

TUTORIALS TO SUPPORT PRACTICAL CLASSES**Tutorial 6. Analysis of landscape dynamics with and without fire****Vanda Acácio and Susana Dias**

OBJECTIVES

Relate landscape dynamics in 1995-2018 with the burned area in 1995-2017

INSTRUCTIONS

1. CLIP BURNED AREA IN 1995-2017 WITH THE STUDY REGION
2. DISSOLVE BURNED AREA IN 1995-2017
3. JOIN BURNED AREA IN 1995-2017 WITH LAND COVER CHANGES IN 1995-2018
4. RECALCULATE AREA IN HA
5. IN MEXCEL, CREATE PIVOT TABLES TO BUILD ABSOLUTE TRANSITION MATRICES FOR BURNED AND UNBURNED AREAS
6. CALCULATE THE RELATIVE TRANSITION MATRICES FOR BURNED AND UNBURNED AREAS
7. ANALYZE RESULTS AND COMPARE RESULTS AMONG STUDY REGIONS

PART 1. CLIP BURNED AREA IN 1995-2017 WITH THE STUDY REGION

- Create a new work map
- Add the layer with burned areas in mainland Portugal between 1995 and 2017 (**Data provided for this Lesson**)
- Add the layer of your PROF region (Results from Lesson 2)
- Clip burned areas with your PROF region (this operation will eliminate parts of the burned areas that are located outside the study region) with *Vector/Geoprocessing tools/ Clip*
- Chose burned area as *input layer* and PROF region as *overlay layer*
- Export the clipped layer as a shapefile named AA95_17_regionPROF.

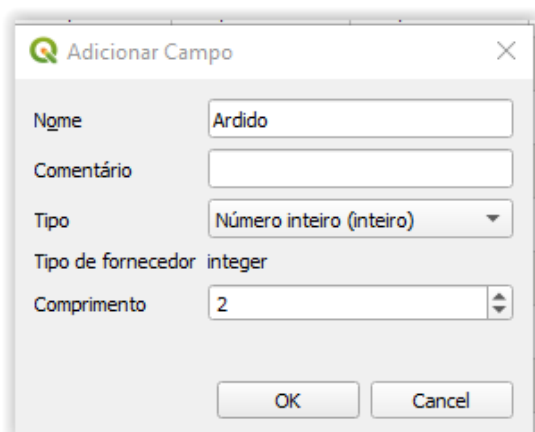
PART 2. DISSOLVE BURNED AREA IN 1995-2017

1. Dissolve burned areas in order to obtain only a single border for all burned polygons in 1995-2017
 - Use *Vector > Geoprocessing tools > Dissolve*
 - Save the output in the Results folder as AA95_17_RegionPROF_dissolv.shp

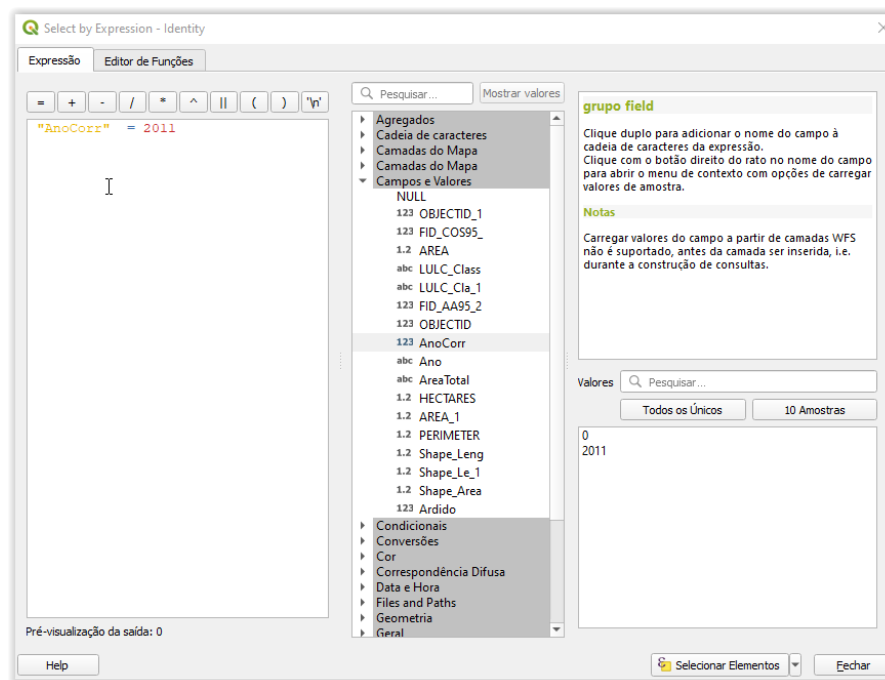
PART 3. JOIN BURNED AREA IN 1995-2017 WITH LANDSCAPE DYNAMICS IN 1995-2018

- Add the layer with the intersection of LULC in 1995 and 2018 from the previous lesson
- Select *Vector > Geoprocessing tools > Union* to join the layer with dissolved burned area in 1995-2017 with the layer with the intersection of LULC (Cos95_2018_RegionPROF). Use ArcGIS instead of QGIS for faster processing, if necessary. Export the resulting layer to C:\(...)\Results\ **AA_Cos95_18 RegionPROF.shp**
- This operation will distinguish the burned from the unburned area, based on the attributes of the burned area layer. Analyze the table of attributes of the joined layer and identify the fields that have information for the burned area (burned polygons) and the fields that have not (NULL or "0" values). See for example, the attribute "Ano" with information for burned polygons but without information for polygons that did not burn in 1995-2017.

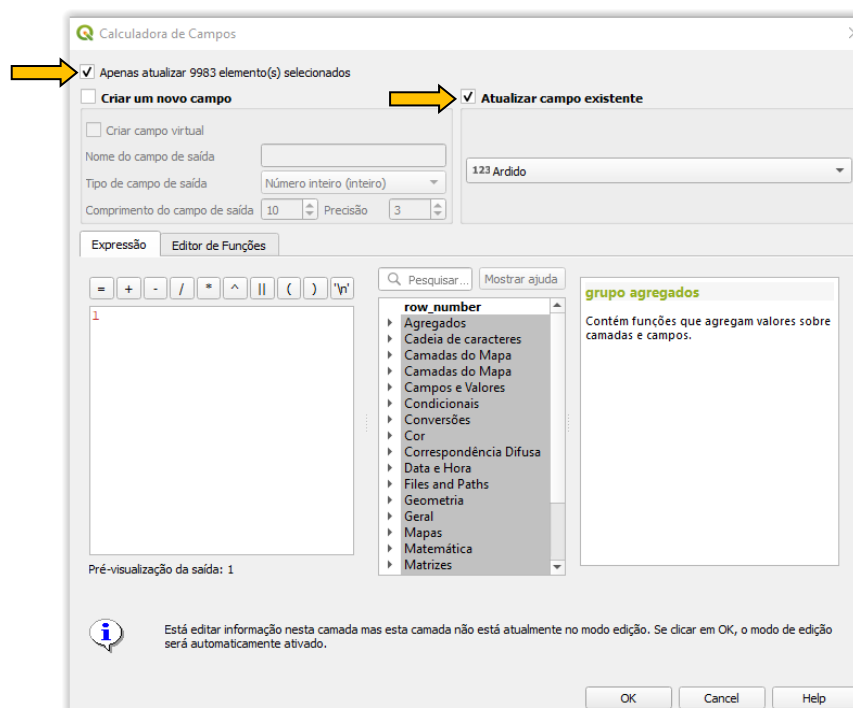
In the attribute table, start editing in  and add a new field named "Ardido" →  as a whole number and length 2




- In order to give the value "1" to the polygons that burned, we will need first to select these polygons by using *Select by expression > Field and Values > "Ano"* and write the expression "Ano = 2011" (only burned polygons will have information for this attribute; note that this expression might be different for other regions, therefore, the attribute table needs to be previously analyzed, as already explained)



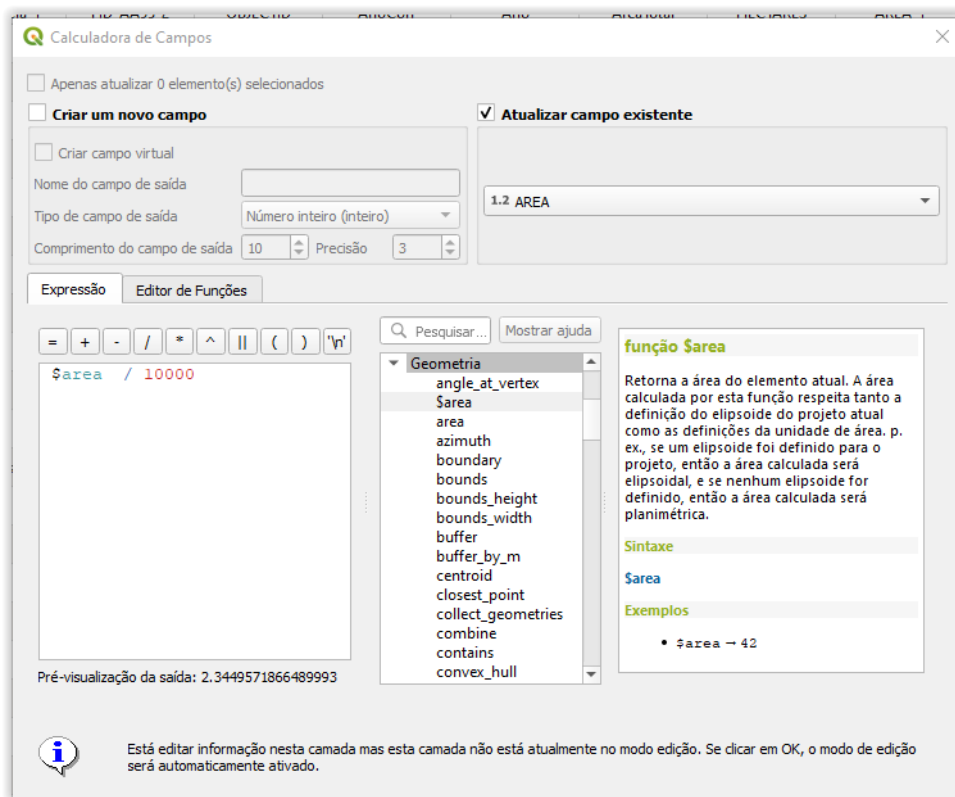
- With *Field calculator*, update the selected values to “1”. Check the box that says “**Update only selected values**” and select the field “Ardido”



- In the attribute table, invert the selection in  and repeat this procedure, using the *Field Calculator* to give the value “0” to the polygons that did not burn
- Don't forget to save and stop editing

PART 4. RECALCULATE AREA IN HA

- Recalculate area in hectares with the Field Calculator (Geometry > \$area) for the layer **AA_Cos95_18_RegionPROF.shp**



PART 5. IN MEXCEL, CREATE PIVOT TABLES TO BUILD ABSOLUTE TRANSITION MATRICES FOR BURNED AND UNBURNED AREAS

- After importing the csv file into MExcel, do not Forget to replace points by comas, if necessary;
- Insert > pivot table; choose LULC_1995 as *Rows*, LULC_2015 as *Columns*, Sum of AREA as *Values*, and **Ardido** as filter

Before activating the filter **Ardido**, the matrix that we will obtain is equal to the one calculated in the last lesson (global matrix), which shows the transitions that occurred in the study region, regardless of whether the areas burned or not.

Ardido	(Tudo)		
Soma de AREA	Rótulos de Coluna		
Rótulos de Linha	AFS with cork oak and_ or holm oak	AFS with other species	Agriculture
AFS with cork oak and_ or holm oak	129562,9879	10,0493104	
AFS with other species	8,864131197	5298,57455	
Agriculture and pastureland	699,0910124	58,24847377	
Areas with sparse vegetation			
Cork oak and_ or holm oak forest	2353,526979	18,08791774	
Deciduous oak and other hardwood forest		24,9427669	
Eucalypt and other exotic forest	12,94915446	105,1706124	
Pine and other coniferous forest	18,94541441	18,73391196	
Shrublands	15,00279748	4,414239812	
Urban			
Water bodies and aquatic systems (em branco)			
Total Geral	132671,3674	5538,221783	

Campos da Tabela D..

Escolha campos para adicionar ao relatório:

Procurar

☒ LULC1995
☒ LULC2018
☒ AREA
☒ Ardido

Mais Tabelas...

Arrastar campos entre as áreas abaixo:

Filtros	Colunas
Ardido	LULC2018
Linhas	Valores
LULC1995	Soma de AREA

- In the pivot table, select the filter Ardido =0 to construct the matrix of absolute transitions for the non-burned areas, for the land use and land cover transitions from 1995 to 2018. **Copy the table and paste only as values into another spreadsheet.**

	A	B	C
1	Ardido	0	
2			
3	Soma de AREA	Rótulos de Coluna	
4	Rótulos de Linha	AFS with cork oak and_or holm oak	AFS with other species
5	AFS with cork oak and_or holm oak	120705,6114	10,0493104
6	AFS with other species	8,864131197	4646,171097
7	Agriculture and pastureland	483,8573315	54,93236515
8	Areas with sparse vegetation		
9	Cork oak and_or holm oak forest	1956,431968	18,08791774
10	Deciduous oak and other hardwood forest		24,9427669
11	Eucalypt and other exotic forest	12,58090531	28,25017987
12	Pine and other coniferous forest	18,94541441	16,69876538
13	Shrublands	13,67824008	4,414239812
14	Urban		
15	Water bodies and aquatic systems		
16	Total Geral	123199,9694	4803,546642
17			

- Once again, in the pivot table, select the filter Ardido =1 to construct the matrix of absolute transitions for the burned areas, for the land use transitions from 1995 to 2018. **Then, copy the table and paste as values into another spreadsheet.**

Three absolute transition matrices were obtained in this way

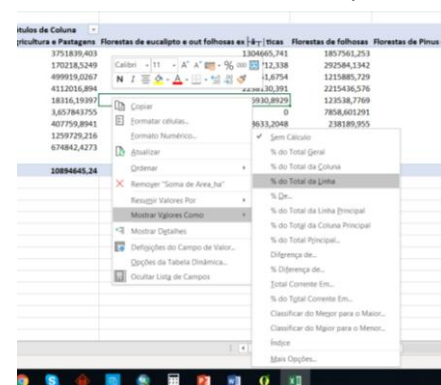
1. Absolute global transition matrix, with land use transitions between 1995 and 2018, covering the entire study region (regardless of fire, includes all areas, burned or not). **Note: this matrix is identical to the one from Lesson 7**
2. Absolute transition matrix of the unburned area, with land use transitions occurring between 1995 and 2018 only in the **area without fire occurrences** between 1995 and 2017
3. Absolute transition matrix of the burned area, with land use transitions occurring between 1995 and 2018 only in the **area with fire occurrences** between 1995 and 2017

PART 6. CALCULATE THE RELATIVE TRANSITION MATRICES FOR BURNED AND UNBURNED AREAS

To calculate the probabilities of transition of LULC classes for burned and unburned areas, we will need to transform the absolute matrices in relative matrices, for Ardido=1 and Ardido=0. This way, for each cell of the matrices:

Proportion of transition(i)= Absolute value(i)/Total in row(i)

- An automatic way of converting an absolute matrix into a relative one is by right-clicking the mouse on the pivot table and select **"Show values as >> % of the total in rows"**



- After converting the 3 absolute matrices into relative matrices, for burned and unburned area (using the filter), copy and paste the relative matrices as values for a new spreadsheet

	B	C	D	E	F	G	H	I	J	K	L	M	N
MATRIZ DE TRANSIÇÃO RELATIVA - GLOBAL													
	Agriculture	Agrofore	Deciduous	Eucalypt	Evergreen	Grassland	Pine	Urban	Water bodies and aquatic systems				
Agriculture and pasture land	0,82	0,00	0,06	0,01	0,00	0,05	0,03	0,03	0,00				
Agroforestry	0,02	0,54	0,43	0,00	0,00	0,00	0,00	0,00	0,00				
Deciduous oaks and other hardwoods	0,01	0,00	0,86	0,11	0,00	0,01	0,02	0,00	0,00				
Eucalypt and other exotic forest	0,00	0,00	0,00	0,96	0,00	0,00	0,03	0,01	0,00				
Evergreen oak forest	0,00	0,00	0,78	0,00	0,20	0,01	0,00	0,00	0,00				
Grasslands and shrublands	0,00	0,00	0,03	0,15	0,00	0,56	0,28	0,01	0,00				
Pine and other coniferous forests	0,00	0,00	0,01	0,14	0,00	0,11	0,72	0,01	0,00				
Urban	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,99	0,00				
Water bodies and aquatic systems	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00				
MATRIZ DE TRANSIÇÃO RELATIVA - ÁREA NÃO ARDIDA													
	Agriculture	Agrofore	Deciduous	Eucalypt	Evergreen	Grassland	Pine	Urban	Water bodies and aquatic systems				
Agriculture and pasture land	0,82	0,00	0,06	0,01	0,00	0,05	0,03	0,04	0,00				
Agroforestry	0,02	0,55	0,42	0,00	0,00	0,00	0,00	0,00	0,00				
Deciduous oaks and other hardwoods	0,01	0,00	0,87	0,10	0,00	0,00	0,02	0,00	0,00				
Eucalypt and other exotic forest	0,00	0,00	0,00	0,94	0,00	0,00	0,05	0,01	0,00				
Evergreen oak forest	0,00	0,00	0,71	0,00	0,27	0,02	0,00	0,01	0,00				
Grasslands and shrublands	0,01	0,00	0,03	0,09	0,00	0,51	0,35	0,01	0,00				
Pine and other coniferous forests	0,01	0,00	0,02	0,14	0,00	0,01	0,82	0,01	0,00				
Urban	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,99	0,00				
Water bodies and aquatic systems	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	1,00				
MATRIZ DE TRANSIÇÃO RELATIVA - ÁREA ARDIDA													
	Agriculture	Agrofore	Deciduous	Eucalypt	Evergreen	Grassland	Pine	Urban	Water bodies and aquatic systems				
Agriculture and pasture land	0,78	0,00	0,07	0,03	0,00	0,06	0,03	0,02	0,00				
Agroforestry	0,00	0,33	0,67	0,00	0,00	0,00	0,00	0,00	0,00				
Deciduous oaks and other hardwoods	0,01	0,00	0,81	0,13	0,00	0,03	0,02	0,00	0,00				
Eucalypt and other exotic forest	0,00	0,00	0,98	0,00	0,00	0,01	0,00	0,00	0,00				
Evergreen oak forest	0,00	0,00	0,98	0,00	0,02	0,00	0,00	0,00	0,00				

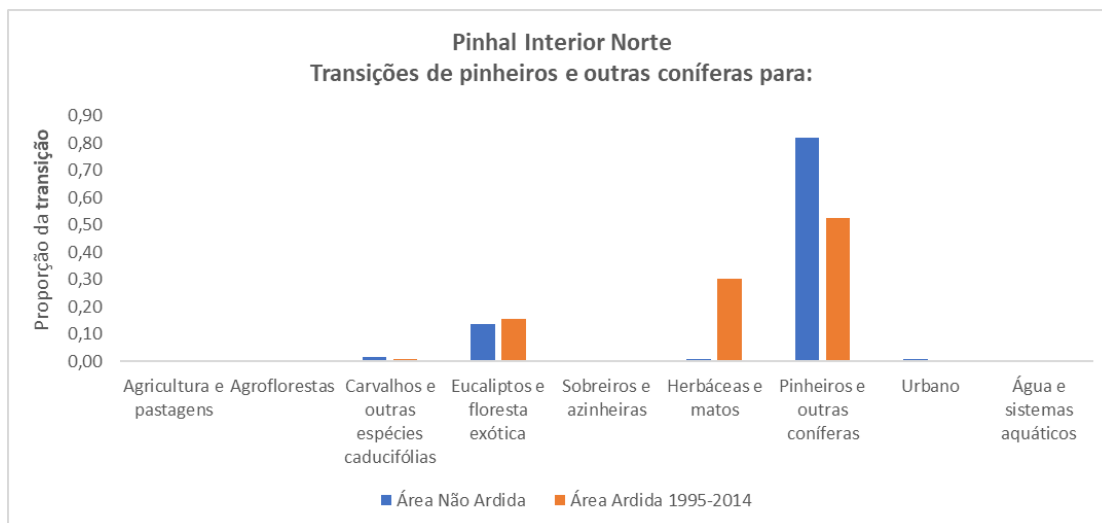
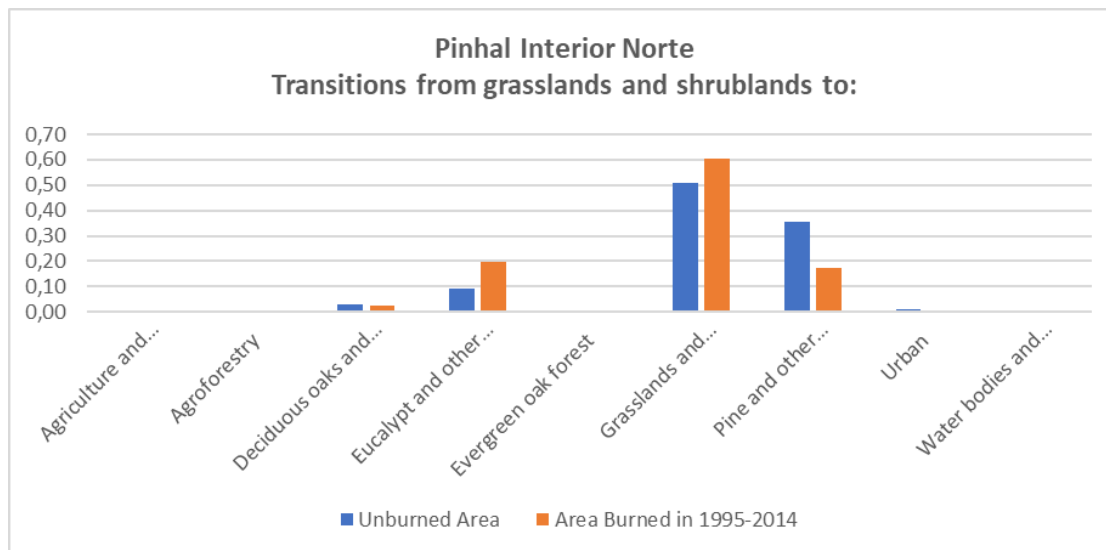
Three relative transition matrices were obtained in this way:

4. Relative global transition matrix, with land use transitions between 1995 and 2018, covering the entire study region (regardless of fire, includes all areas, burned or not). **Note: this matrix is identical to the one from the previous Lesson**
5. Relative transition matrix of the unburned area, with land use transitions occurring between 1995 and 2018 only in the **area without fire occurrences** between 1995 and 2017
6. Relative transition matrix of the burned area, with land use transitions occurring between 1995 and 2018 only in the **area with fire occurrences** between 1995 and 2017

Note that the values of the global matrix are a weighted average of the values of the other two matrices (burned area and unburned area). These latter two matrices provide information about each of the processes that occurring in the landscape of the study region (burning, not burning).

PART 7. ANALYZE RESULTS AND COMPARE RESULTS AMONG REGIONS

1. For our analysis, we will only consider LULC classes that occupy more than 2% (0,02) of the study region (total in rows)
2. Built charts with proportions of burned/unburned area for the greatest LULC transitions



Built tables with:

- The 3 transitions in 1995-2018 with the highest proportion (or %) in the burned area
- The 3 transitions in 1995-2018 with the lowest proportion (or %) in the burned area
- The 3 transitions in 1995-2018 with the highest proportion (or %) in the unburned area
- Compare these results with the ones from the previous lesson (transitions with highest proportion – global matrix)
- Compare results among PROF regions