Exercise 1

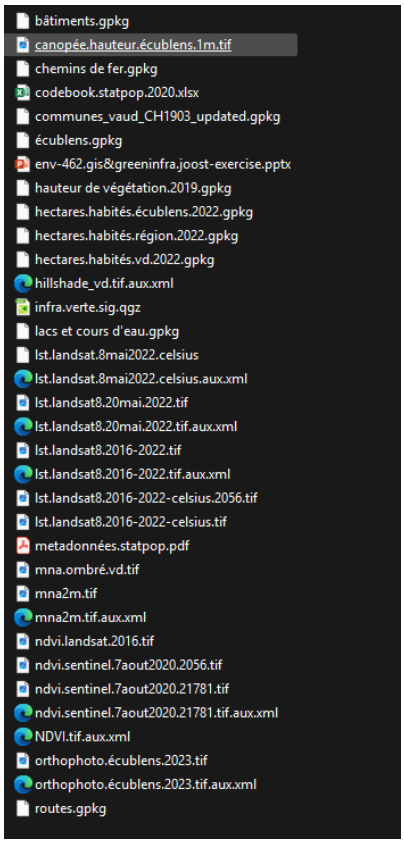
1. Install QGIS on your personal laptop
   https://www.qgis.org/en/site/forusers/download.html

   We recommend to install version 3.4 LTR
   (long term release)

2. In case the language of your QGIS version is set to French or to any another language but english, set it to American English.
   Go in the menu Preferences > Options > General, and then tick the box “Substitute system’s regional parameters” and select “American English”.
   Then leave and restart QGIS.

3. Download the data stored here:
   https://filesender.switch.ch

4. Unzip the file named gis4ugbi.ecublens.zip (!! 227 Mb !!)
   You will get this list of files



5. Double-click on the QGIS project file named “infra.verte.sig.qgz”

6. Play with the QGIS interface in order to display/hide the different layers, change the superposition order of the different layers, zoom in and zoom out.

7. I will describe all layers so that you have explanations on data sources, about how the data were acquired, and about why we will use this source of information. During the explanations, display the corresponding data layer only (tick this layer only in the Layers Panel and then, select the Layer, right-click and choose Zoom to Layer (s))

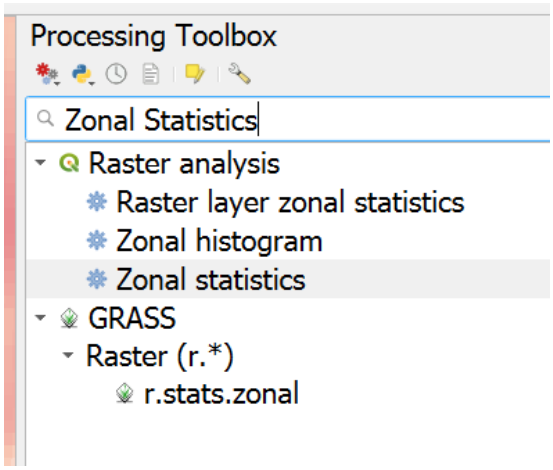
8. Select the “hectares.habités.écublens.2022” layer and then click on the Open Attribute Table tool ( ) to access the attributes of the inhabited hectares.

9. Find the location of the Esplanade at EPFL (with the Pan tool) and indicate the land surface temperature (information tool on the LST raster layer)

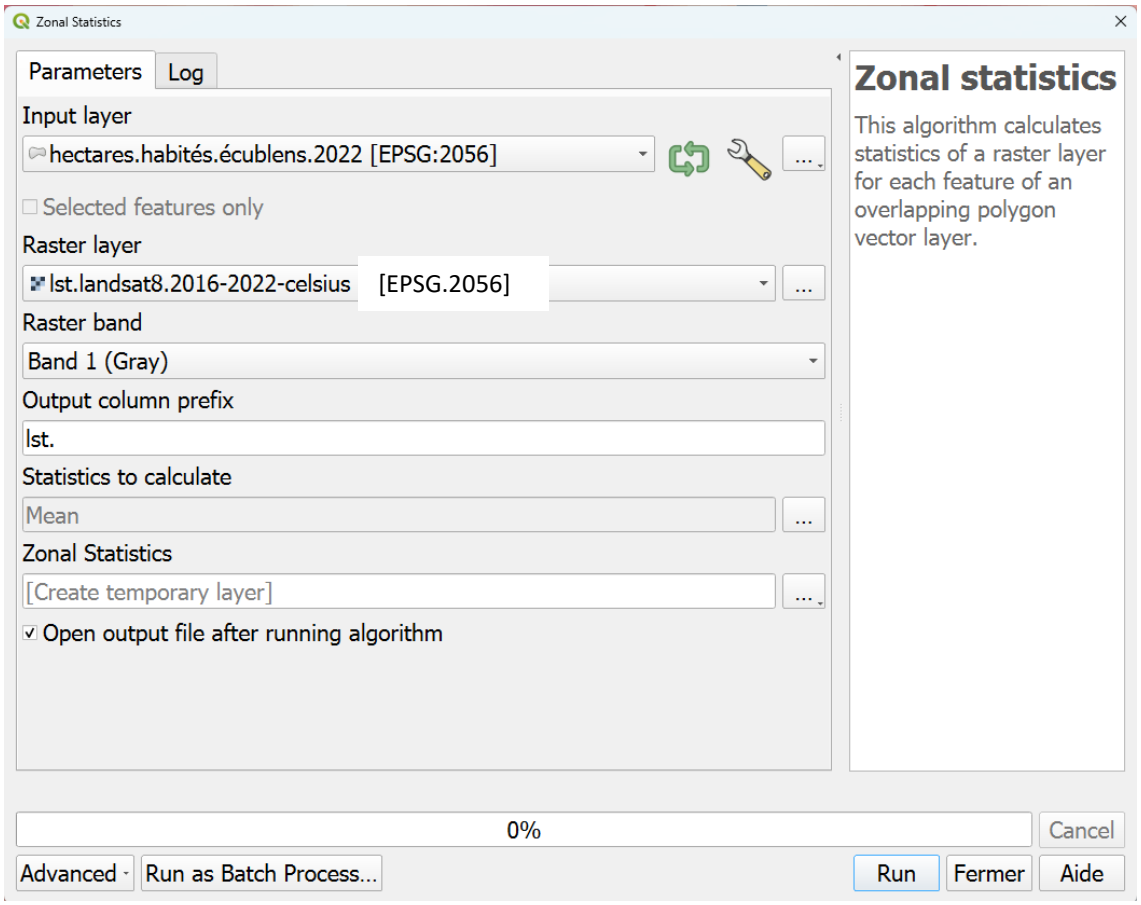
10. We will calculate three useful statistics to take into account and assess environmental conditions that will have an effect on the population’s health and well-being. These three statistics are:
    - the mean LST in inhabited hectares
    - the mean NDVI in inhabited hectares
    - the mean canopy height in inhabited hectares

    These statistics will be used later in the semester.

    a) To calculate the mean of LST (“lst.landsat8.2016-2022-celsius.2056”, which is the mean of land surface temperatures in June, July and August for years 2016-2022), we need the Zonal Statistics tool that you can find in the menu Processing > Toolbox (or Ctrl+Alt+t).
    b) Then type “Zonal Statistics” in the search field on the top as illustrated in the following figure.



c) Double-click on Zonal Statistics and you will get the following window:

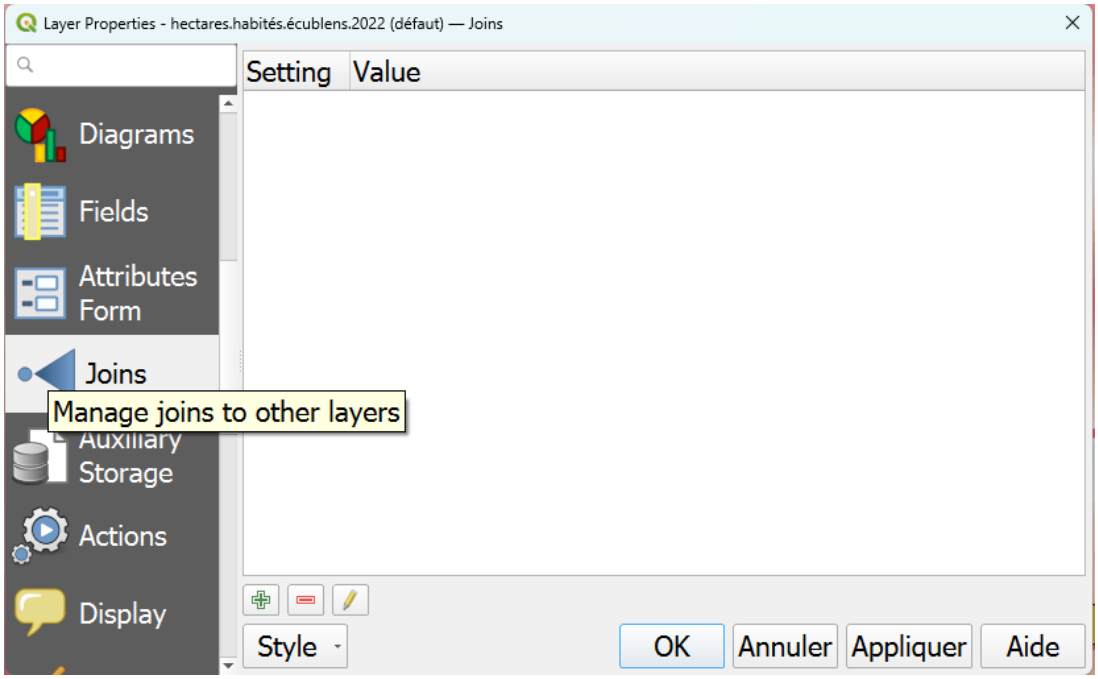


The input layer is the vector file (inhabited hectares) in which we want to calculate the mean of LST (and later of the two other variables). The raster layer is the LST file ("lst.landsat8.2016-2022-celsius.2056"). The raster band 1 is the unique band available for the LST file we use (idem for NDVI and canopy).

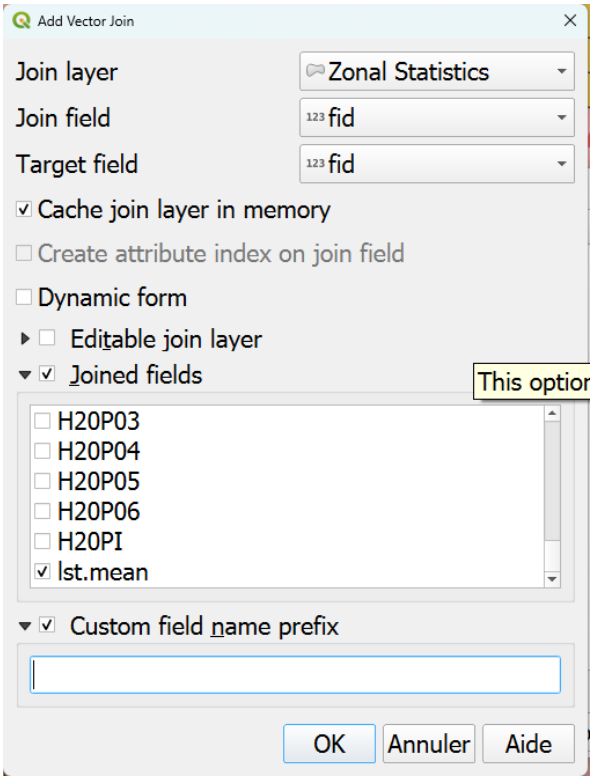
Indicate “lst.” as output column prefix, and set the Statistics to calculate the “Mean” only. When you click on Run, the Zonal statistics will be stored in a new temporary layer named “Zonal statistics”, and constituting a copy of the original “hectares.habités.écublens.2022” with the last column named “lst.mean”.

d) After having clicked on Run, the Log panel will be displayed, and a new layer named Zonal statistics will appear in the Layers panel. Click on the Parameters panel and repeat the operation with the “ndvi.sentinel.7aout2020” layer. Choose “ndvi.” As prefix, select the Mean statistic to be computed, and Run. Again the Log panel will be displayed, and a new layer named Zonal statistics will appear in the Layers panel. Do it again with the third variable (“canopée.hauteur.écublens.1m”).

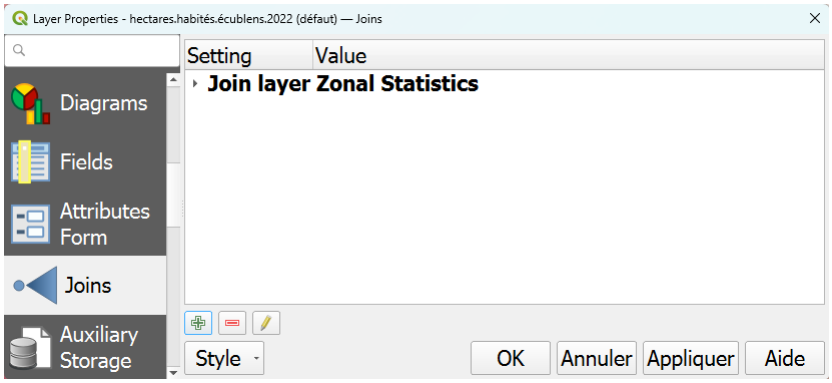
e) You now have 3 “Zonal Statistics” layers in your Layers panel. We will now transfer the variables we calculated and transfer them to the file “hectares.habités.écublens.2022” by means of a join. Double-click on the “hectares.habités.écublens.2022” layer, and then click on Joins (see hereunder):



Then click on the + button. The following window will open:



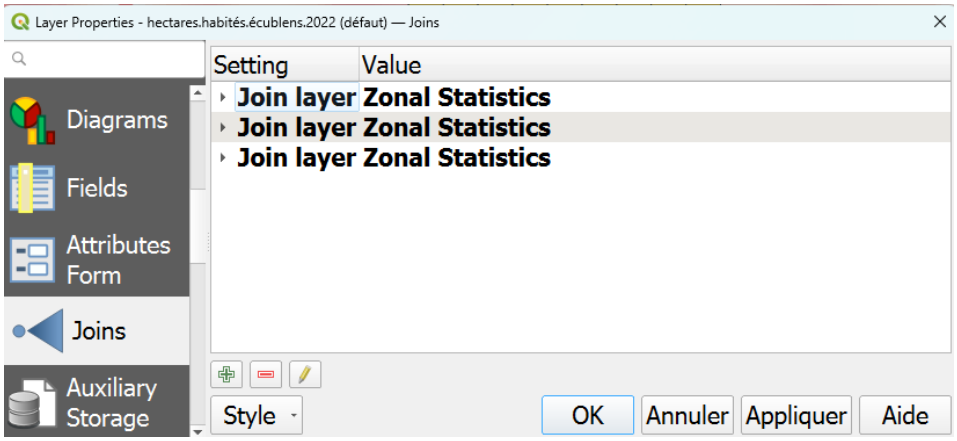
In the first “Join layer” field, select the first “Zonal Statistics” layer (choose any of the 3), then be sure the “fid” field is selected as join field. Tick the “Joined fields” box, go to the bottom of the list and tick the “lst.mean” field. Tick also the “Custom field name prefix” and delete the text to get an empty box like on the illustration here above. Then click OK. The first join will appear in the list (see hereunder)



f) Click on + to create the second join for the “ndvi.sentinel.7aout2020” layer and indicate the same parameters. You will observe that the two remaining “Zonal Statistics” layers only can be linked. Choose any of the two and achieve the operation.

g) Click on + to create the third join for the “canopée.hauteur.écublens.1m” layer. There is only one “Zonal Statistics” layer remaining.

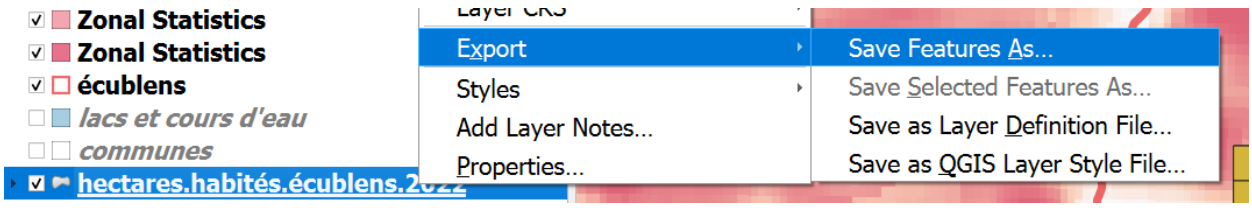
h) You now have the 3 joins completed (see hereunder) and you can click on OK.



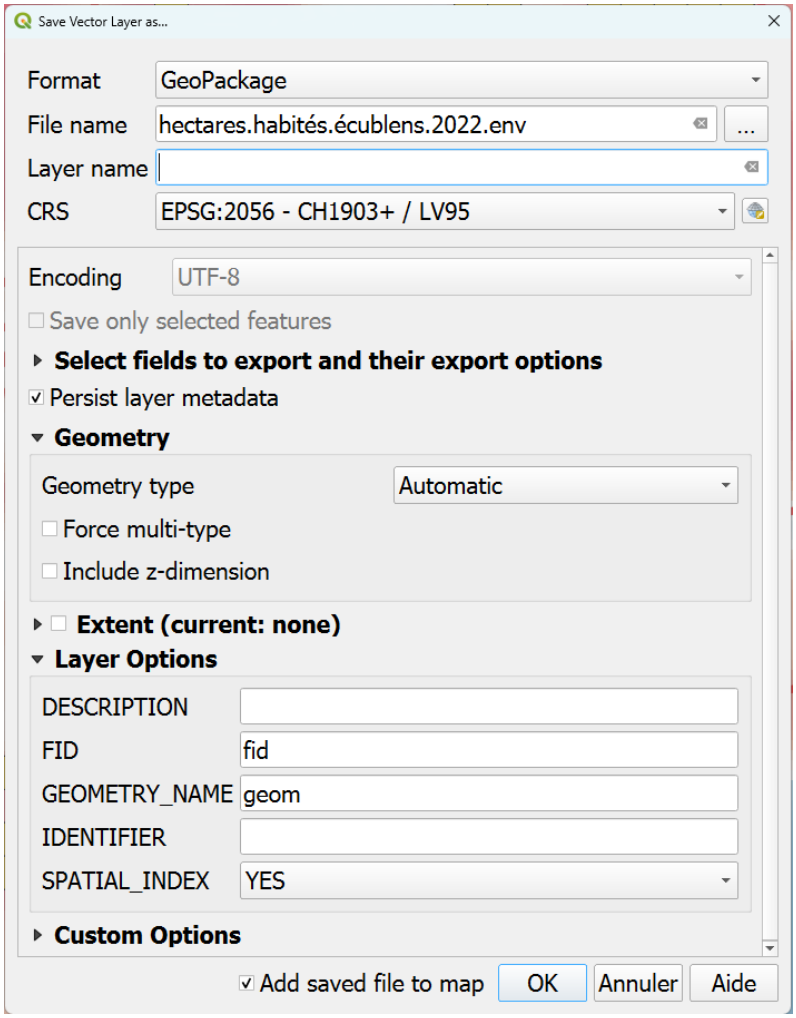
Select the layer “hectares.habités.écublens.2022” and open the table of attributes. You will see that the last three columns are the 3 means you just computed.

i) Finally, we need to save this layer, including the 3 statistics we computed. Indeed the latter are still temporary as they are based on the 3 “Zonal Statistics” temporary layers. Thus they are stored in the Random Access Memory and we need to create a new version of the file with the inhabited hectares now characterized by mean land surface temperature, NDVI and canopy height.

h) Select the layer “hectares.habités.écublens.2022”, right-click, choose “Export” and “Save Features As…”.



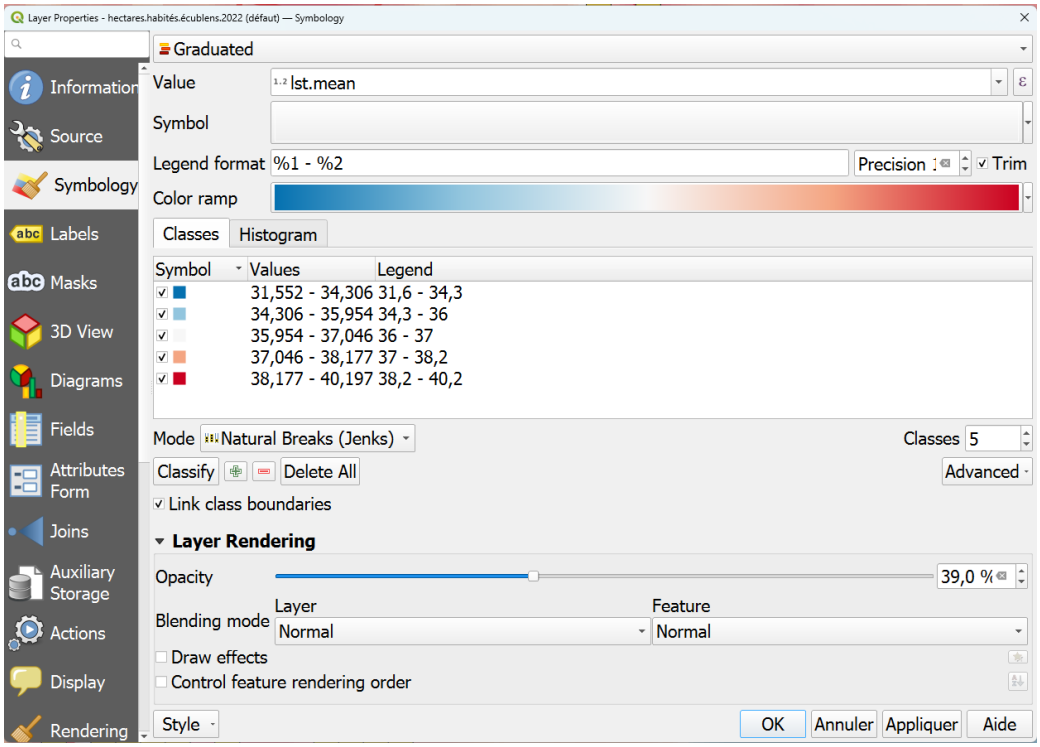
The following window will open. Choose the GeoPackage format, add “.env” to the name of the inhabited hectares file, keep the same projection system (CRS) and be sure that the “Add saved file to map” box is ticked (see illustration hereafter). Then click on OK and the new layer will be displayed in your Layers panel.



11. To finish this exercise, you can create a thematic map of each of the 3 variables we just computed. To do so, double-click on the “hectares.habités.écublens.2022.env” layer and choose “Symbology”.

    Choose the “graduated” type of discretization as we have quantitative variables. Select the variable you want to represent (value) and then click on the Classify button, choose an adapted color ramp (e.g. colder temperatures in blue versus hotter temperatures in red), set the mode to “Natural Breaks” and 5 classes. You can also set an opacity value to your new thematic map (see next illustration).

    Save your project ! (ctrl + s)



Once your map is ready and displayed, you need to duplicate your “hectares.habités.écublens.2022.env” layer to create your second map (“Duplicate Layer”). You will have to do it again to create your third map.

Rename your layer (“Rename Layer”) with the name of your maps (e.g. “LST.inhabited.hectares”, “NDVI.inhabited.hectares”, and “CAN,inhabited hectares").