

Lesson 3 - 06.03.2024

OBJECTIVES

- Become familiar with Land Use/Land Cover (LULC) data in Portugal. Manipulate spatial information for queries and edits;
- Calculate the total area of each LULC class using COS2018 (“Carta de Ocupação do Solo2018” - Land use and land cover map for Portugal), for the study region;
- Calculate the total number of fire ignition points within each LULC class;
- Calculate and interpret a selection index to analyze the selectivity of fire ignition points by LULC class, that is, to understand which classes are “preferred” or “avoided” by fire ignition points, in the study region.

INSTRUCTIONS

Part 1. Create a new project and add the layer COS2018_PROF

Part 2. Change symbology and explore the information contained in the attribute table

Part 3. Add the 2017 ignition points for your study region and calculate the number of ignition points for each land use/land cover class

Part 4. Analyze, compare and discuss results using Excel

PART 1 | CREATE A NEW PROJECT AND ADD THE LAYER COS2018

Land Use and Land Cover Map 2018:

COS2018 is a thematic mapping of land use / land cover for mainland Portugal for the year 2018, with the General Directorate of the Territory as the entity responsible for its production. The cartographic information of COS2018 is in vector format and divides the area into landscape units (polygons) that share the concepts of land use / land cover, and do not include any linear or point elements. COS2018 has a minimum mapping unit (mmu) of 1 ha, a minimum distance between lines of 20 m and the equivalent scale is 1:25000.

COS2018 has got a total of 83 classes of land use / land cover, grouped into 4 levels and each polygon is classified with a code that corresponds to one of these classes. The legend and description of each class can be consulted in a document with technical specifications published in 2019 by DGT. COS2018 is available at the site of the General Directorate of the Territory (DGT), National System of Geographic Information (SNIG):
<https://snig.dgterritorio.gov.pt/rndg/srv/por/catalog.search#/search?anysnig=COS&fast=index>

1. Open QGIS and create a new project named “EPA03.qgs” to save in the folder C:\ISA\EPA\Lesson03\Results

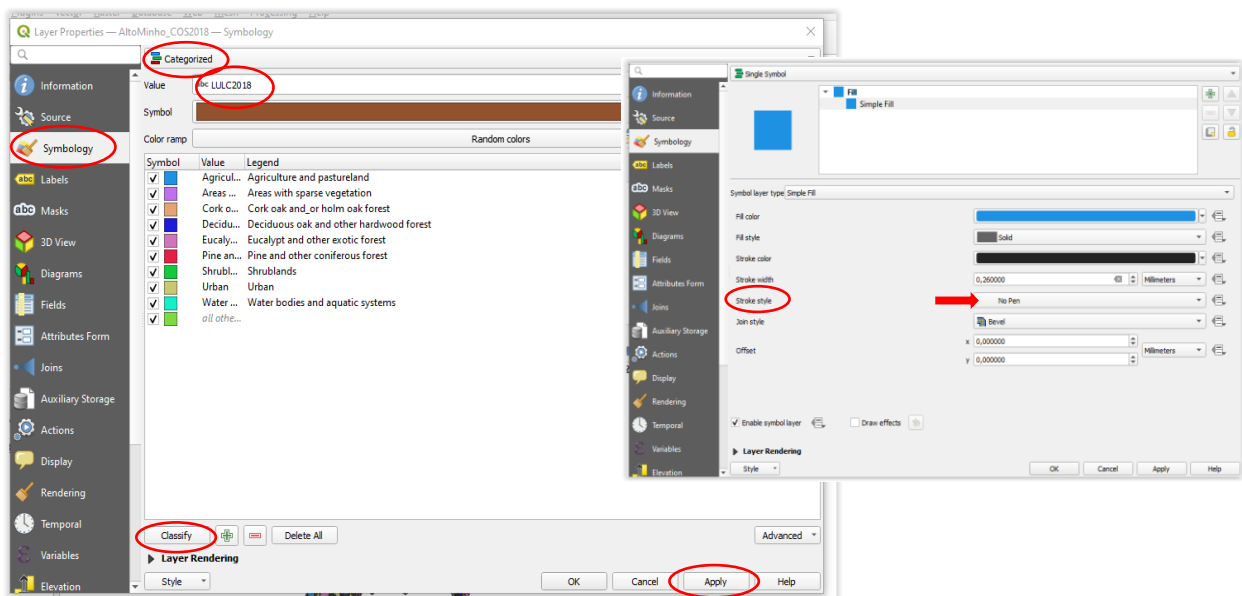


2. Add the layer

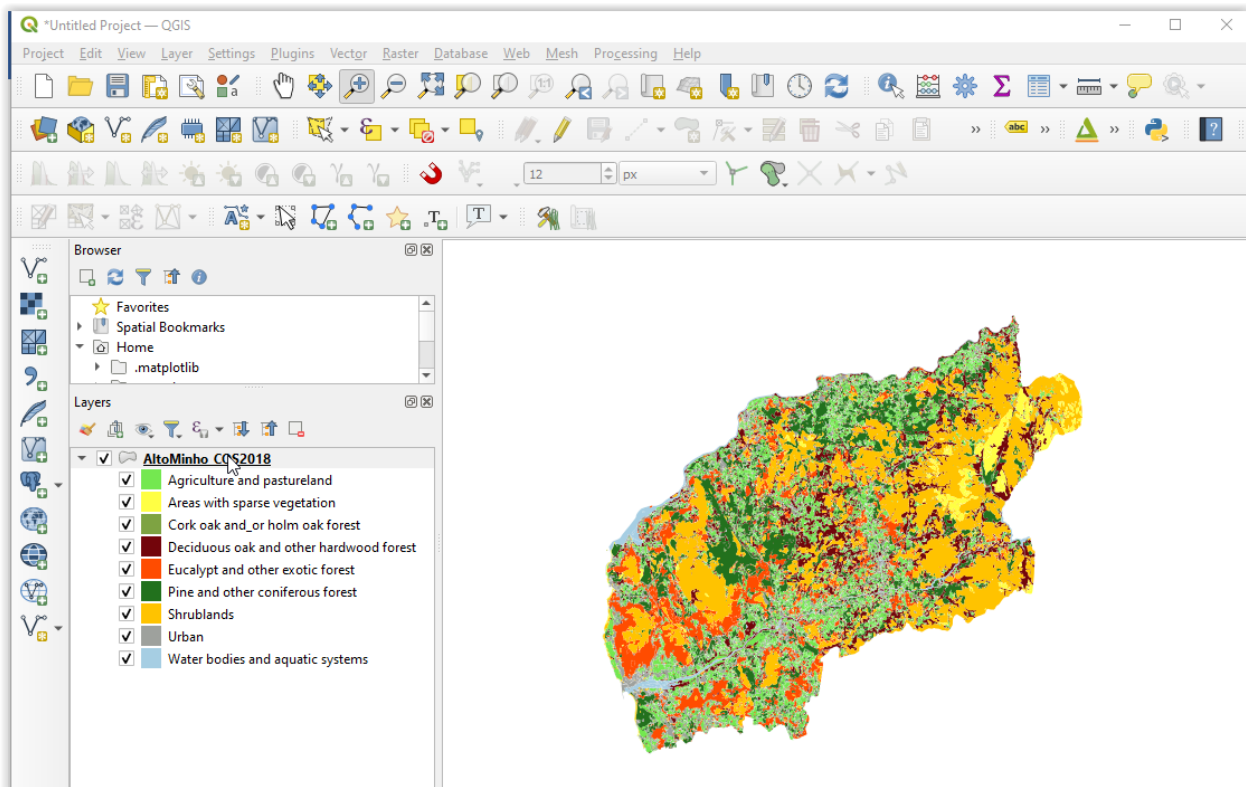
3. Search the data provided for this exercise (Folder “Dados”) and add the shapefile “COS2018_PROF”, corresponding to the LULC map for your study region

PART 2 | CHANGE SYMBOLOGY AND EXPLORE THE INFORMATION CONTAINED IN THE ATTRIBUTE TABLE

1. Open the table of attributes by right-clicking on the layer and selecting *Open Attribute Table*. Explore the classes represented by the different attributes (columns). The attributes COS18n_1_C to COS18n4_L correspond to the original classification from DGT. The last column (LULC2018) shows these classes grouped into 11 classes in English, which will be used in this exercise (see Annex).
2. Close the attribute table and open layer properties (right-click on the layer and select *Properties*).
3. In the *Layer Properties* box, select *Symbology*, *Categorized*, in relation to the “LULC2018” column. Click on *Classify* to add all 11 classes and assign a color palette of your choice. You can select colors individually for each class of land use if you wish. Because many polygons are very small, the display will look better if you remove the outline around the colors. You can remove the outline by selecting “No pen” for the *Stroke style* in the *Fill Selector*. In the end, apply and close.



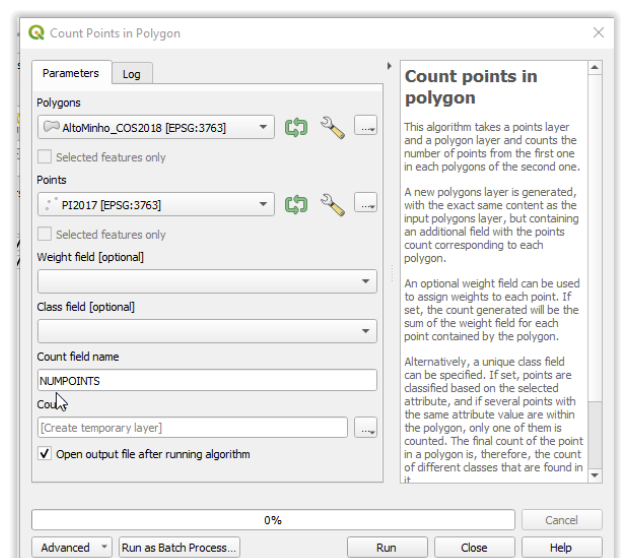
4. Explore the mosaic of land uses with the zoom tools.



PART 3 | ADD THE 2017 FIRE IGNITION POINTS FOR YOUR STUDY REGION AND COUNT THE NUMBER OF IGNITION POINTS FOR EACH LAND USE/LAND COVER POLYGON

1. Add the fire ignition points for your region, saved in the last class (Folder Aula02\Results\PI2017_PROF.shp)

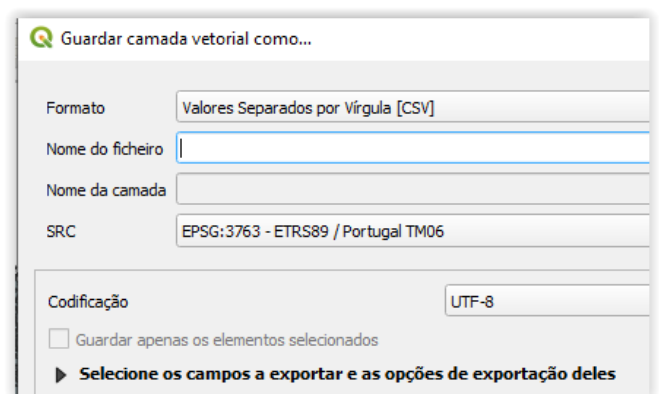
- Select *Vector > Analysis Tools > Count Points in Polygon*. This procedure will add the number of ignition points to each polygon in “COS2018_PROF”.
- The polygon layer is “COS2018_PROF.shp”
- The point layer is “PI2017_PROF.shp”
- Leave the Count field name as NUMPOINTS or choose another name
- Save the output shapefile as “PI_COS2018_PROF”
- Click Run



2. Check that the attribute table of the new layer has a new column (attribute) with the number of fire ignitions (NUMPOINTS) for each line (polygon).

ID	COS18n1_C	COS18n1_L	COS18n2_C	COS18n2_L	COS18n3_C	COS18n3_L	COS18n4_C	COS18n4_L	Area_ha	LULC2018	NUMPOINTS	
1	1787	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	2,22404986715	Urban	0
2	1790	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	15,22871061120	Urban	1,000000000000...
3	1794	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	17,88907506467	Urban	1,000000000000...
4	1795	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	10,02367051503	Urban	0
5	1796	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	18,32973937497	Urban	0
6	1797	1	Territórios artifi...	1.1	Tecido edificado	1.1.1	Tecido edificad...	1.1.1.1	Tecido edificad...	2,09815651013	Urban	0

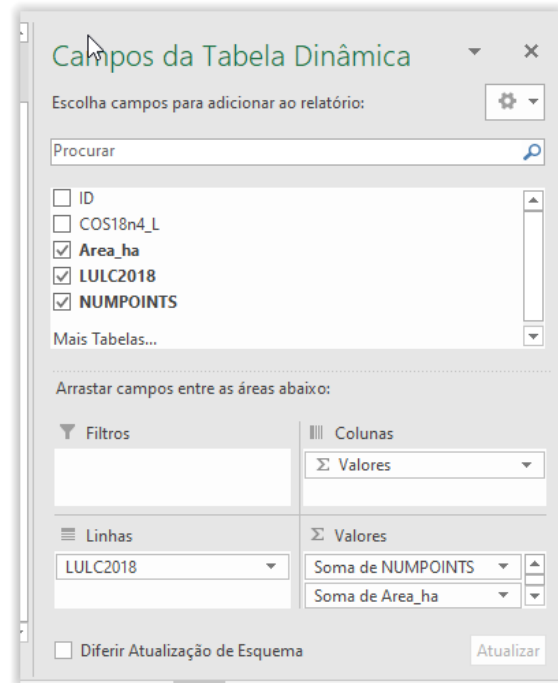
3. Right click on the layer with point counts (PI_COS2018_PROF) and select *Export*. Export the layer as csv (save as csv) to the Results folder. Name the output file “PI_COS2018_PROF.csv” (or open the dbf extension directly in Excel, if you prefer).



PART 4 | ANALYZE, COMPARE AND DISCUSS RESULTS USING EXCEL

1. Open the csv file in MExcel (if needed, see how to do this in the tutorials of Lesson2). Check that the file has the same number of lines as the number of polygons from “COS2018_PROF” or “PI_COS2018_PROF”. Each line in MEXcel corresponds to a polygon.
2. Replace points by commas, if necessary.
3. Delete the columns that we will not use, leaving only the columns “COS18n4_L”, “Area_ha”, “LULC2018”, and “NUMPOINTS”. The column “Area_ha” contains the area of polygons in hectares. The column “COS18n4_L” will allow visualizing the original classes, to facilitate the interpretation of results, if necessary.
4. Calculate the number of points in each LULC category using a Pivot table.
 - Select all columns in the spreadsheet
 - Select *Insert > PivotTable>check the box for “New worksheet” > OK*

- Select “LULC2018” as the Row column (“Linhas” in the image) and “Sum of NUMPOINTS” and “SUM of Area_ha” as the Value (“Valores” in the image). You should now see the number of fire ignition points and the total area for each land use/land cover class.
- Copy the pivot table to a new worksheet, remove formatting by copying only the values.



5. Confirm that the total number of fire ignition points is equal to the one in the shapefile PI2017_PROF and also confirm that the total area is equal to the area of the shapefile of your study region (PROF_Region.shp)
6. Rename the columns for better understanding, if necessary (Example: Area, LULC Class, number of fire ignition points)
7. Calculate the **Index of selectivity for ignition points (IS)** for each LULC class

IS = Pi / Pa

Pi = Number of points for each class / total number of points (represents the proportion of ignition points per LULC class)

Pa = Area of each class/ total area of the PROF region (represents the proportion of the area occupied by each LULC class in the study region)

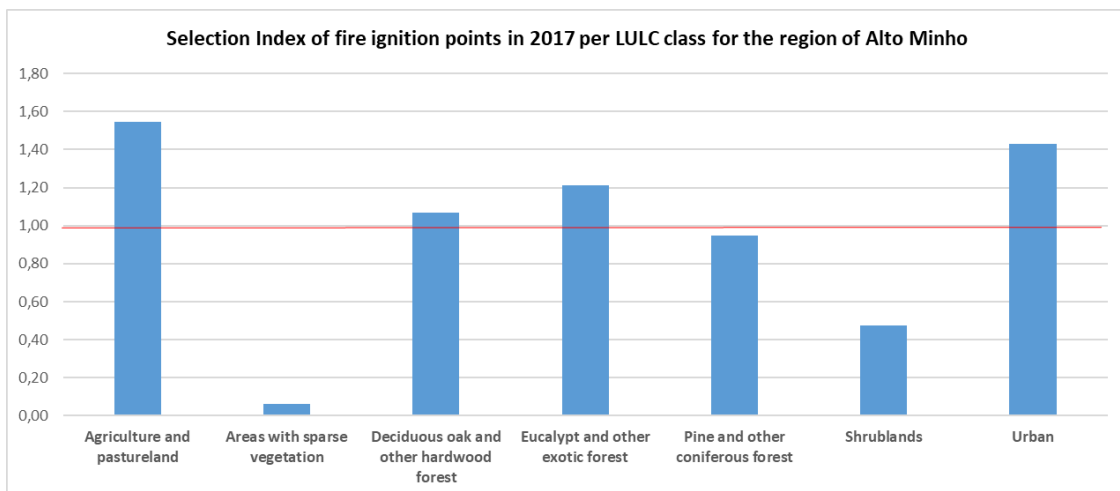
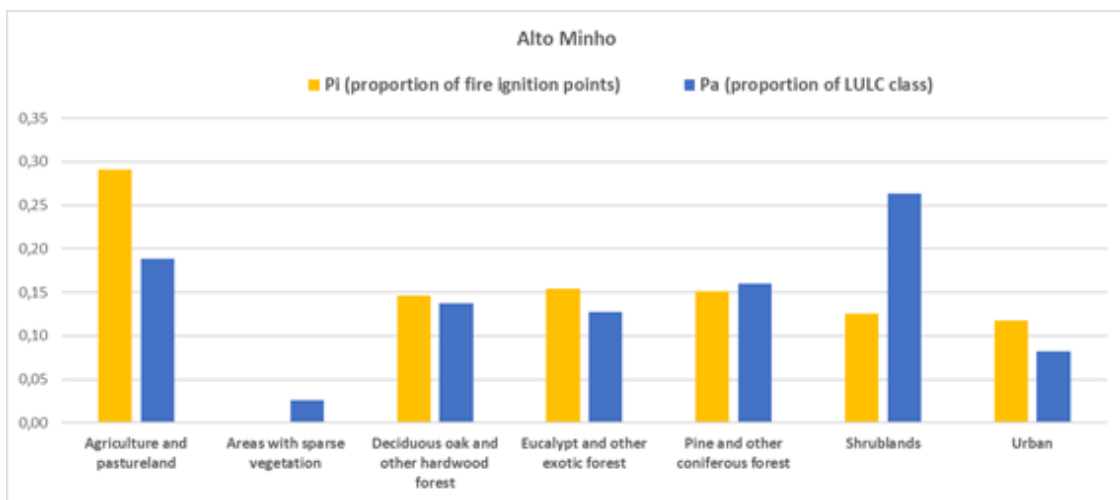
A	B	C	D
LULC Class	Number of fire ignition points	Area_ha	Pi (proportion of points)
Agriculture and pastureland	353	41823,49012	0,29
Areas with sparse vegetation	2	5845,714797	0,00
Cork oak and_ or holm oak forest	0	1,587078166	0,00
Deciduous oak and other hardwood forest	177	30374,01886	0,15
Eucalypt and other exotic forest	187	28270,81822	0,15
Pine and other coniferous forest	183	35396,75697	0,15
Shrublands	152	58526,55302	0,13
Urban	143	18324,07748	0,12
Water bodies and aquatic systems	15	3314,396801	0,01
Total	1212	221877,4134	1,00

A	B	C	D	E	F
LULC Class	Number of fire ignition points	Area_ha	Pi (proportion of points)	Pa (proporção of LULC class)	Selection Index (IS)
Agriculture and pastureland	353	41823,49012	0,29	0,188	1,55
Areas with sparse vegetation	2	5845,714797	0,00	0,026	0,06
Cork oak and_ or holm oak forest	0	1,587078166	0,00	0,000	0,00
Deciduous oak and other hardwood forest	177	30374,01886	0,15	0,137	1,07
Eucalypt and other exotic forest	187	28270,81822	0,15	0,127	1,21
Pine and other coniferous forest	183	35396,75697	0,15	0,160	0,95
Shrubland	152	58526,55302	0,13	0,264	0,48
Urban	143	18324,07748	0,12	0,083	1,43
Water bodies and aquatic systems	15	3314,396801	0,01	0,015	0,83
Total	1212	221877,4134	1,00	1	

Interpretation of the selection index (IS):

- IS > 1 – positive selection of fire ignition points for the LULC class
- IS < 1 – negative selection (“avoidance”) of fire ignition points for the LULC class
- IS = 1 – without selection

8. Create graphs to illustrate the analysis (Note: do not use the LULC classes that occupy less than 2% of the study region)



Annex - Table showing the correspondence between original LULC classes (COS 2018) and the 11 grouped classes used in the exercise

Uso/ocupação do dolo - Classes agrupadas (PT)	Land Use/Land Cover (LULC) - Grouped classes (ENG)	COS2018 - Classes originais (código e nome) (PT)	COS2018 - Original classes (code and name)
Agricultura e Pastagens	Agriculture and pasture land	2. Agricultura (culturas temporárias e permanentes, vinhas, pomares, olivais) + 3. Pastagens (espontâneas e melhoradas)	2. Agriculture (temporary and permanent crops, vineyards, orchards, olive groves) + 3. Pastures (natural, improved)
Sistemas agroflorestais de sobreiro e/ou azinheira	Agroforestry systems (AFS) with cork oak and_or holm oak	4.111 SAF de sobreiro + 4.112. SAF de azinheira + 4.1.1.6. SAF de sobreiro com azinheira	4.111 AFS with cork oak + 4.112. AFS with holm oak + 4.1.1.6. AFS with cork oak and holm oak
Sistemas agroflorestais com outras espécies	Agroforestry systems (AFS) with other species	4.1.1.3. SAF de carvalhos + 4.1.1.4. SAF de pinheiro manso + SAF 4.1.1.5 SAF de outras espécies + 4.1.1.7 SAF de outras misturas	4.1.1.3. AFS with deciduous oaks + 4.1.1.4. AFS with umbrella pine + 4.1.1.5 AFS with other species + 4.1.1.7 AFS with other mixtures
Florestas de carvalhos e outras folhosas	Deciduous oaks and other hardwood forest	5.1.1.3. Florestas de outros carvalhos + 5.1.1.4. Castanheiros + 5.1.1.7. Outras folhosas	5.1.1.3. Deciduous oak forests + 5.1.1.4. Chestnut forests + 5.1.1.7. Other hardwood forests
Florestas de eucalipto e outras exóticas	Eucalypt and other exotic forest	5.1.1.5. Floresta de eucalipto + 5.1.1.6 Floresta de espécies invasoras	5.1.1.5. Eucalypt forests + 5.1.1.6 Forests of invasive species
Florestas de sobreiro e/ou azinheira	Cork oak and_or holm oak forest	5.1.1.1 Florestas de sobreiro + 5.1.1.2 Florestas de azinheira	5.1.1.1 Cork oak forests + 5.1.1.2 Holm oak forests
Matos	Shrublands	6. Matos	6. Shrublands
Espaços com pouca vegetação	Areas with sparse vegetation	7. Espaços descobertos ou com pouca vegetação (praias, dunas, rochas, vegetação esparsa)	7. Open spaces or areas with sparse vegetation (beaches, dunes, rocks, sparse vegetation)
Florestas de pinheiro e outras coníferas	Pine and other coniferous forest	5.1.2.1. Florestas de pinheiro bravo + 5.1.2.2. Florestas de pinheiro manso + 5.1.2.3. Florestas de outras resinosas	5.1.2.1. Maritime pine forests + 5.1.2.2. Umbrella pine forests + 5.1.2.3. Forests with other coniferous species
Urbano	Urban	1. Territórios artificializados (áreas urbanas, vias de transporte, infraestruturas, indústrias, jardins e parques urbanos)	1. Artificial territories (urban areas, transport networks, infrastructures, industries, gardens and urban parks)
Massas de água e sistemas aquáticos	Water bodies and aquatic systems	8. Zonas húmidas + 9 Massas de água superficiais	8. Wetlands + 9. Surface water bodies