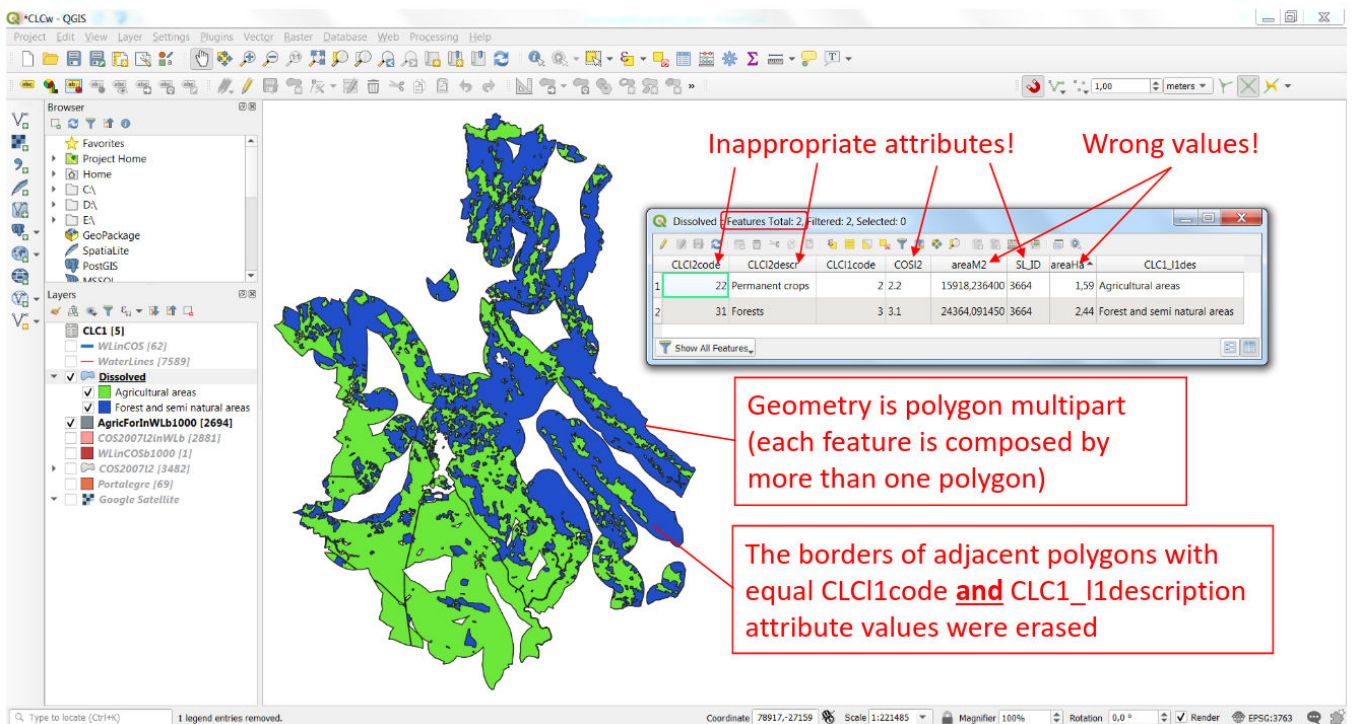
One solution:

To answer to question A:

1. Dissolve the gds **AgricForInWlB1000** in order to create one polygon representing land classified as "agricultural areas" and one polygon representing land classified as "Forest and semi natural areas". Give to the new gds the name `AgricForDiss`
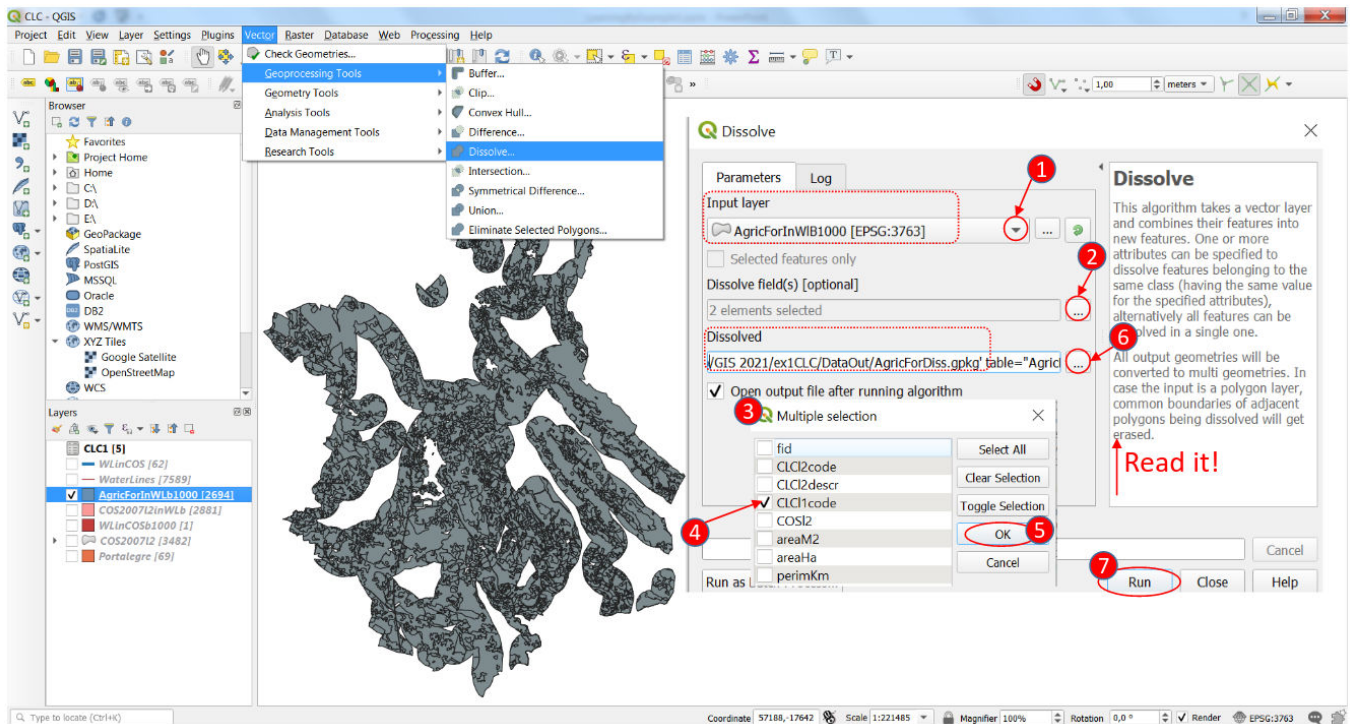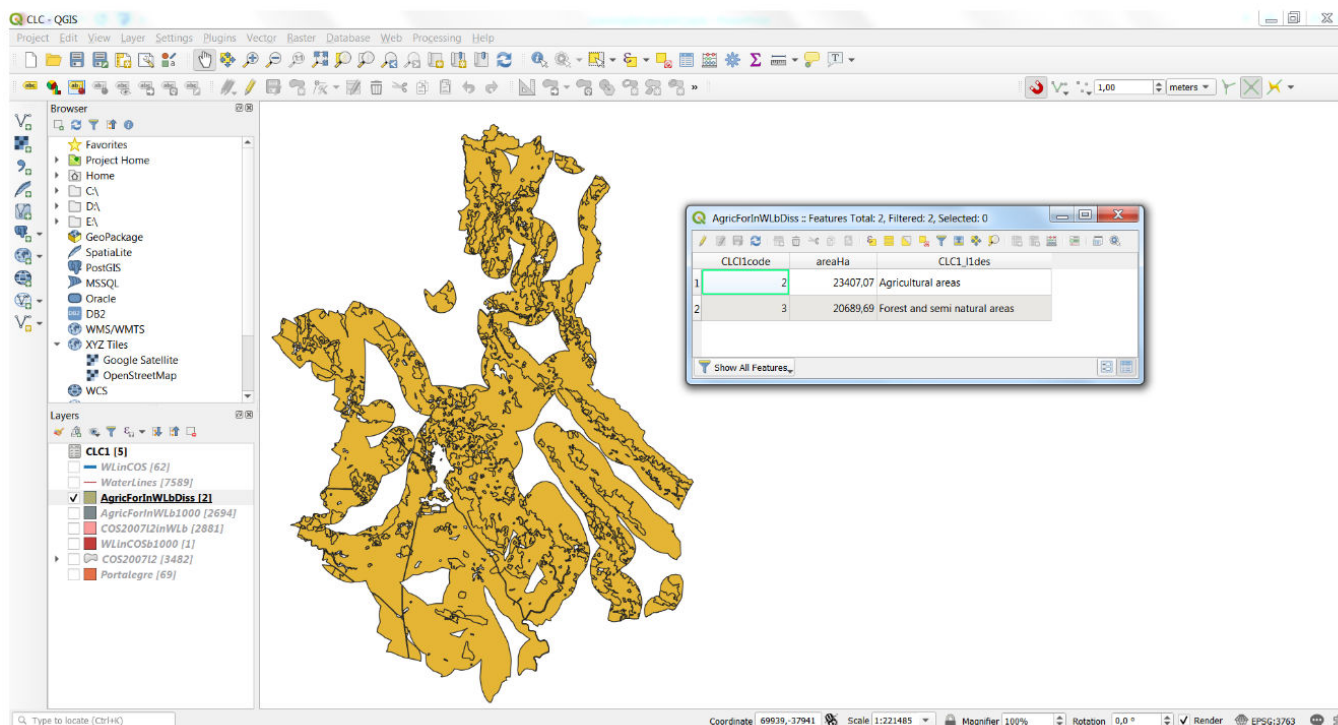
Analyze the results:

Fix the issues:

- Delete the inappropriate attributes of the new gds **AgricForDiss**
- Update the values of the attributes **areaM2**, **areaHa** and **perimKm** of the new gds **AgricForDiss**
    - Use the Field Calculator only to update the attribute values
- Save the updates to data (gds **AgricForDiss**)
- Save your QGIS project

See the final result:

To answer to question B:

1. Create polygons by the 1st class of land coverage classification ("agricultural areas" or "Forest and semi natural areas") subdivided by "freguesia"
   - use the **Intersect** spatial operation to intersect **AgricForDiss** with **Portalegre** and create a new gds named `AgricForFreg`
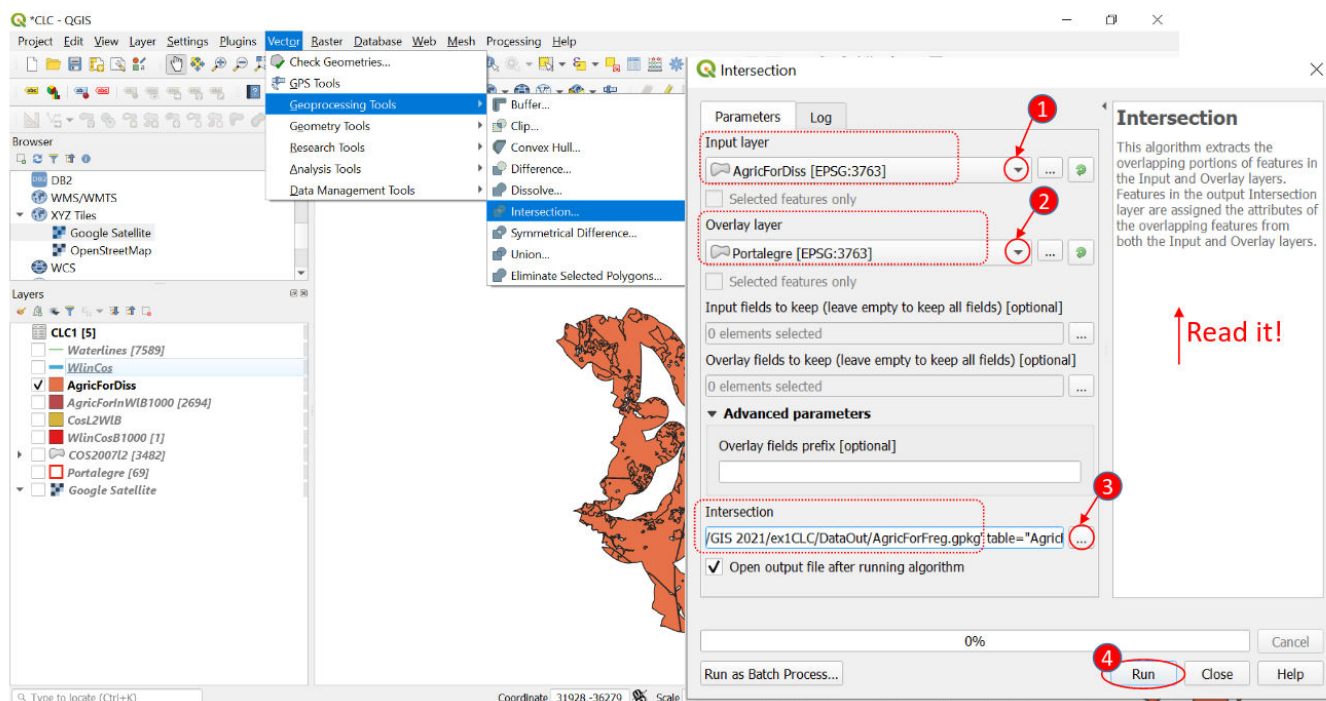
2. Update the **Symbology** to display the combination of land cover and freguesias - use the **Expression Dialog** tool to add an expression that results in the following legend:
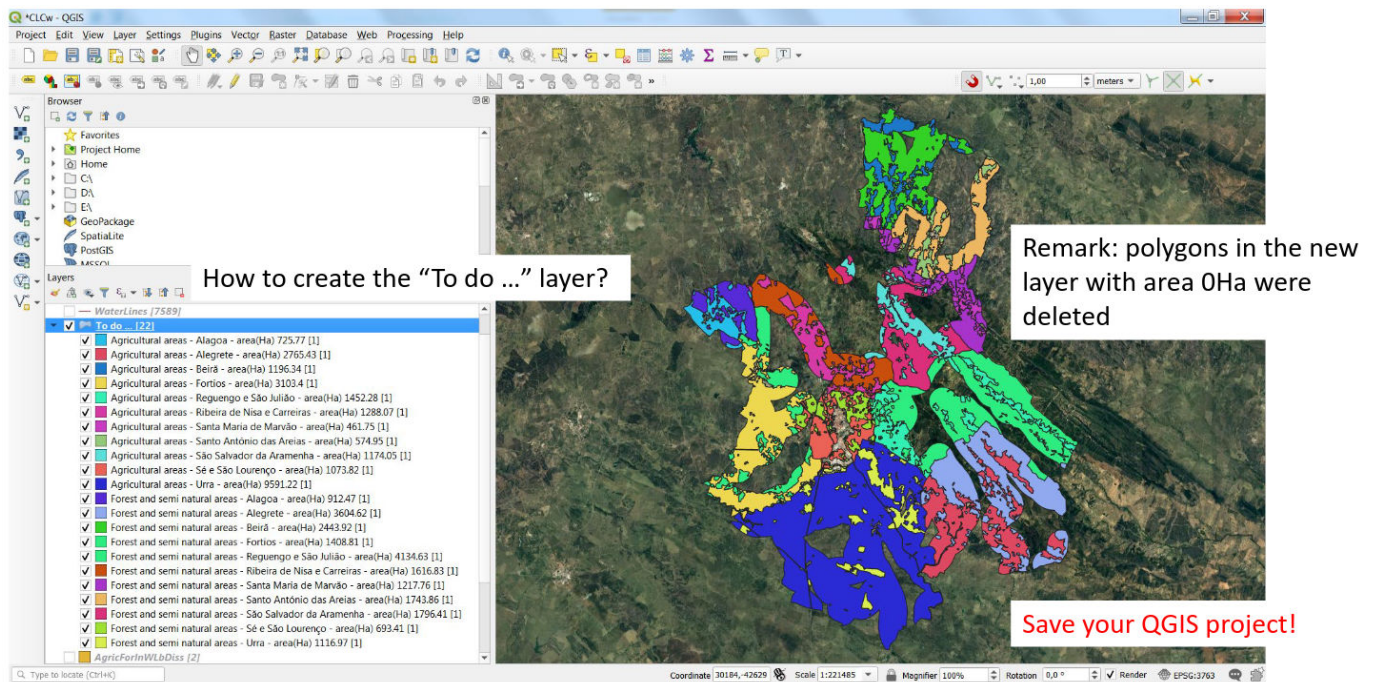
3. Update the values of attributes **areaM2**, **areaHa** and **perimKm**

Task 3 - Describe quality control measures

Describe which quality control measures did you take during the analysis workflow:

- ...
- ...
- ...

...

Summary and wrap up – Intro do QGIS

This is what you leaned during the first three exercise:

- QGIS support documentation
- Opening a QGIS project
- The QGIS interface
    - Terminology
    - Identify and reset panes
    - Zooming and panning
    - Viewing and hiding toolbars
    - Understand file geodatabases
    - Connecting to Google Satellite Imagery
    - Other buttons of the standard toolbar
        - Open Attribute Table
        - Identify Features
        - Select Features
        - Deselect Features from All Layers
    - Saving a QGIS project
        - Save

- - - - Save As ...
    - Exiting a QGIS project
  - Some basic QGIS functions
    - Active Layer Context Menu / Properties / Symbology
      - Single symbol
      - Unique values (categorical legend)
      - Graduate colors (numerical legend
    - Active Layer Context Menu / Properties / Labels
    - Active Layer Context Menu / Properties / Joins
    - Field Calculator
      - Creating a new attribute filled with values
      - Functions: $length, $area and $perimeter
    - Selecting features using a logical expression (condition)
    - Vector menu / Processing Tools
      - Buffer
      - Clip
      - Dissolve
      - Intersect
- Map legends (categorical and numerical)
- Map labels
- Non-spatial operations
  - Select By Attribute
  - Join of 2 tables (associations 1:n)
- Spatial operations
  - Clip
  - Buffer
  - Dissolve
  - Intersect