

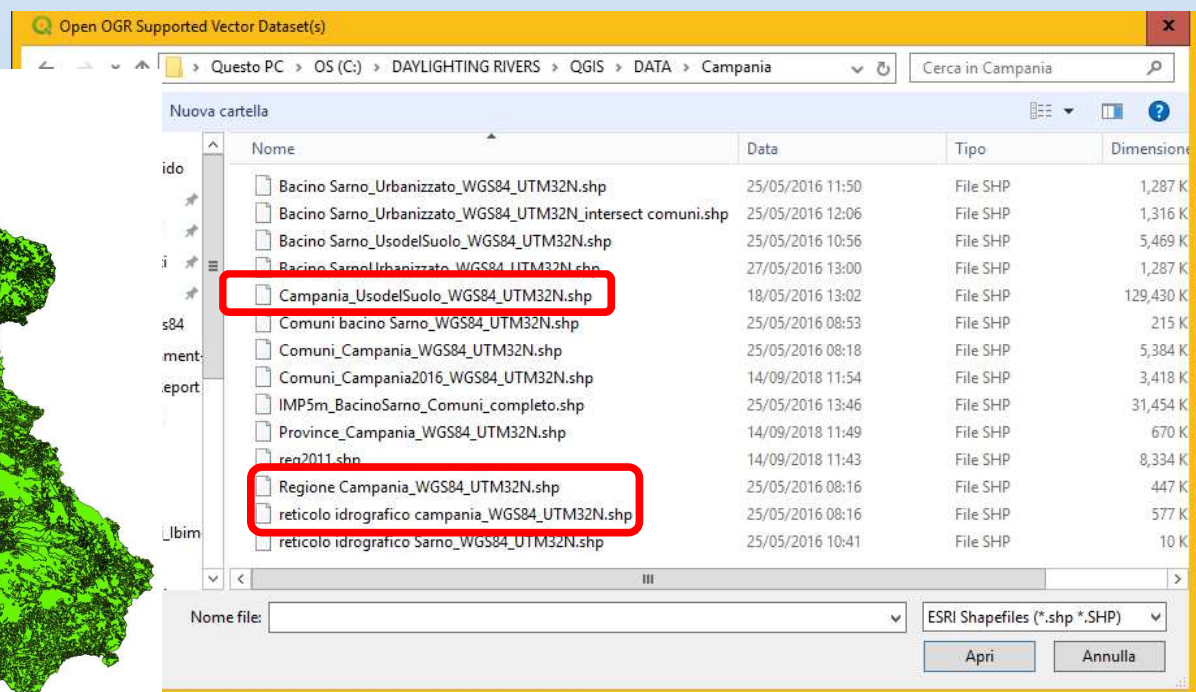
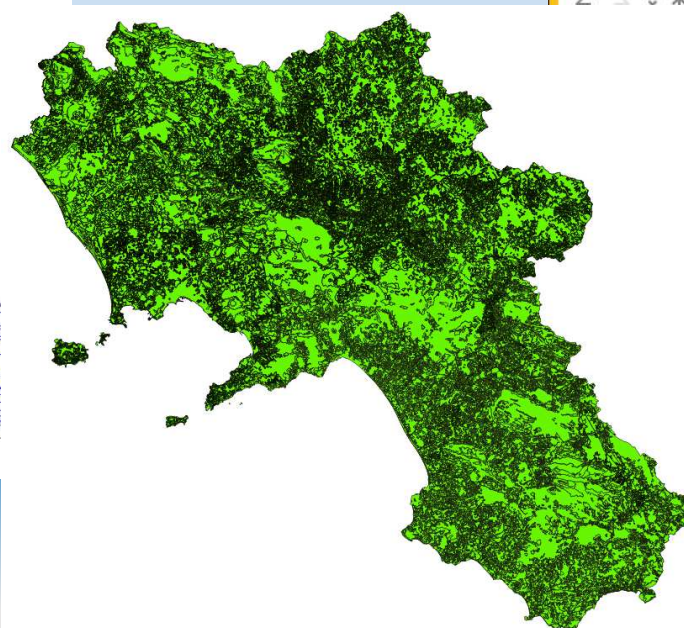
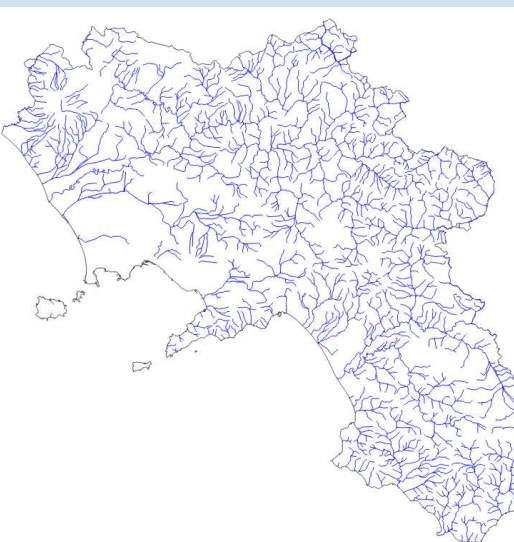
# An Introduction to GIS Fundamentals

PART 10. Estimate soil sealing in the municipalities of the Sarno river catchment



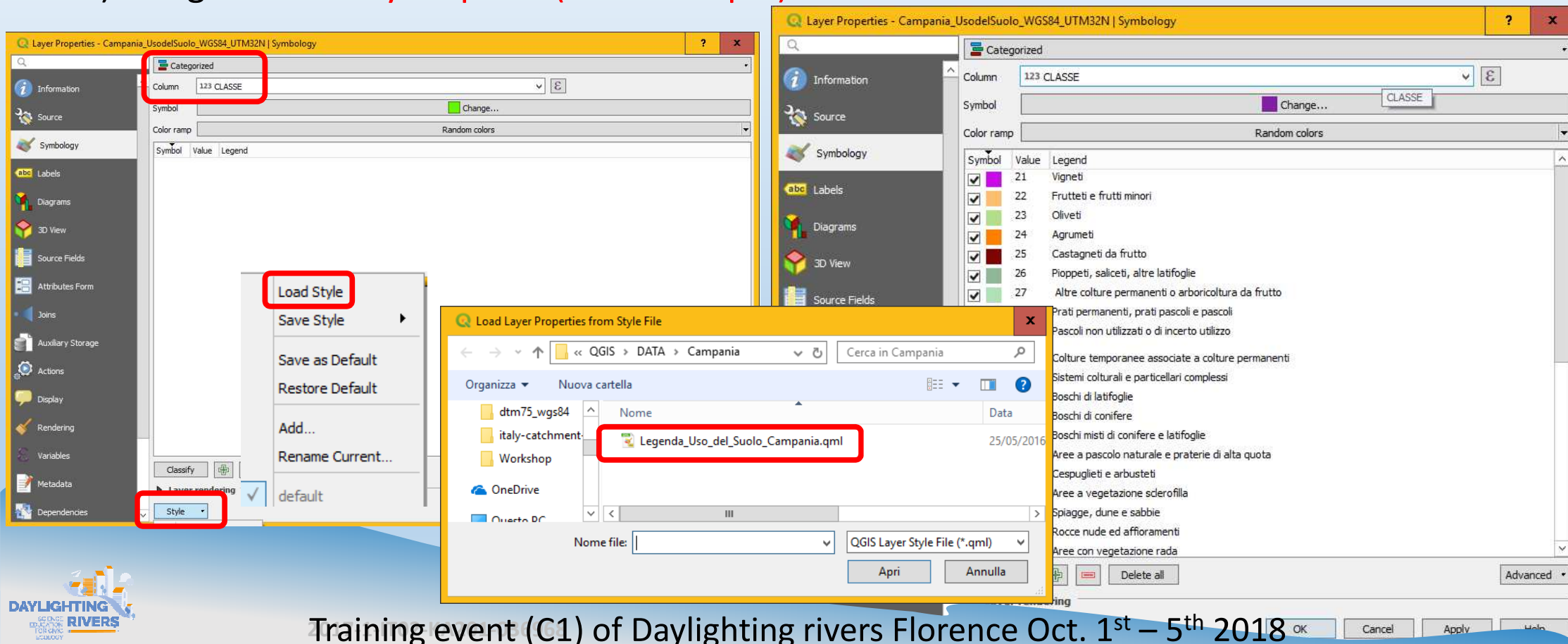
# Estimate soil sealing in the municipalities of the Sarno river catchment

1. Create a new QGIS project
2. Load the following layers (shape files): (from....DATA\Campania\...)
  1. Regione Campania\_WGS84\_UTM32N.shp (region boundaries)
  2. Campania\_UsodelSuolo\_WGS84\_UTM32N (CORINE land cover)
  3. reticolo idrografico campania\_WGS84\_UTM32N (regional river network)



# Estimate soil sealing in the municipalities of the Sarno river catchment

3. Classify with the «CLASSE» field Campania\_UsodelSuolo\_WGS84\_UTM32N (CORINE land cover) using the **load style option (filename.qml)**



Layer Properties - Campania\_UsodelSuolo\_WGS84\_UTM32N | Symbology

Column: 123 CLASSE

Symbol: Change...

Color ramp: Random colors

Symbol Value Legend

Load Style

Save Style

Save as Default

Restore Default

Add...

Rename Current...

default

Load Layer Properties from Style File

Organizza Nuova cartella

Nome

Legenda\_Uso\_del\_Suolo\_Campania.qml

Nome file: QGIS Layer Style File (\*.qml)

Apri Annulla

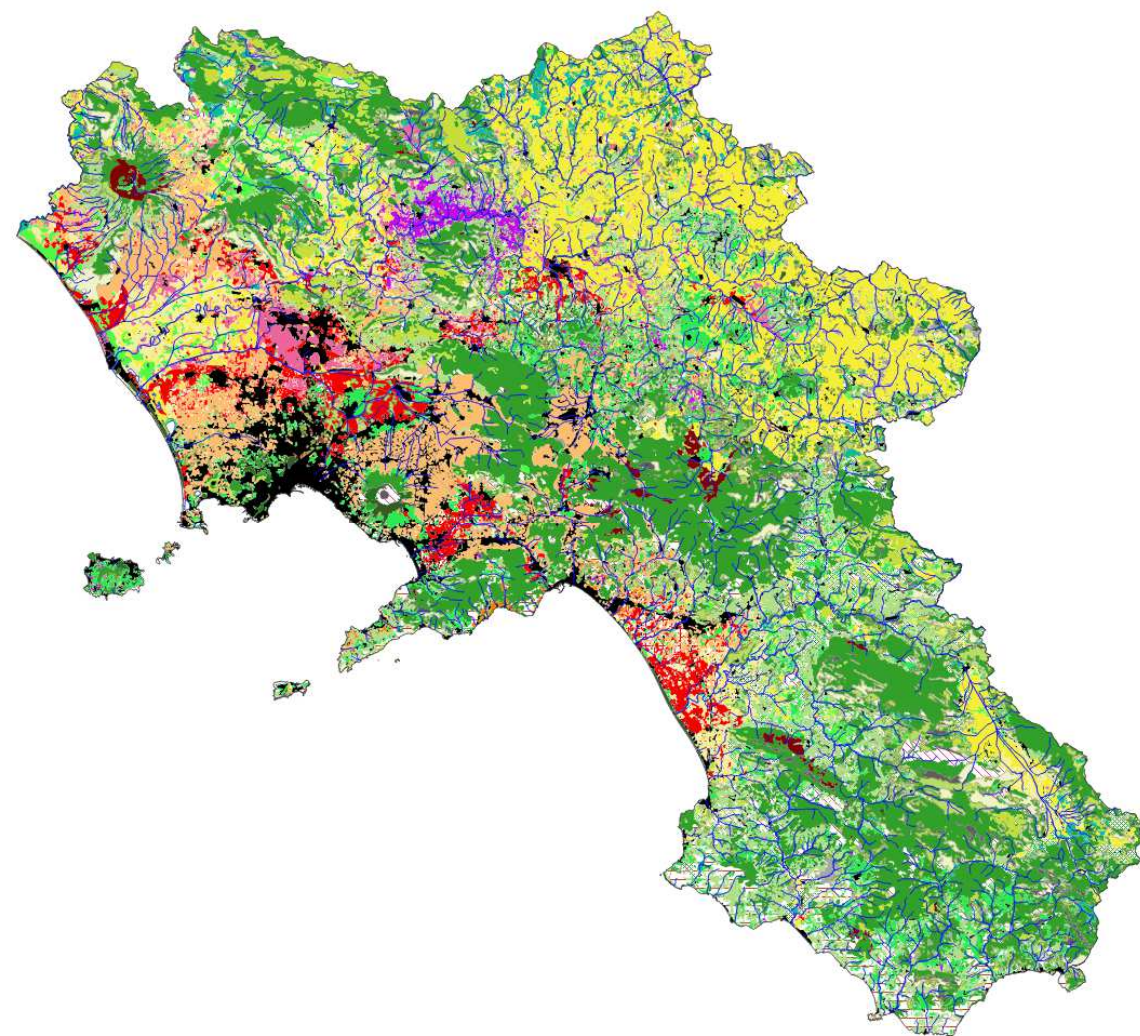
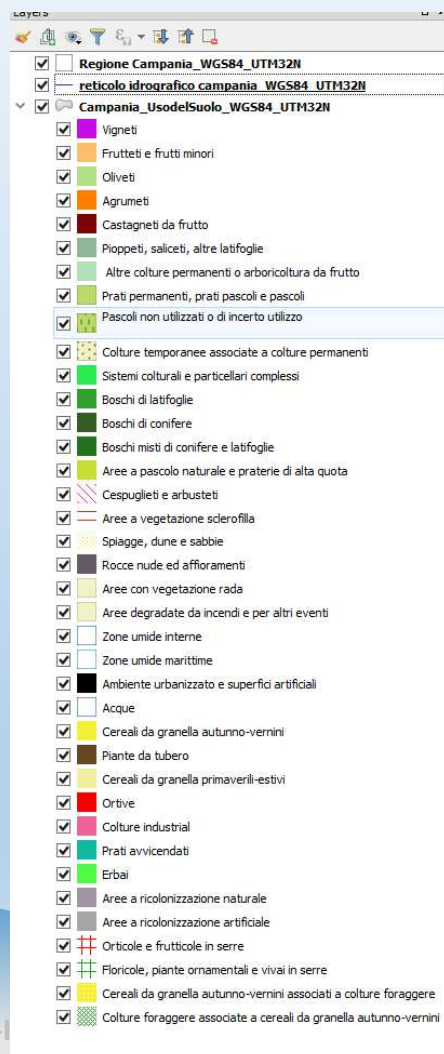
Symbol	Value	Legend
<input checked="" type="checkbox"/>	21	Vigneti
<input checked="" type="checkbox"/>	22	Frutteti e frutti minori
<input checked="" type="checkbox"/>	23	Oliveti
<input checked="" type="checkbox"/>	24	Agrumeti
<input checked="" type="checkbox"/>	25	Castagneti da frutto
<input checked="" type="checkbox"/>	26	Pioppeti, saliceti, altre latifoglie
<input checked="" type="checkbox"/>	27	Altre colture permanenti o arboricoltura da frutto
		Prati permanenti, prati pascoli e pascoli
		Pascoli non utilizzati o di incerto utilizzo
		Colture temporanee associate a colture permanenti
		Sistemi colturali e particellari complessi
		Boschi di latifoglie
		Boschi di conifere
		Boschi misti di conifere e latifoglie
		Aree a pascolo naturale e praterie di alta quota
		Cespuglieti e arbusteti
		Aree a vegetazione sclerofilla
		Spiagge, dune e sabbie
		Rocce nude ed affioramenti
		Aree con vegetazione rada

Training event (C1) of Daylighting rivers Florence Oct. 1<sup>st</sup> – 5<sup>th</sup> 2018




# Estimate soil sealing in the municipalities of the Sarno river catchment

CORINE land cover (2004)



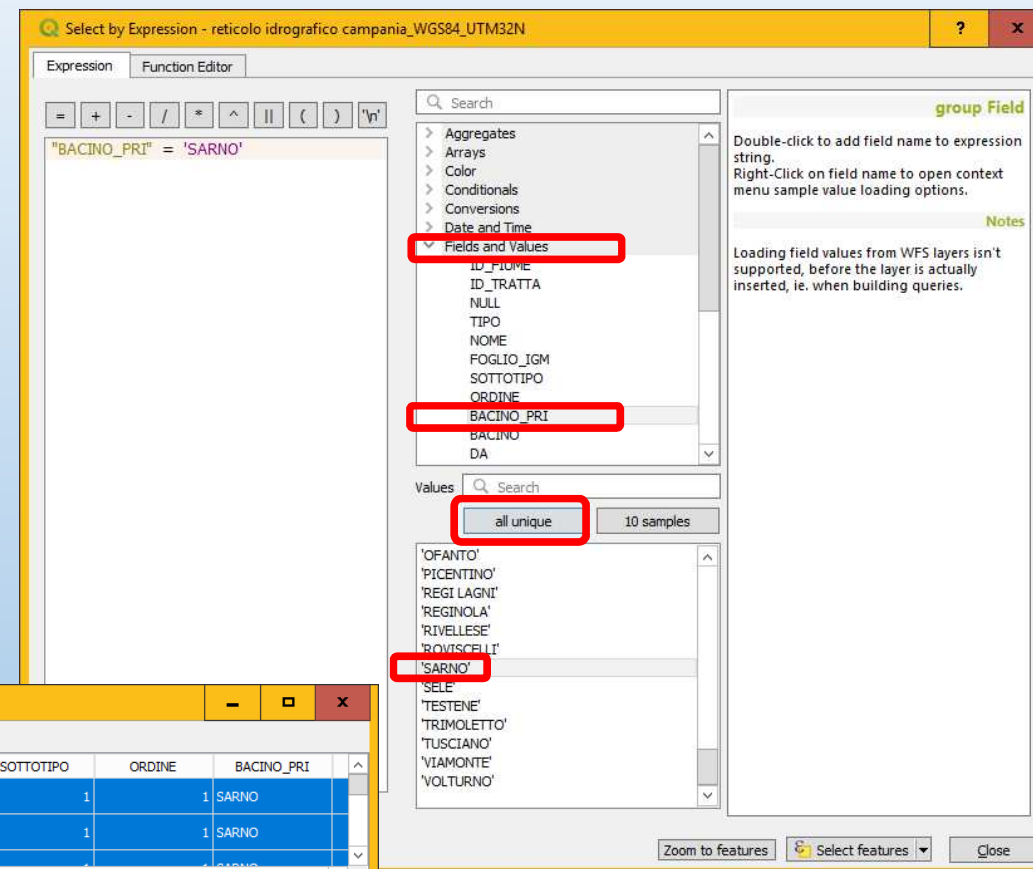
# Estimate soil sealing in the municipalities of the Sarno river catchment

4. Select from «reticolo idrografico campania\_WGS84\_UTM32N» all the water-streams of the Sarno river catchment:

4.1 Click on the layer panel on the left to select the vector and the click on the 

4.2 In the window «Select by Expression», from the list «Fields and Values» select "BACINO\_PRI" and insert = 'SARNO' by selecting from the «all unique» list at the center bottom of the window; click on «select features»

37 elements are selected from the table



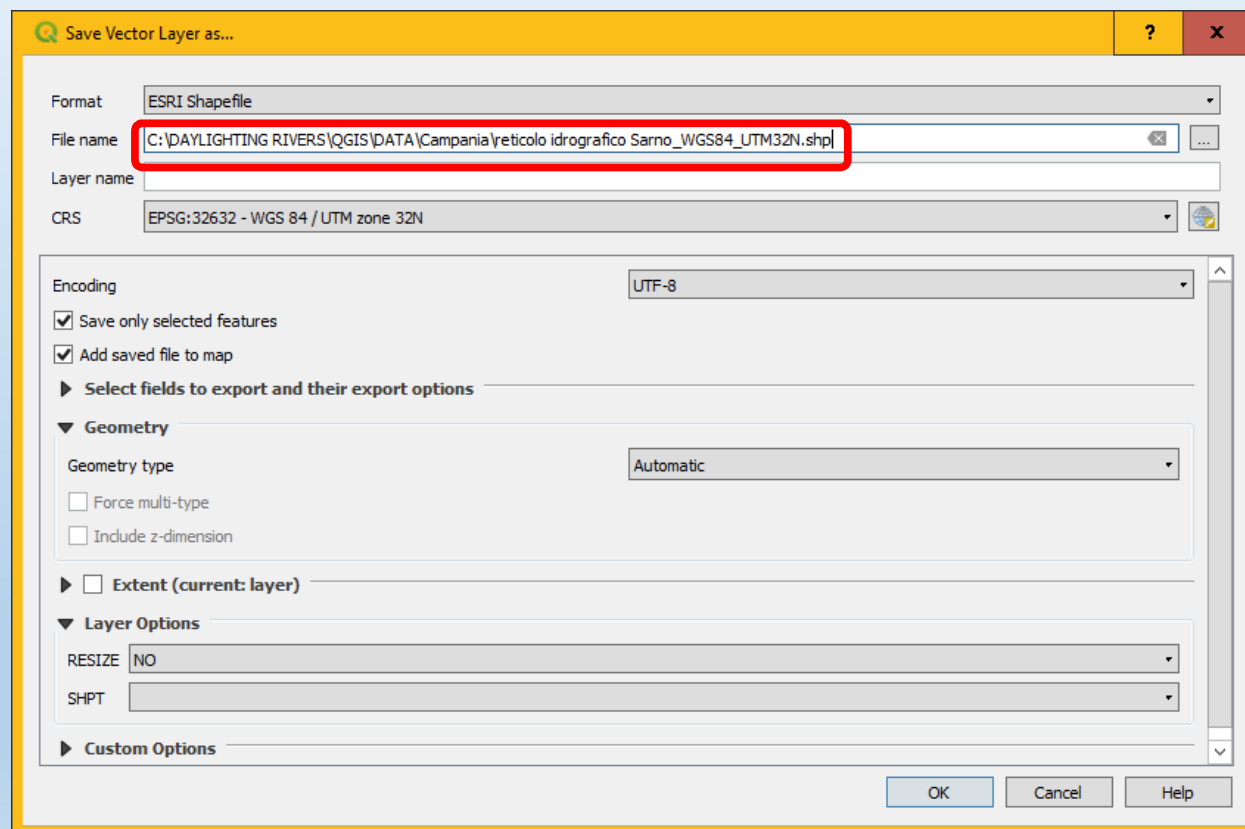
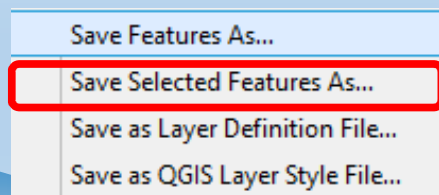
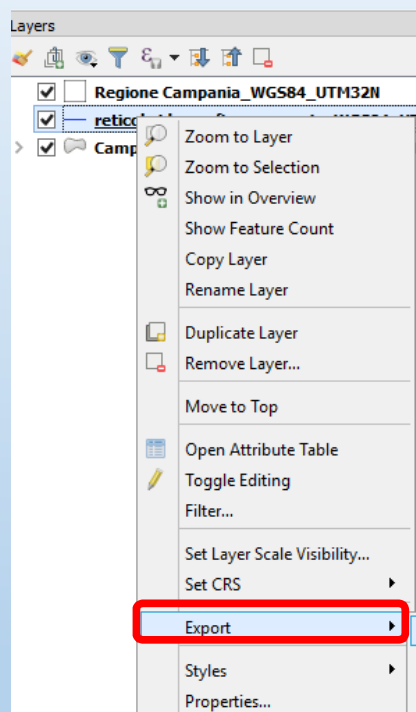
reticolo idrografico campania\_WGS84\_UTM32N :: Features Total: 2078, Filtered: 2078, Selected: 37

	ID_FIUME	ID_TRATTA	TIPO	NOME	FOGLIO_IGM	SOTTOTIPO	ORDINE	BACINO_PRI
1	40054	43716	FIUME	SARNO	NAPOLI	1	1	SARNO
2	40054	43750	FIUME	SARNO	NAPOLI	1	1	SARNO

Show All Features

# Estimate soil sealing in the municipalities of the Sarno river catchment

## 4.3 Save the selected items in a new layer "reticolo idrografico Sarno\_WGS84\_UTM32N.shp"





# Estimate soil sealing in the municipalities of the Sarno river catchment



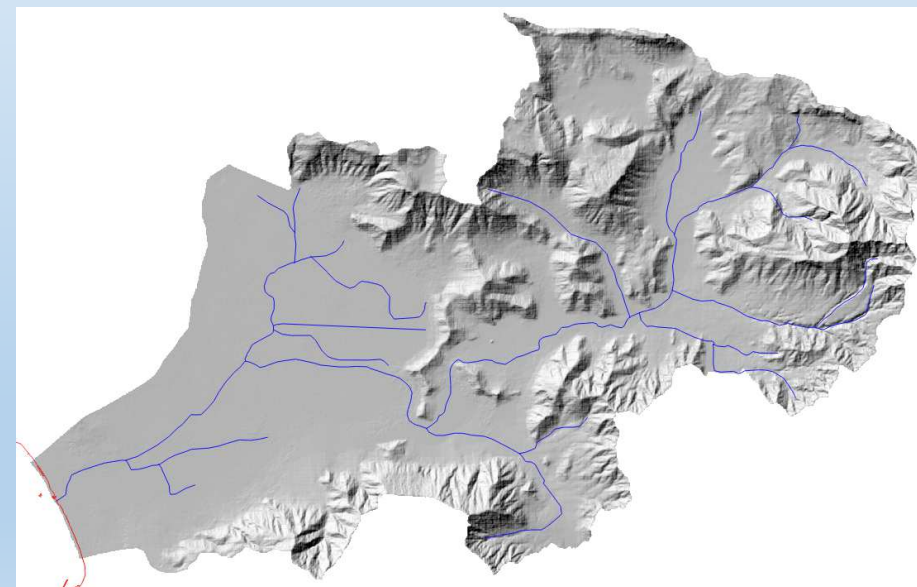
5. Add the layer DATA/Italy/italy-catchment-shape/»Bacini\_idrografici\_principali\_0607.shp» Select «SARNO» from the field «NOME\_BAC» and save it as a new layer in: DATA/Campania/Bacino Sarno\_WGS84\_UTM32N

6. Add the raster DEM .../DATA/Italy/dtm20\_wgs84/dtm\_20m\_32 and clip it to the extent of the Sarno catchment (**Clip Raster by Mask Extent**) saving it as /DATA/Campania/DEM20\_Sarno.tif

Bacini\_idrografici\_principali\_0607 :: Features Total: 137, Filtered: 137, S...

	DGC_CODICE	ID_BACINO	NOME_BAC	NOME_CORSO	FOGLIO_IGM
1	5,000000000000		SARNO	FIUME SARNO	NAPOLI
2	1,000000000000	0	SERCHIO	FIUME SERCHIO	FIRENZE
3	1,000000000000	0	ROJA	FIUME ROJA	
4	1,000000000000	0	ISONZO	FIUME ISONZO	VENEZIA
5	1,000000000000	0	PIAVE	FIUME PIAVE	VENEZIA

Show All Features

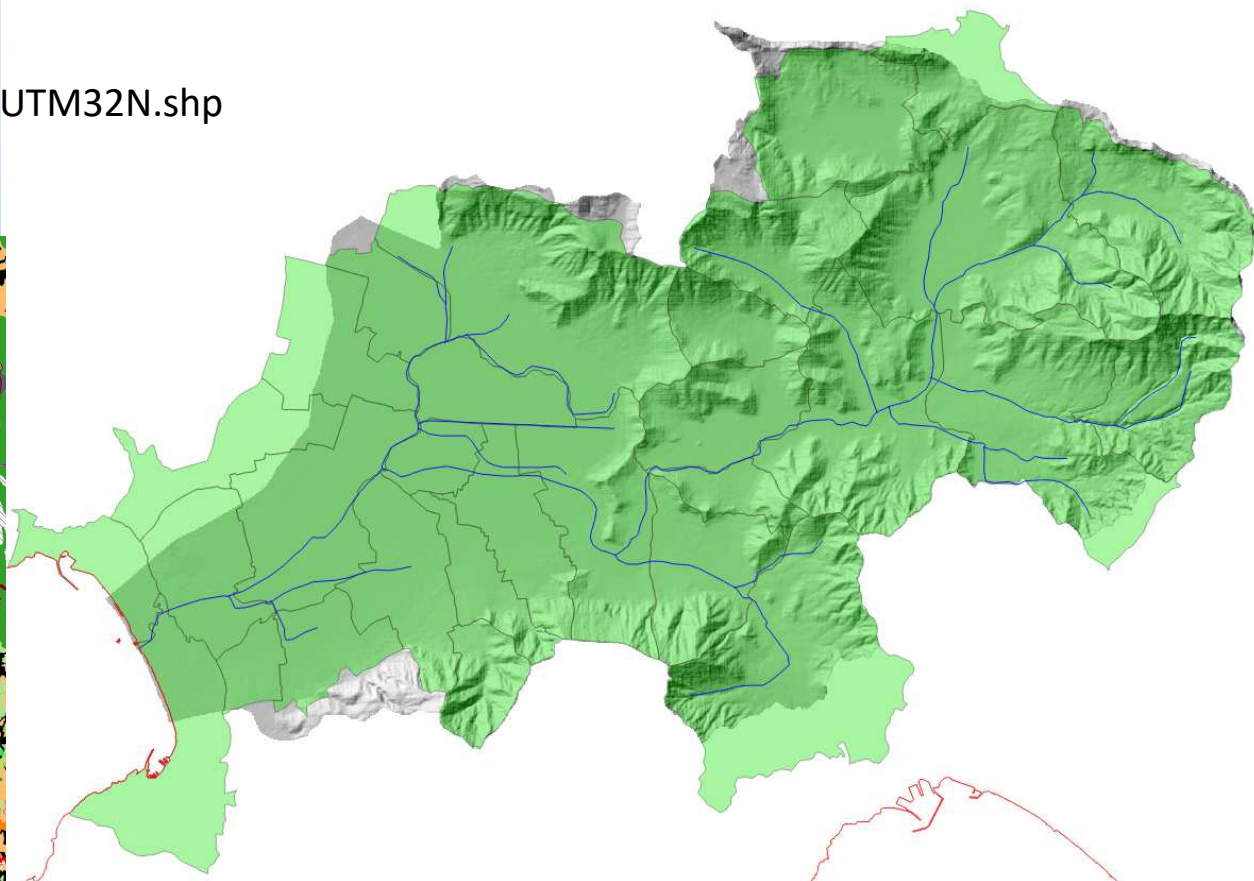
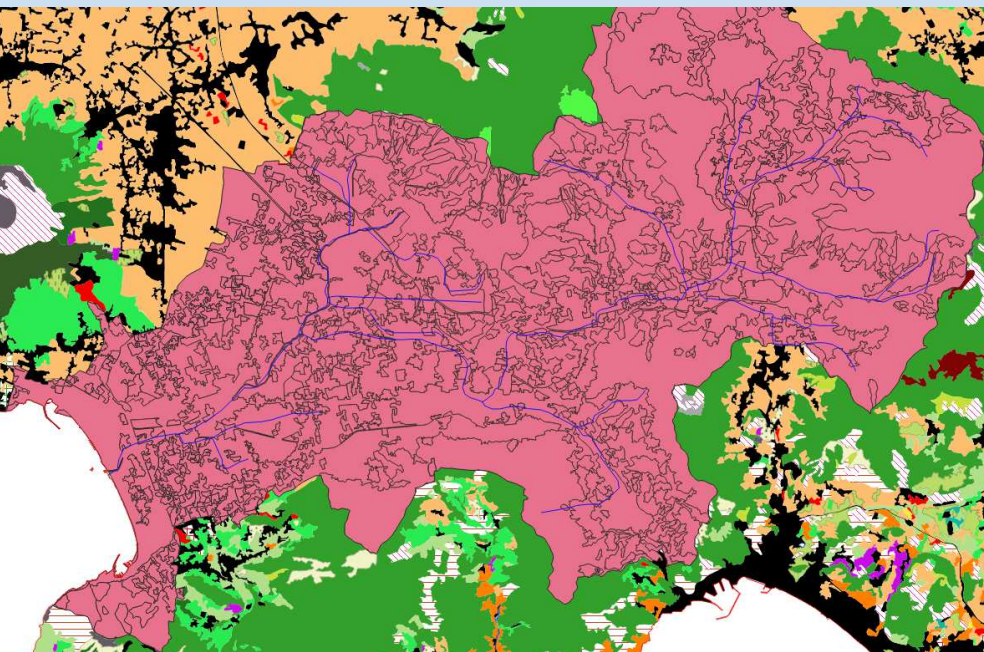


# Estimate soil sealing in the municipalities of the Sarno river catchment

6. Which are the municipalities in the catchment? Load the shape ....\DATA\Italy\italy-administrative-shape\Com2016\_WGS84.shp

Set the transparency of the layer to ca. 45% and select the municipality overlapping the DEM and save the selection as a new layer «Comuni bacino Sarno2016\_WGS84\_UTM32N»

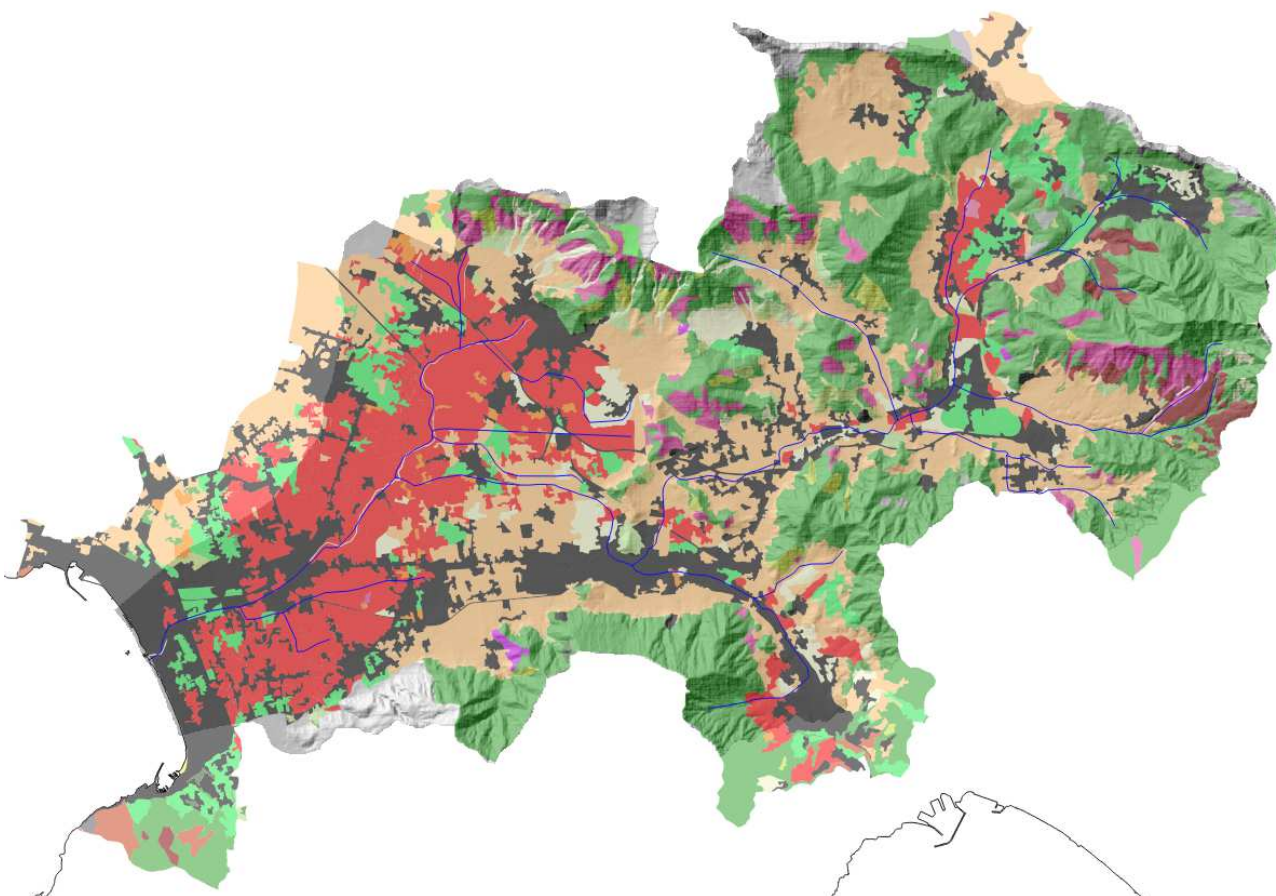
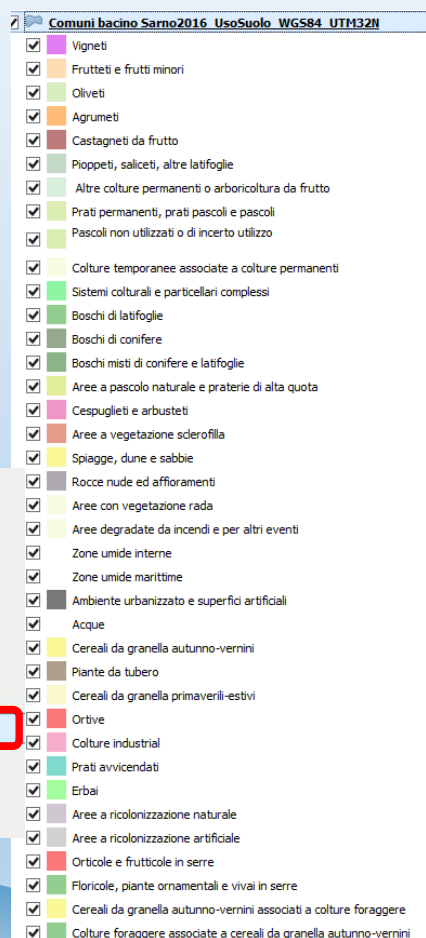
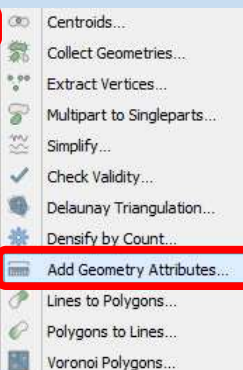
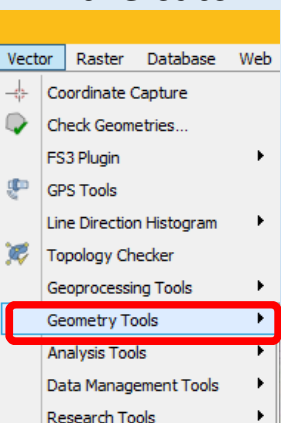
7. Use this layer to clip the land use map of the region  
Save it as Comuni bacino Sarno2016\_UsoSuolo\_WGS84\_UTM32N.shp  
Classify the land use classes loading the style





# Estimate soil sealing in the municipalities of the Sarno river catchment

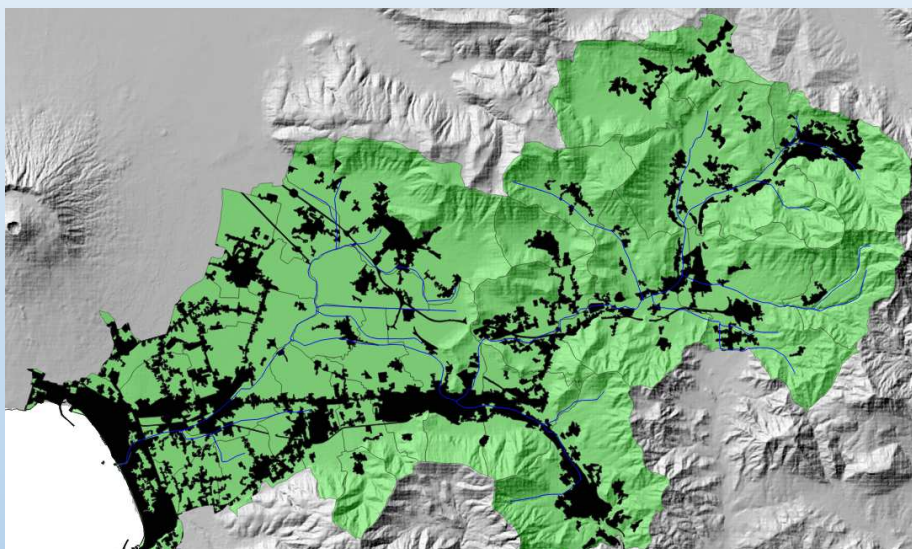
8. Calculate the area under each land use class in the catchment



# Estimate soil sealing in the municipalities of the Sarno river catchment

9. Analyze land use and land take (soil sealing) for each municipality.

Create a new layer containing only the LU class 91 (Urban areas and artificial surface) using «Select by expression» and save the selected geometry to a new file «Sarno\_Urbanizzato\_WGS84\_UTM32N.shp»

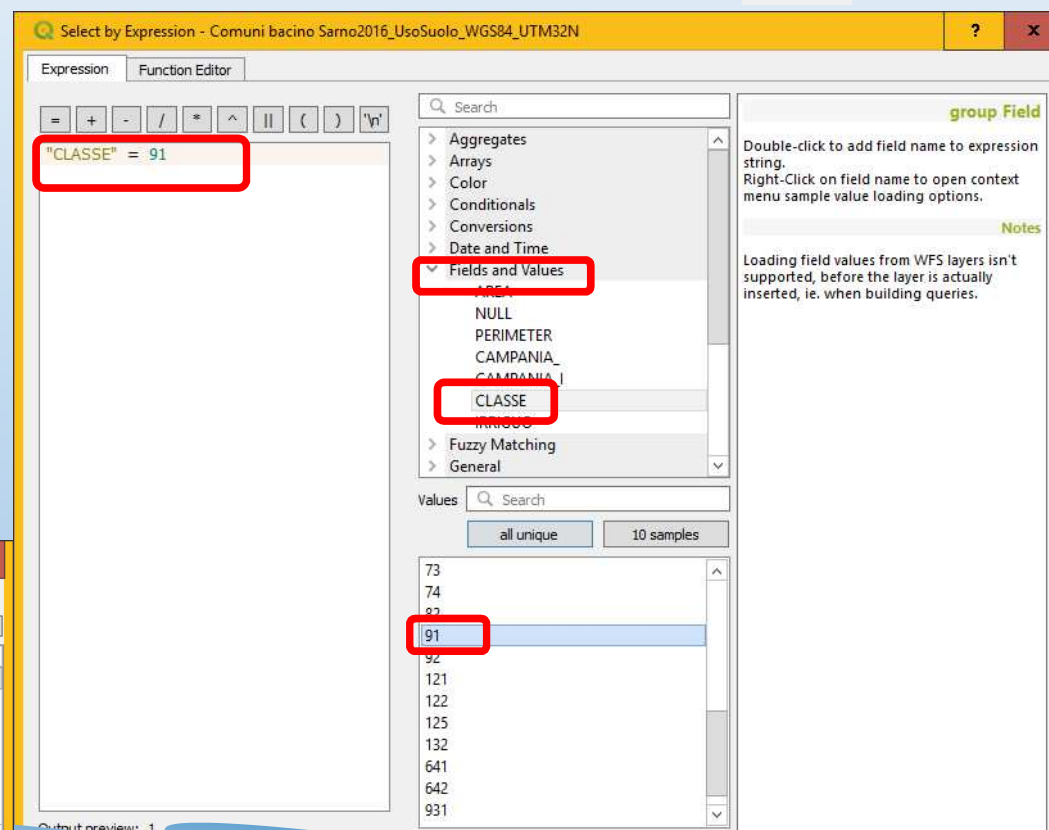


Comuni bacino Sarno2016\_UsoSuolo\_WGS84\_UTM32N :: Features Total: 782, Filtered: 782, Selected: 134

1.2 AREA = E

	AREA	PERIMETER	CAMPANIA_	CAMPANIA_I	CLASSE	IRRIGUO
1	25591,130	1020,285	20607	20586	91	
2	26588,560	835,514	20631	20610	91	
3	28129,000	893,271	20209	20188	91	
4	28285,560	682,368	18826	18805	91	
5	28515,630	857,307	21523	21502	91	

Show All Features

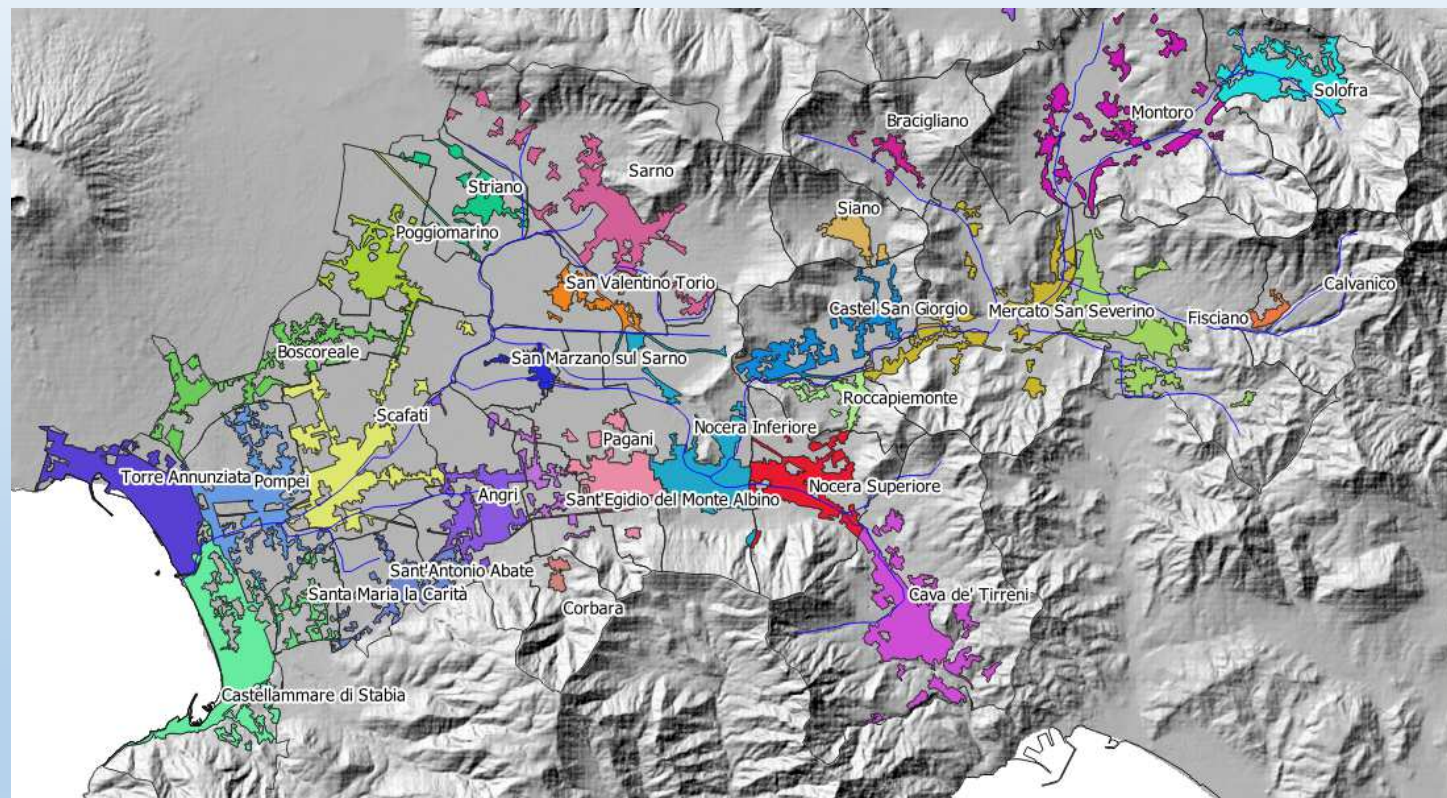
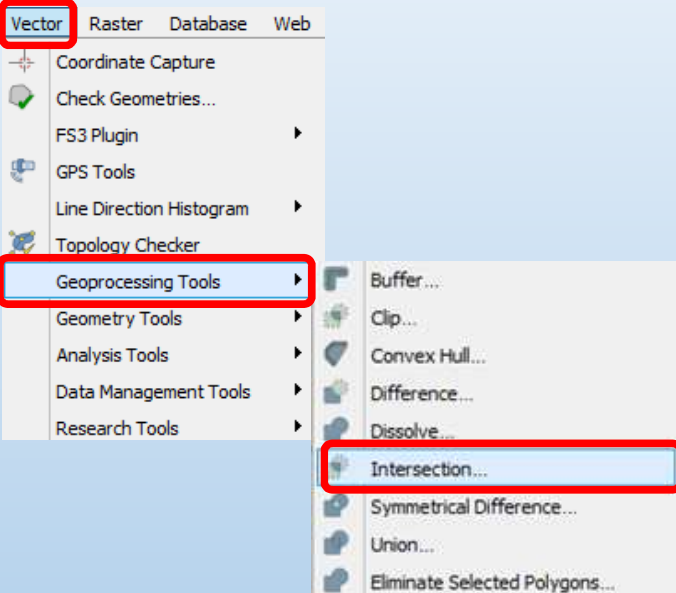


ers Florence Oct. 1<sup>st</sup> – 5<sup>th</sup> 2018



# Estimate soil sealing in the municipalities of the Sarno river catchment

10. Make an intersection of the urbanization layer with the municipality layer so to assess the urban areas for each municipality.

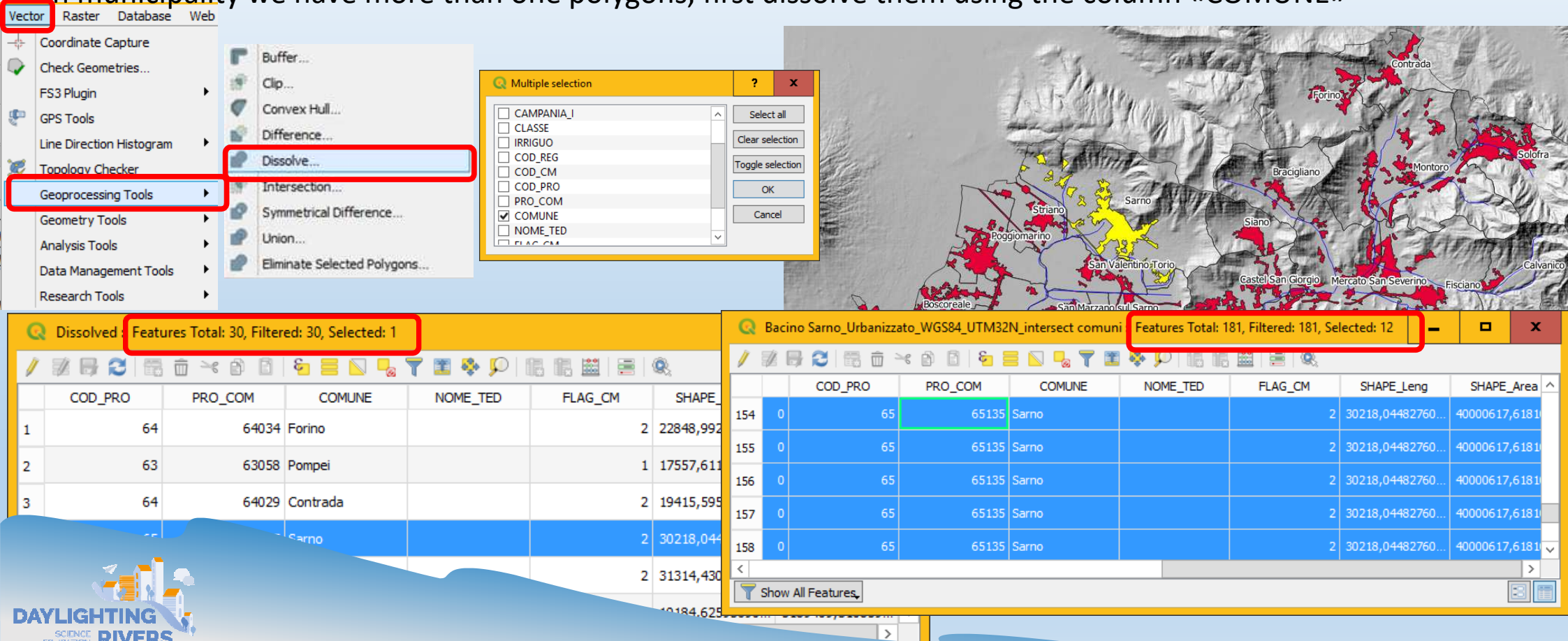


Bacino Sarno\_Urbanizzato\_WGS84\_UTM32N\_intersect comuni.shp



# Estimate soil sealing in the municipalities of the Sarno river catchment

11. Calculate the urbanised areas and its share for each municipality by adding the geometry columns. But as for each municipality we have more than one polygons, first dissolve them using the column «COMUNE»



**Multiple selection**

- ☐ CAMPANIA\_I
- ☐ CLASSE
- ☐ IRRIGUO
- ☐ COD\_REG
- ☐ COD\_CM
- ☐ COD\_PRO
- ☐ PRO\_COM
- ☒ COMUNE
- ☐ NOME\_TED
- ☐ FLAG\_CM

**Dissolved** Features Total: 30, Filtered: 30, Selected: 1

	COD_PRO	PRO_COM	COMUNE	NOME_TED	FLAG_CM	SHAPE
1	64	64034	Forino		2	22848,992
2	63	63058	Pompei		1	17557,611
3	64	64029	Contrada		2	19415,595
			Sarno		2	30218,044
					2	31314,430

**Bacino Sarno\_Urbanizzato\_WGS84\_UTM32N\_intersect comuni** Features Total: 181, Filtered: 181, Selected: 12

	COD_PRO	PRO_COM	COMUNE	NOME_TED	FLAG_CM	SHAPE_Leng	SHAPE_Area
154	0	65	65135	Sarno	2	30218,04482760...	40000617,6181...
155	0	65	65135	Sarno	2	30218,04482760...	40000617,6181...
156	0	65	65135	Sarno	2	30218,04482760...	40000617,6181...
157	0	65	65135	Sarno	2	30218,04482760...	40000617,6181...
158	0	65	65135	Sarno	2	30218,04482760...	40000617,6181...

Training event (C1) of Daylighting rivers Florence Oct. 1<sup>st</sup> – 5<sup>th</sup> 2018

# Estimate soil sealing in the municipalities of the Sarno river catchment

Added geom info :: Features Total: 30, Filtered: 30, Selected: 0

	COMUNE	NOME_TED	FLAG_CM	SHAPE_Leng	SHAPE_Area	area_2	perimeter
1	Forino		2	22848,99230640...	20389556,83439...	1258276,219238...	17745,30217167...
2	Pompei		1	17557,61181030...	12430339,11219...	4816998,962646...	69475,84388951...
3	Contrada		2	19415,59502310...	10310635,44020...	1292070,223097...	10000,17297499...
4	Sarno		2	30218,04482760...	40000617,61810...	4834722,848144...	62822,27933245...
5	Cava de' Tirreni		2	31314,43033010...	36531120,76009...	5599983,645996...	54140,75328071...
6	San Marzano sul Sarno		2	10184,62593690...	5189409,310859...	641584,2617187...	9234,565939478...
7	Nocera Superiore		2	18636,74621360...	14662451,68789...	3370575,809082...	36702,76084365...

Show All Features

Builtup area (m<sup>2</sup>)

Total area (m<sup>2</sup>)

Activate the **Edit** mode,  
 calculate the areas in ha anche  
 calculate the share of build up  
 areas in each municipality using  
 the **Field calculator**.  
 Display the results on the map

# Estimate soil sealing in the municipalities of the Sarno river catchment

**Field Calculator**

☐ Only update 0 selected features

☒ Create a new field ☐ Update existing field

☐ Create virtual field

Output field name: **Area\_T**

Output field type: Decimal number (real)

Output field length: 10 Precision: 3

Expression: "SHAPE\_Area" / 10000

Function Editor: [Search] [group Field]

Values: [all unique] [10 samples]

Output preview: 915.632359372

**Field Calculator**

☐ Only update 0 selected features

☒ Create a new field ☐ Update existing field

☐ Create virtual field

Output field name: **Area\_U**

Output field type: Whole number (integer)

Output field length: 10 Precision: 3

Expression: "area\_2" / 10000

Function Editor: [Search] [group Field]

Values: [all unique] [10 samples]

**Field Calculator**

☐ Only update 0 selected features

☒ Create a new field ☐ Update existing field

☐ Create virtual field

Output field name: **URB\_share**

Output field type: Decimal number (real)

Output field length: 10 Precision: 3

Expression: ( "Area\_U" / "Area\_T" ) \* 100

Function Editor: [Search] [group Field]

Values: [all unique] [10 samples]

**Added geom info :: Features Total: 30, Filtered: 30, Selected: 0**

1.2 AREA = [Symbol]

	COMUNE	NOME_TED	FLAG_CM	SHAPE_Leng	SHAPE_Area	area_2	perimeter_	Area_T	Area_U	URB_share
22	Pompei			1 17557,61181030...	12430339,01219...	4816998,962646...	69475,84388951...	1243,034	481,700	38,752
23	Contrada			2 19415,59502310...	10310635,44620...	1292678,225097...	16608,17297499...	1031,064	129,268	12,537
24	Sarno			2 30218,04482760...	40000617,61810...	4834722,848144...	62822,27933245...	4000,062	483,472	12,087
25	Torre Annunziata			1 22669,66131480...	7508025,094949...	6179761,118652...	32999,37589819...	750,803	617,976	82,309

Show All Features

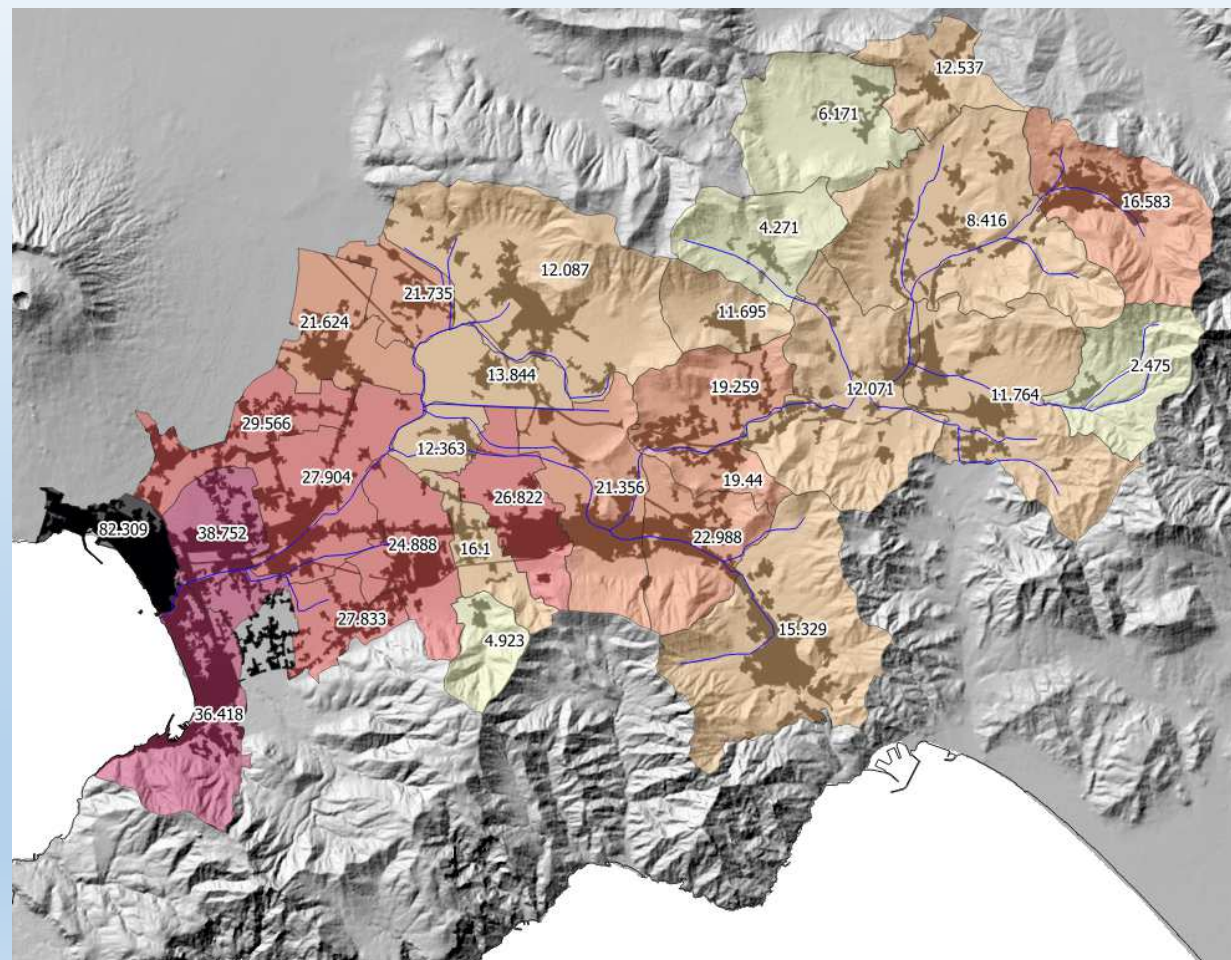
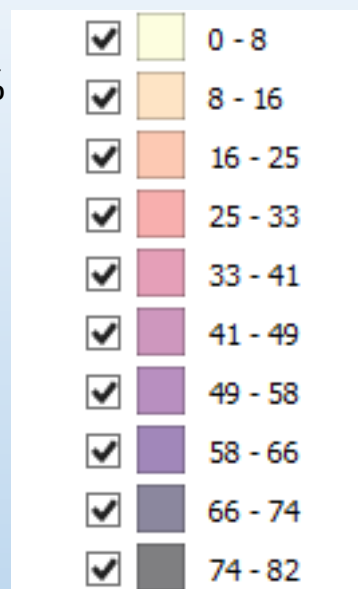


# Estimate soil sealing in the municipalities of the Sarno river catchment

Regional average (2017) 10.4%

Results are based on CORINE land cover (res. 5 ha) from 2004.

Let's see what happens if we use **2017 data** with a **10 m resolution** provided as raster by ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale)



# Estimate soil sealing in the municipalities of the Sarno river catchment

Load the raster layer ...\\DATA\\Italy\\italy-buildup-raster\\bu\_2017\_EPSG\_32632.tif

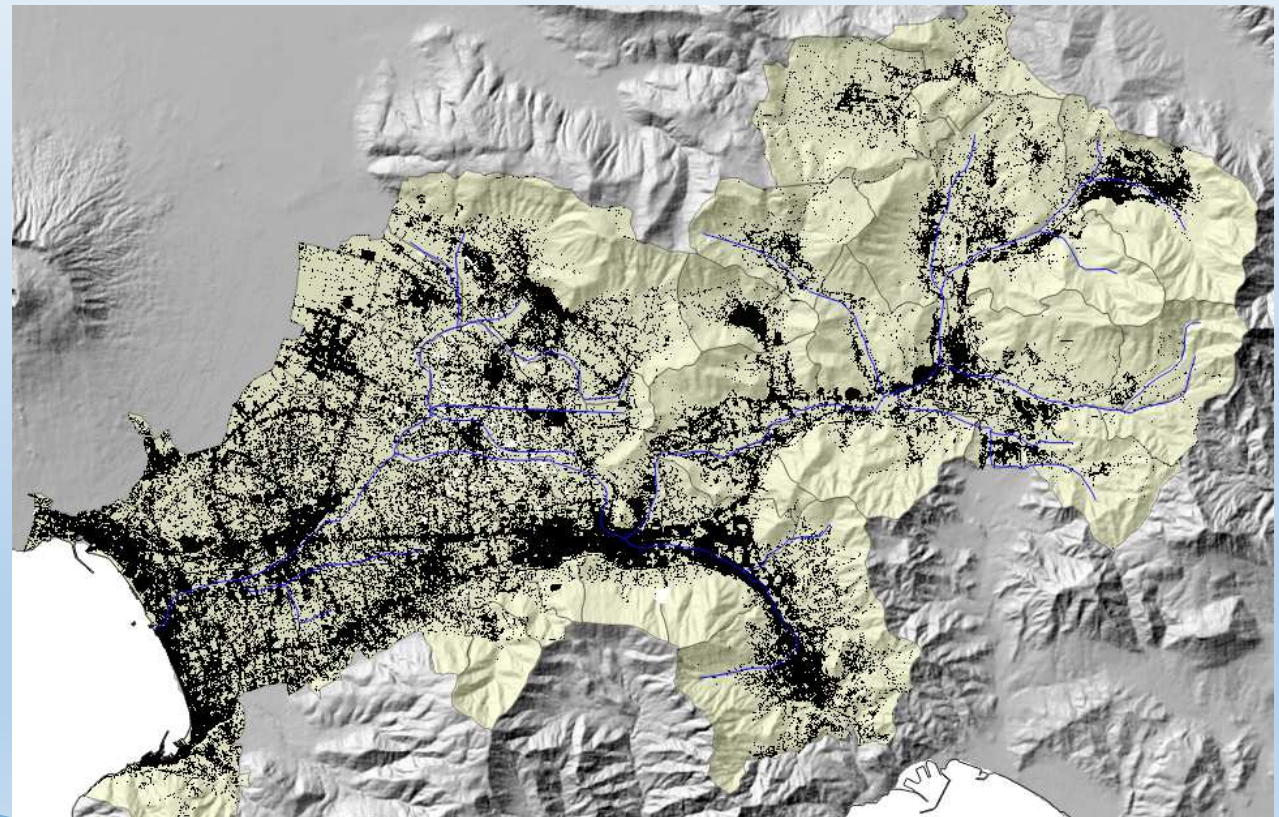
Clip the raster using the municipalities area layer as mask

First convert the raster in a shape file,  
using the menu command:

**Raster > Conversion > Polygonize**

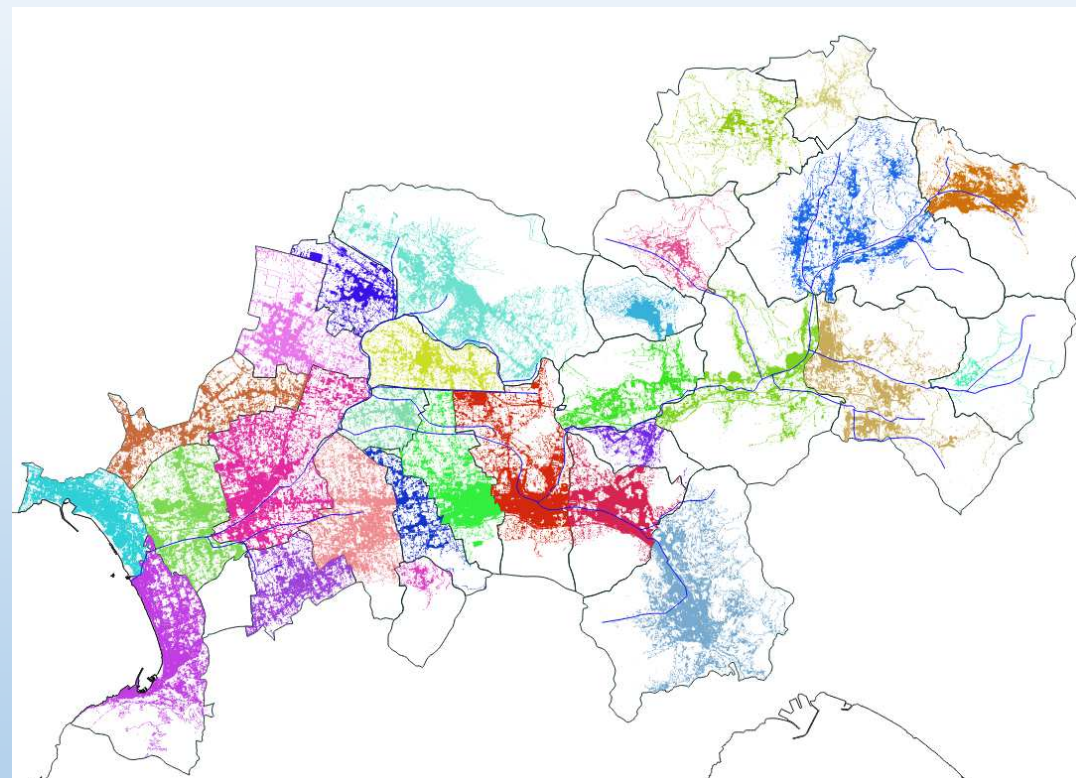
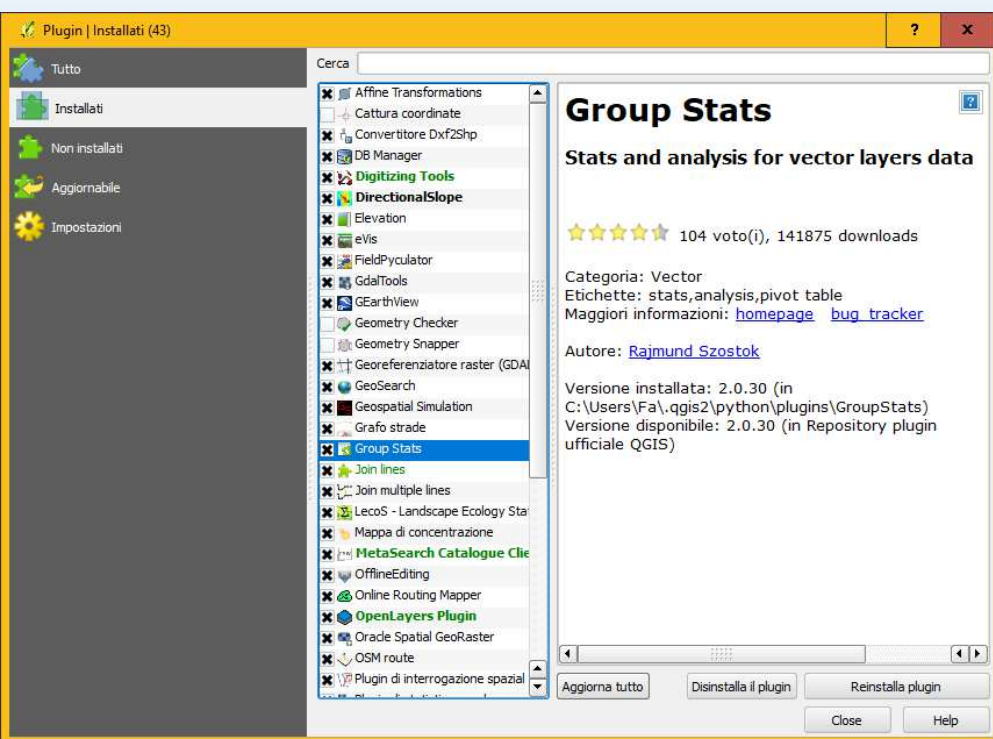
Then select **DN=1** and save the  
selection to a new vector layer, and  
intersect this layer with the  
boundaries of the municipalities.

**NB Use QGIS 2.18 !!**





# Estimate soil sealing in the municipalities of the Sarno river catchment



## Install the plugin GroupStats



# Estimate soil sealing in the municipalities of the Sarno river catchment

**Group Stats**

Data Features Window Help

	1	2
	COMUNE	
2	Angri	6.07443e+06
3	Boscoreale	4.89311e+06
4	Bracigliano	1.3165e+06
5	Calvanico	501415
6	Castel San Giorgio	3.16011e+06
7	Castellammare di Stabia	7.13677e+06
8	Cava de' Tirreni	8.68614e+06
9	Contrada	937249
10	Corbara	525730
11	Fisciano	5.40372e+06
12	Forino	1.86458e+06
13	Mercato San Severino	4.68711e+06
14	Montoro	5.32805e+06
15	Nocera Inferiore	7.23662e+06
16	Nocera Superiore	4.71926e+06
17	Pagani	5.13552e+06
18	Poggiomarino	4.0955e+06
19	Pompei	6.21577e+06
20	Roccapiemonte	1.21607e+06

Control panel

Layers  
Bu2017\_EPSG32632\_SarnoCatchm\_DN1\_Comuni\_AREA-DN1

Fields

- PRO\_COM
- SHAPE\_Area
- SHAPE\_Leng
- Area
- Perimeter
- average
- count
- max
- median
- min
- stand.dev.
- sum
- unique
- variance

Filter

Columns

Rows

COMUNE

Value

sum  
Area

☐ use NULL values

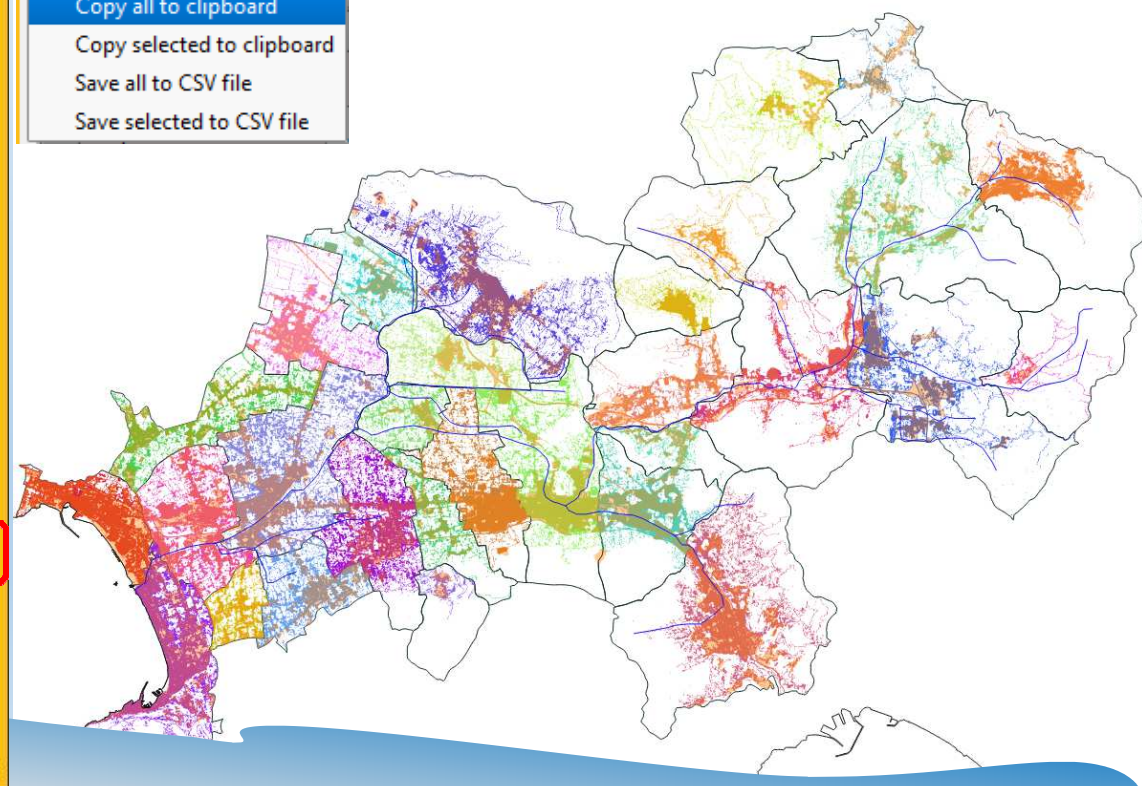
☐ Use only selected features

Calculate

**Group Stats**

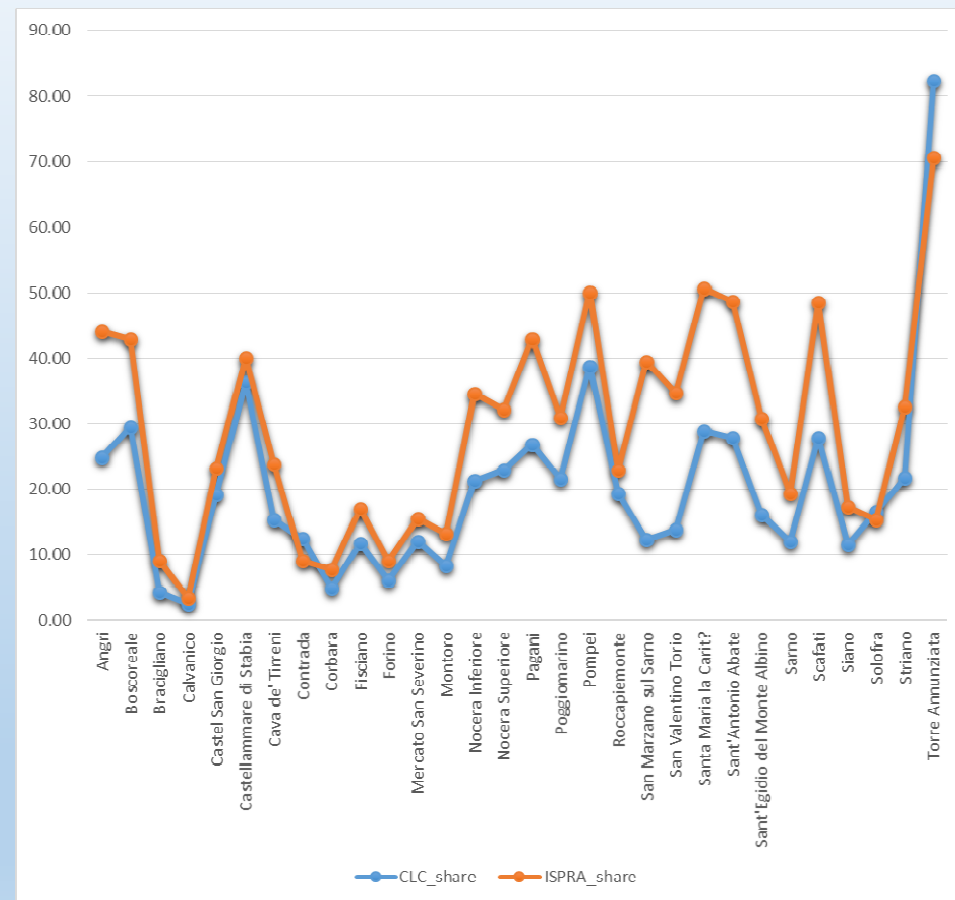
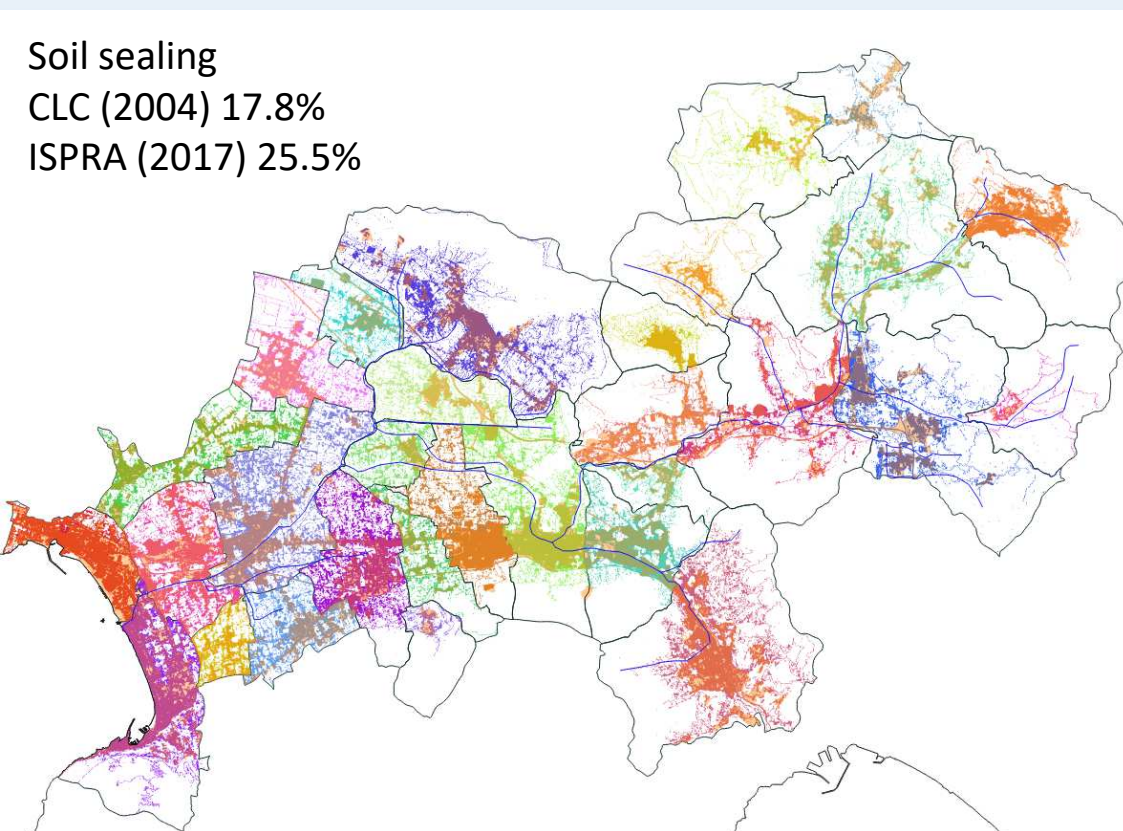
Data Features Window Help

- Copy all to clipboard
- Copy selected to clipboard
- Save all to CSV file
- Save selected to CSV file



# Estimate soil sealing in the municipalities of the Sarno river catchment

Soil sealing  
 CLC (2004) 17.8%  
 ISPRA (2017) 25.5%



Source: DATA/Campania/ Soil sealing comparison.xlsx

## Resources (just a few)

QGIS Support resources for users <https://www.qgis.org/en/site/forusers/support.html>

QGIS documentation (V.2.18) <https://qgis.org/en/docs/index.html>

QGIS Training Manual [https://docs.qgis.org/2.8/en/docs/training\\_manual/](https://docs.qgis.org/2.8/en/docs/training_manual/)

Introduction to GIS Using Open Source Software <https://www.baruch.cuny.edu/confluence/display/geoportal/GIS+Practicum>

Tutorials and Tips [https://www.qgistutorials.com/en/docs/learning\\_resources.html](https://www.qgistutorials.com/en/docs/learning_resources.html)

Video tutorials <https://www.youtube.com/channel/UCrBM8Ka8HhDAYvQY1VX2P0w/videos>  
<http://qgis-tutorials.mangomap.com/>

### Books

- Learning QGIS: Create great maps and perform geoprocessing tasks with ease 2016 by Anita Graser
- QGIS: Becoming a GIS Power User 2017 by Anita Graser and Ben Mearns
- Create a thematic map in 60 minutes: Examples with QGIS 2017 by Stamatis Kalogirou
- QGIS by Example: Leverage the Power of Qgis in Real-world Applications to Become a Powerful User in Cartography and Gis Analysis 2015 by Alexander Bruy and Daria Svidzinska
- Hands-On Geospatial Analysis with R and QGIS: A beginner's guide to manipulate, analyse and visualize spatial data 2018 by Islam Shammunul
- Mastering QGIS: Go Beyond the Basics and Unleash the Full Power of Qgis With Practical, Step-by-step Examples 2015 by Kurt Menke and Smith Richard



# Thank you for your kind attention!

Fabrizio Ungaro: [f.ungaro@ibimet.cnr.it](mailto:f.ungaro@ibimet.cnr.it)

