Exercise 3

Production of an open environmental dataset for the State of Geneva area

The goal of this exercise is to create an open dataset containing environmental descriptors to be compared to health data. It will constitute the reference dataset to be used by all groups to elaborate the semester projects/scientific articles.

In Moodle you will be able to download to the following data:

1. **Land Surface Temperature** (LST) is the mean for months of June, July and August in 2009, 2010 and 2011 using Landsat 7 images. When you open these datasets, please assign them the LV03 Swiss coordinate system (EPSG 21781).
2. **Normalized Difference Vegetation Index** (NDVI) is the mean for months of June, July and August in 2009, 2010 and 2011 using Landsat 7 images. When you open these datasets, please assign them the LV03 Swiss coordinate system (EPSG 21781).

   These data were extracted using Google Earth Engine.

   Information on Landsat bands can be found here: https://www.usgs.gov/faqs/what-are-best-landsat-spectral-bands-use-my-research?
3. SonBase **road traffic noise** produced by the Swiss Federal Office for the Environment, characterizing **day** time and **night** time. Please read the documentation hereunder to understand how this database was produced: https://www.bafu.admin.ch/bafu/en/home/topics/noise/state/gis-laermdatenbank-sonbase.html
4. Air pollution **N02**, **PM10** and **PM2.5** produced by the Swiss Federal Office for the Environment and Meteotest. See following link: Map of annual values
5. Hectometric vector grid ("hecto.grid.ge.2015") representing **inhabited hectares** of the Canton of Geneva in 2015. Produced by the Swiss Federal Statistical Office, GEOSTAT service, the center of competence for geoinformation and digital image processing : https://www.bfs.admin.ch/bfs/en/home/services/geostat.html

All datasets are in the Swiss Coordinate System (LV03 or EPSG 21781).

Tasks

1. In Moodle (https://go.epfl.ch/edenv) download the different files containing the datasets described above on a local drive.
2. Open QGIS, name and save your project
3. Import the LST, NDVI, the 2 SonBase road traffic noise (night and day), and the 3 air pollution files (NO2, PM2.5 and PM10). Check that the LV03 Swiss coordinate system (EPSG 21781) was attributed to the 7 files.

4. Open the grid showing inhabited hectares "hecto.grid.ge.2015.
   Save your project (do not forget to save regularly during your work)
5. Then we will characterize each cell of the hectometric grid by different statistics calculated from the 7 raster files. In the Processing menu, choose Toolbox, and then type "zonal" in the search field. Then double-click on the "Zonal statistics" element.
   Select 3 statistics that we want to compute by clicking on the three dots situated next to the "Statistics to calculate" parameter.

   The statistics we need from all raster layers are: mean, median, and standard deviation.

   ***Caution**: use a relevant output column prefix: e.g. for NDVI → "ndvi_"; or for Road Daily Traffic Noise → "rdtn_" or "rdn_". The name of the statistic (mean, median, std) will be automatically added by QGIS to the column output prefix.*

   *In addition, it is important that **all variables have names of maximum 10 digits** because Geoda displays only the 10 first digits of variable names.*

   Calculate these statistics for all 7 raster layers and then right click on the hectometric layer and look at the attribute table.

6. Check that the 21 new columns have been recorded in the target-layer ("hecto.grid.ge.2015.shp").
7. Open the "hecto.grid.ge.2015" layer properties and go to the Symbology tab to impose a graduated color scheme. Create a thematic map with the mean of the NDVI variable on the hectometric (Ha) grid. Choose a discretization in 5 classes with Mode = "Natural breaks". Choose to represent high NDVI values with a dark green hue and low NDVI values with a light green hue.
8. **Save your project**. It is important as the 21 variables mentioned above constitute the dataset you will use during the semester.
9. Open Geoda, import your "hecto.grid.ge.2015" shapefile and start freely investigating the data. Create thematic maps, test the different exploratory tools you discovered in the tutorial last week.
10. Use your free exploratory analysis with Geoda to elaborate your short report. Include 2 or 3 images to illustrate your report.

Again, this "hecto.grid.ge.2015" dataset will be used along the semester for exercises and for your semester project, so please do not forget to save it in a safe place!