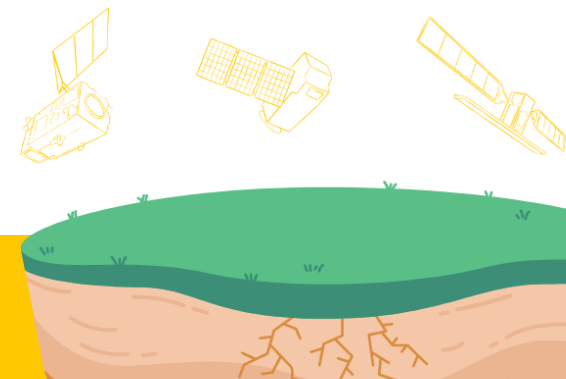




Monitoring Land Use Change in urban areas with Copernicus Land datasets

David García Álvarez

davidg@ucm.es





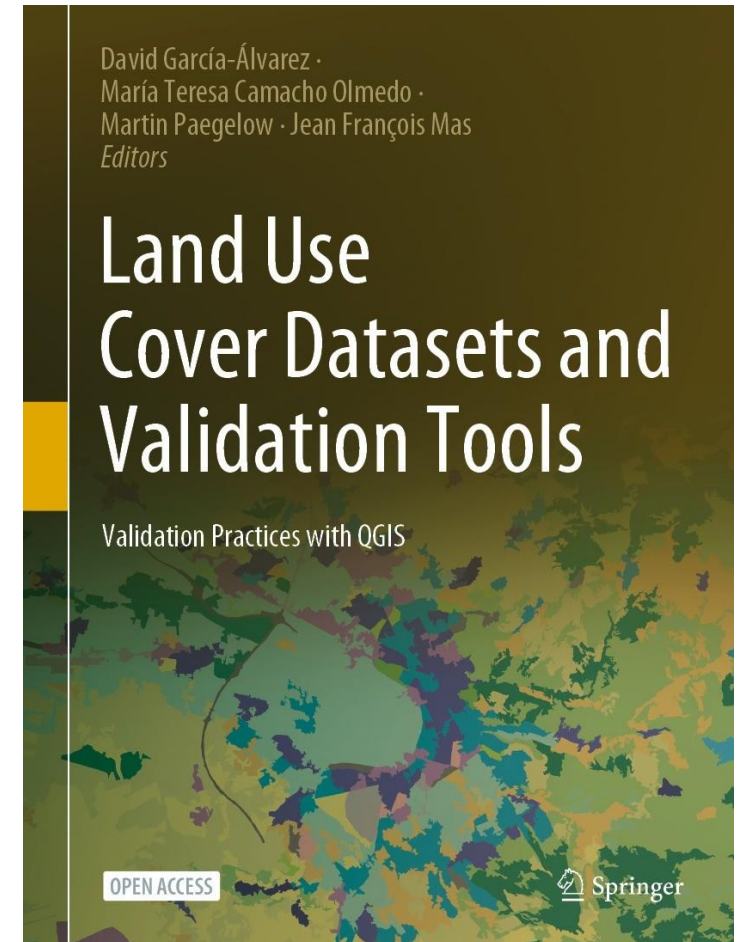
David García Álvarez

CV

- Assistant Professor at Complutense University of Madrid
- Expert for the Knowledge Centre on Earth Observation (JRC, European Commission)

Research lines

- Land Use Change analysis in urban and rural areas
- Pattern based Land Use Cover Change models
- Uncertainty in Land Use Cover mapping and modelling
- Review and comparison of Land Use Cover datasets



Available open access at:
<https://link.springer.com/book/10.1007/978-3-030-90998-7>





Monitoring Land Use Change in urban areas **HOW?**

Own developed datasets

Fit for purpose

Methods: Remote sensing, photointerpretation, auxiliary datasets

Require time investment

Reusable?

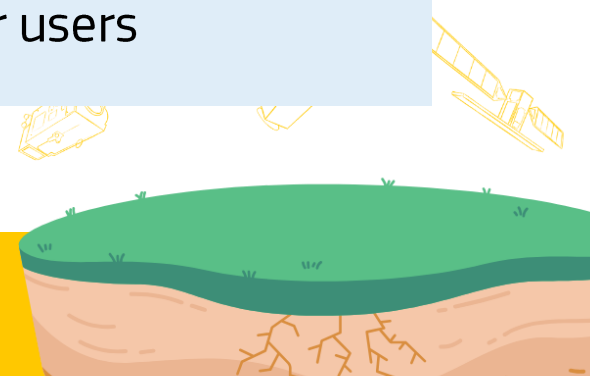
Available standard datasets

Comparability

Reusable

Validated

Experience provided by other users





Monitoring Land Use Change in **EUROPEAN** urban areas



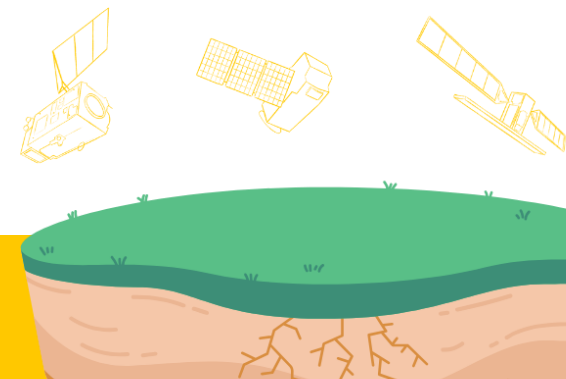
<https://www.copernicus.eu/en>



<https://land.copernicus.eu/en>



<https://www.wekeo.eu/>





Products available in



CORINE Land Cover 1

The CORINE Land Cover (CLC) inventory was initiated in 1985 (reference year 1990). Updates have been produced in 2000, 2006, 2012, and 2018. It consists of an inventory of land cover ...

Details Add to map

Urban Atlas 2

The Urban Atlas provides pan-European comparable land cover and land use data for Functional Urban Areas (FUA).

Details Select layers

High Resolution Layers 6

Pan-European High Resolution Layers (HRL) provide information on specific land cover characteristics, and are complementary to land cover / land use mapping such as in the CORINE land cover...

Details Select layers

Other products of interest

- European Settlement map
2012, 2015 | 2 2.5m | Urban / Non urban and +
- Global Urban Land
1980 2015 | 30m | Urban / Non urban
- Global Human Settlement Layer (GHSL)
1975 2018 | 10 30m | Urban / Non urban
- Global Artificial Impervious Areas (GAIA)
1985 2018 | 30m | Urban / Non urban
- Global Urban Footprint (GUF)
2011 | 12m | Urban / Non urban
- World Settlement Footprint (WSF)
1985 2019 | 10m | Urban / Non urban | %Urban (100m)

■ ... and many more ([check here](#))

****Check additional national and regional products as well for local studies!**





Recommended for...

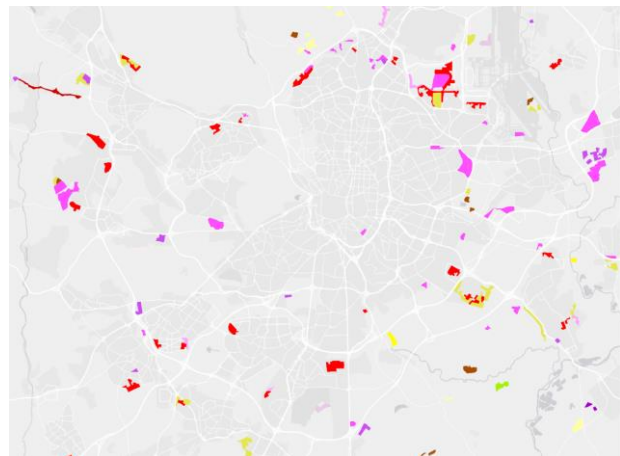
- General and cross country analyses of Land Use / Cover change in European cities
- General trend analyses at coarse levels of spatial and thematic detail



CORINE Land Cover 1 CLC ☆

The CORINE Land Cover (CLC) inventory was initiated in 1985 (reference year 1990). Updates have been produced in 2000, 2006, 2012, and 2018. It consists of an inventory of land cover ...

[Details](#) [Add to map](#)



Layer of
changes to
study
Land Use Cover
change

Years

90, 00, 06, 12, 18

Updated every 6 years

Extent

39 European countries (last update)

Spatial Detail

Scale of reference (1:100.000)

Minimum Mapping Unit of 25ha (5ha for changes)

Minimum Mapping Width of 100 m

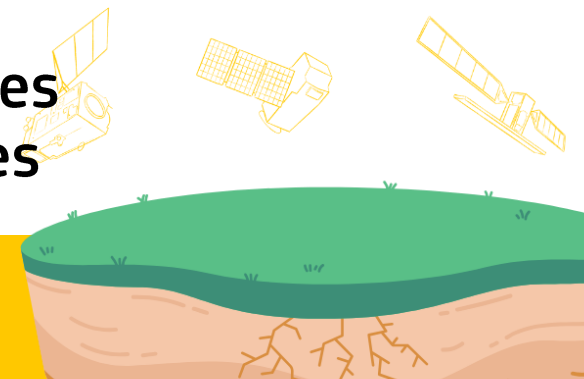
Format

Vector (gdb, geopackage)

Raster available (spatial resolution of 100m)

Thematic detail

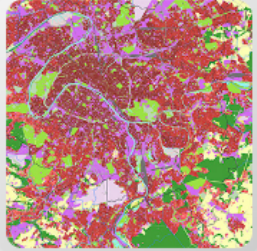
39 Land Use / Cover categories
of which 11 artificial categories





Recommended for...

- Detailed analyses of European Functional Areas
- Analyses of Land Use intensity



Urban Atlas 2 **UA** ☆

The Urban Atlas provides pan-European comparable land cover and land use data for Functional Urban Areas (FUA).

Details

Select layers



Layer of
changes to
study
Land Use Cover
change

Years

06, 12, 18

Updated every 6 years

Extent

Functional Urban Areas of 39 European countries

Spatial Detail

Scale of reference (1:10.000)

Minimum Mapping Unit of 0.25ha for urban areas and 0.1ha for urban changes

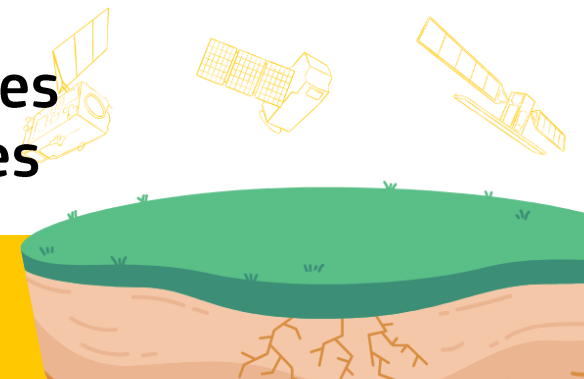
Minimum Mapping Width of 10 m

Format

Vector (gdb, geopackage)

Thematic detail

29 Land Use / Cover categories of which 17 artificial categories





Recommended for...

- Analyses of Land Cover change and intensity at very detailed scales
- Analyses of the urban footprint, independent of the land uses

High Resolution Layers 6 HRL

Pan-European High Resolution Layers (HRL) provide information on specific land cover characteristics, and are complementary to land cover / land use mapping such as in the CORINE land cover...

Details

Select layers

Years

06, 09, 12, 15, 18

Updated every 3 years

Extent

39 European countries

Spatial Detail

10 20m

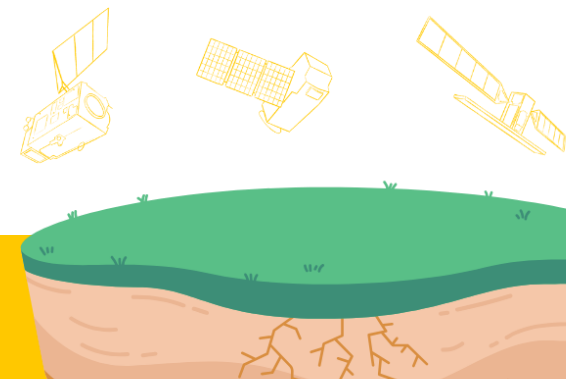
Format

Raster (.tiff)



Thematic detail

% imperviousness

Layer of
changes to
study
Land Use Cover
change







CORINE Land Cover 1  



The CORINE Land Cover (CLC) inventory was initiated in 1985 (reference year 1990). Updates have been produced in 2000, 2006, 2012, and 2018. It consists of an inventory of land cover ...

[Details](#) [Add to map](#)

Urban Atlas 2  

The Urban Atlas provides pan-European comparable land cover and land use data for Functional Urban Areas (FUA).

[Details](#) [Select layers](#)

High Resolution Layers 6  

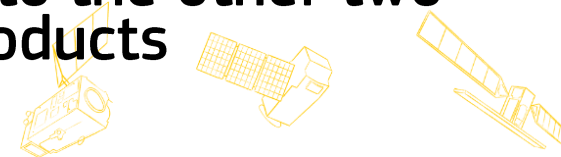
Pan-European High Resolution Layers (HRL) provide information on specific land cover characteristics, and are complementary to land cover / land use mapping such as in the CORINE land cover...

[Details](#) [Select layers](#)

3 scales of analysis

Potential for validation exercises and fine scale profile analyses of Land Use / Cover datasets

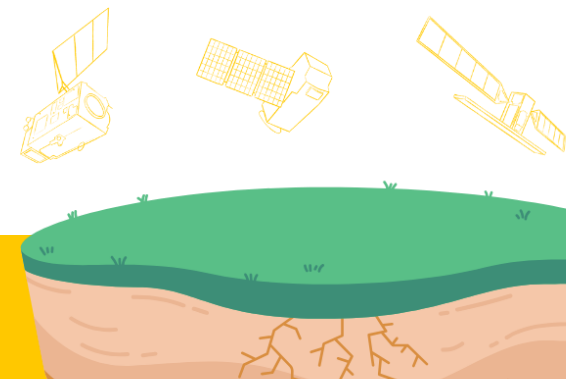
CLC and UA provide similar information at different levels of spatial detail.
HRL provide complementary information to the other two products





Practical case

Monitoring Land Use Change in Madrid
Functional Urban Area at three scales of
analysis



Download datasets in

WEKEO

data viewer

The screenshot shows the WEKEO data viewer interface. The 'Catalogue' panel is open, displaying search filters and a list of datasets. A red circle with the number '1' highlights the 'Layers' button in the top left. A red circle with the number '2' highlights the search input field containing 'corine'. A red circle with the number '3' highlights the 'Add to map' button for the 'CORINE Land Cover' dataset.

Filters

FREE-TEXT SEARCH
corine

Datasets 3

- Coastal Zones 1**
Land Cover/Land Use (LC/LU) classification as part of the Copernicus Land Monitoring Service (CLMS) Local Component, tailored to the needs of monitoring of an important region for...
Details Add to map
- CORINE Land Cover 1**
The CORINE Land Cover (CLC) inventory was initiated in 1985 (reference year 1990). Updates have been produced in 2000, 2006, 2012, and 2018. It consists of an inventory of land cover...
Details Add to map
- High Resolution Layers 6**
Pan-European High Resolution Layers (HRL) provide information on specific land cover characteristics, and are complementary to land cover / land use mapping such as in the CORINE land cover...

The screenshot shows the 'Layers' panel of the WEKEO data viewer. A red circle with the number '4' highlights the download icon. A red circle with the number '5' highlights the selected 'Corine Land Change 2012 2018' product type. A red circle with the number '6' highlights the selected 'GeoPackage' format. A red circle with the number '7' highlights the 'I agree to the Terms and Conditions' checkbox. A red circle with the number '8' highlights the 'Request data' button.

Layers: 3 Jobs: 1

- Land principally occupied by agriculture, with significant areas of natural vegetation and semi-natural areas, or foresty areas

Product type*

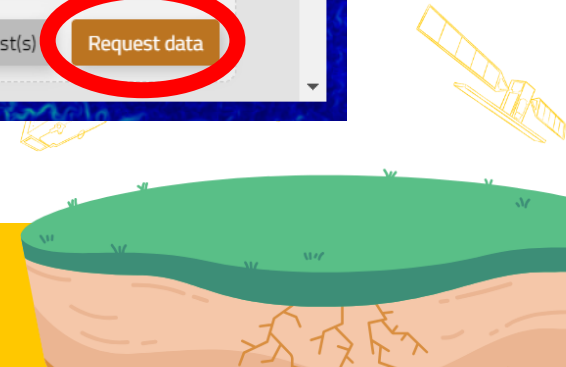
- Corine Land Change 1990 2000
- Corine Land Change 2000 2006
- Corine Land Change 2006 2012
- Corine Land Change 2012 2018
- Corine Land Cover 1990
- Corine Land Cover 2000
- Corine Land Cover 2006
- Corine Land Cover 2012
- Corine Land Cover 2018

Format*

- ESRI fgdb
- GeoPackage
- GeoTiff100

I agree to the Terms and Conditions

Show API request(s) Request data

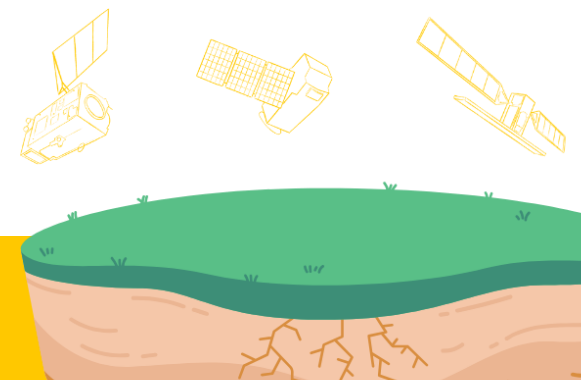


Download datasets in

WEKEO

data viewer

The screenshot displays the WEKEO data viewer interface. At the top, there is a navigation bar with the WEKEO logo and menu items: SERVICES, DATA, COMPUTING, USE CASES, and SUPPORT. Below the navigation bar, a job completion notification is shown for 'CORINE land cover', indicating it is completed with 1 result. A red circle labeled '1' highlights the folder icon in the notification. A second red circle labeled '2' highlights the download icon (a square with a downward arrow) next to the file name 'u2018_cha1218_v2020_20u1_geoPackage'. A third red circle labeled '3' highlights a 'Guardar como' (Save as) dialog box that is open over the notification. The dialog box shows the file name 'u2018_cha1218_v2020_20u1_geoPackage' and the type 'Compressed (zipped) Folder'. The background of the interface shows a satellite map of a coastal region with a heatmap overlay.



Download datasets in

WEKEO

data viewer

← Urban Atlas ×

↳ Building height 2012 Add to map

↳ Urban Atlas Remove

Layers: 1 + Jobs: 1 🗨️

Urban Atlas ×

31/01/2024 | 12:38 | **Completed: 785 results**

</> 📁

183. ua_change1218#ES001L3_MADRID_ch... Order

01/01/1990 00:00 | 25.03 MB

Layers: 4 + Jobs: 1 🗨️

- Railways and associated land
- Port areas
- Airports
- Mineral extraction and dump sites
- Construction sites

📄 📄 ⚙️

Product type* ×

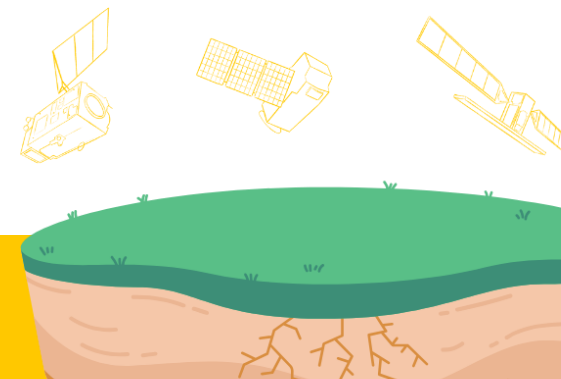
- Building Height 2012
- Street tree layer
- Street tree layer 2012
- Urban Atlas 2006
- Urban Atlas 2012
- Urban Atlas 2018
- Urban Atlas Change 2006 2012
- Urban Atlas Change 2012 2018

Version* ×

- Unspecified
- v012

I agree to the Terms and Conditions*

Show API request(s) Request data





Download datasets in WEkEO

data viewer

Monitoring #LandUse

High Resolution Layers

- ◀ Dominant leaf type Add to map
- ◀ Forest type Add to map
- ◀ Grassland Add to map
- ◀ Imperviousness % Remove
- ◀ Tree cover density % Add to map
- ◀ Water and wetness Add to map

Layers: 1 + Jobs: 5

Imperviousness x

30/01/2024 | 16:03 | Completed: 28 results

</> 📁

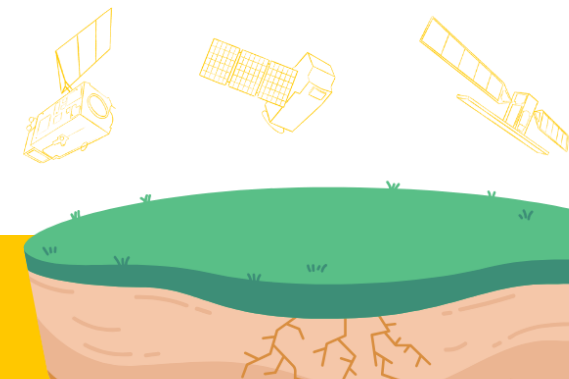
28.	IMC_1215_020m_eu_03035_d03_Full	Order
	01/01/1990 00:00 350.92 MB	

Layers: 1 + Jobs: 5

- Imperviousness Change 2012-2015
- Imperviousness Change 2015-2018
- Imperviousness Classified Change 2006-2009
- Imperviousness Classified Change 2006-2012
- Imperviousness Classified Change 2009-2012
- Imperviousness Classified Change 2012-2015
- Imperviousness Classified Change 2015-2018
- Imperviousness Density 2006
- Imperviousness Density 2009
- Imperviousness Density 2012
- Imperviousness Density 2015
- Imperviousness Density 2018
- Small Woody features 2015
- Tree cover density 2012
- Tree cover density 2015
- Tree cover density 2018
- Tree cover density change 2012-2015
- Water and wetness 2015
- Water and wetness 2018

Resolution* x

<input type="radio"/> 005m	<input type="radio"/> 010m	<input checked="" type="radio"/> 020m
<input type="radio"/> 100m	<input type="radio"/> 20m	<input type="radio"/> vec





Download datasets in

WEKEO

data viewer

Monitoring #LandUse

High Resolution Layers

- Dominant leaf type Add to map
- Forest type Add to map
- Grassland Add to map
- Imperviousness %** Remove
- Tree cover density % Add to map
- Water and wetness Add to map

Layers: 1 + Jobs: 1

Imperviousness ×

31/01/2024 | 12:37 | **Completed: 40 results**

</> 📁

13. **IMC_1518_020m_eu_03035_v010** Order

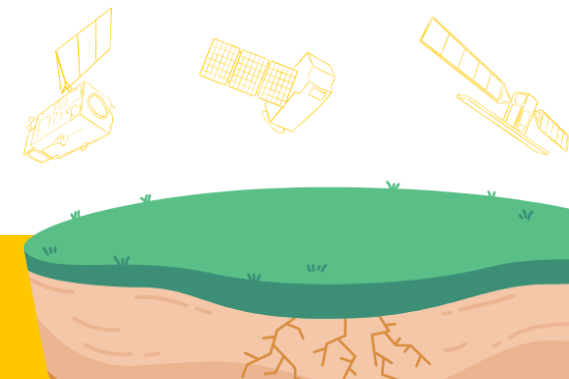
01/01/1990 00:00 | 470.81 MB

Layers: 1 + Jobs: 5

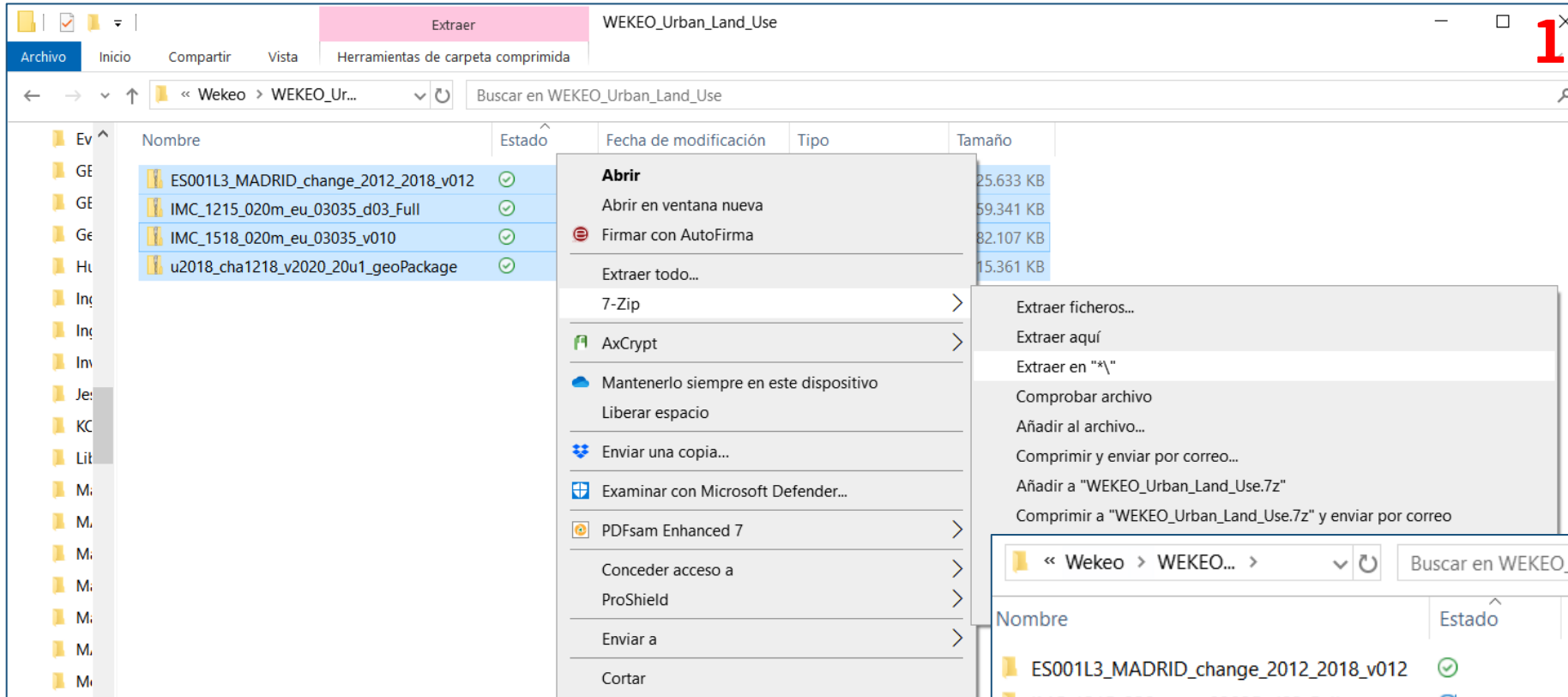
- Imperviousness Change 2012-2015
- Imperviousness Change 2015-2018
- Imperviousness Classified Change 2006-2009
- Imperviousness Classified Change 2006-2012
- Imperviousness Classified Change 2009-2012
- Imperviousness Classified Change 2012-2015
- Imperviousness Classified Change 2015-2018
- Imperviousness Density 2006
- Imperviousness Density 2009
- Imperviousness Density 2012
- Imperviousness Density 2015
- Imperviousness Density 2018
- Small Woody features 2015
- Tree cover density 2012
- Tree cover density 2015
- Tree cover density 2018
- Tree cover density change 2012-2015
- Water and wetness 2015
- Water and wetness 2018

Resolution* ×

- 005m
- 010m
- 020m
- 100m
- 20m
- vec



Unzip files



2

Nombre	Estado	Fecha de modificación	Tipo	Tamaño
ES001L3_MADRID_change_2012_2018_v012	✓	31/01/2024 12:54	Carpeta de archivos	
IMC_1215_020m_eu_03035_d03_Full	↻	31/01/2024 12:54	Carpeta de archivos	
IMC_1518_020m_eu_03035_v010	↻	31/01/2024 12:54	Carpeta de archivos	
u2018_cha1218_v2020_20u1_geoPackage	↻	31/01/2024 12:54	Carpeta de archivos	
ES001L3_MADRID_change_2012_2018_v012	✓	29/01/2024 20:45	Carpeta compri...	25.633 KB
IMC_1215_020m_eu_03035_d03_Full	✓	30/01/2024 15:37	Carpeta compri...	359.341 KB
IMC_1518_020m_eu_03035_v010	✓	30/01/2024 16:31	Carpeta compri...	482.107 KB
u2018_cha1218_v2020_20u1_geoPackage	✓	30/01/2024 12:25	Carpeta compri...	115.361 KB

Boundary of Madrid FUA for clipping data (CLC and HRL Imperviousness)



1. Red circle around the Data Source Manager icon in the top toolbar.

2. Red circle around the Vector source type icon in the left sidebar.

3. Red circle around the ellipsis button in the Source field.

4. Red circle around the file browser window showing the path to the data folder.

5. Red circle around the 'Abrir' (Open) button in the file browser.

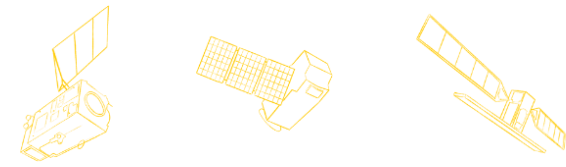
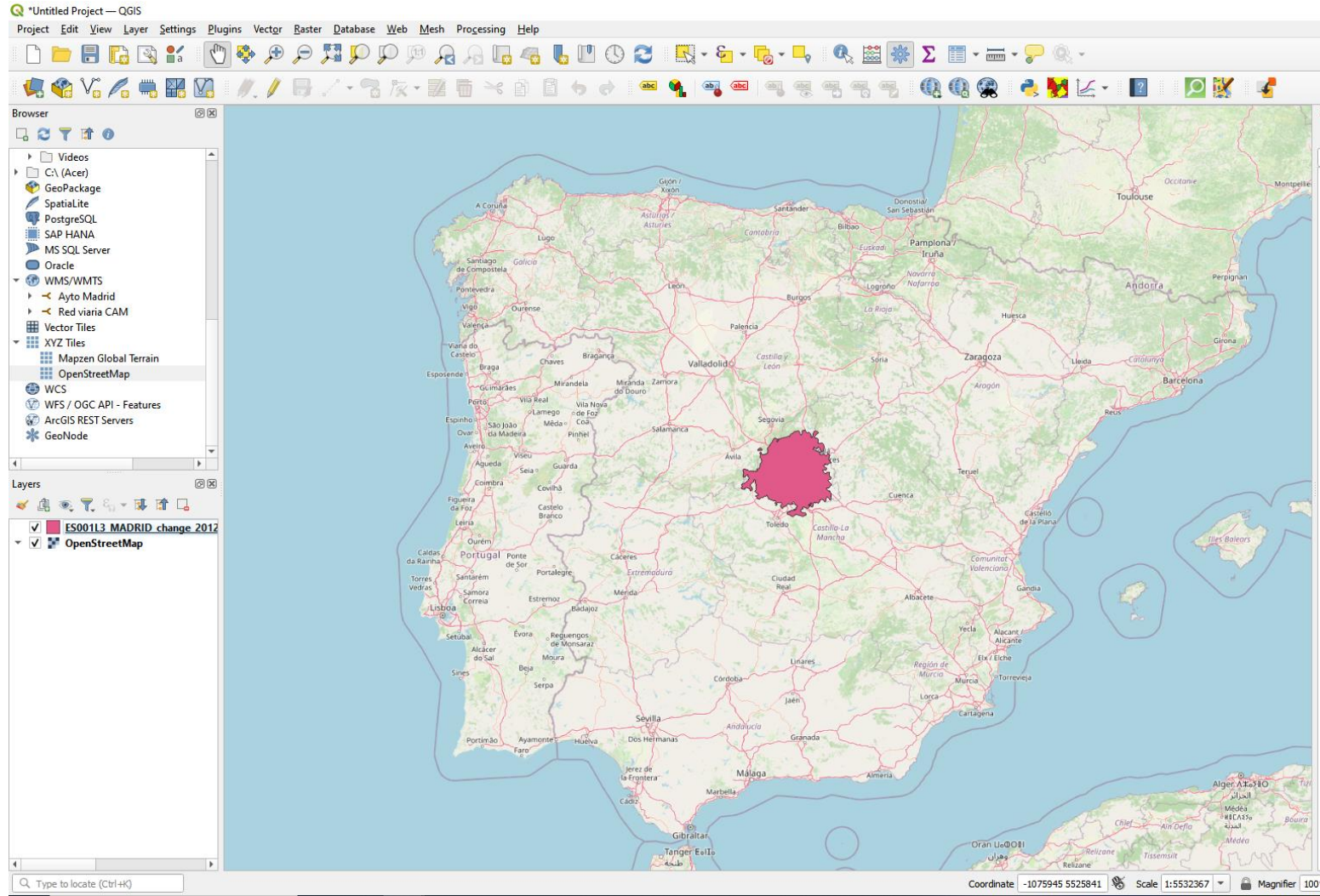
6. Red circle around the 'Add' button at the bottom right of the dialog box.

7. Red circle around the selected item 'ES001L3_MADRID_change_2012_2018_Boundary' in the list.

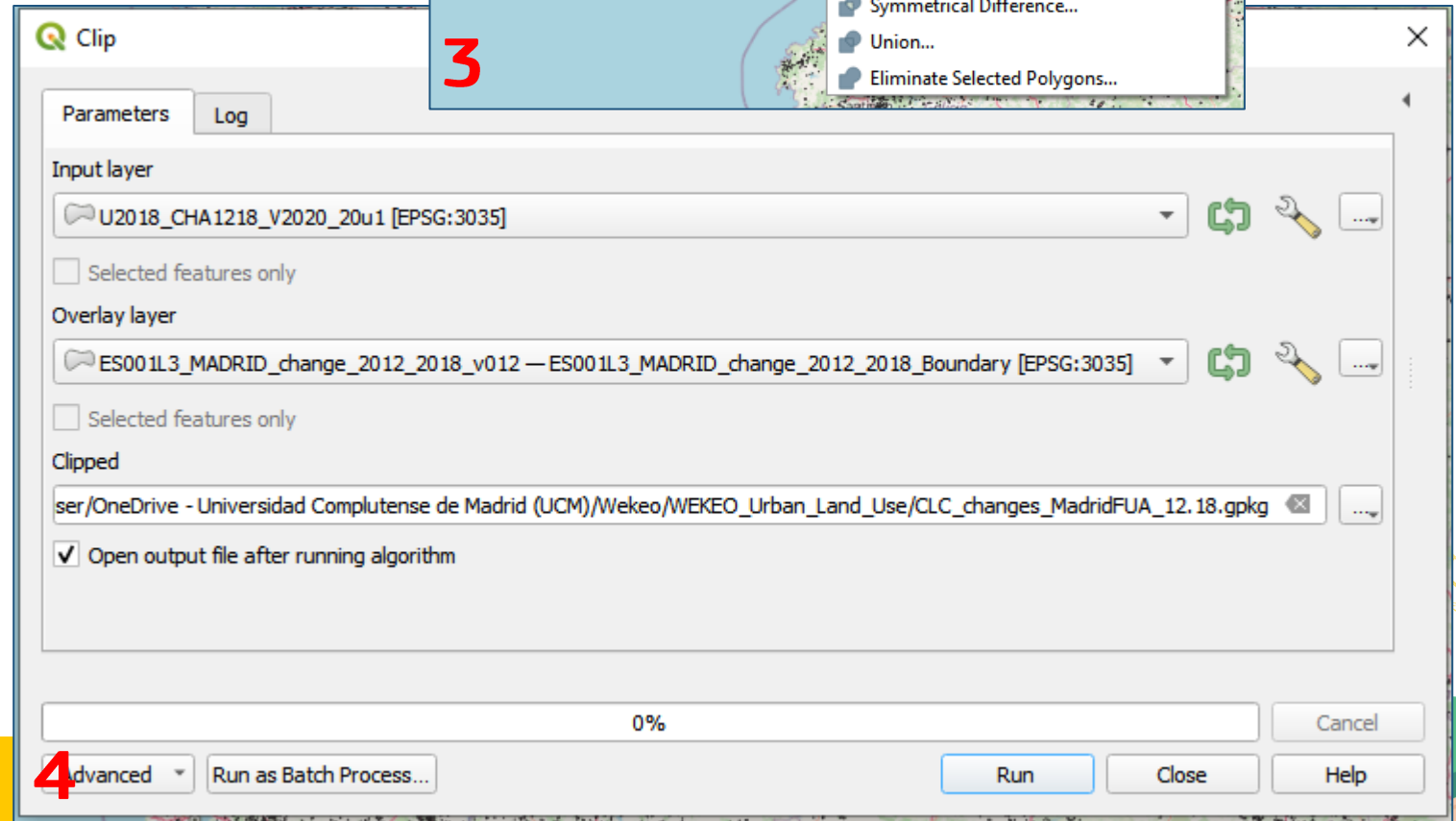
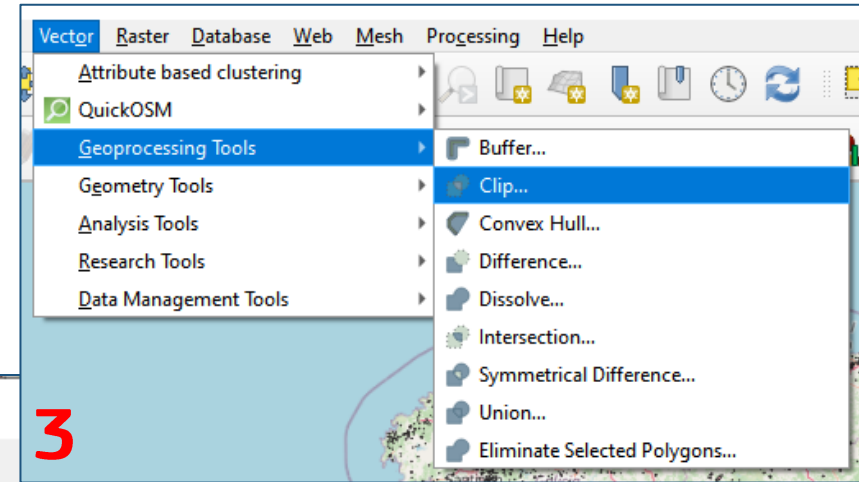
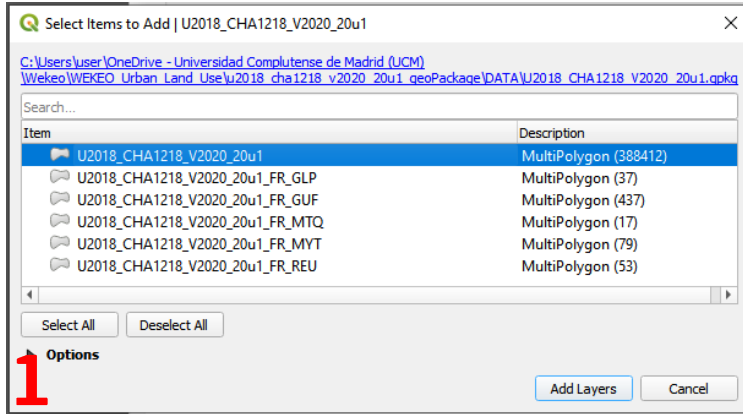
8. Red circle around the 'Add Layers' button at the bottom right.

Item	Description
ES001L3_MADRID_change_2012_2018	MultiPolygon (1)
ES001L3_MADRID_change_2012_2018_Boundary	MultiPolygon (1)
ES001L3_MADRID_change_2012_2018_UrbanCore	MultiPolygon (1)

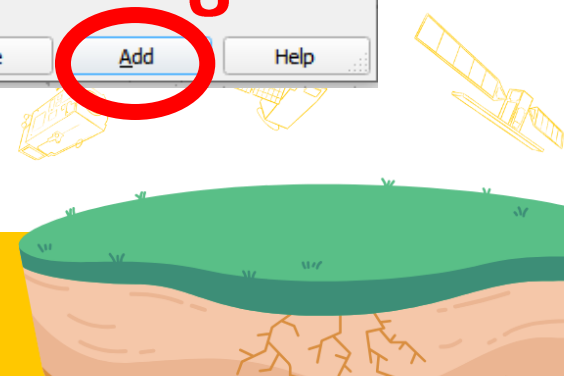
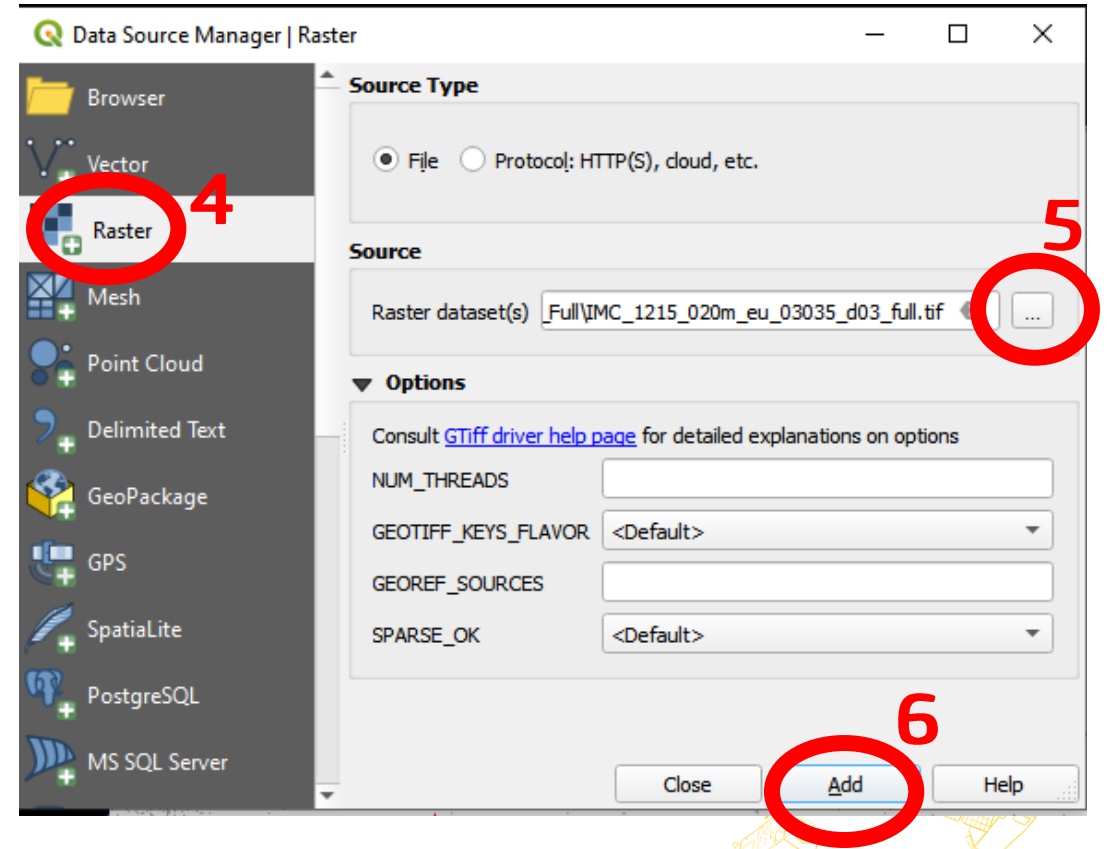
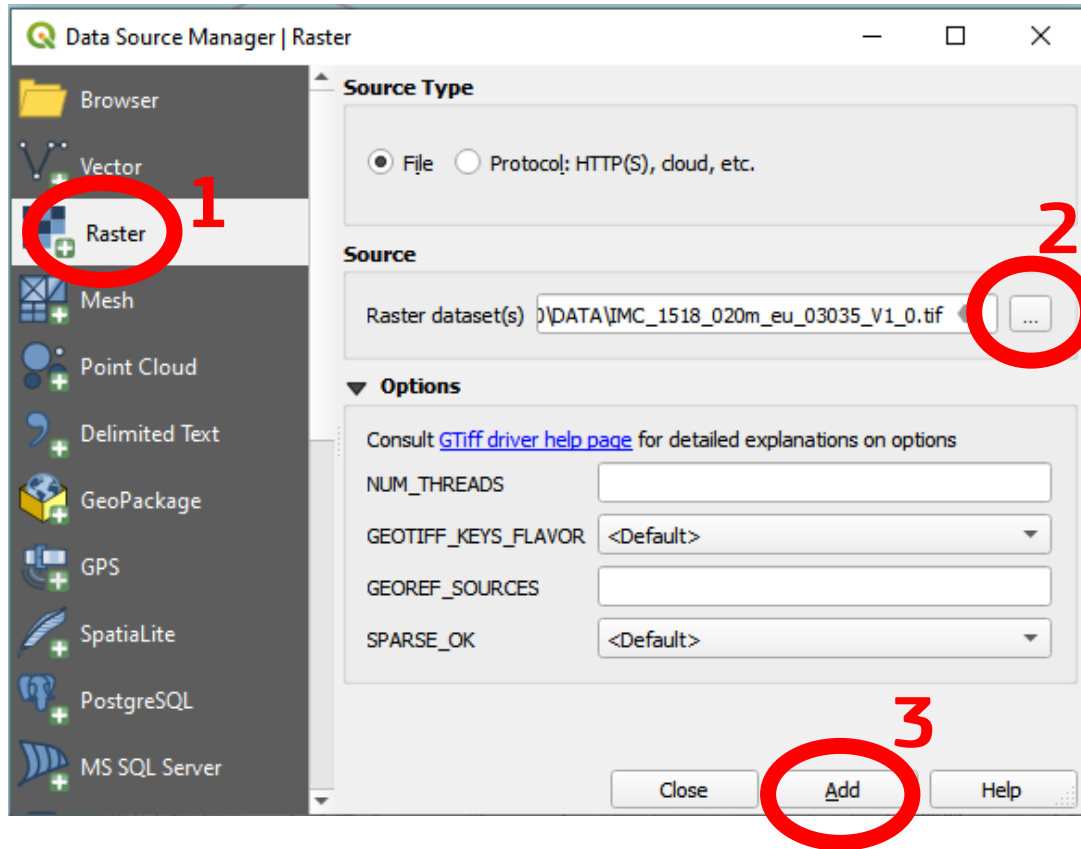
Boundary of Madrid FUA for clipping data (CLC and HRL Imperviousness)



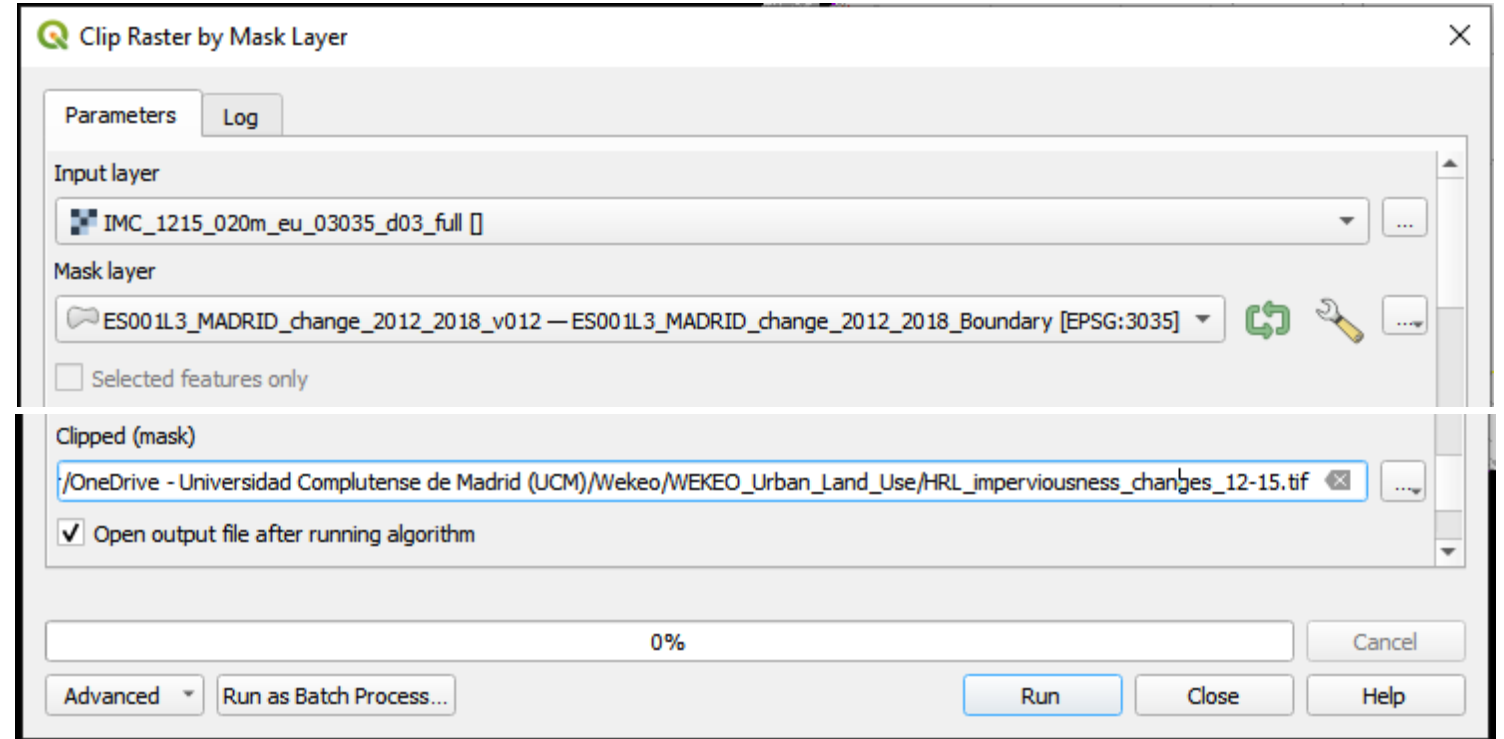
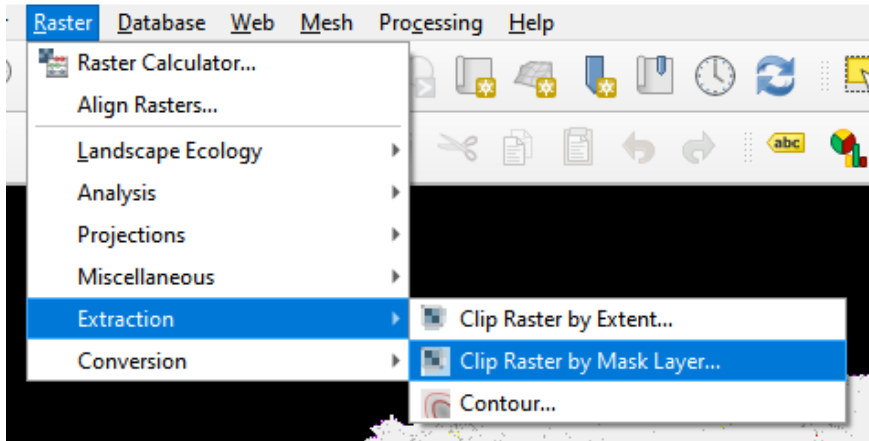
Boundary of Madrid FUA for clipping data (CLC)



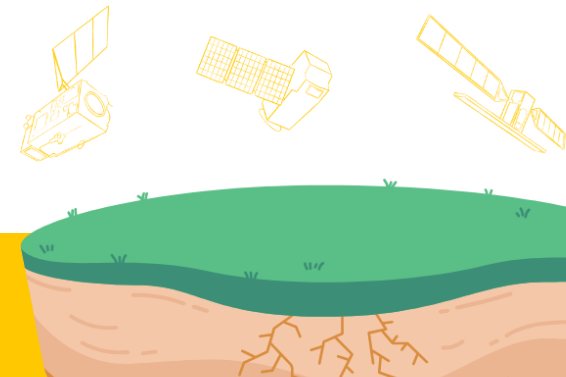
Boundary of Madrid FUA for clipping data (HRL Imperviousness)



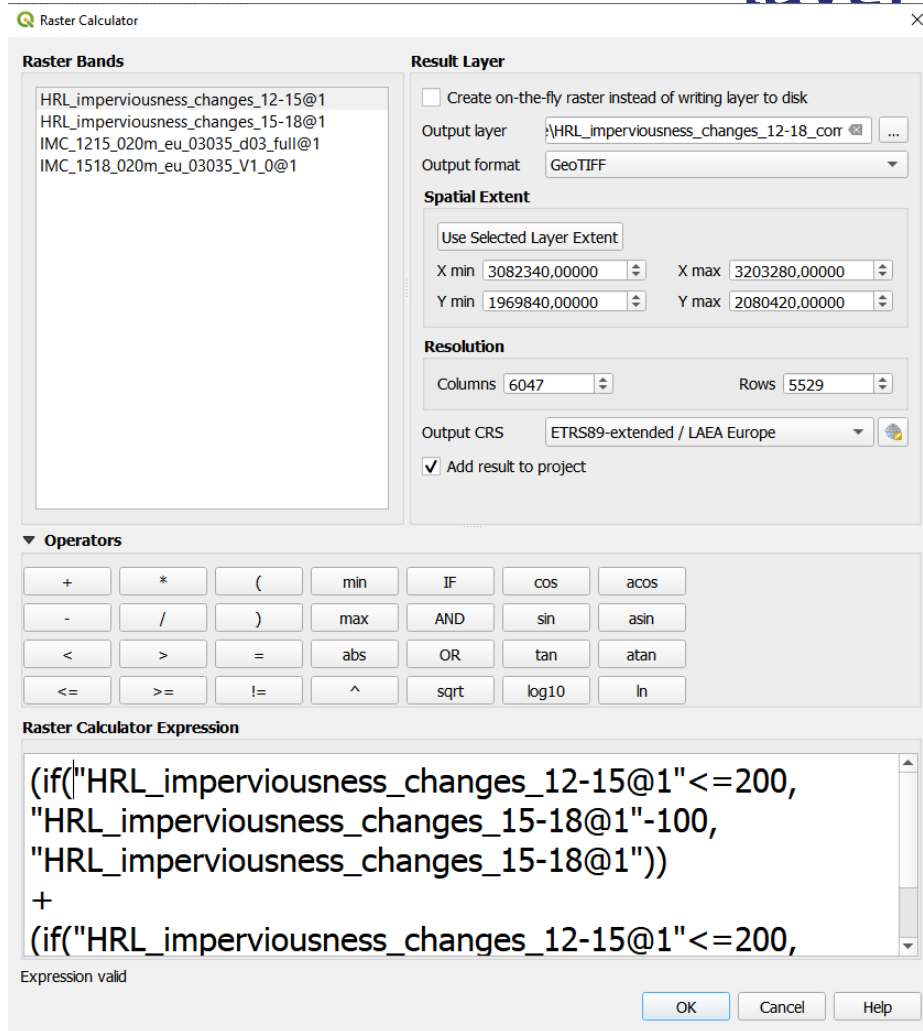
Boundary of Madrid FUA for clipping data (HRL Imperviousness)



**X2 HRL
layers**



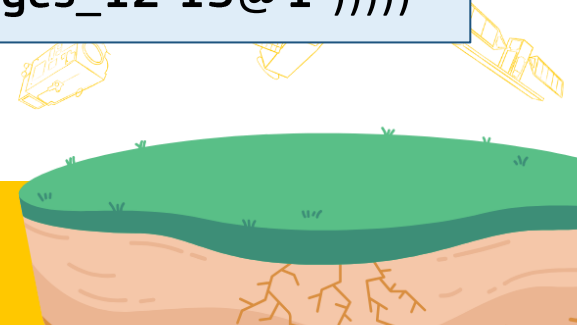
Combination of the 2 HRL Imperviousness layers of changes (12 15, 15 18) in one layer



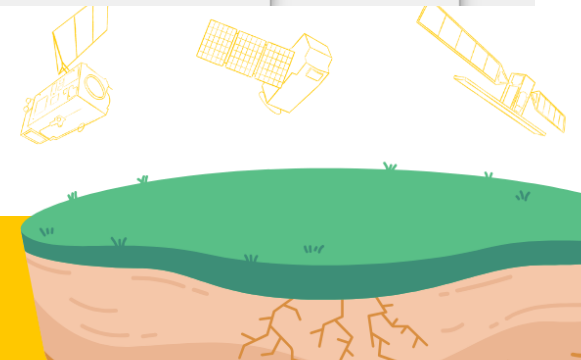
Raster calculator expression

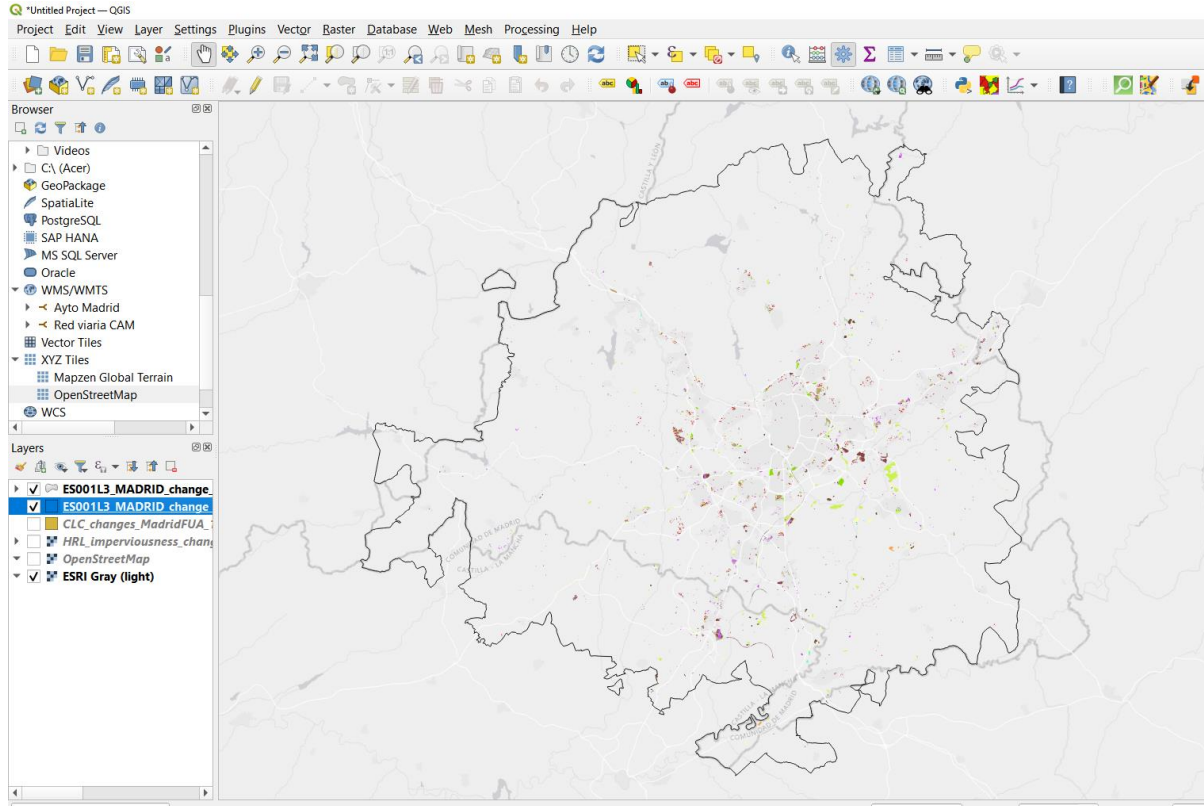
```
((if("HRL_imperviousness_changes_15
18@ 1"=201,
0,
(if("HRL_imperviousness_changes_15
18@ 1"<=200,
"HRL_imperviousness_changes_15 18@ 1" 100,
"HRL_imperviousness_changes_15 18@ 1")))))
```

```
((if("HRL_imperviousness_changes_12
15@ 1"=201,
0,
(if("HRL_imperviousness_changes_12
15@ 1"<=200,
"HRL_imperviousness_changes_12 15@ 1" 100,
"HRL_imperviousness_changes_12 15@ 1")))))
```

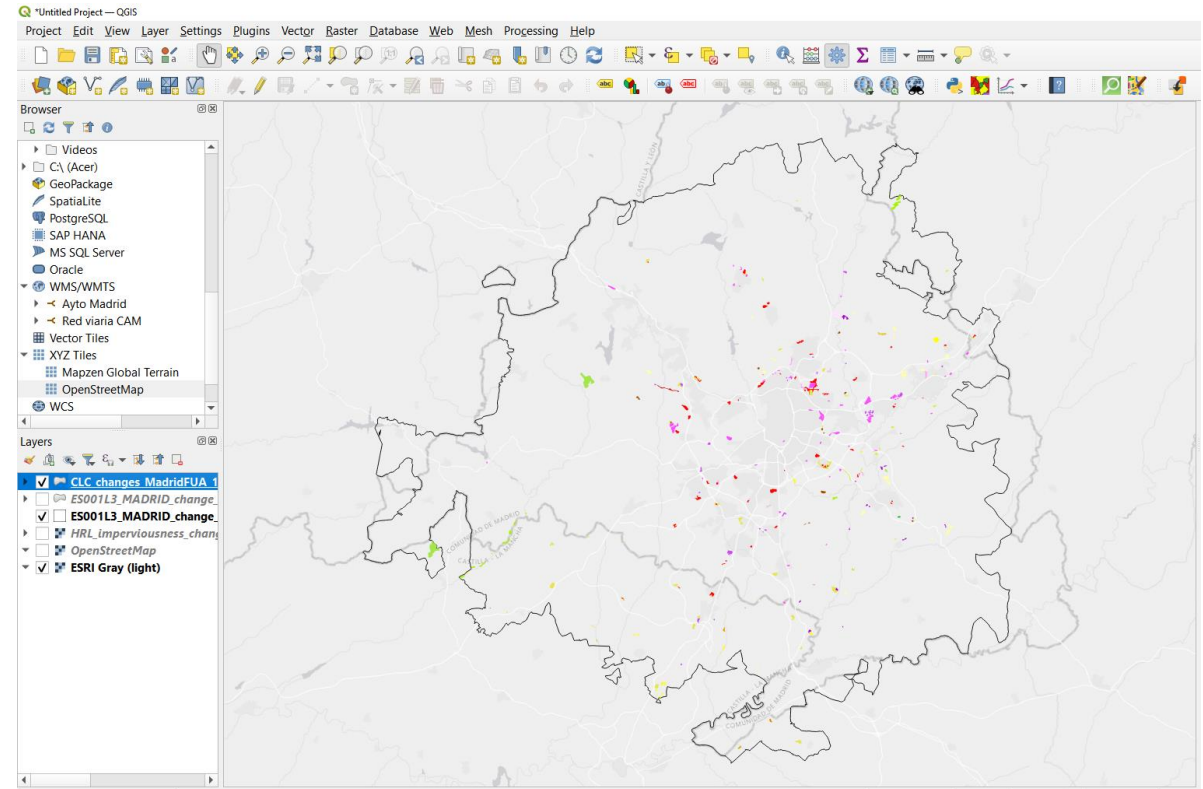


Symbolization of layers (UA and CLC)





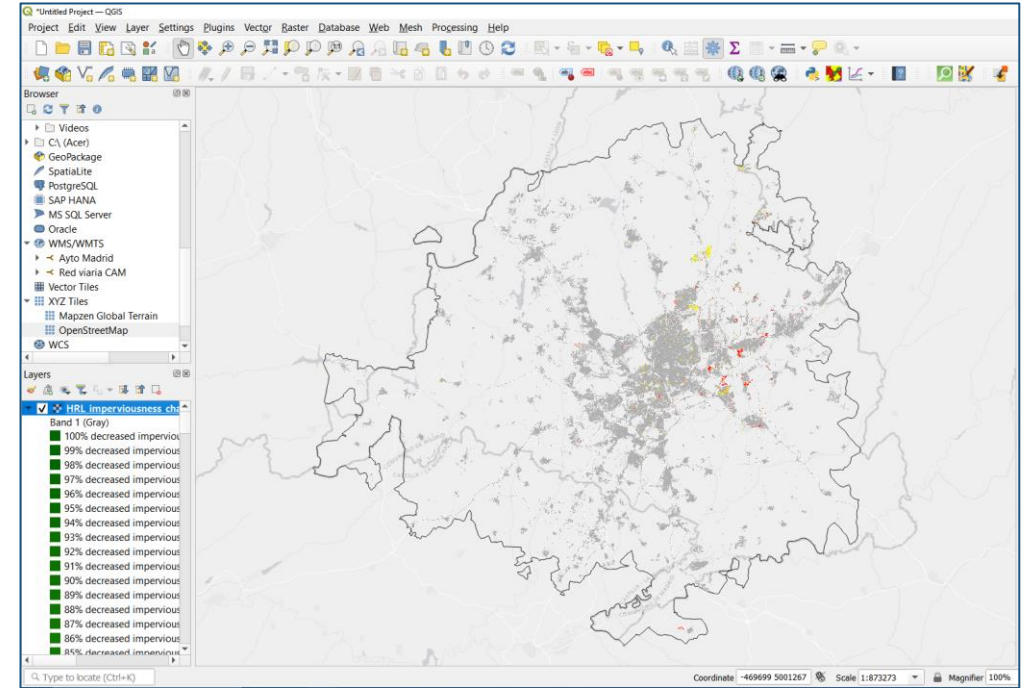
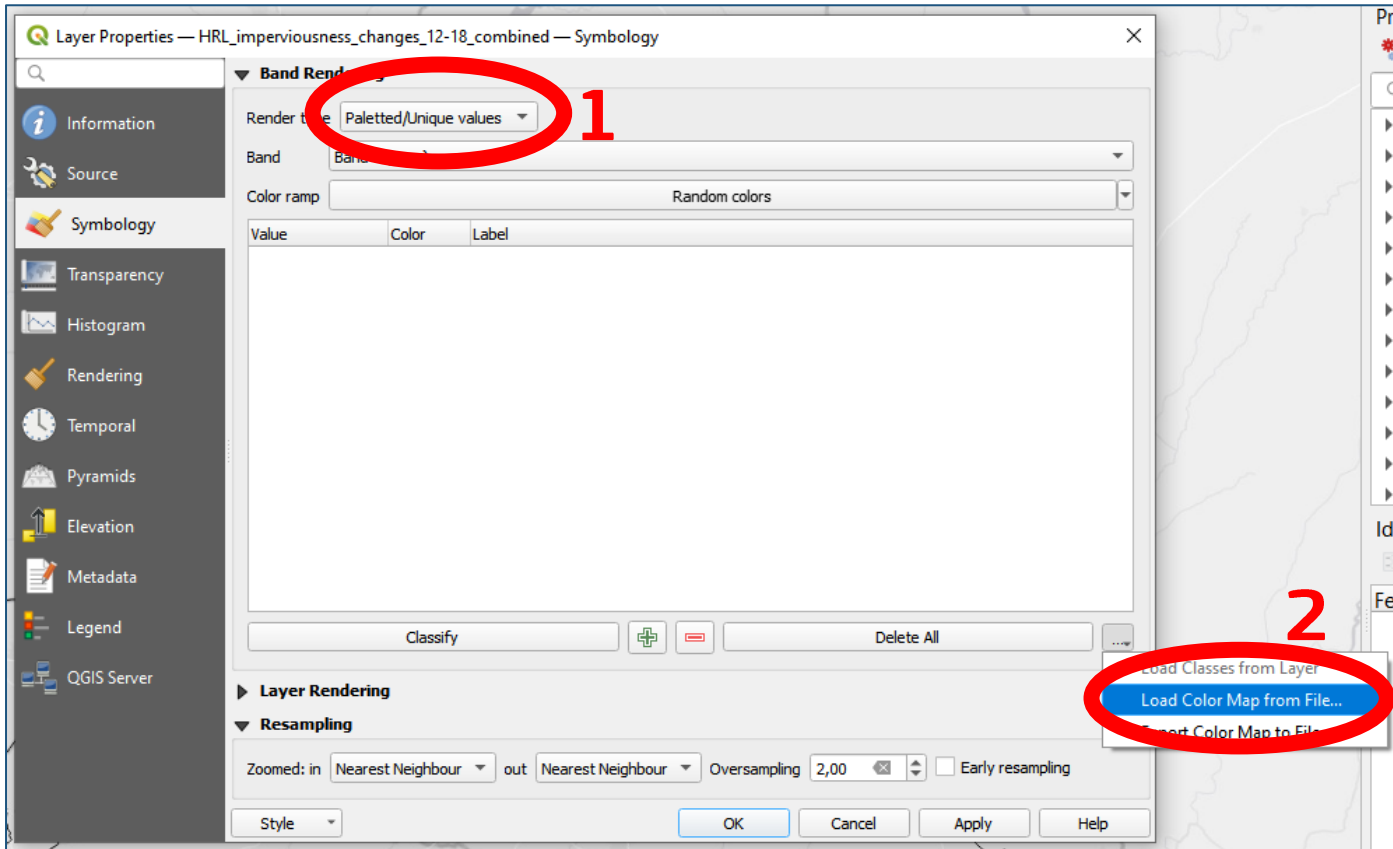
Urban Atlas (UA) changes



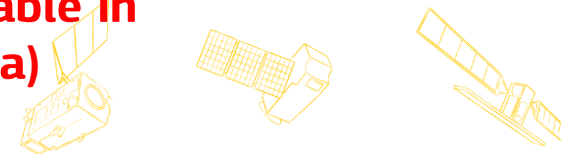
CORINE Land Cover (CLC) changes



Symbolization of layers (HRL imperviousness)

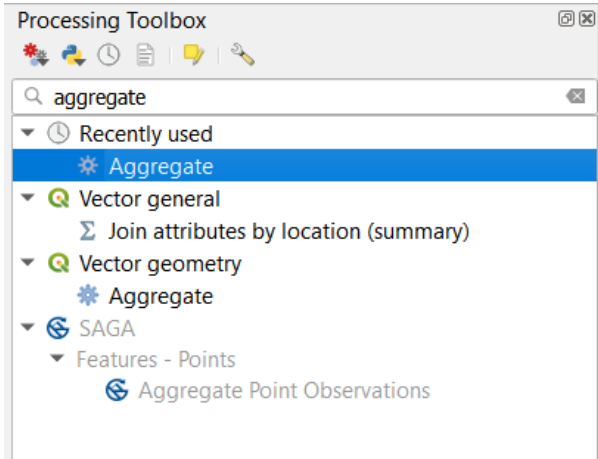


Color map specifically created by the author for the combined HRL layer (not available in downloaded data)





Statistical summary of changes (CLC)



Aggregate

Parameters Log

Input layer
CLC_changes_MadridFUA_12.18 -- CLC_changes_MadridFUA_12 [EPSG:3035]

Selected features only

Group by expression (NULL to group all features)
abc Change

	Source Expression	Aggregate Function	Delimiter	Name	Type	Length	Precision
0	abc Change	first_value	,	Change	abc Text (string)	0	0
1	abc Code_12	first_value	,	Code_12	123 Integer (32 bit)	0	0
2	abc Label_12	first_value	,	Label_12	abc Text (string)	0	0
3	abc Code_18	first_value	,	Code_18	123 Integer (32 bit)	0	0
4	abc Label_18	first_value	,	Label_18	abc Text (string)	0	0
5	abc Change	count	,	N_change_polyg	123 Integer (32 bit)	0	0
6	1.2 Area_Ha	sum	,	Area_change	1.2 Decimal (double)	0	0

Load fields from template layer Load Fields

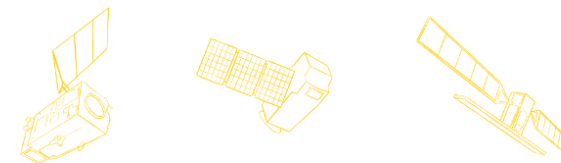
Aggregated
Users/user/OneDrive - Universidad Complutense de Madrid (UCM)/Wekeo/WEKEO_Urban_Land_Use/CLC_changes_MadridFUA_12.18_summary.gpkg

Open output file after running algorithm

0%

Advanced Run as Batch Process... Run Close Help

The fields "Label_12" and "Label_18" include the description of the CLC categories in 2012 and 2018. They have been manually added to the layer by joining the layer with the CLC legend .xls file



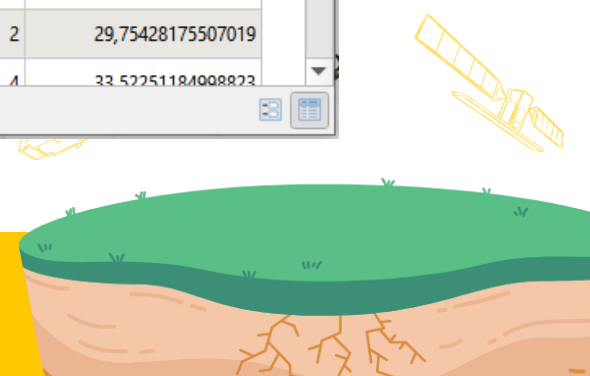
Statistical summary of changes (CLC)

CLC_changes_MadridFUA_12 — Features Total: 63, Filtered: 63, Selected: 0

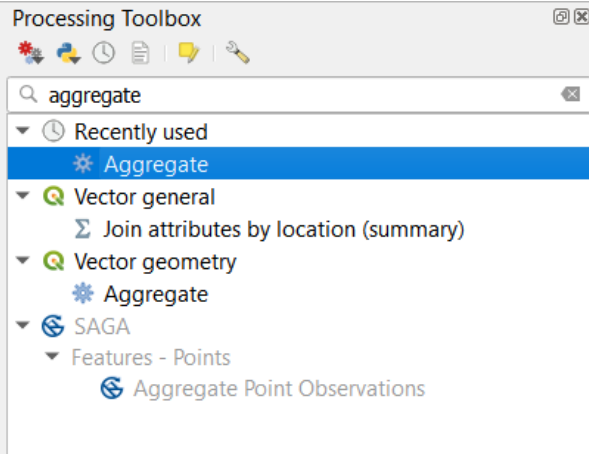
fid	Change	Code_12	Label_12	Code_18	Label18	N_change_polyg	Area_change
1	36 121-133	121	Industrial or commercial units	133	Construction sites	6	75,37690247999437
2	41 131-211	131	Mineral extraction sites	211	Non-irrigated arable land	2	51,33565336496545
3	27 131-212	131	Mineral extraction sites	212	Permanently irrigated land	1	22,985856324953097
4	38 131-231	131	Mineral extraction sites	231	Pastures	3	33,93209591498327
5	48 131-323	131	Mineral extraction sites	323	Sclerophyllous vegetation	1	18,332705340038846
6	46 131-324	131	Mineral extraction sites	324	Transitional woodland-shrub	2	39,93781467496433
7	42 132-133	132	Dump sites	133	Construction sites	2	25,017920900003773
8	47 132-211	132	Dump sites	211	Non-irrigated arable land	2	45,40836441497611
9	28 132-231	132	Dump sites	231	Pastures	7	81,72340884491926
10	5 133-112	133	Construction sites	112	Discontinuous urban fabric	43	972,4418851949807
11	3 133-121	133	Construction sites	121	Industrial or commercial units	12	158,13544197009168
12	55 133-122	133	Construction sites	122	Road and rail networks and associated land	1	54,40514990996852
13	17 133-141	133	Construction sites	141	Green urban areas	4	78,07701461003874
14	29 133-142	133	Construction sites	142	Sport and leisure facilities	5	236,67882744999685
15	2 133-231	133	Construction sites	231	Pastures	32	875,0910132398938
16	51 142-133	142	Sport and leisure facilities	133	Construction sites	2	29,75428175507019
17	4 211-121	211	Non-irrigated arable land	121	Industrial or commercial units	4	33,522511810008823

Show All Features

Can be exported to a .csv or .xls file for analysis / creation of graphics, etc



Statistical summary of changes (UA)



Aggregate

Parameters Log

Input layer
ES001L3_MADRID_change_2012_2018_v012 -- ES001L3_MADRID_change_2012_2018 [EPSG:3035]

Selected features only

Group by expression (NULL to group all features)
abc Change

	Source Expression	Aggregate Function	Delimiter	Name	Type	Length	Precision
0	abc Change	first_value	,	Change	abc Text (string)	0	0
1	abc code_2012	first_value	,	Code_12	123 Integer (32 bit)	0	0
2	abc class_2012	first_value	,	Label_12	abc Text (string)	0	0
3	abc code_2018	first_value	,	Code_18	123 Integer (32 bit)	0	0
4	abc class_2018	first_value	,	Label_18	abc Text (string)	0	0
5	abc Change	count	,	N_change_polyg	123 Integer (32 bit)	0	0
6	1.2 area_ha	sum	,	Area_change	1.2 Decimal (double)	0	0

Load fields from template layer [] Load Fields

Aggregated
C:/Users/user/OneDrive - Universidad Complutense de Madrid (UCM)/Wekeo/WEKEO_Urban_Land_Use/UA_changes_MadridFUA_12.18_summary.gpkg

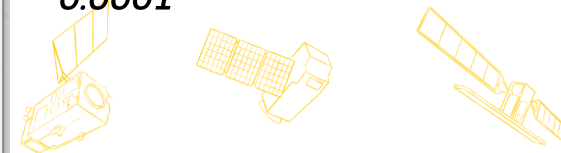
Open output file after running algorithm

0%

Advanced Run as Batch Process... Run Close Help

The field "Change" is not included in the downloaded layer and has been manually created by the author by concatenating the fields "code_2012" and "code_2018":
concat("code_2012", '- ', "code_2018")

The field "area_ha" is not included in the downloaded layer and has been manually created by the author by calculating each polygon area in ha: $\$area * 0.0001$



Statistical summary of changes (UA)

UA_changes_MadridFUA_12 — Features Total: 162, Filtered: 162, Selected: 0

fid	Change	Code_12	Label_12	Code_18	Label_18	N_change_polyg	Area_change
1	35	13100-32000	13100 Mineral extraction and dump sites	32000	Herbaceous vegetation associations (natural grassland, ...	111	1427,861638773...
2	32	13300-13400	13300 Construction sites	13400	Land without current use	289	1112,035941121...
3	25	13100-21000	13100 Mineral extraction and dump sites	21000	Arable land (annual crops)	68	441,5124327087...
4	48	13400-11210	13400 Land without current use	11210	Discontinuous dense urban fabric (S.L. : 50% - 80%)	389	386,2758412433...
5	82	21000-12100	21000 Arable land (annual crops)	12100	Industrial, commercial, public, military and private units	246	330,2002053463...
6	46	13400-13300	13400 Land without current use	13300	Construction sites	135	277,6985253960...
7	37	13300-12100	13300 Construction sites	12100	Industrial, commercial, public, military and private units	130	273,6979796464...
8	54	13400-14100	13400 Land without current use	14100	Green urban areas	125	261,9131333083...
9	57	13400-12100	13400 Land without current use	12100	Industrial, commercial, public, military and private units	196	231,5273102612...
10	30	13100-14100	13100 Mineral extraction and dump sites	14100	Green urban areas	21	226,6412940757...
11	84	21000-13100	21000 Arable land (annual crops)	13100	Mineral extraction and dump sites	49	218,0500034285...
12	8	13300-11210	13300 Construction sites	11210	Discontinuous dense urban fabric (S.L. : 50% - 80%)	200	214,3834299621...
13	120	32000-13100	32000 Herbaceous vegetation associations (natural grassland, moor...	13100	Mineral extraction and dump sites	32	213,0582217674...
14	116	32000-13300	32000 Herbaceous vegetation associations (natural grassland, moor...	13300	Construction sites	29	206,2748050034...
15	44	13300-12220	13300 Construction sites	12220	Other roads and associated land	74	175,474617526574
16	115	32000-12100	32000 Herbaceous vegetation associations (natural grassland, moor...	12100	Industrial, commercial, public, military and private units	95	163,6669145240...
17	47	13300-32000	13300 Construction sites	32000	Herbaceous vegetation associations (natural grassland, ...	27	161,3150731358...

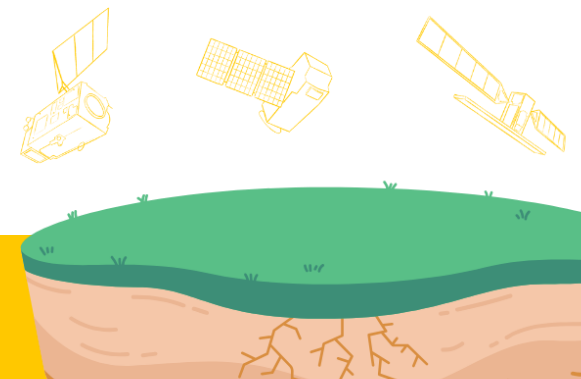
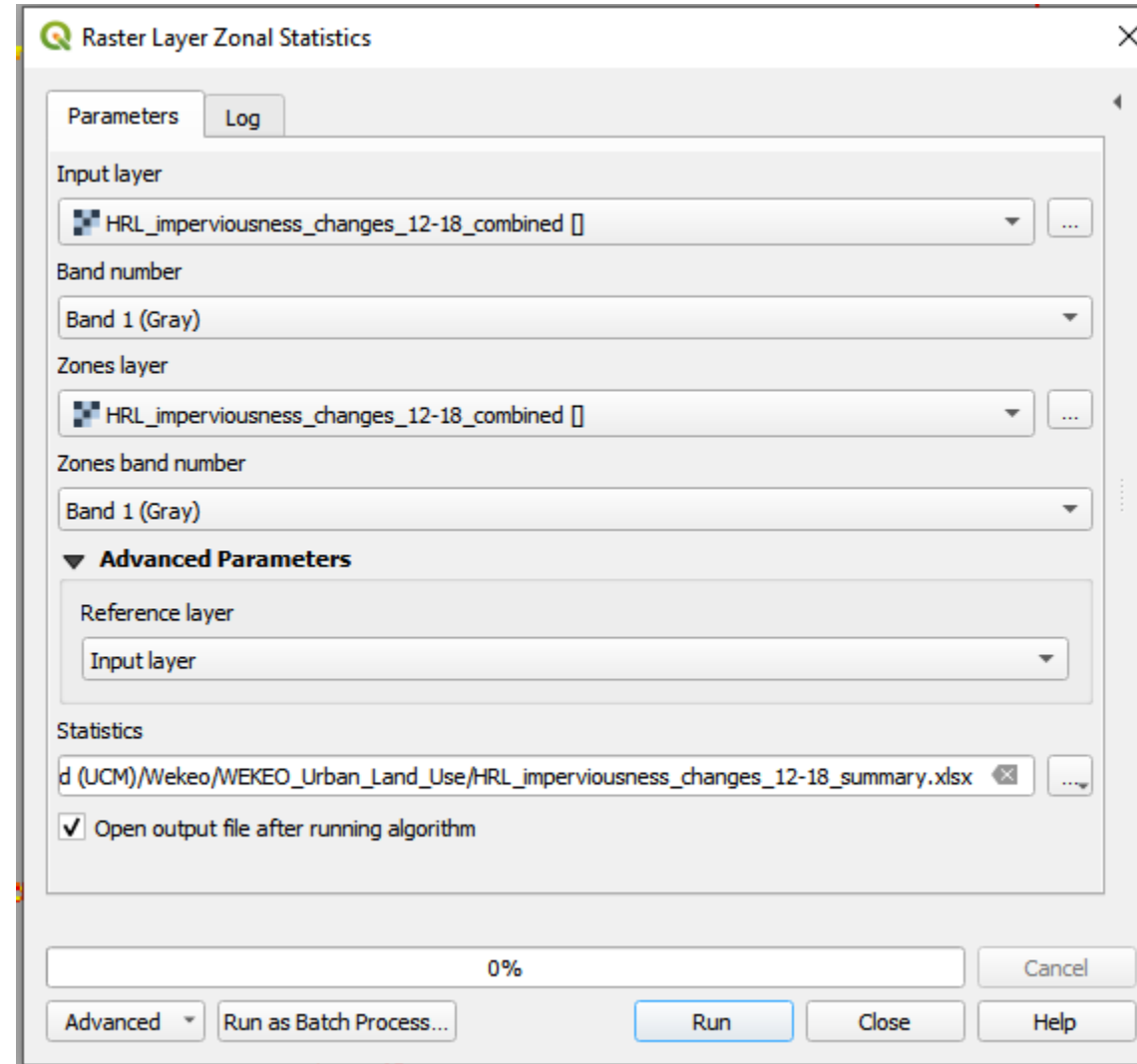
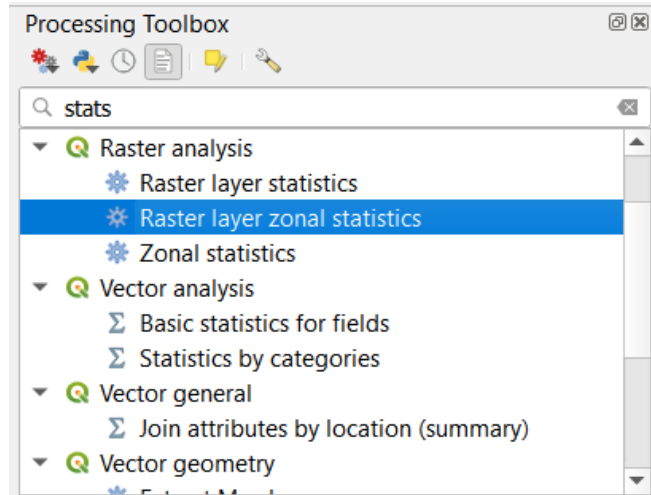
Show All Features

Can be exported to a .csv or .xls file for analysis / creation of graphics, etc



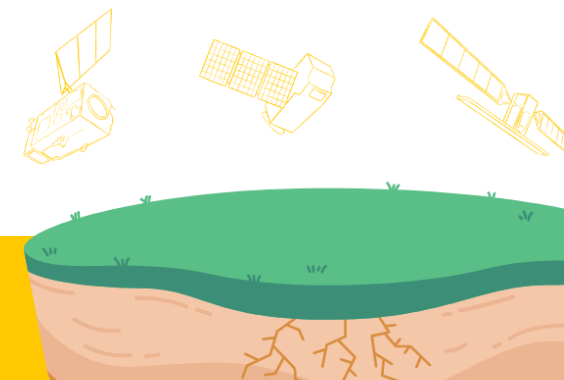


Statistical summary of changes (HLR imperviousness)



Statistical summary of changes (HLR imperviousness)

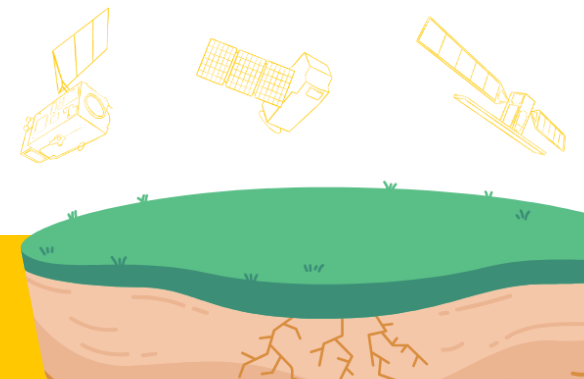
	Raster value	Area (m2)	sum	Nº pixels	min	max	mean
1	-100	400	-100	1	-100	-100	-100
2	-99	1200	-297	3	-99	-99	-99
3	-98	400	-98	1	-98	-98	-98
4	-97	400	-97	1	-97	-97	-97
5	-93	1200	-279	3	-93	-93	-93
6	-92	800	-184	2	-92	-92	-92
7	-91	400	-91	1	-91	-91	-91
8	-90	1600	-360	4	-90	-90	-90
9	-89	400	-89	1	-89	-89	-89
10	-88	1200	-264	3	-88	-88	-88
11	-87	2000	-435	5	-87	-87	-87
12	-86	2000	-430	5	-86	-86	-86
13	-85	3200	-680	8	-85	-85	-85
14	-84	3200	-672	8	-84	-84	-84
15	-83	4400	-913	11	-83	-83	-83
16	-82	3600	-738	9	-82	-82	-82
17	-81	4000	-810	10	-81	-81	-81





And next....

- Compare the information provided by each dataset cartographically and statistically
- Cross tabulate datasets to see agreements / disagreements
- Identify errors
-





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