Environmental Analysis and Landscape Mapping

Landscape Architecture / Land Landscape Heritage

TUTORIAL 3

A Gis methodology for defining potential limits to urbanization

Professors:
Mattia Previtali
Fabio Manfredini

Tutorial by:
Luigi Carboni

A.A. 2019/2020

Aims

The tutorial presents a GIS based procedure for the definition of potential limits to urbanization. The exercise is based on a methodology developed by Iacopo Zatti and Fabio Lucchesi, Department of Architecture, Università degli Studi di Firenze, within the Prin 2010 Project “Postmetropoli” Post-metropolitan territories as emergent forms of urban space: coping with sustainability, habitability and governance. Further information is available at the following link.

The methodology produces a spatial mask showing the potential limits to urbanization, to future urban growth and to settlement systems transformation taking into account different spatial constraints. In particular, the mask is composed by the spatial integration of the following conditions:

- Slope with a declivity > 10 %
- Internal water bodies
- Swamps and humid areas
- Protected areas (National and regional Parks, Eu special protection areas, other local protected areas)
- High agricultural value, according to the Lombardia region classification of agricultural soils

Each condition is represented by one spatial layer according to specific data sources. The idea is that when at least a condition is verified, a potential limit to urbanization occurs. The spatial combination of the spatial conditions produces a new mask that can be used for further analysis and spatial operations.

References

- Batty M. (2001), “Polynucleated Urban Landscapes”, Urban Studies, 38 (4), 635-655.
- De Landa M. (2000), A Thousand Years of Nonlinear History, Swerve Edition, New York.
- MacKaye B. (1928), The New Exploration: A Philosophy of Regional Planning, Harcourt, Brace and Company, New York.
- Muratori S., (1967), Civiltà e territorio, Centro Studi di Storia Urbanistica, Rome.

Data Source

http://www.geoportale.regione.lombardia.it/

- DUSAF 5.0 (vector)
- Aree_protette (vector)
- Valore agricolo dei suoli (raster)
- DTM20 (raster)

Index

PART 1

Dusaf 5: Wetlands and Water Bodies

The Dusaf 5 database is related to the Land-use for all the provinces of Lombardy (Destination of Use of Agricultural and Forestry Soils). The information presented are: land use, rows/hedges.

Therefore, in this first part of the tutorial, *Wetlands* and *Water Bodies* features are selected from the Dusaf 5 database as potential areas where to limit urbanisation.

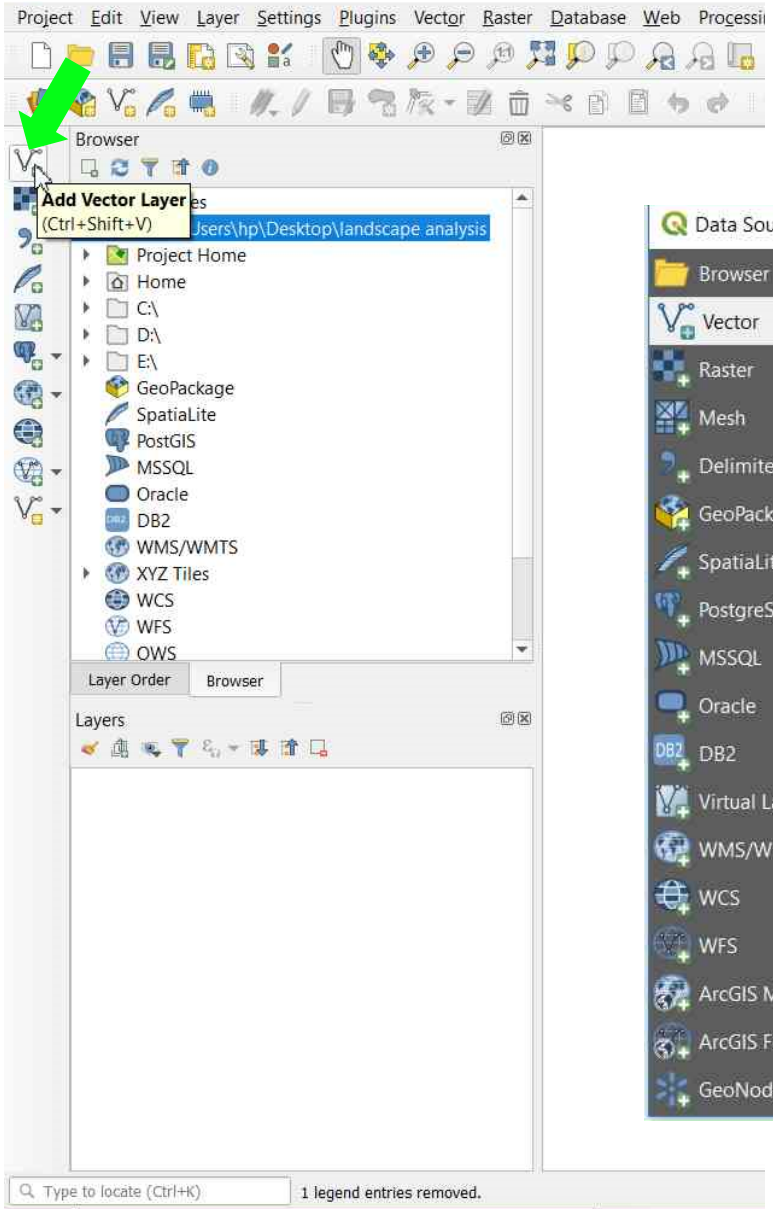
Tools

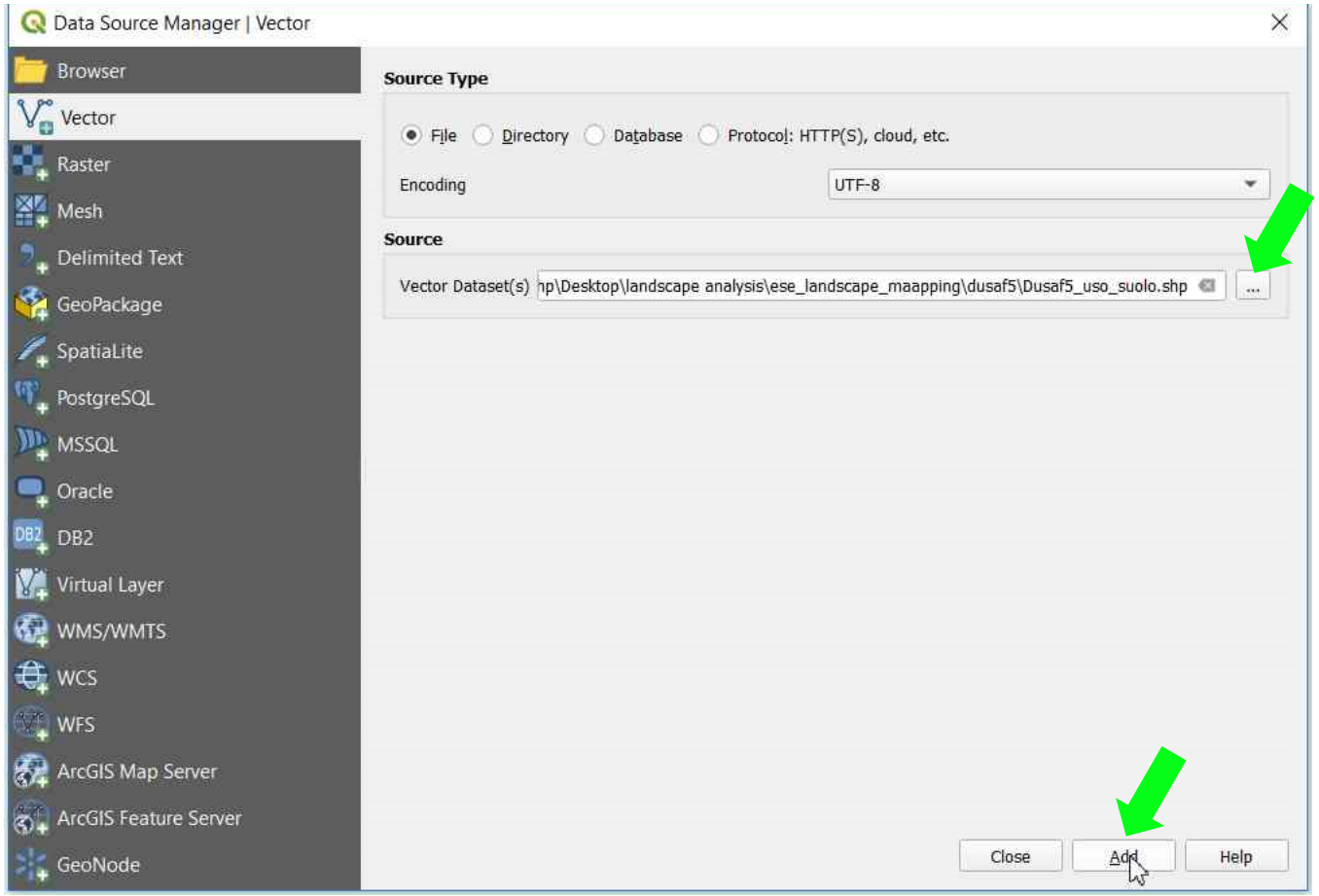
- Manage Layer Toolbar → Add Vector Layers
- Select Features → Select features using an expression
- Export →Save Selected Features As…

Metadata

http://www.geoportale.regione.lombardia.it/metadati?p_p_id=PublishedMetadata_WAR_geoportalemetadataportlet&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&_PublishedMetadata_WAR_geoportalemetadataportlet_view=editPublishedMetadata&_PublishedMetadata_WAR_geoportalemetadataportlet_uuid=%7B8A509A02-97FD-458A-84D1-280F81A96640%7D&_PublishedMetadata_WAR_geoportalemetadataportlet_editType=view&_PublishedMetadata_WAR_geoportalemetadataportlet_fromAsset=true&rid=local

ADD VECTOR LAYERS → Press the **'Add vector Layer…'** button in the **Manage Layer** toolbar to upload the vector files : *Dusaf5_uso_suolo*

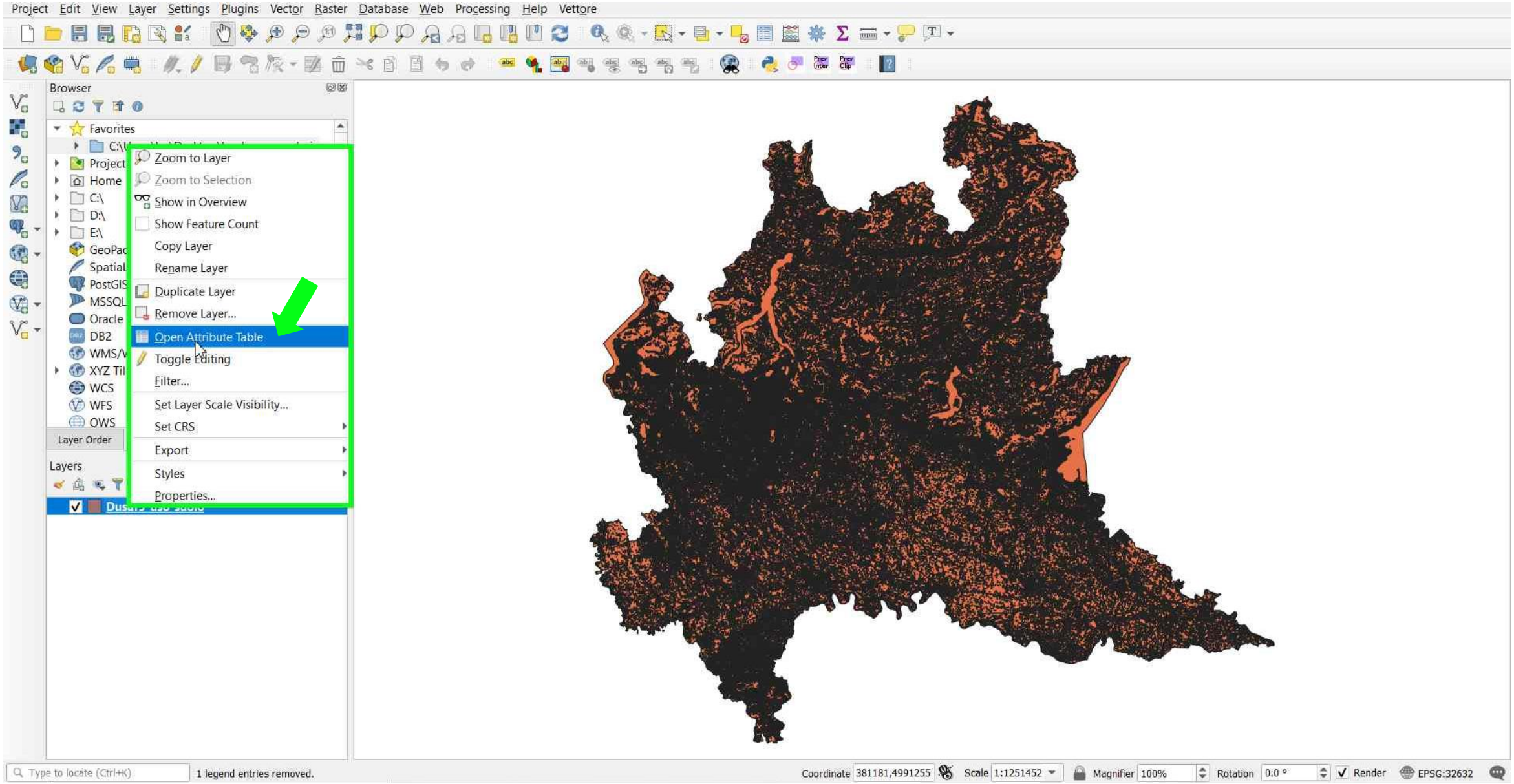




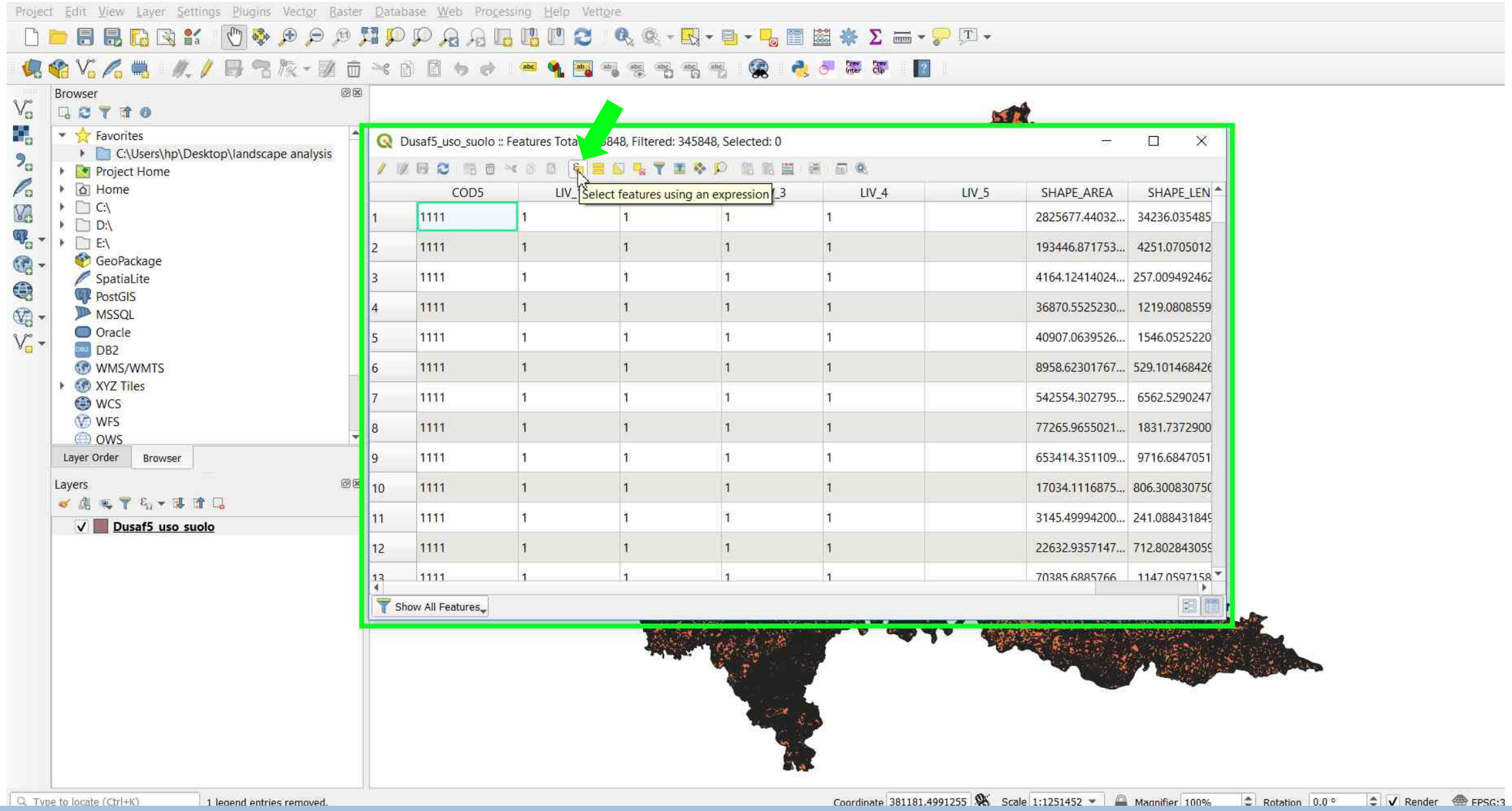
Click to choose the **data source**

Click **Add** to visualise the selected .shp file

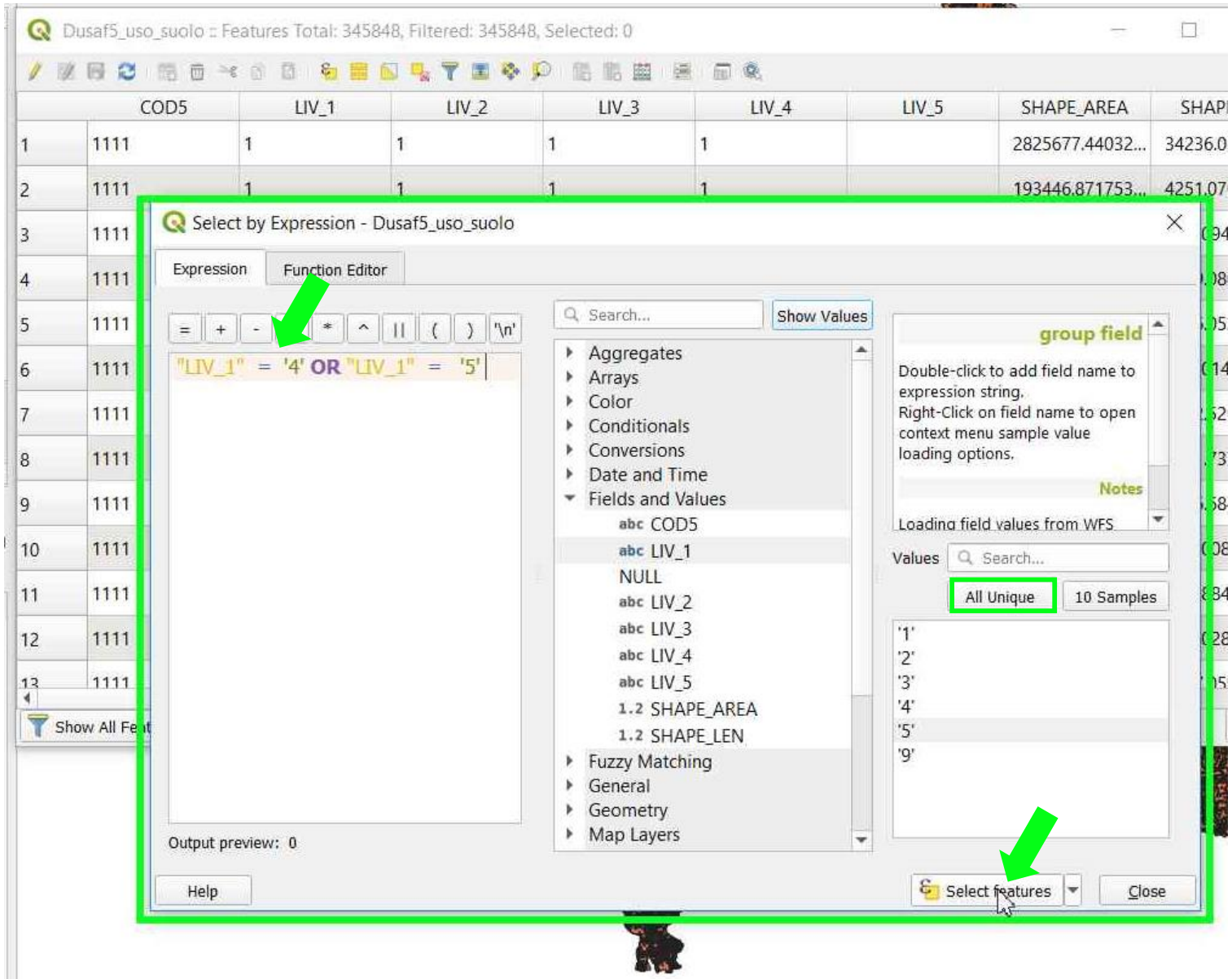
SELECT FEATURES → Right click on the layer to open the **Attribute Table**



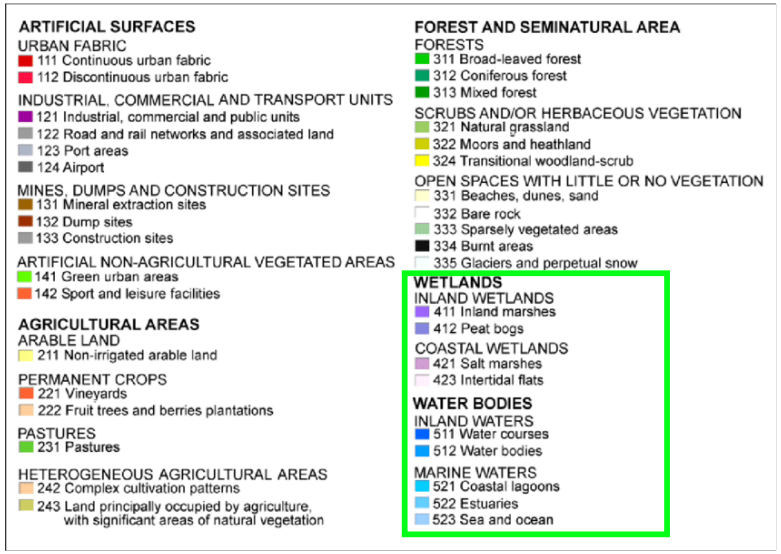
SELECT FEATURES → Press the icon to **Select features using an expression**



SELECT FEATURES → Type the Expression **"LIV_1" = '4' OR "LIV_1" = '5'** → Click **Select Features** to run the expression → **Close**



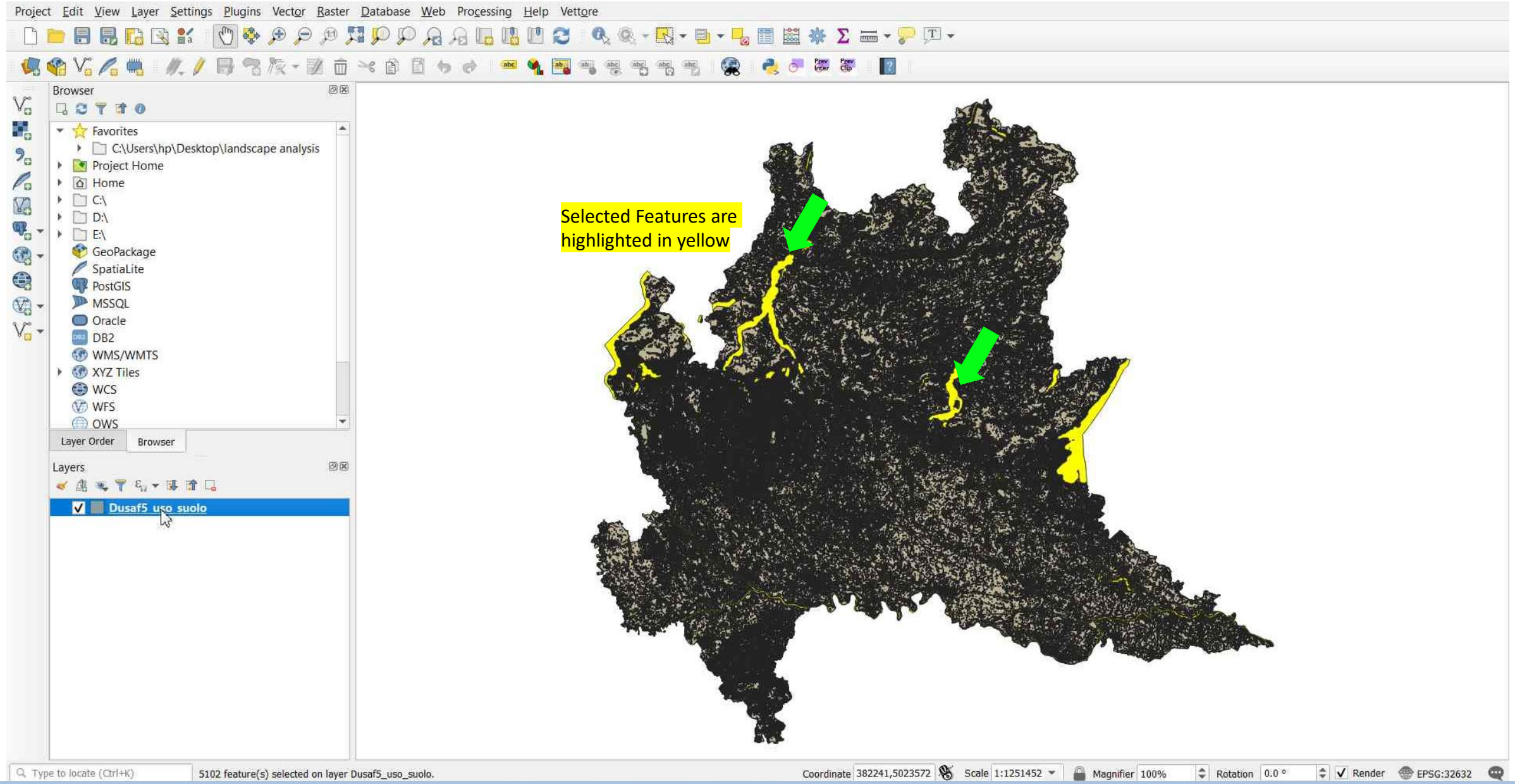
Values "4"= **WETLANDS**
Values "5"= **WATER BODIES**



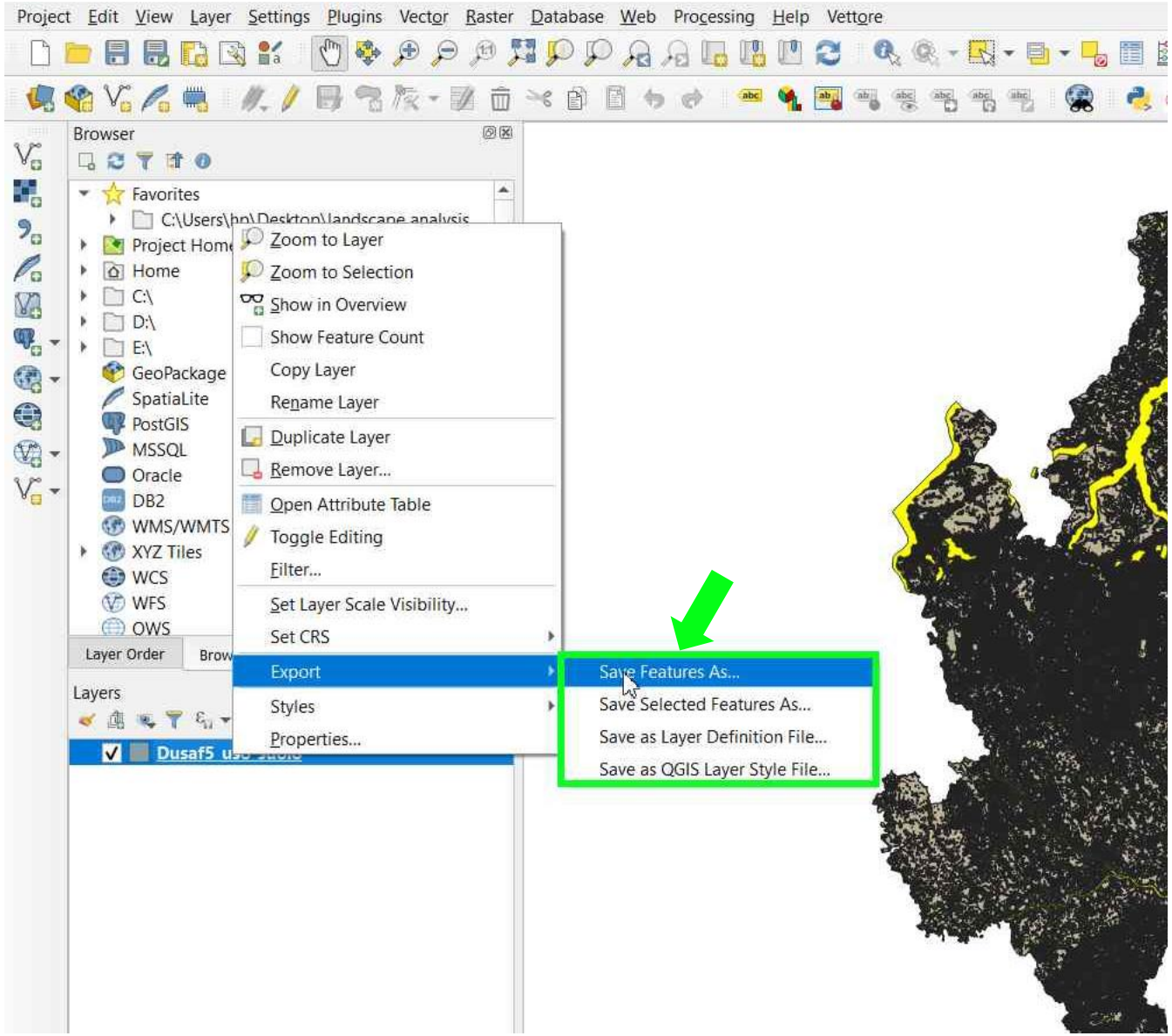
Click **All Unique** to see all the selectable values from a field.

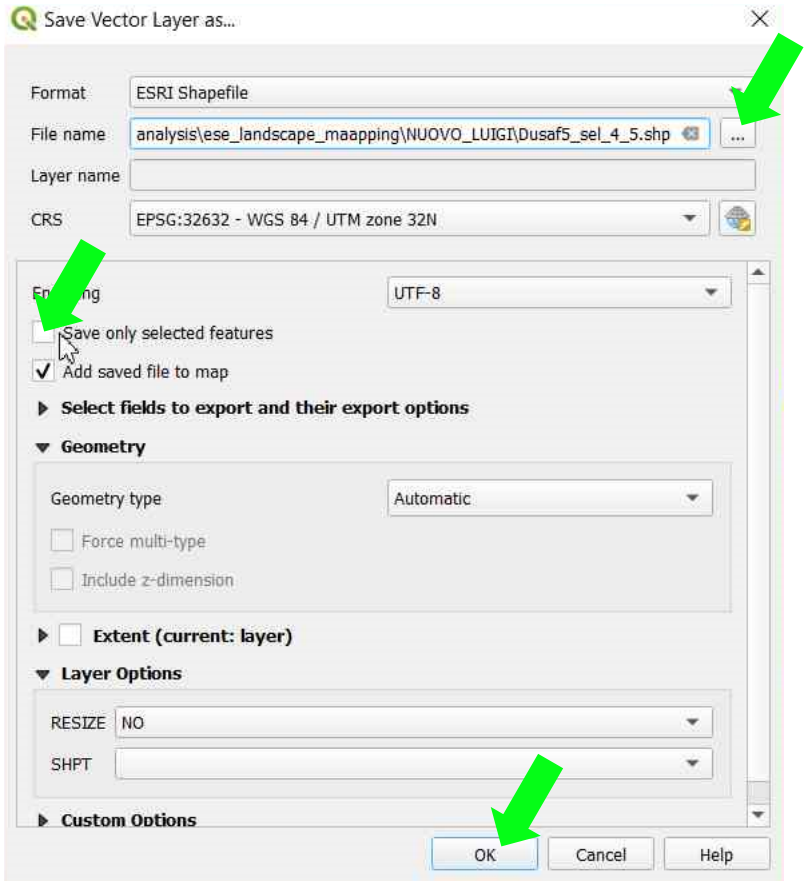
To add a value to the expression double click its name in the list.

SELECT FEATURES → **Wetlands** and **Water Bodies** have been selected



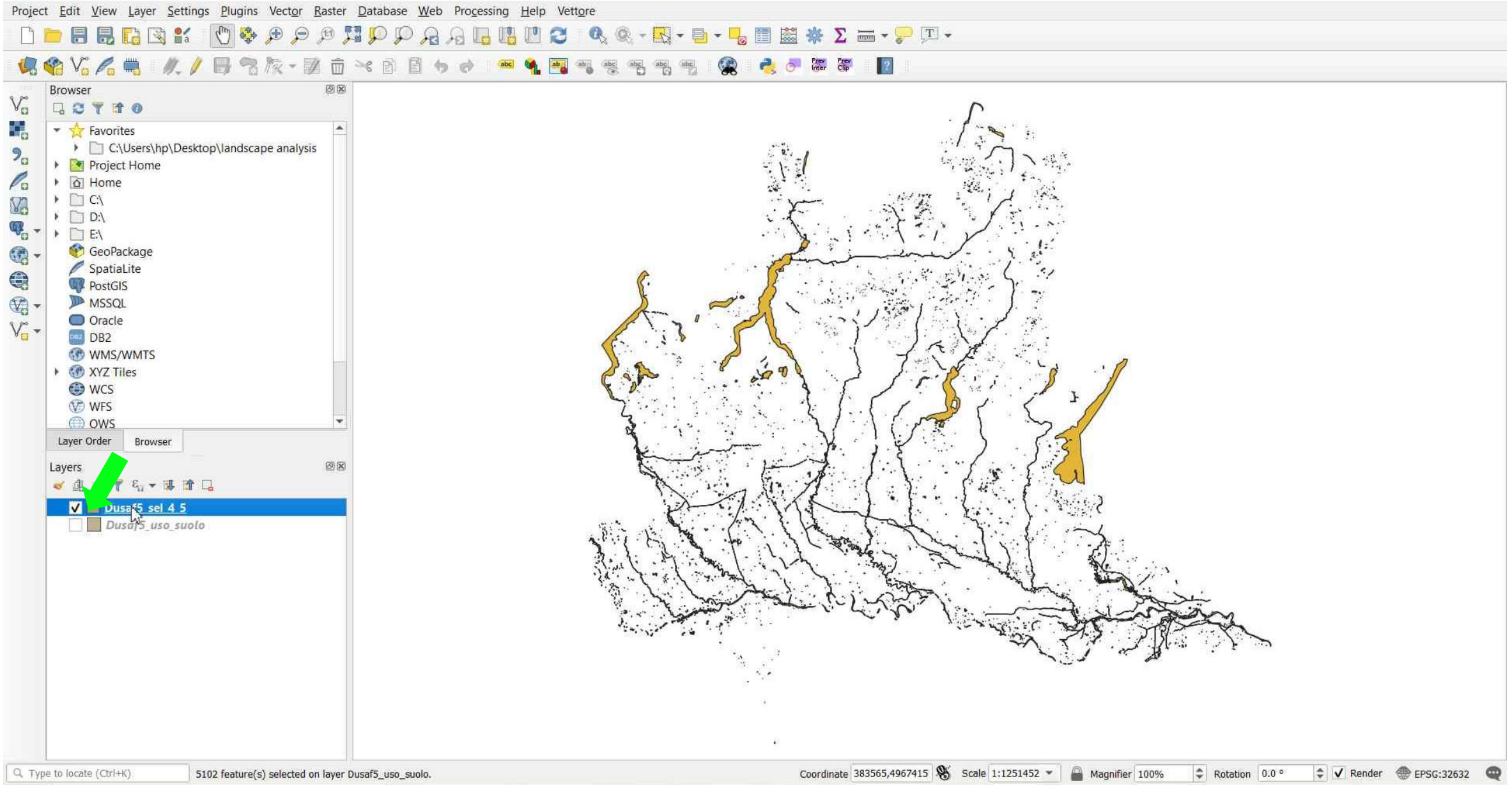
EXPORT → Right-click to **Export** → **Save** (Selected) **Features As…** → **File name** to select the directory and name the new vector layer → **OK**





!! Flag "**save only the selected** features"

EXPORT → Turn off the *Dusaf5_uso_suolo* layer to visualise only the new vector layer file



PART 2

Aree Protette (Protected Areas)

This map service contains boundaries of protected areas in Lombardy:

- Regional Parks, Natural Parks and the Stelvio National Park - Natural Reserves - Natural Monuments - Local Parks of Supra-municipal Interest (PLIS) - Special Conservation Areas / Sites of Community Importance (ZSC, SIC) - Special Protection Areas (ZPS).

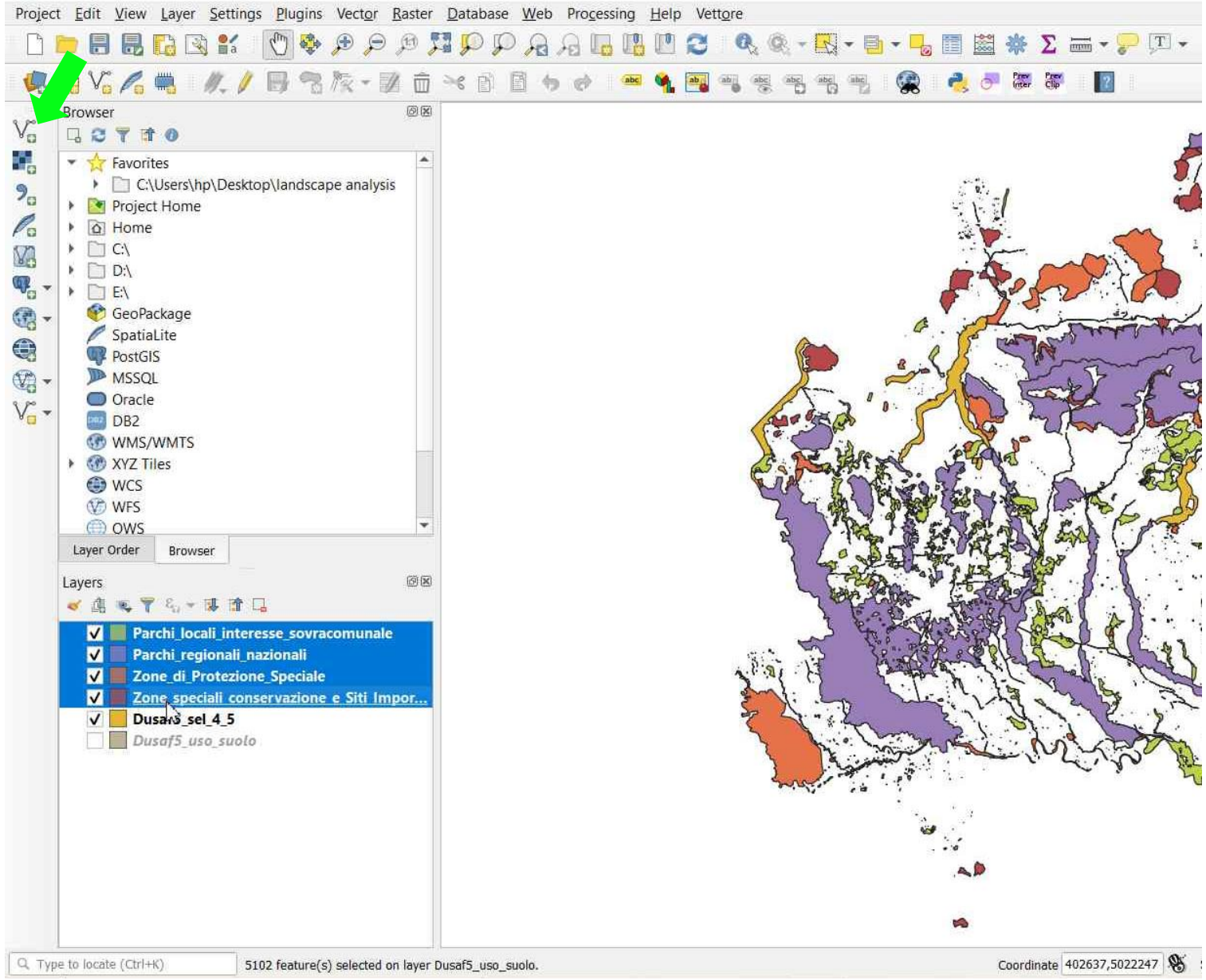
Tools

- Manage Layer Toolbar → Add Vector Layers
- Geoprocessing → Merge / Fix Geometries / Dissolve
- Export → Save Selected Features As…

Metadata

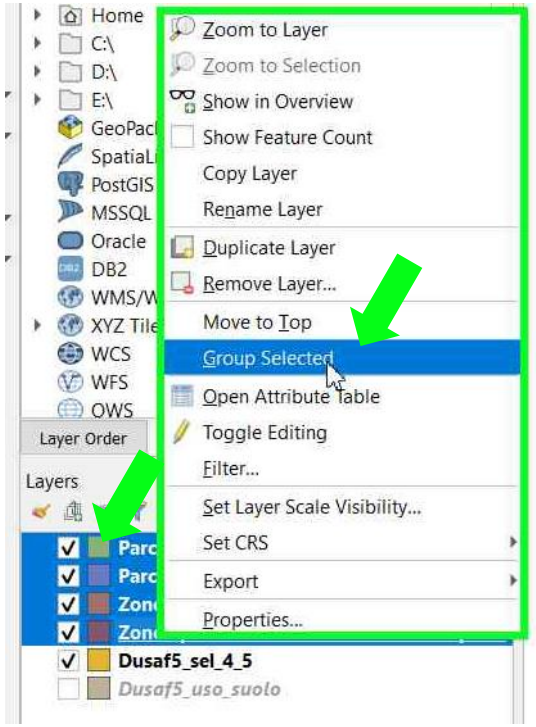
http://www.geoportale.regione.lombardia.it/metadati?p_p_id=PublishedMetadata_WAR_geoportalemetadataportlet&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&_PublishedMetadata_WAR_geoportalemetadataportlet_view=editPublishedMetadata&_PublishedMetadata_WAR_geoportalemetadataportlet_uuid={2C140B4A-AEBA-4928-B162-F40E7D0601CB}&_PublishedMetadata_WAR_geoportalemetadataportlet_editType=view&_PublishedMetadata_WAR_geoportalemetadataportlet_fromAsset=true&rid=local

ADD VECTOR LAYERS → Click **Add vector Layer** on the **Manage Layer** Toolbar to upload files



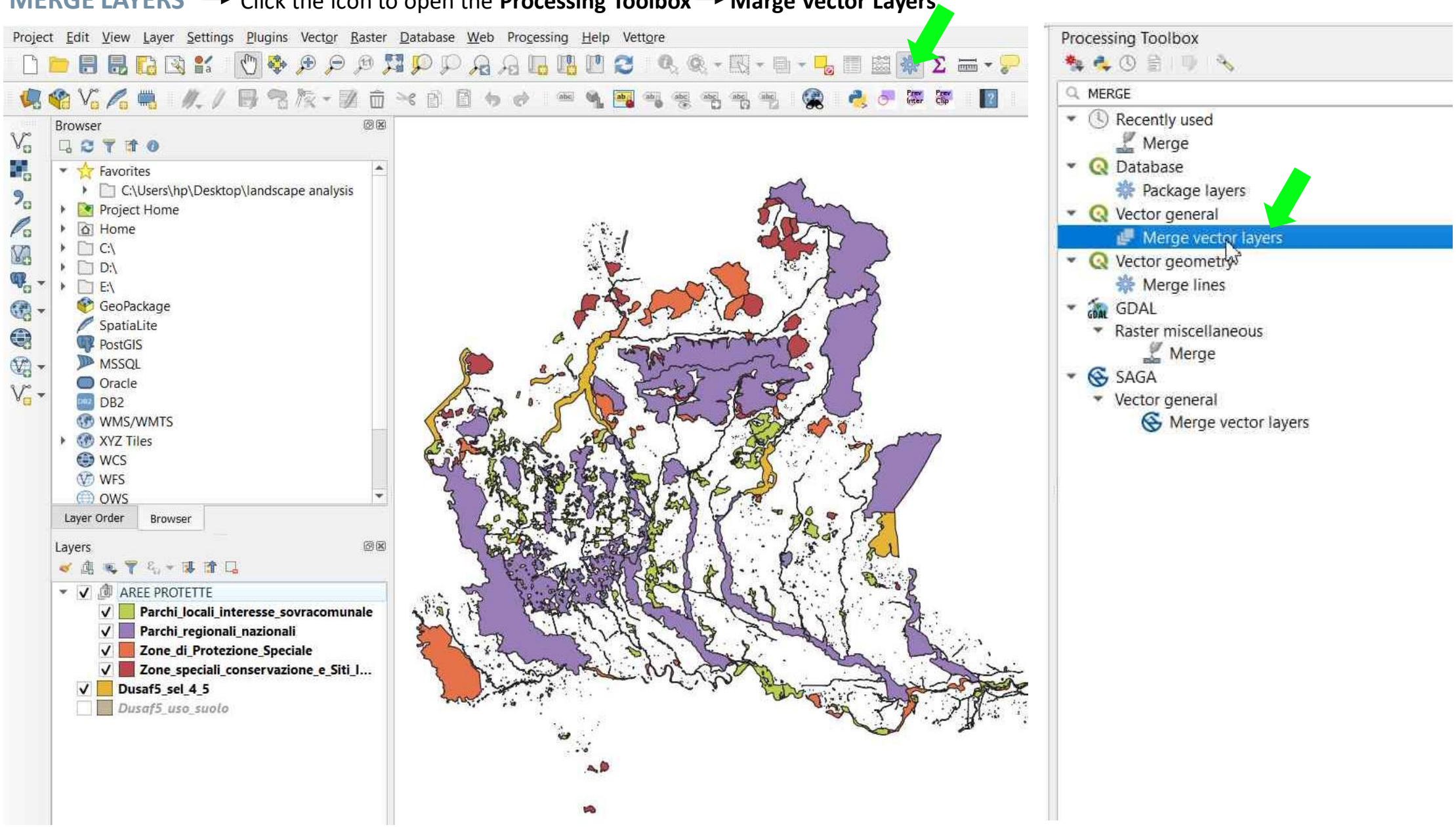
DATA TO ADD

- Parchi_locali_Interesse_sovracomunale (PLIS)
- Parchi_regionali_nazionali
- Zone_speciali_conservazione_e_Sit_Importanza_Comunitaria
- Zone_di_Protezione_Speciale (ZPS)

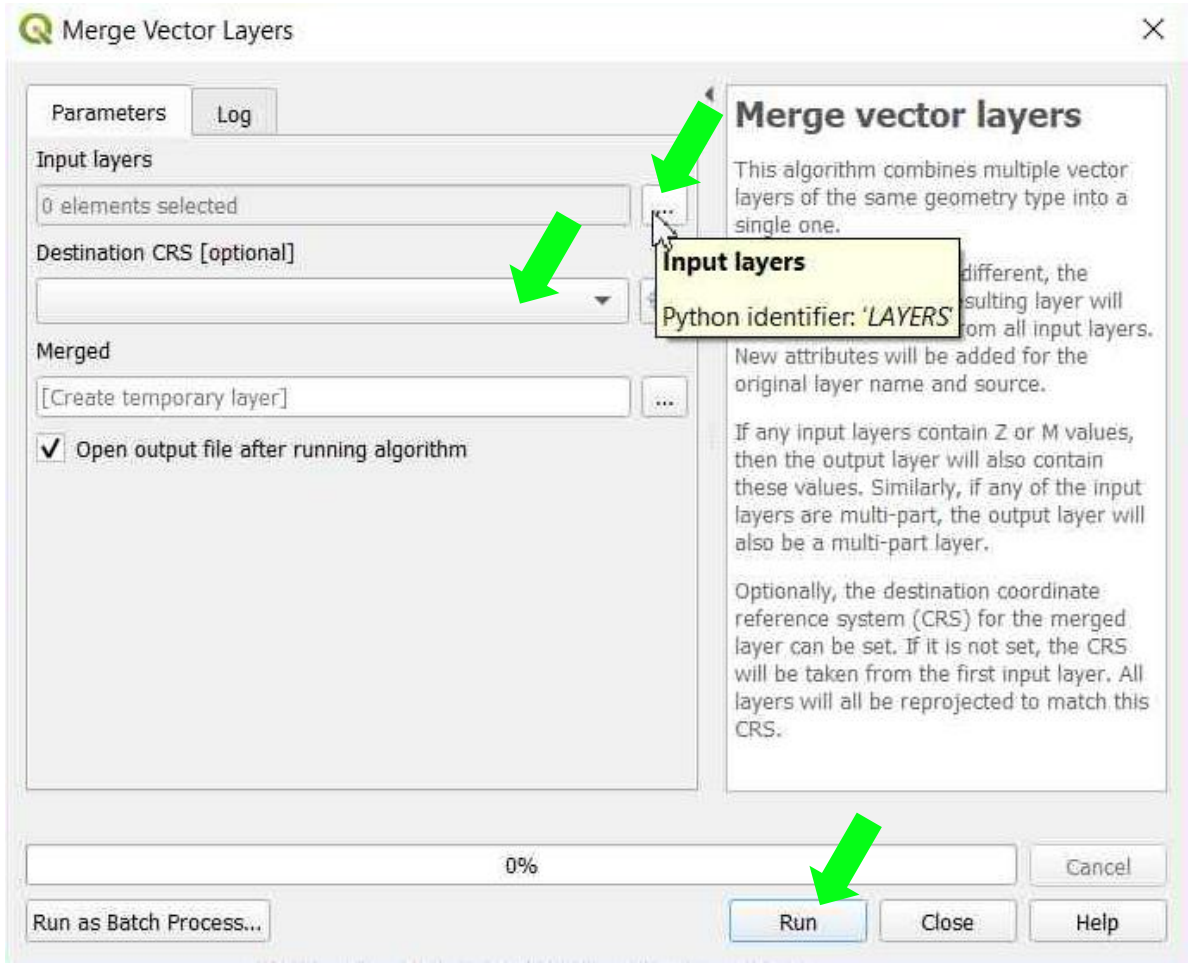


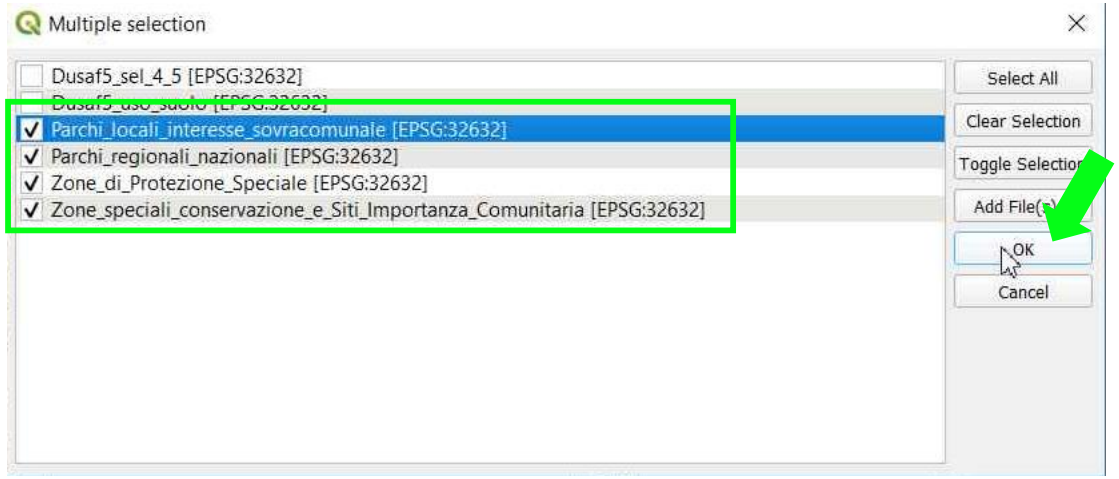
Right-click on the selected layers and **Group Selected** to group layers

MERGE LAYERS → Click the icon to open the **Processing Toolbox** → **Marge Vector Layers**



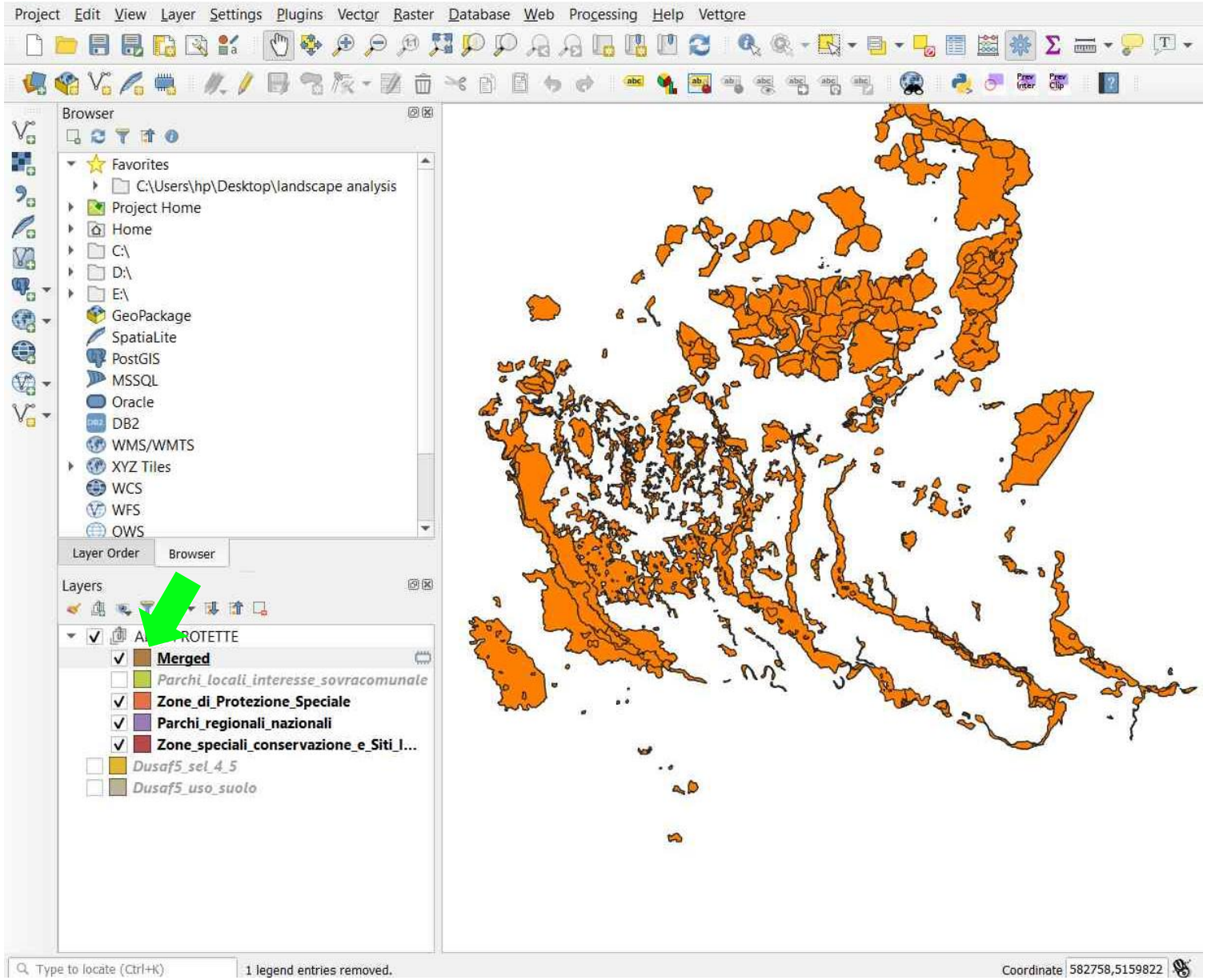
MERGE LAYERS → Click on **Input Layer** to select the layers to merge → Select the **Destination CRS** → **Run**



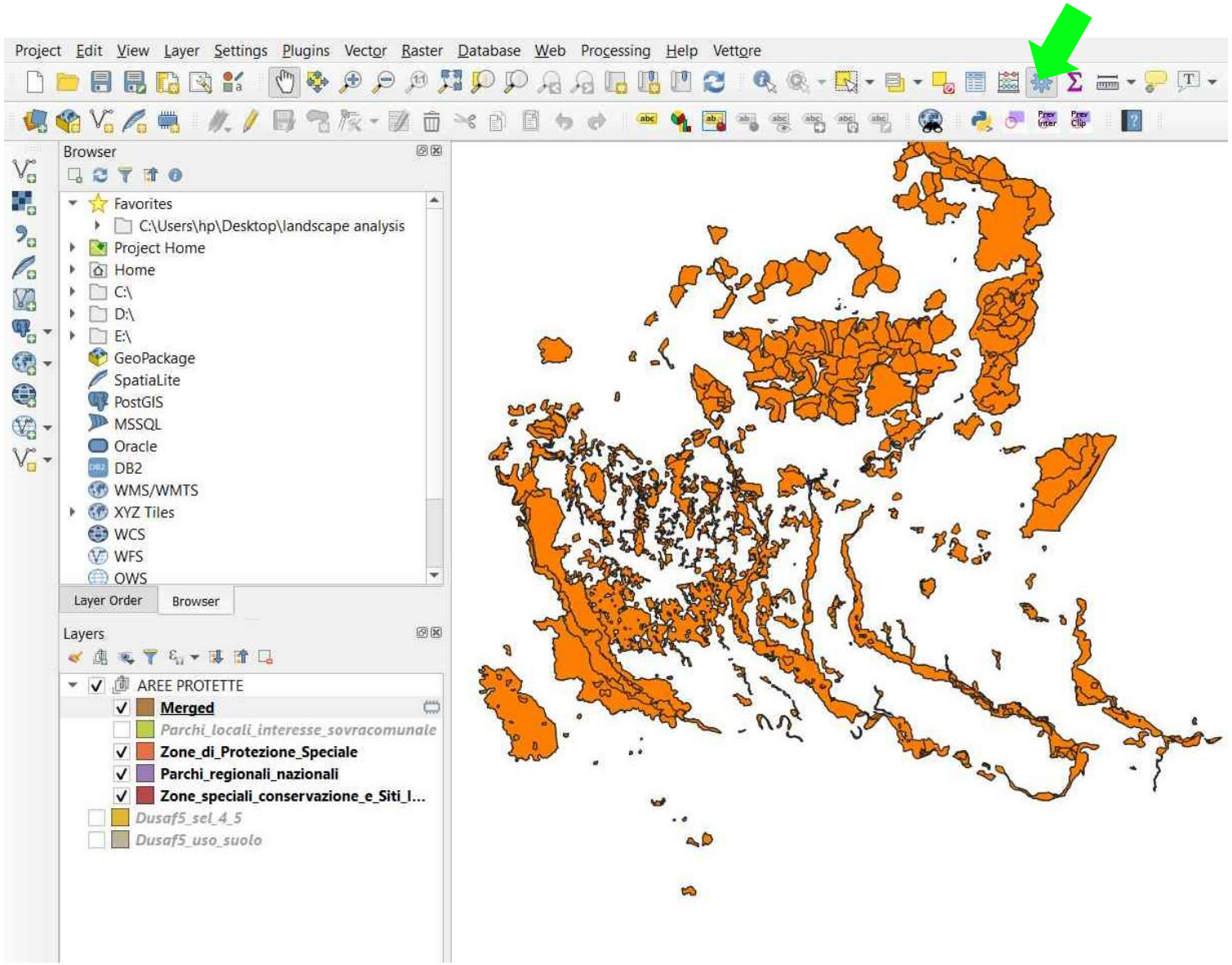


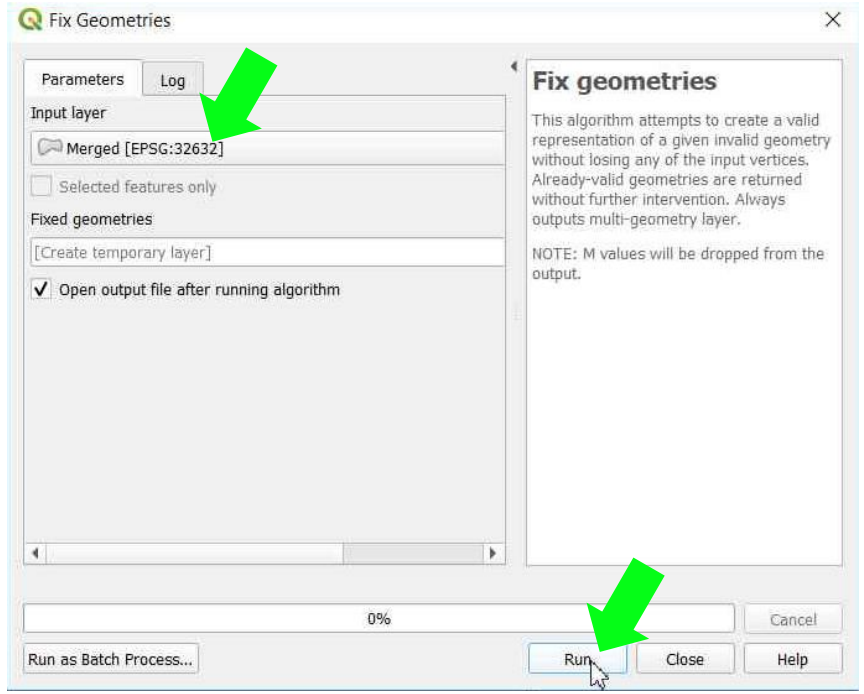
Select the layers and press ok

MERGE LAYERS → The layers have been merged

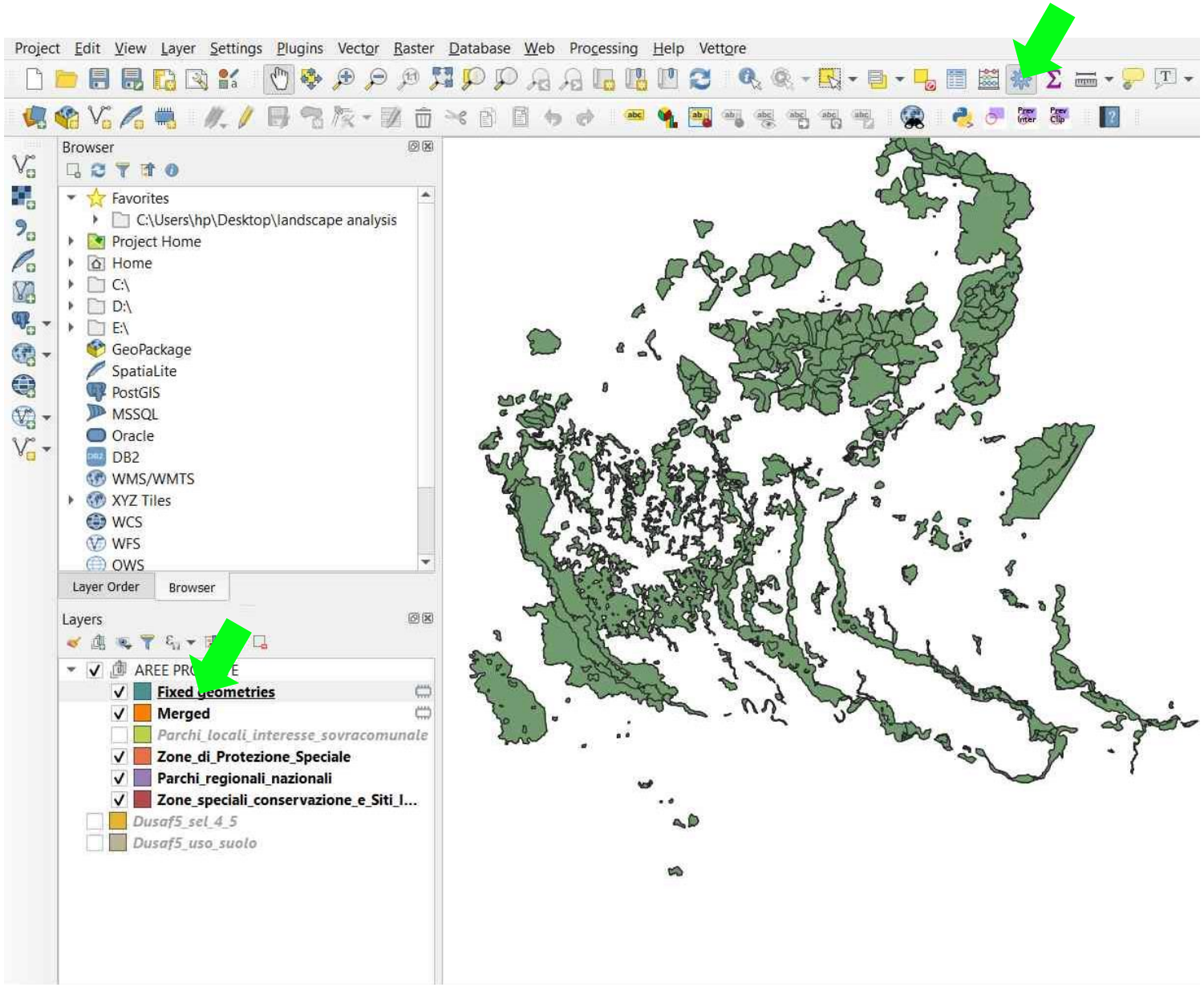


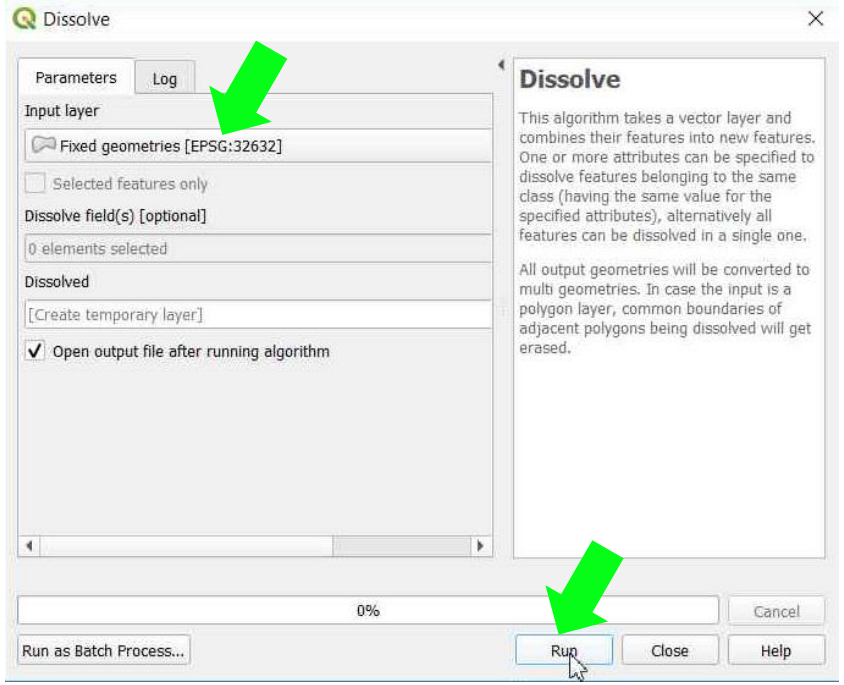
FIX GEOMTRIES → Open the **Processing Toolbox** → **Fix Geometries** → Select the layer *Merged* → **Run** to fix the invalid geometries



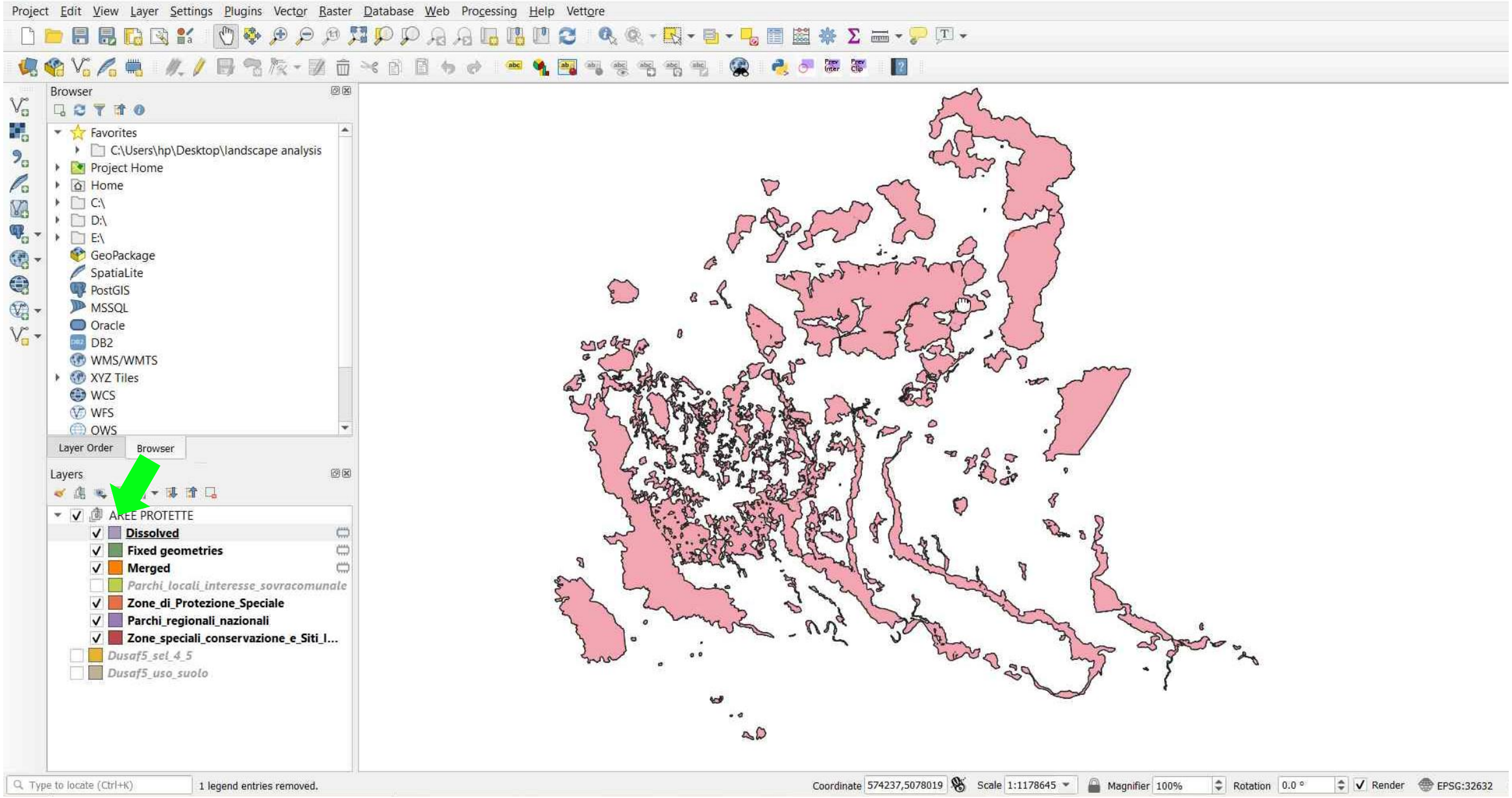


DISSOLVE GEOMETRIES → Open the **Processing Toolbox** → **Dissolve** → Select the *Fixed geometries* layer → **Run** to dissolve into a single features





EXPORT → Right-click to Export → **Save Features As**… to make it permanent *Aree_Protette*



PART 3

Valore Agricolo (Agricultural value)

The agricultural value database identifies three classes of agricultural value:

1. Low or absent
2. Moderate
3. High

For the purpose of this tutorial therefore, high agricultural value is selected.

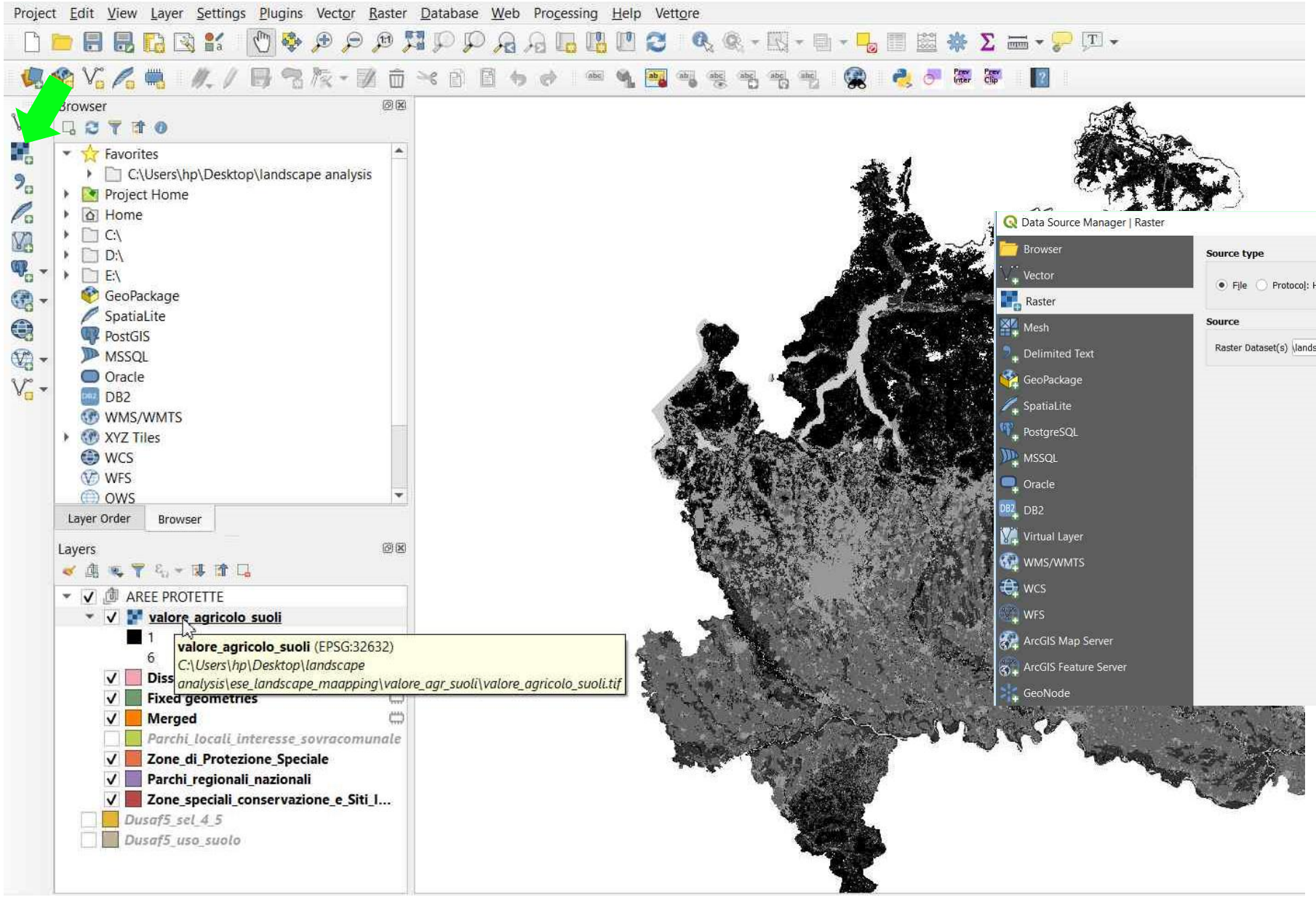
Tools

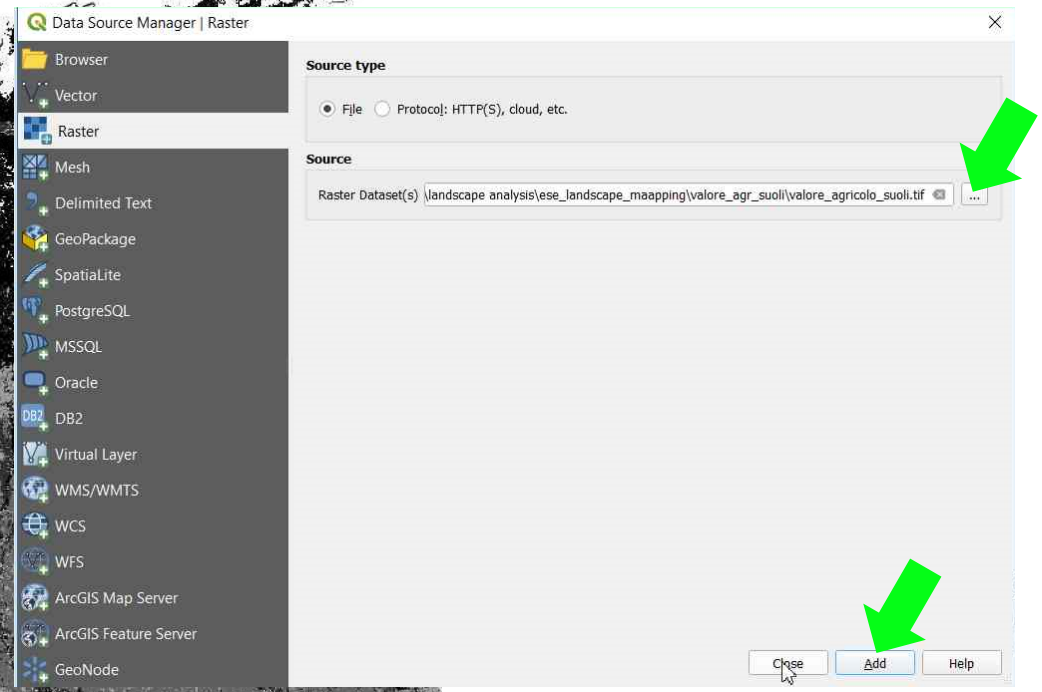
- Manage Layer Toolbar → Add Raster Layers
- Layer Properties → Symbology
- Raster → Raster Calculator

Metadata

http://www.geoportale.regione.lombardia.it/en/metadati?p_p_id=PublishedMetadata_WAR_geoportalemetadataportlet&p_p_lifecycle=0&p_p_state=maximized&p_p_state=view&_PublishedMetadata_WAR_geoportalemetadataportlet_view=editPublishedMetadata&_PublishedMetadata_WAR_geoportalemetadataportlet_uuid=%7B22B66AAB-5FC7-4E59-A5BF-47A33D85D8E9%7D&_PublishedMetadata_WAR_geoportalemetadataportlet_editType=view&_PublishedMetadata_WAR_geoportalemetadataportlet_fromAsset=true&rid=local

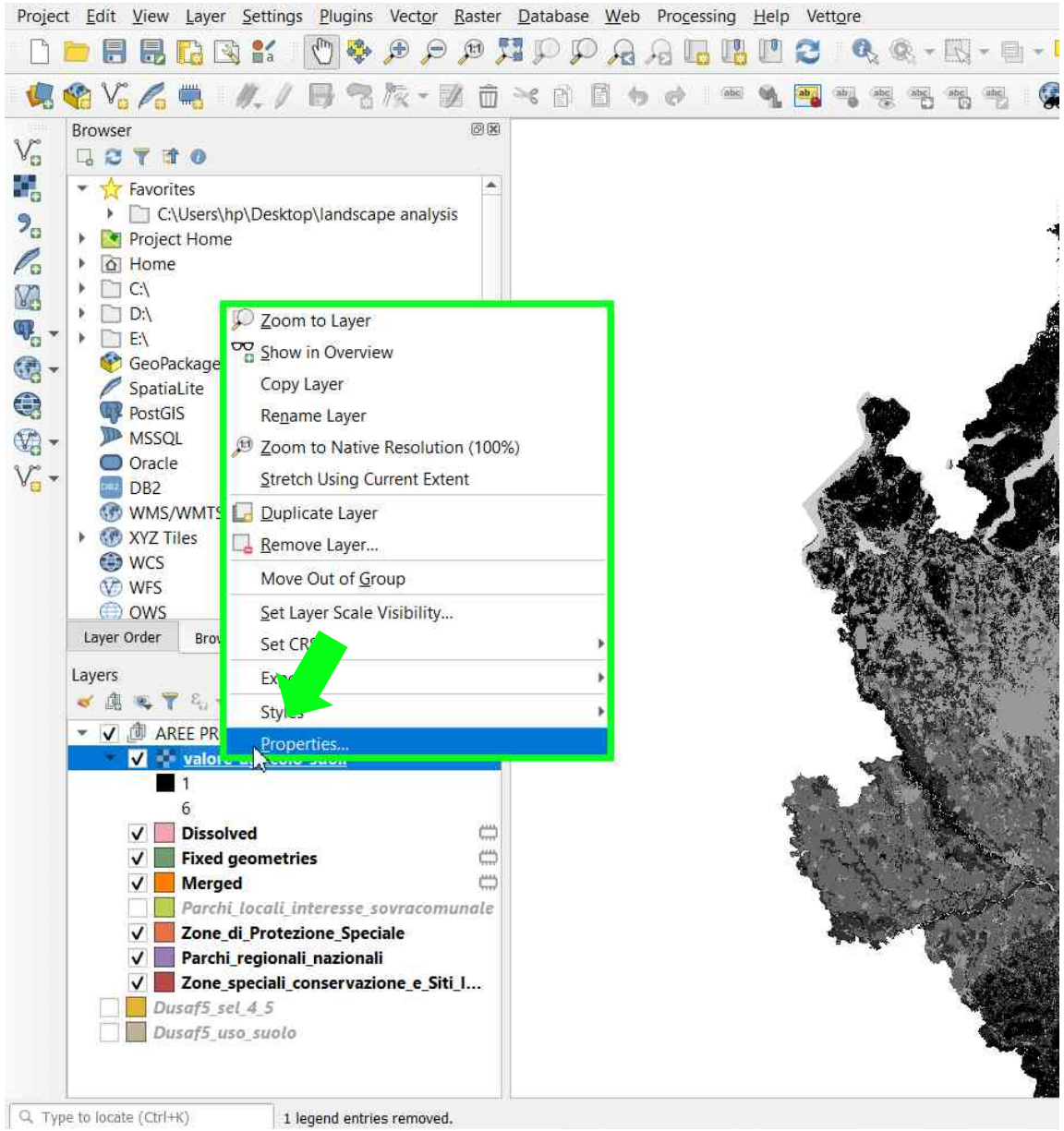
ADD RASTER LAYERS → Click **Add Raster Layer** on the Manage Layer Toolbar to upload the raster file : ***Valore Agricolo***



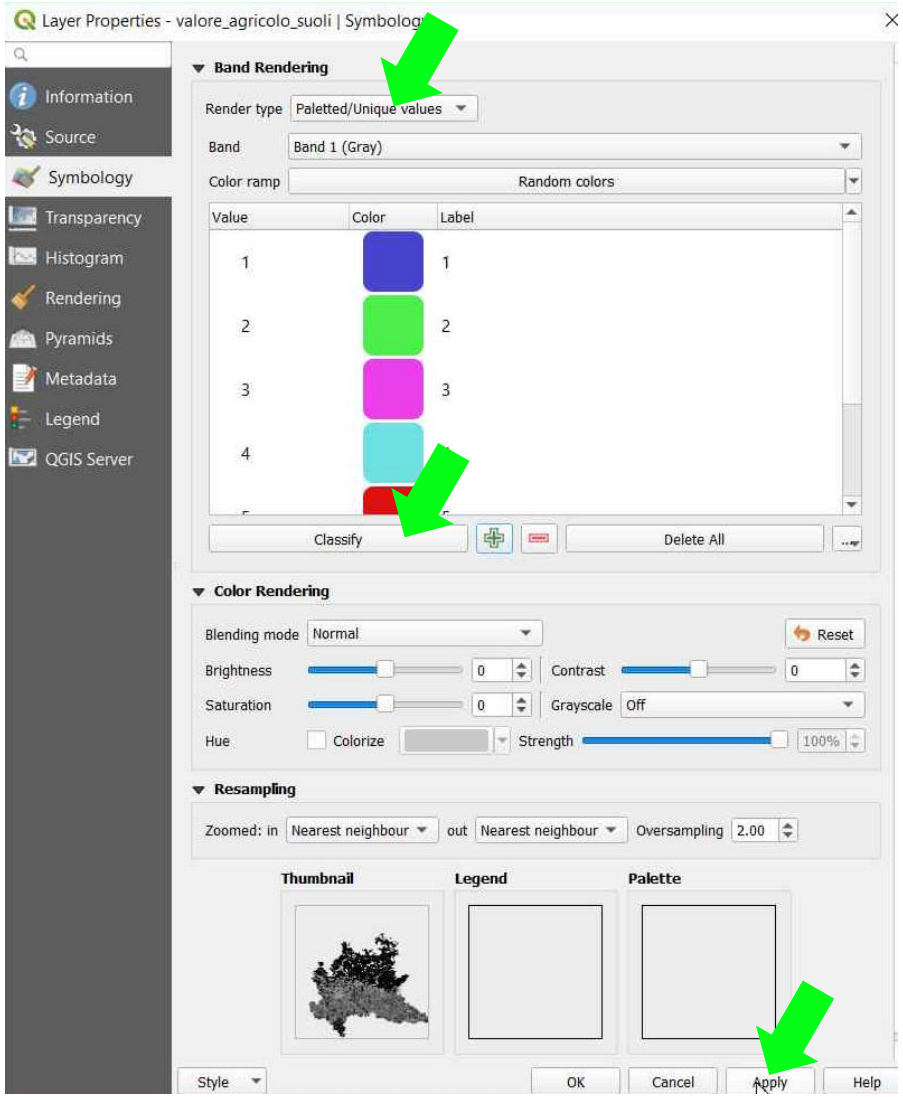


Click to choose the **data source** then **Add** to visualise the selected file

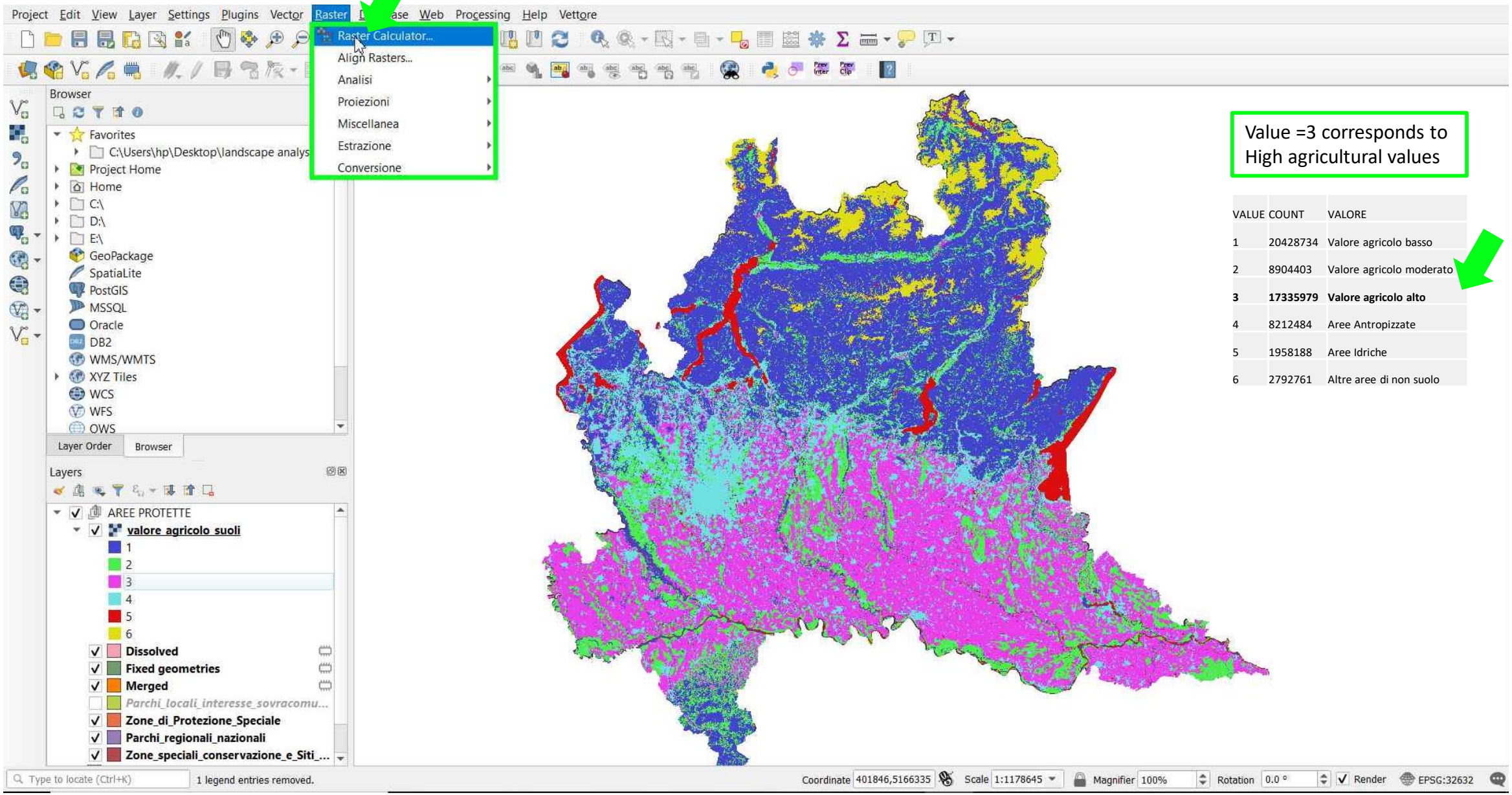
CHANGE SYMBOLOGY → Right-click to see the layer *Valore Agricolo* → **Properties** → **Symbology** → **Render type**: select **Paletted/Unique values**



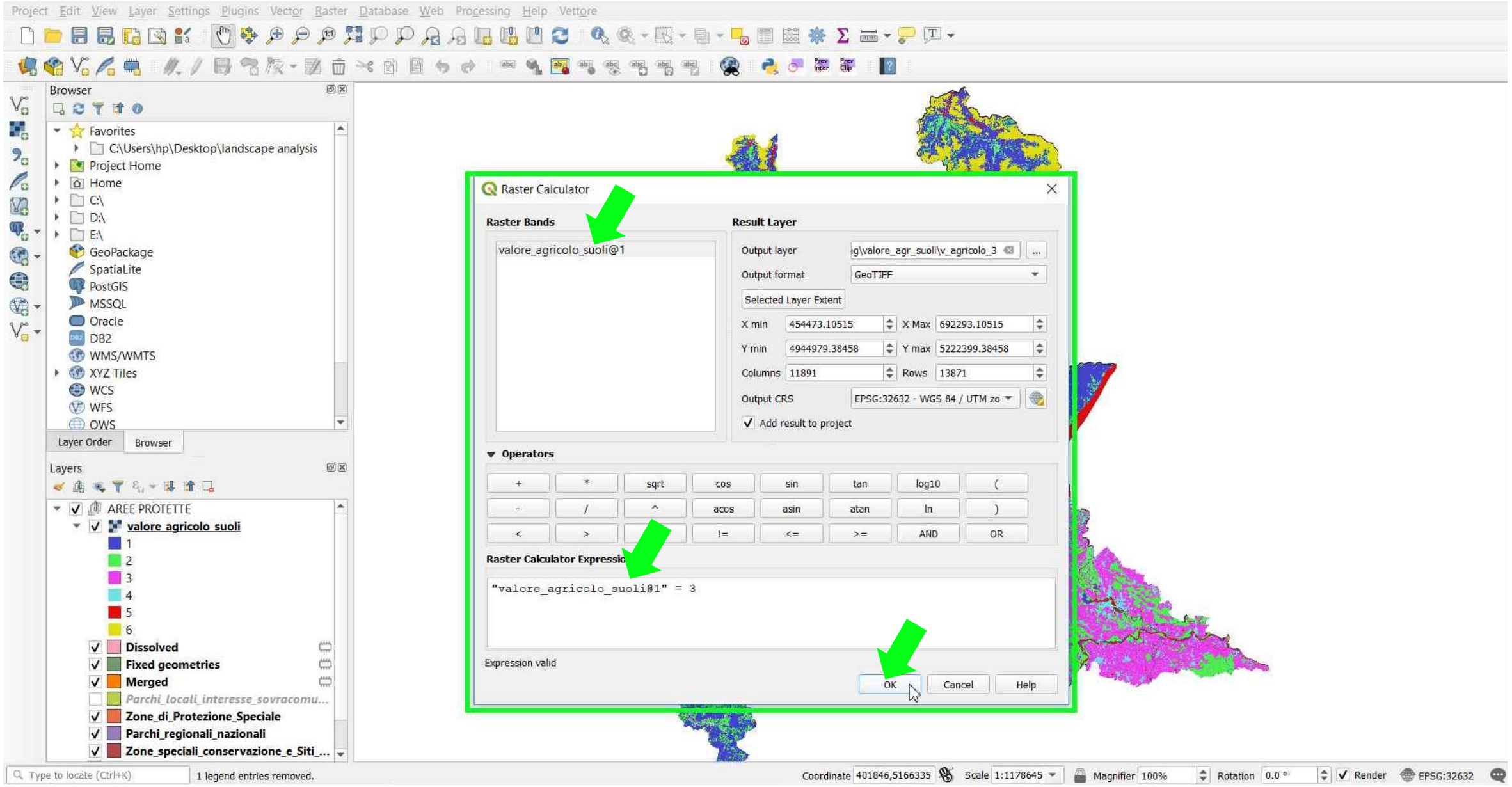
Click **Classify** then **Apply**



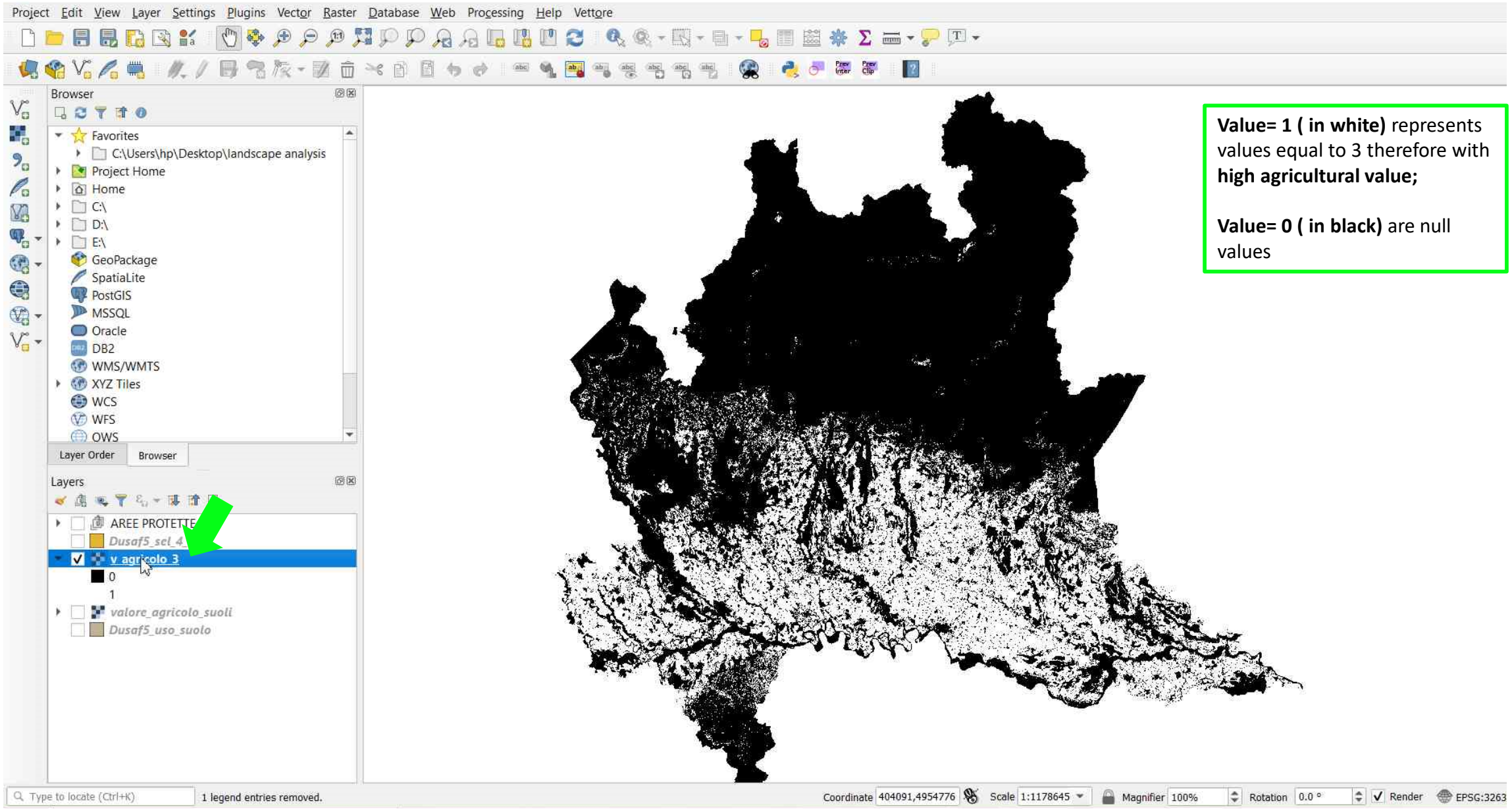
RASTER CALCULATOR → **Raster** → **Raster Calculator** to select attribute value=3



RASTER CALCULATOR → Double click on *"valore_agricolo_suoli@1"* → Type the Expression "**valore_agricolo_suoli@1"= 3** → **OK**



RASTER CALCULATOR → A new raster layer has been created *Valore_Agricolo_3*



PART 4

DTM 20

The DTM (Digital Elevation Model, DEM) is represented by a grid structure with sampling step of 20 meters, which can be used to analyse the orographic trend of the Lombardy area. The coverage includes the hilly and mountainous areas of the Lombardy Region.

In this part, areas with a declivity > 10 % are selected.

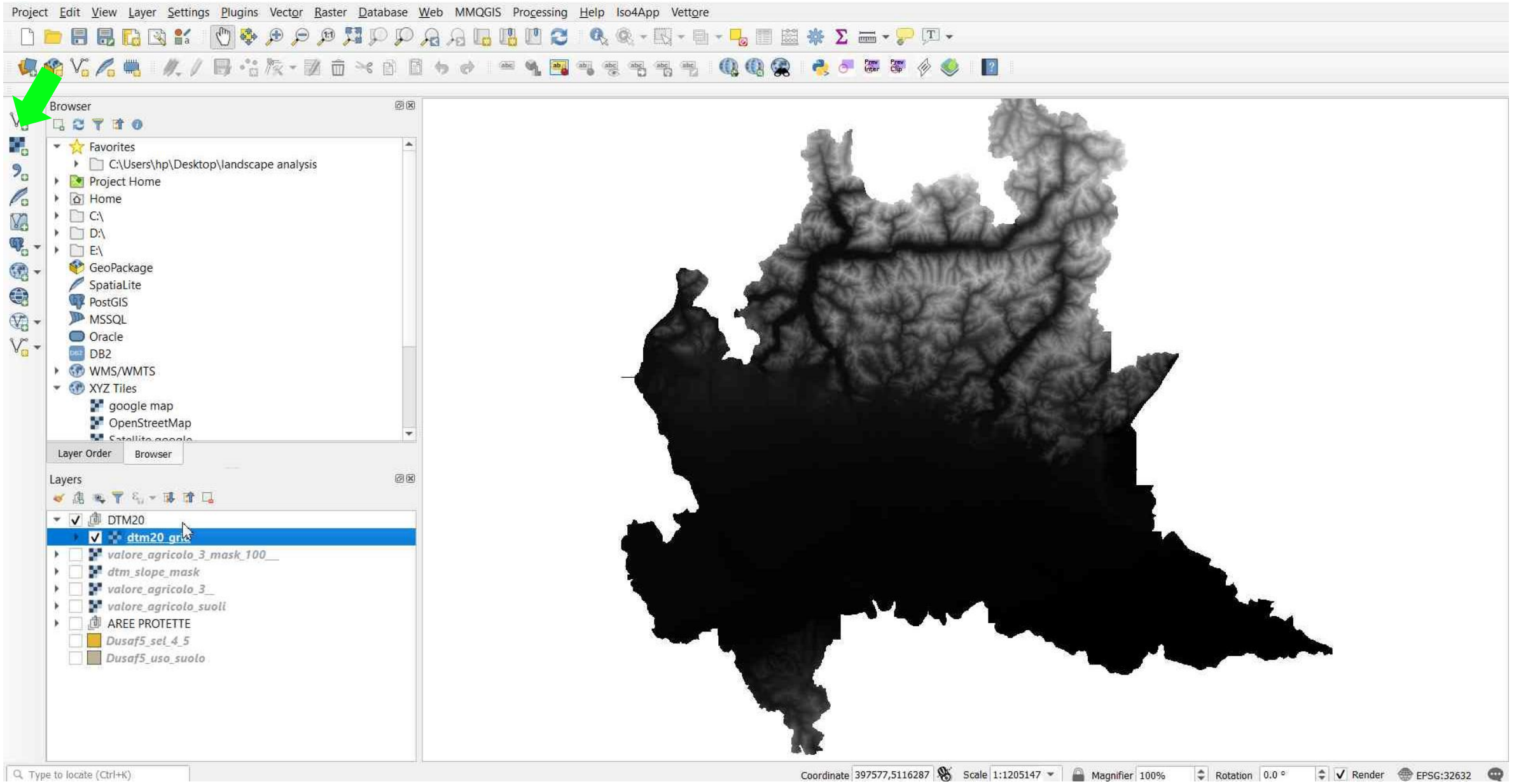
Tools

- Manage Layer Toolbar → Add Raster Layers
- Raster Analisi → Slope
- Raster → Raster Calculator

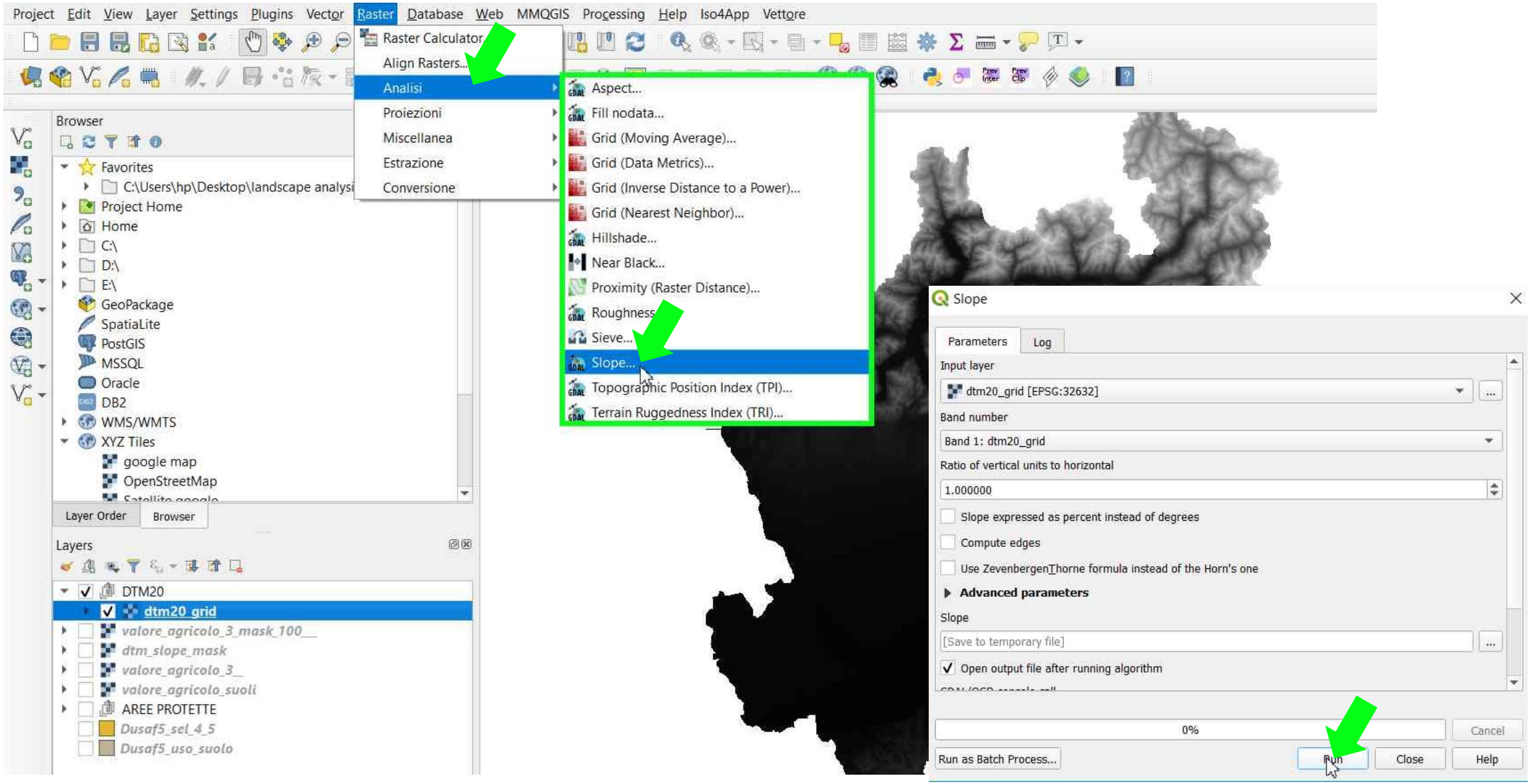
Metadata

http://www.geoportale.regione.lombardia.it/en/metadati?p_p_id=PublishedMetadata_WAR_geoportalemetadataportlet&p_p_lifecycle=0&p_p_state=maximized&p_p_state=view&_PublishedMetadata_WAR_geoportalemetadataportlet_view=editPublishedMetadata&_PublishedMetadata_WAR_geoportalemetadataportlet_uuid=%7B293FC764-D101-41F5-AC74-235BA0F5E415%7D&_PublishedMetadata_WAR_geoportalemetadataportlet_editType=view&_PublishedMetadata_WAR_geoportalemetadataportlet_fromAsset=true&rid=local

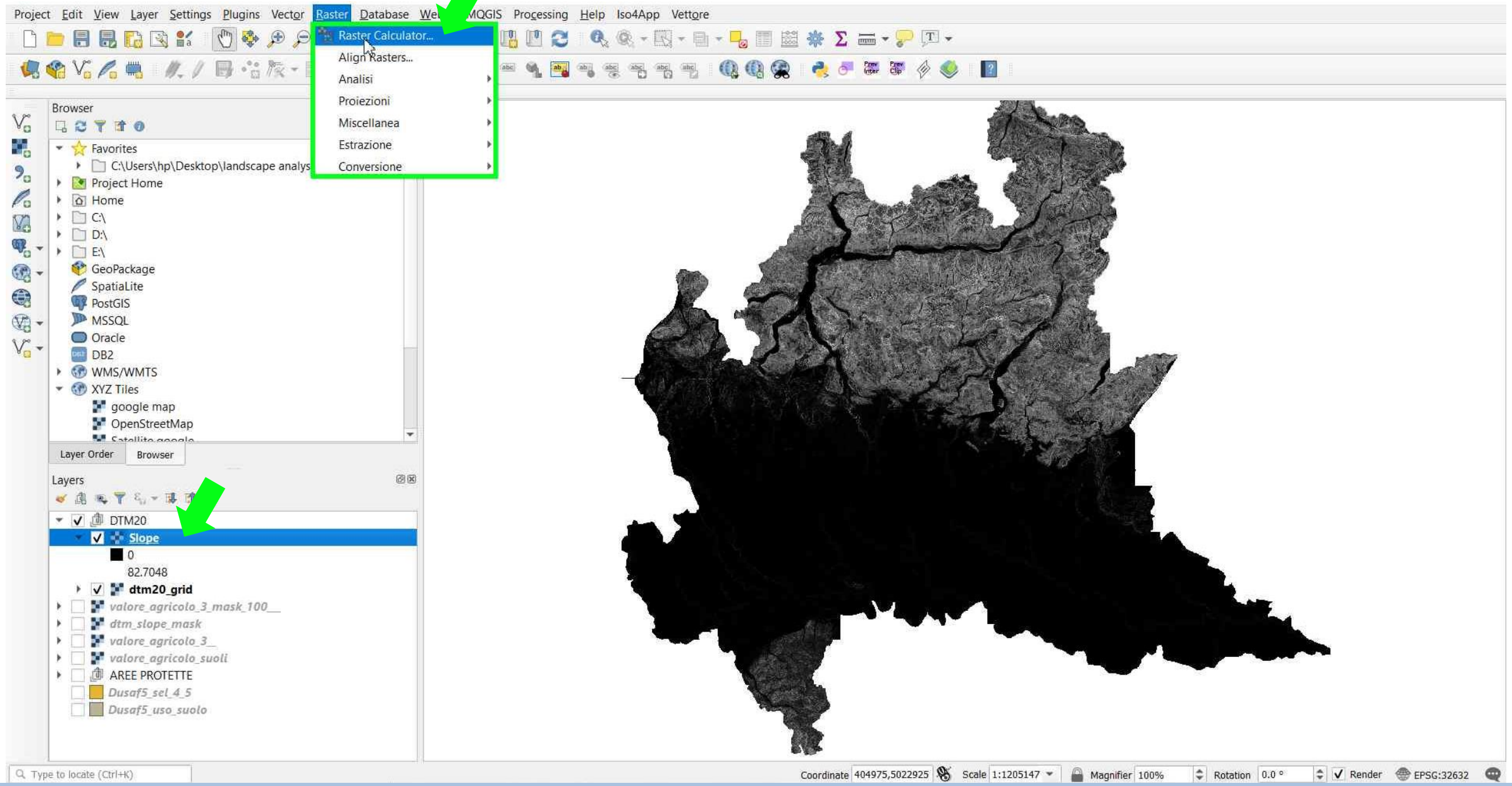
ADD RASTER LAYER → DTM20



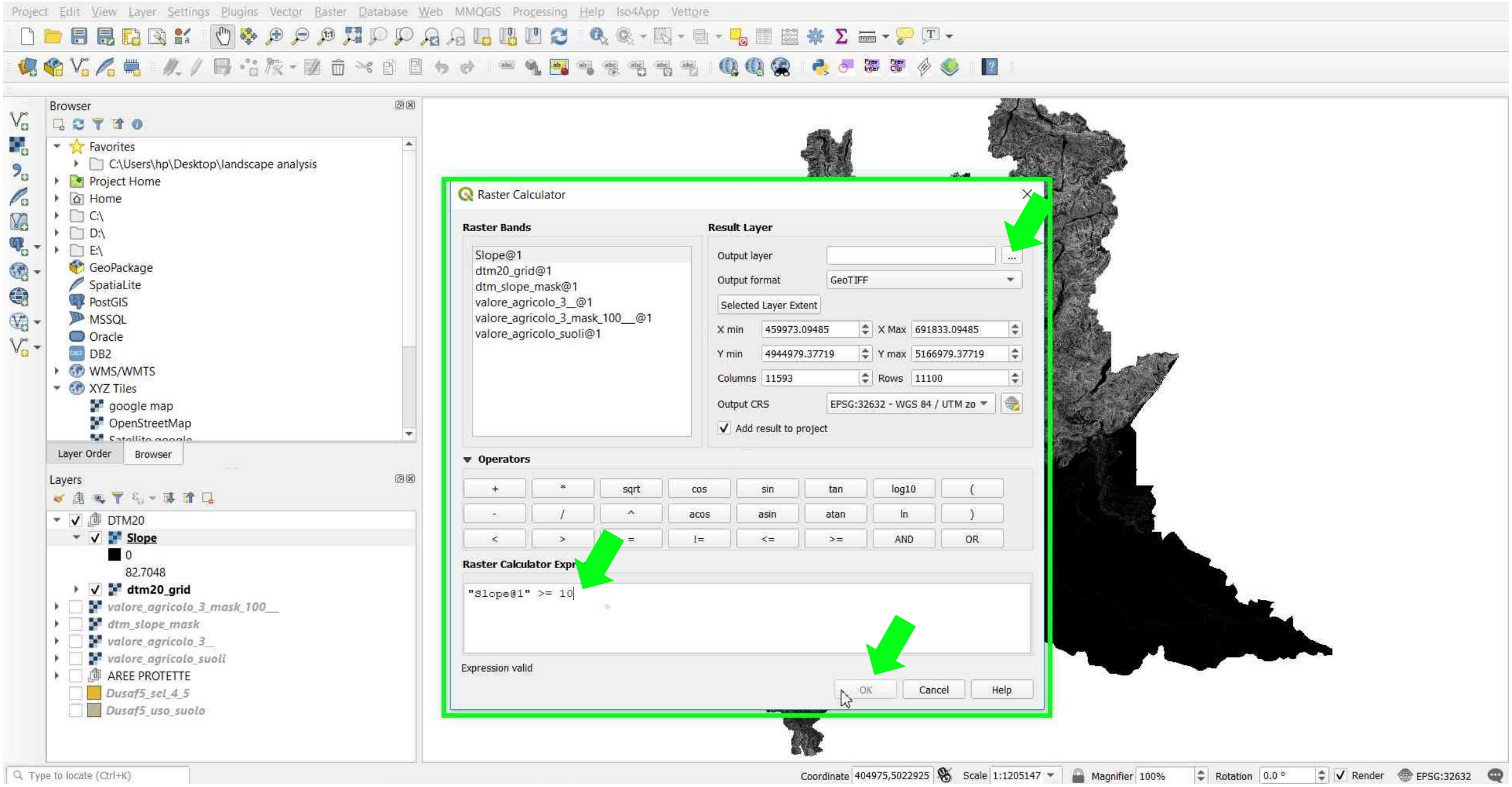
RASTER SLOPE → Raster → Analisi → Slope... → Run



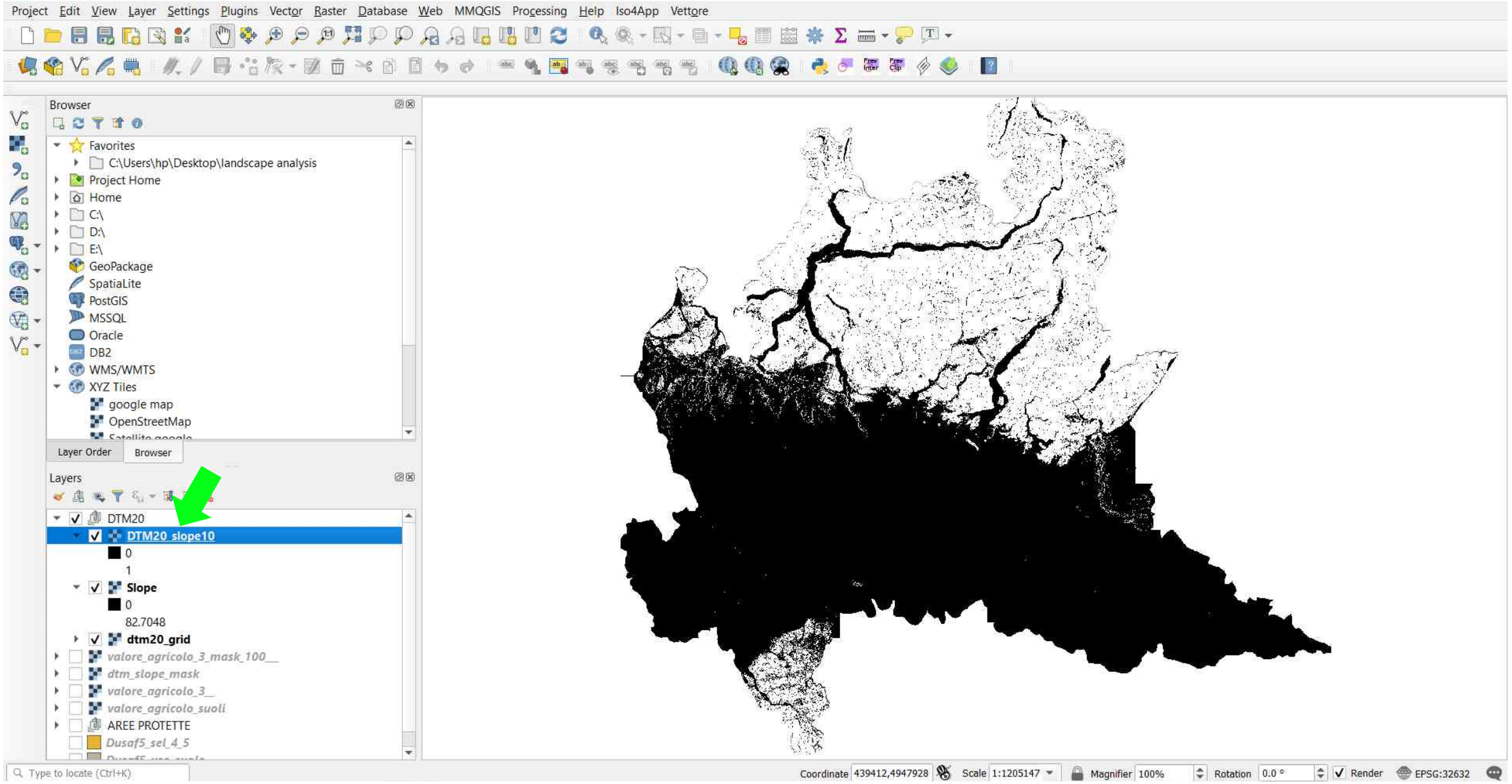
RASTER CALCULATOR → **Raster** → **Raster Calculator** to select slope >=10



RASTER CALCULATOR → Double click on *"Slope@1"* →Type the Expression ***"Slope@1">= 10*** → select the **Output Layer** → **OK**



RASTER CALCULATOR → A new raster layer has been created *DTM20_ Slope_10*

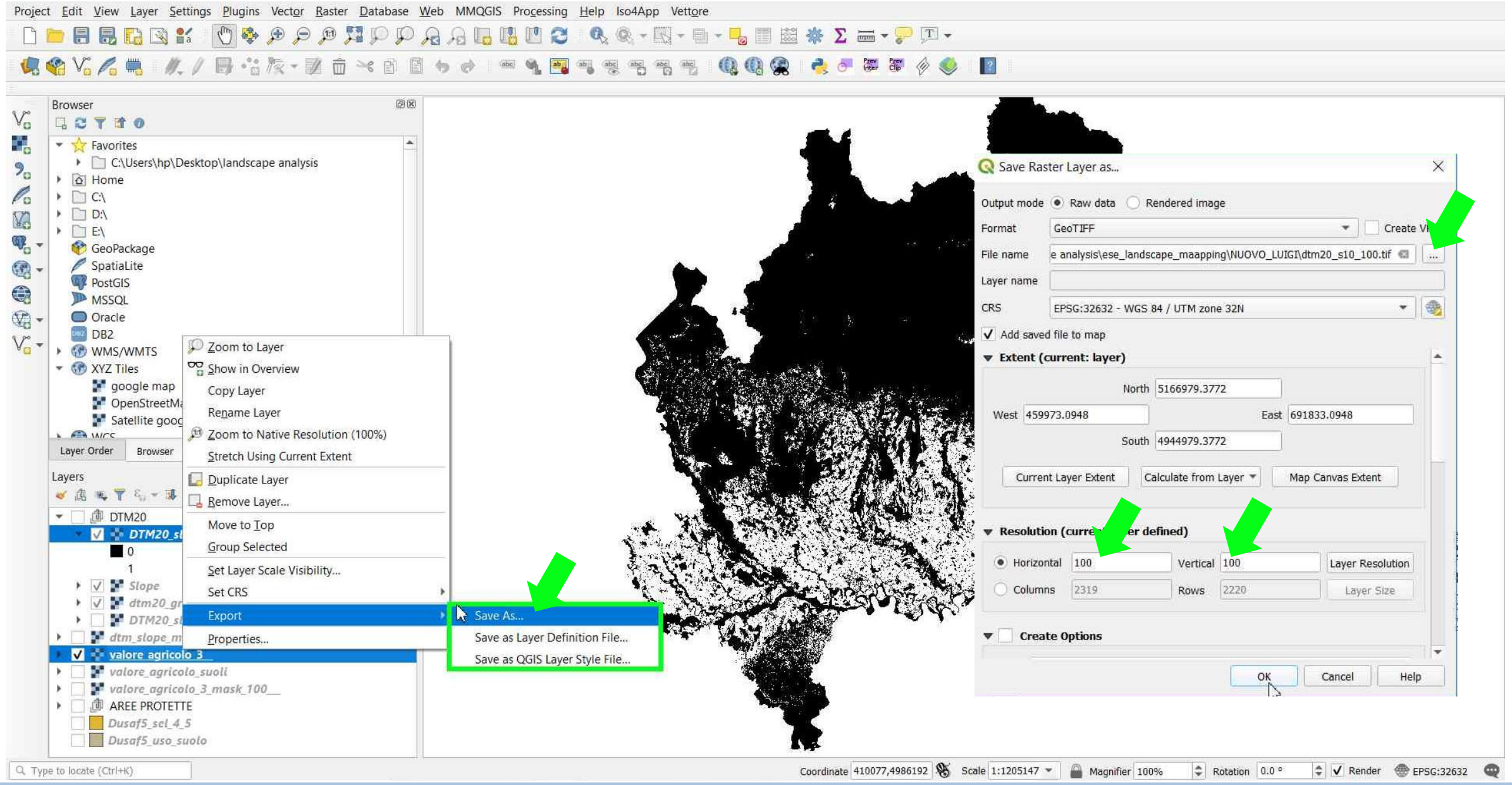


PART 5

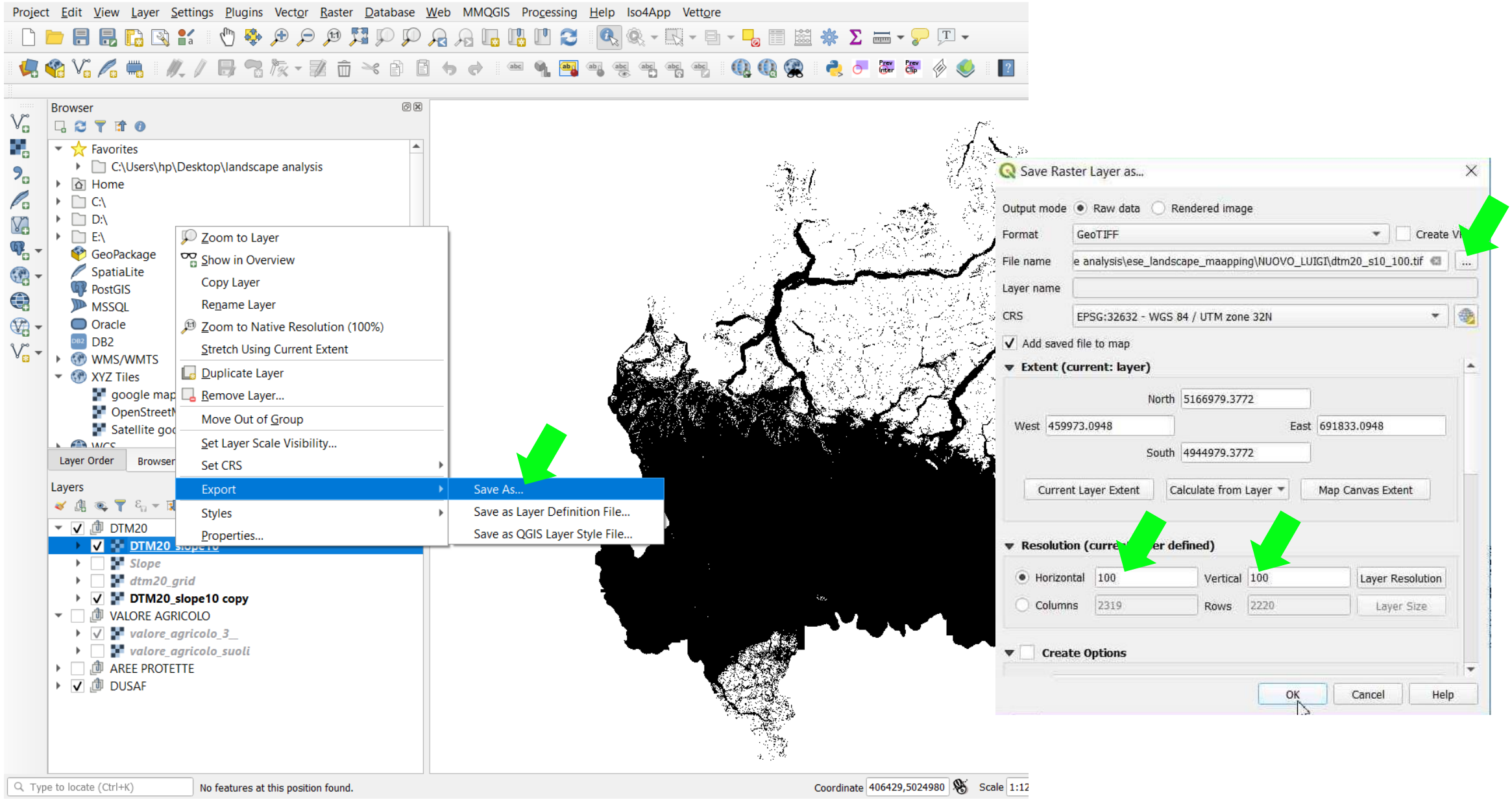
Raster resolution

- Export Raster → Change raster resolution
- Geoprocessing → Vector to Raster

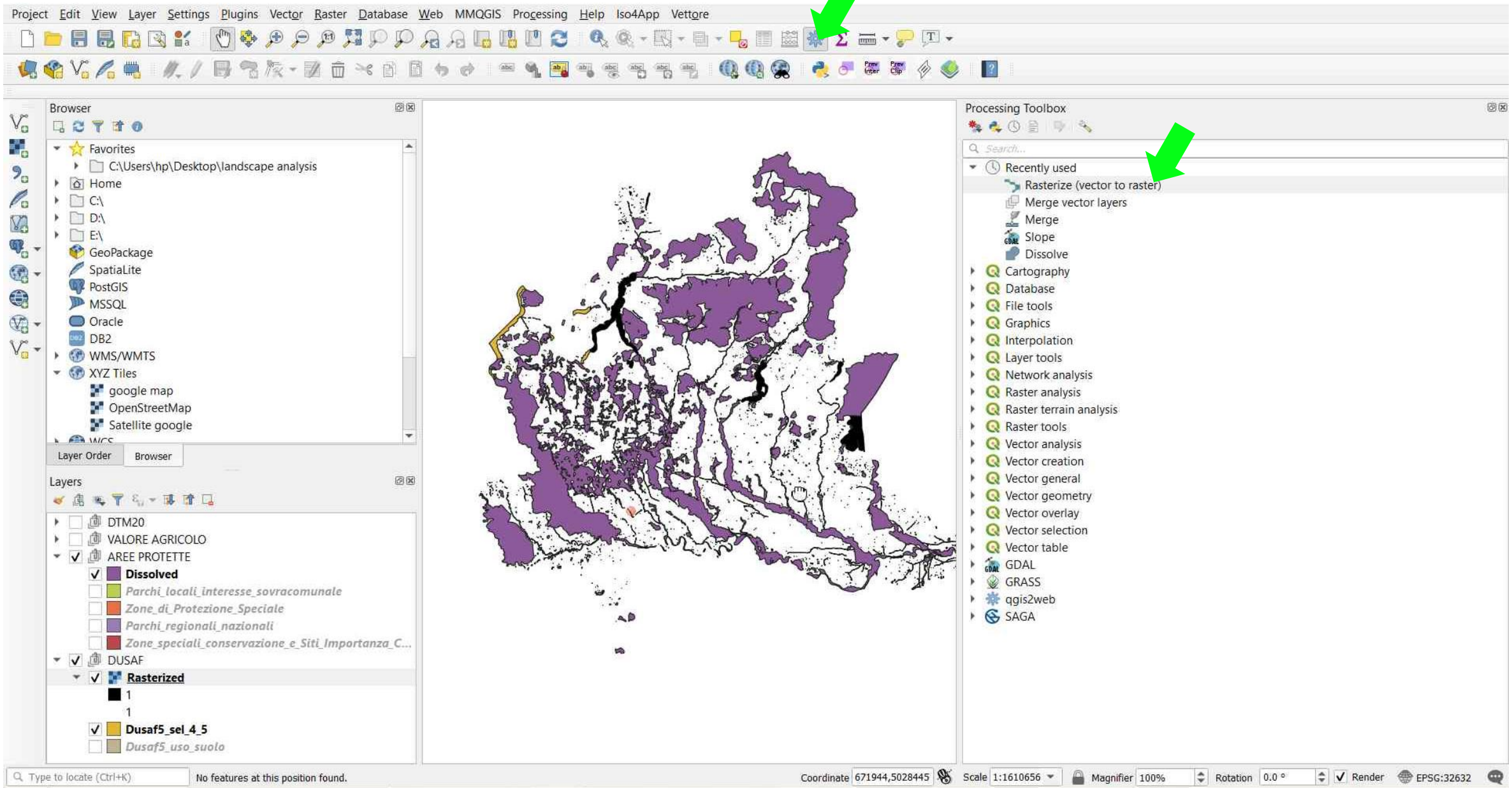
EXPORT RASTER → Right-click to *Valore_Agricolo_3* → **Export** → **Save As…** → Chose File Name → Type **Resolution 100x100**



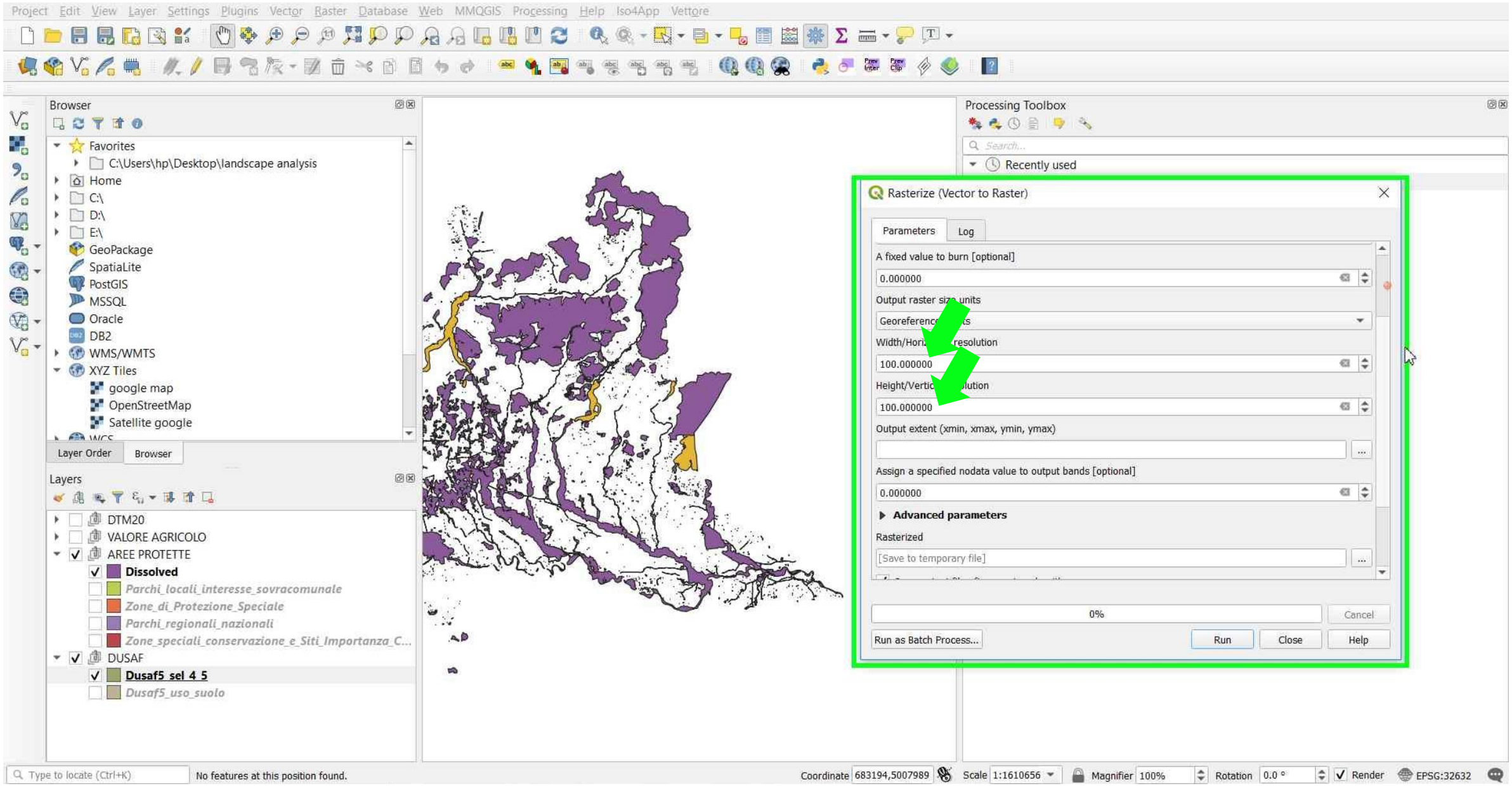
EXPORT RASTER → repeat the same operation for the layer *DTM20_ Slope_10*



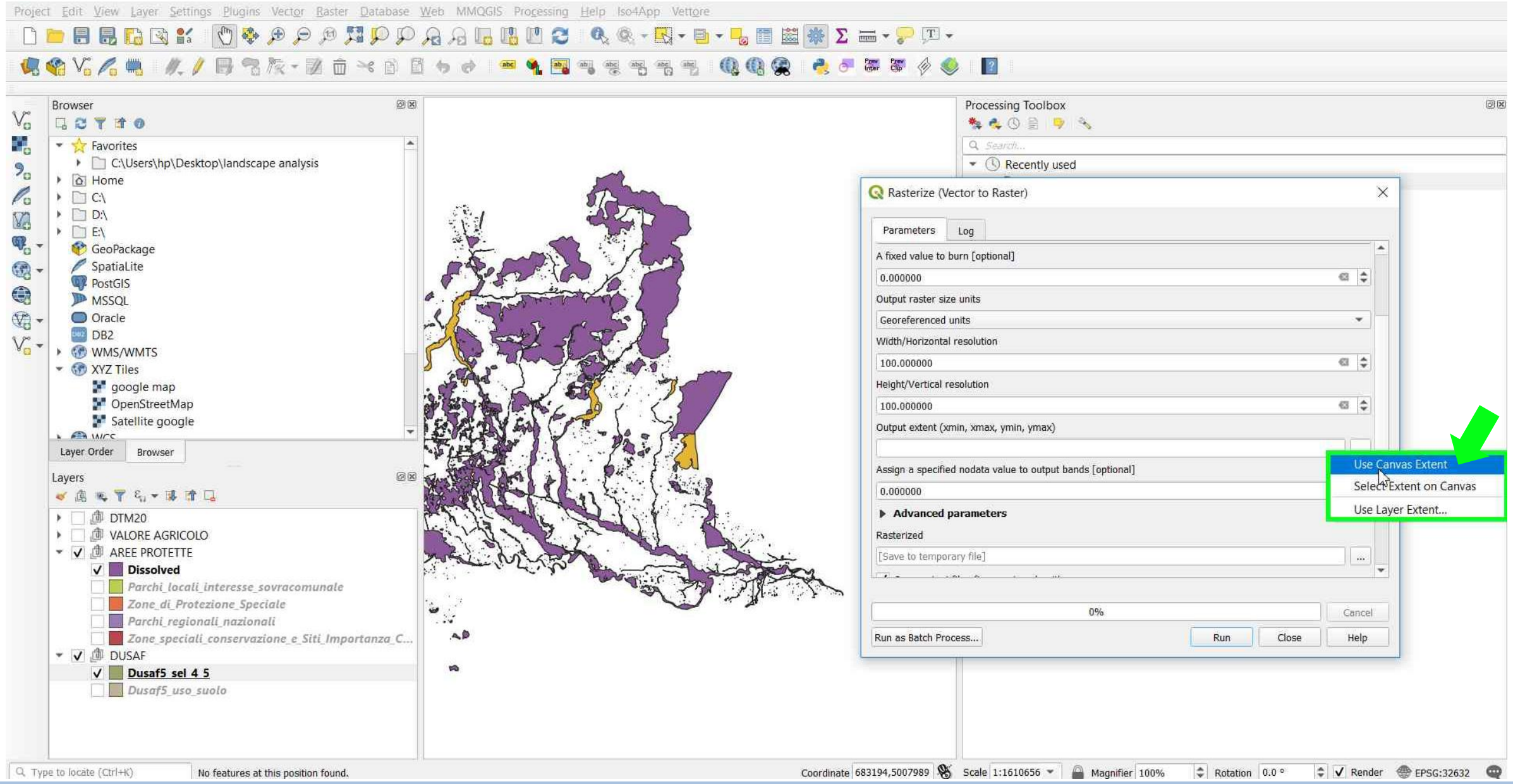
VECTOR TO RASTER → Open the **Processing Toolbox** → **Rasterize** (vector to raster) → run the operation for → ***Dusaf_4_5*** & ***Aree_Protette***



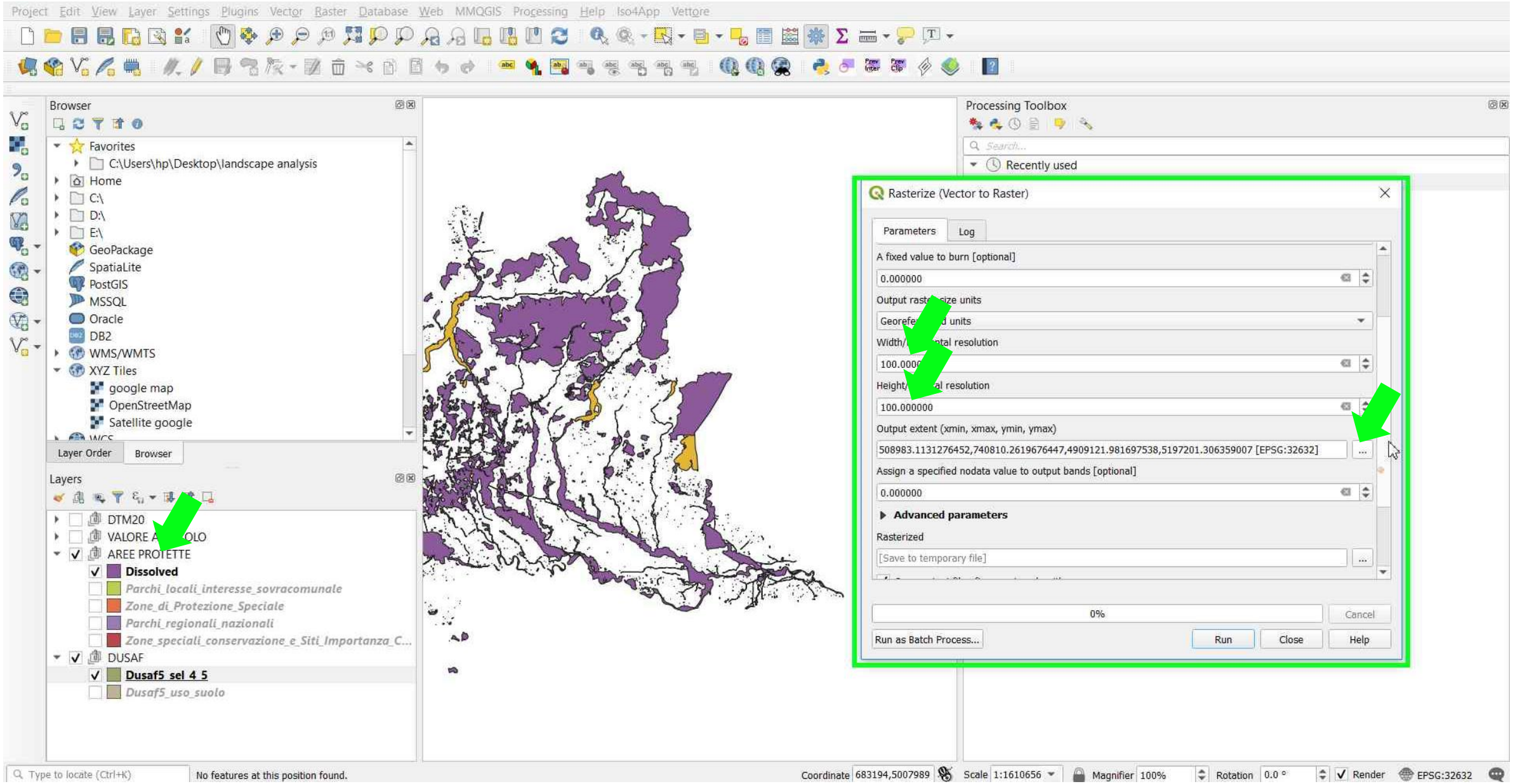
VECTOR TO RASTER → Set **Resolution 100x100**



VECTOR TO RASTER → Output extent → **Use Canvas Extent**



VECTOR TO RASTER → Repeat the same operation to *Aree_Protette* vector layer

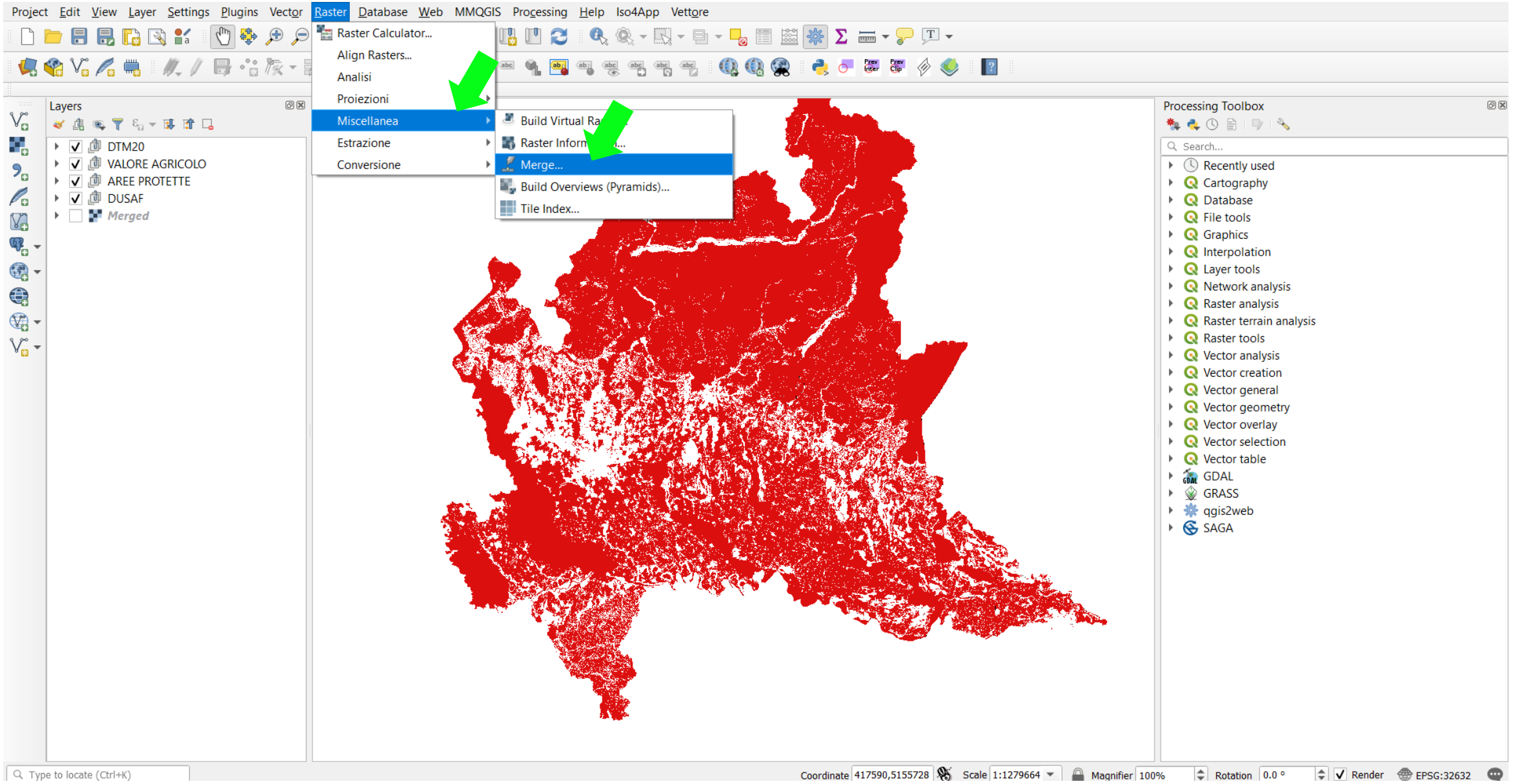


PART 6

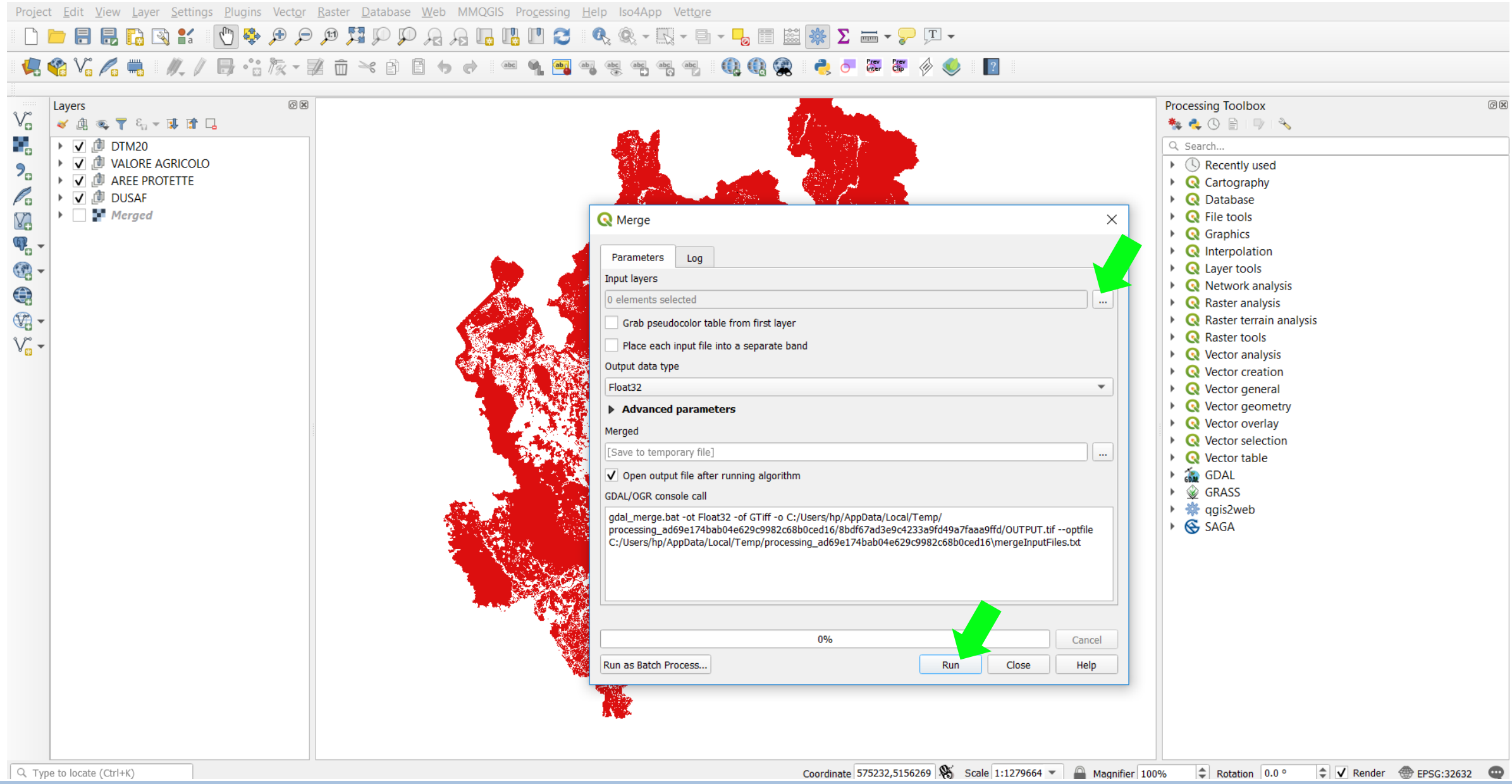
Spatial Mask

- Raster Miscellanea → Merge

MERGE RASTER LAYERS → Raster → Miscellanea → **Merge…**



MERGE RASTER LAYERS → Select the raster layers from the **Input Layers** window → *DTM20_Slope10 / Aree_protette / Dusaf_4_5 / Valore_Agricolo_3*



MERGE RASTER LAYERS → Raster layers have been merged to produce a spatial mask showing the potential limits to urbanization