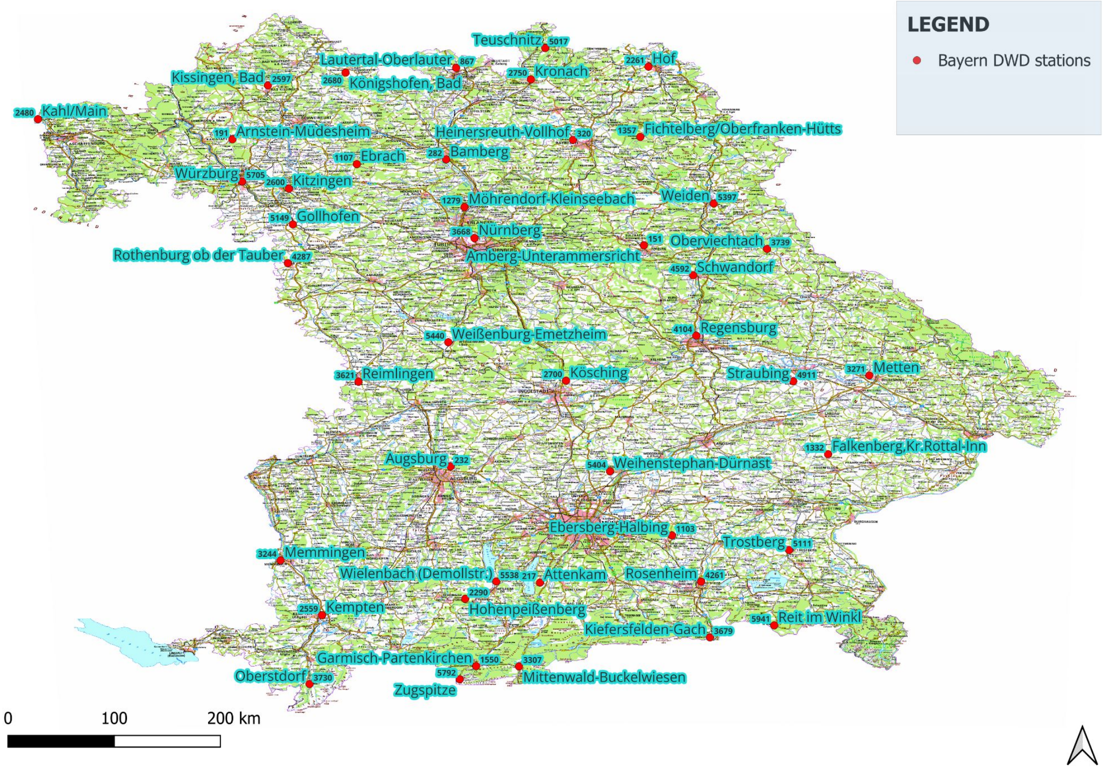
GeoData WS 2024-2025
group_b20

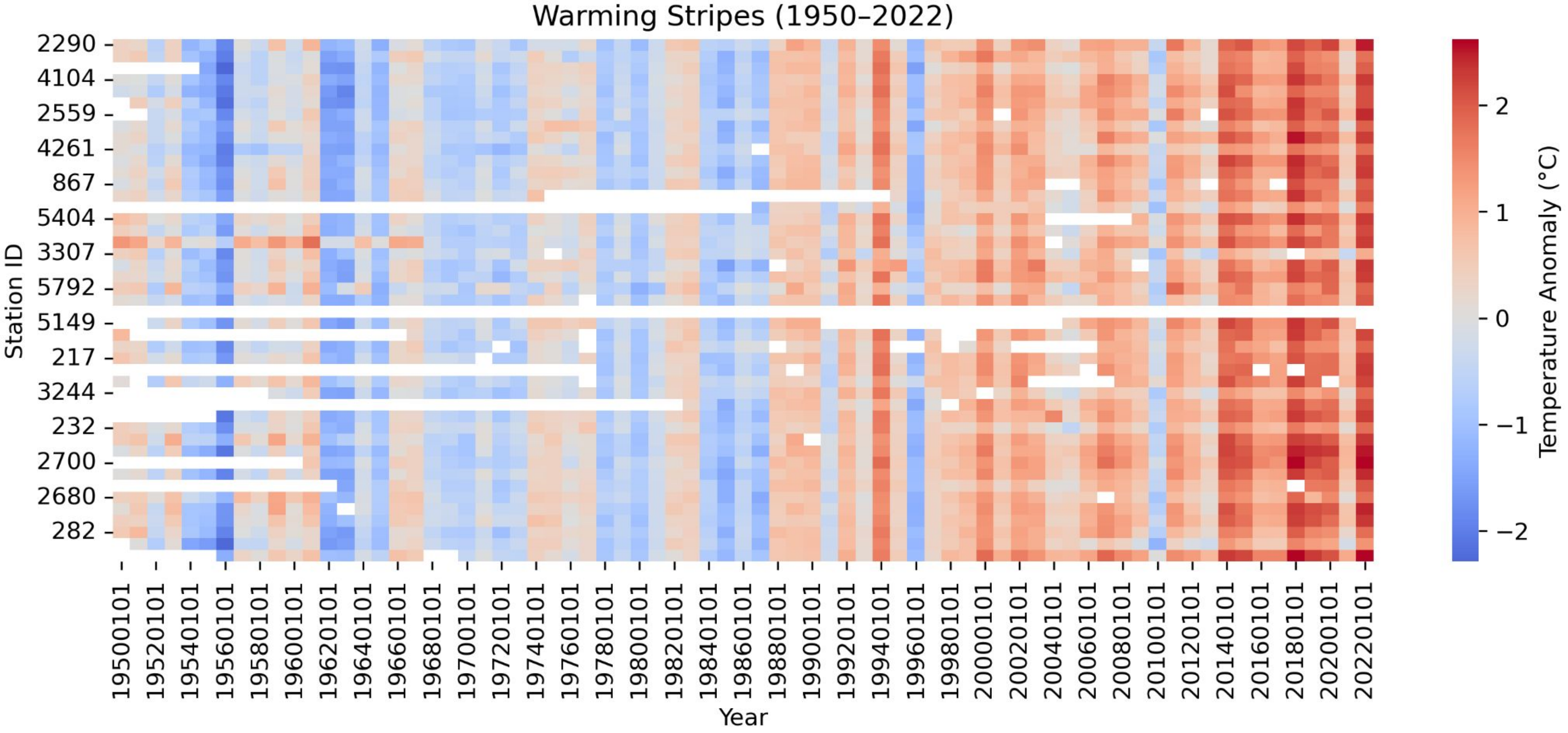
Tasio Rodriguez Puy - 32375
Daniel Jose Centeno Gonzalez - 32998

Task 1 Warming Stripes

1.2 Map with the active stations in Bavaria.



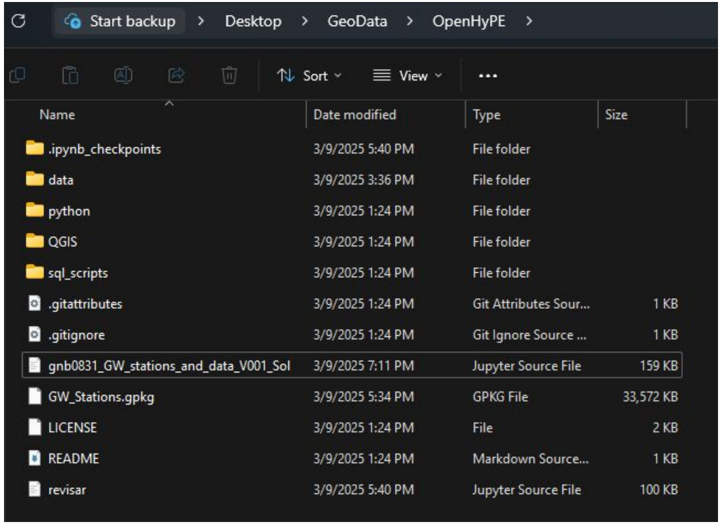
1.4 Plot with the warming stripes for the stations in Bavaria.



TASK 2 OpenHygrisC Nitrate Data: Creation of a movie with the QGIS Temporal Controller Connected to PostgreSQL/PostGIS

- Cloned OpenHygrisC repository

  Using the “git clone” command the repository was cloned to a local computer.

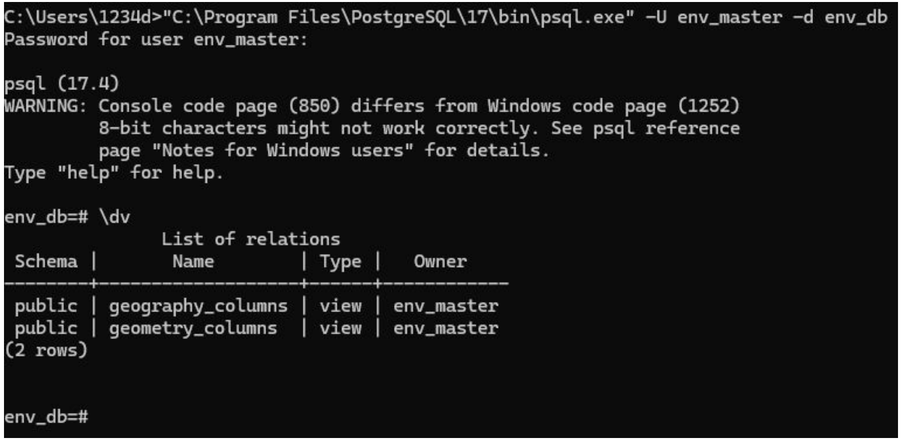


Name	Date modified	Type	Size
.ipynb_checkpoints	3/9/2025 5:40 PM	File folder	
data	3/9/2025 3:36 PM	File folder	
python	3/9/2025 1:24 PM	File folder	
QGIS	3/9/2025 1:24 PM	File folder	
sql_scripts	3/9/2025 1:24 PM	File folder	
.gitattributes	3/9/2025 1:24 PM	Git Attributes Sour...	1 KB
.gitignore	3/9/2025 1:24 PM	Git Ignore Source ...	1 KB
gnb0831_GW_stations_and_data_V001_Sol	3/9/2025 7:11 PM	Jupyter Source File	159 KB
GW_Stations.gpkg	3/9/2025 5:34 PM	GPKG File	33,572 KB
LICENSE	3/9/2025 1:24 PM	File	2 KB
README	3/9/2025 1:24 PM	Markdown Source...	1 KB
revisar	3/9/2025 5:40 PM	Jupyter Source File	100 KB

TASK 2 OpenHygrisC Nitrate Data: Creation of a movie with the QGIS Temporal Controller Connected to PostgreSQL/PostGIS

- Create env_db into PostgreSQL

  Inside the “sql_scripts” were important scripts to create user and the database.

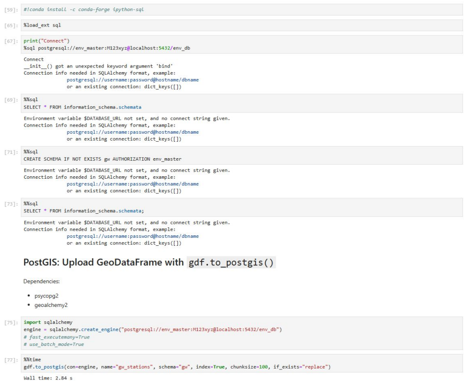


```
C:\Users\1234d>"C:\Program Files\PostgreSQL\17\bin\psql.exe" -U env_master -d env_db
Password for user env_master:

psql (17.4)
WARNING: Console code page (850) differs from Windows code page (1252)
         8-bit characters might not work correctly. See psql reference
         page "Notes for Windows users" for details.
Type "help" for help.

env_db=# \dv
               List of relations
 Schema |       Name        | Type |   Owner
--------+-------------------+------+------------
 public | geography_columns | view | env_master
 public | geometry_columns  | view | env_master
(2 rows)


env_db=#
```

TASK 2 OpenHygrisC Nitrate Data: Creation of a movie with the QGIS Temporal Controller Connected to PostgreSQL/PostGIS

- Jupyter Notebook manipulation

Using the “gnb0831_GW_stations_and_data_V001_Sol.ipynb” were formatted the data from the .csv files to be stored on PostgreSQL.



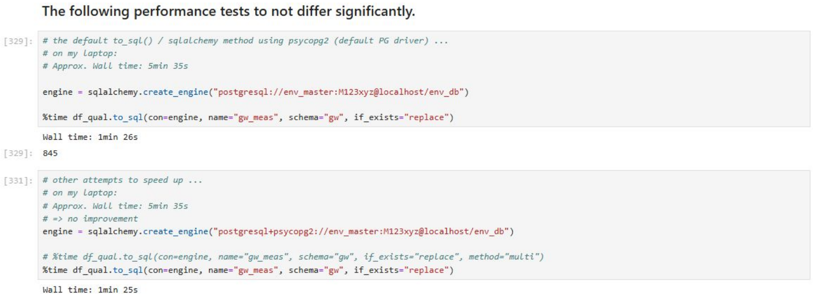
```
[59]: #!conda install -c conda-forge ipython-sql

[65]: %load_ext sql

[67]: print("Connect")
      %sql postgresql://env_master:M123xyz@localhost:5432/env_db

      Connect
      __init__() got an unexpected keyword argument 'bind'
      Connection info needed in SQLAlchemy format, example:
                     postgresql://username:password@hostname/dbname
                     or an existing connection: dict_keys([])

[69]: %%sql
      SELECT * FROM information_schema.schemata

      Environment variable $DATABASE_URL not set, and no connect string given.
      Connection info needed in SQLAlchemy format, example:
                     postgresql://username:password@hostname/dbname
                     or an existing connection: dict_keys([])

[71]: %%sql
      CREATE SCHEMA IF NOT EXISTS gw AUTHORIZATION env_master

      Environment variable $DATABASE_URL not set, and no connect string given.
      Connection info needed in SQLAlchemy format, example:
                     postgresql://username:password@hostname/dbname
                     or an existing connection: dict_keys([])

[73]: %%sql
      SELECT * FROM information_schema.schemata;

      Environment variable $DATABASE_URL not set, and no connect string given.
      Connection info needed in SQLAlchemy format, example:
                     postgresql://username:password@hostname/dbname
                     or an existing connection: dict_keys([])
```

PostGIS: Upload GeoDataFrame with `gdf.to_postgis()`

Dependencies:

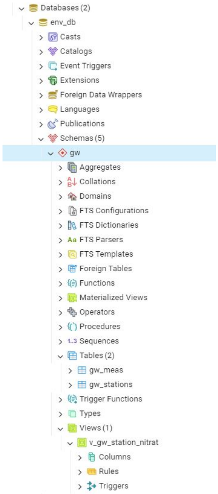
- psycopg2
- geoalchemy2

```
[75]: import sqlalchemy
      engine = sqlalchemy.create_engine("postgresql://env_master:M123xyz@localhost:5432/env_db")
      # fast_executemany=True
      # use_batch_mode=True

[77]: %%time
      gdf.to_postgis(con=engine, name="gw_stations", schema="gw", index=True, chunksize=100, if_exists="replace")

      Wall time: 2.84 s
```



The following performance tests to not differ significantly.

```
[329]: # the default to_sql() / sqlalchemy method using psycopg2 (default PG driver) ...
       # on my laptop:
       # Approx. Wall time: 5min 35s

       engine = sqlalchemy.create_engine("postgresql://env_master:M123xyz@localhost/env_db")

       %time df_qual.to_sql(con=engine, name="gw_meas", schema="gw", if_exists="replace")

       Wall time: 1min 26s

[329]: 845

[331]: # other attempts to speed up ...
       # on my laptop:
       # Approx. Wall time: 5min 35s
       # => no improvement
       engine = sqlalchemy.create_engine("postgresql+psycopg2://env_master:M123xyz@localhost/env_db")

       # %time df_qual.to_sql(con=engine, name="gw_meas", schema="gw", if_exists="replace", method="multi")
       %time df_qual.to_sql(con=engine, name="gw_meas", schema="gw", if_exists="replace")

       Wall time: 1min 25s
```

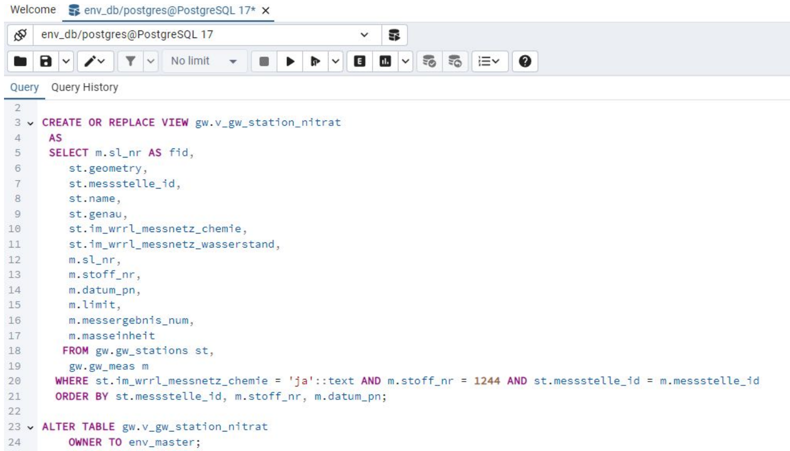


```
Databases (2)
  env_db
    Casts
    Catalogs
    Event Triggers
    Extensions
    Foreign Data Wrappers
    Languages
    Publications
    Schemas (5)
      gw
        Aggregates
        Collations
        Domains
        FTS Configurations
        FTS Dictionaries
        FTS Parsers
        FTS Templates
        Foreign Tables
        Functions
        Materialized Views
        Operators
        Procedures
        Sequences
        Tables (2)
          gw_meas
          gw_stations
        Trigger Functions
        Types
        Views (1)
          v_gw_station_nitrat
            Columns
            Rules
            Triggers
```

TASK 2 OpenHygrisC Nitrate Data: Creation of a movie with the QGIS Temporal Controller Connected to PostgreSQL/PostGIS

- View creation

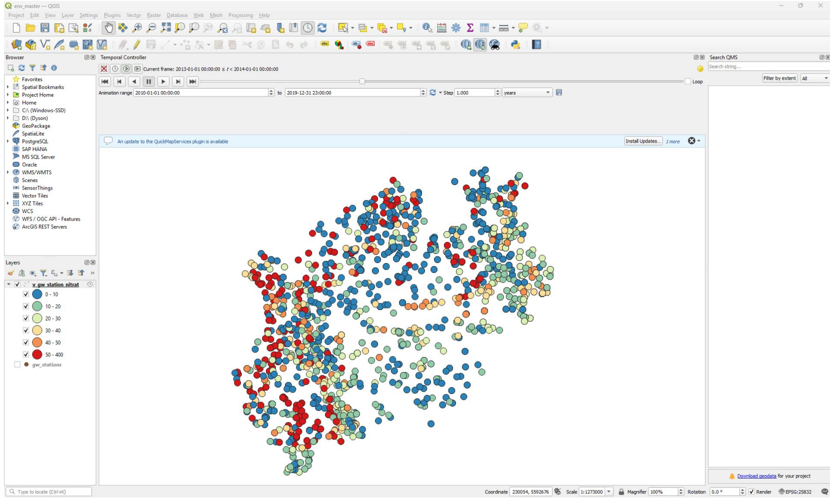
  Execute command to create a Nitrat view



```

CREATE OR REPLACE VIEW gw.v_gw_station_nitrat
 AS
 SELECT m.sl_nr AS fid,
    st.geometry,
    st.messstelle_id,
    st.name,
    st.genau,
    st.im_wrrl_messnetz_chemie,
    st.im_wrrl_messnetz_wasserstand,
    m.sl_nr,
    m.stoff_nr,
    m.datum_pn,
    m.limit,
    m.messergebnis_num,
    m.masseinheit
   FROM gw.gw_stations st,
    gw.gw_meas m
  WHERE st.im_wrrl_messnetz_chemie = 'ja'::text AND m.stoff_nr = 1244 AND st.messstelle_id = m.messstelle_id
  ORDER BY st.messstelle_id, m.stoff_nr, m.datum_pn;

ALTER TABLE gw.v_gw_station_nitrat
    OWNER TO env_master;
```

TASK 2 OpenHygrisC Nitrate Data: Creation of a movie with the QGIS Temporal Controller Connected to PostgreSQL/PostGIS

- QGIS Nitrat temporal controller



env_master — QGIS

Temporal Controller

Current frame: 2013-01-01 00:00:00 ≤ *t* < 2014-01-01 00:00:00

□ Loop

Animation range 2010-01-01 00:00:00 to 2019-12-31 23:00:00 Step 1.000 years

An update to the QuickMapServices plugin is available

Install Updates... *1 more*

Coordinate 230054, 5592676 Scale 1:1273000 Magnifier 100% Rotation 0.0 ° ☑ Render EPSG:25832

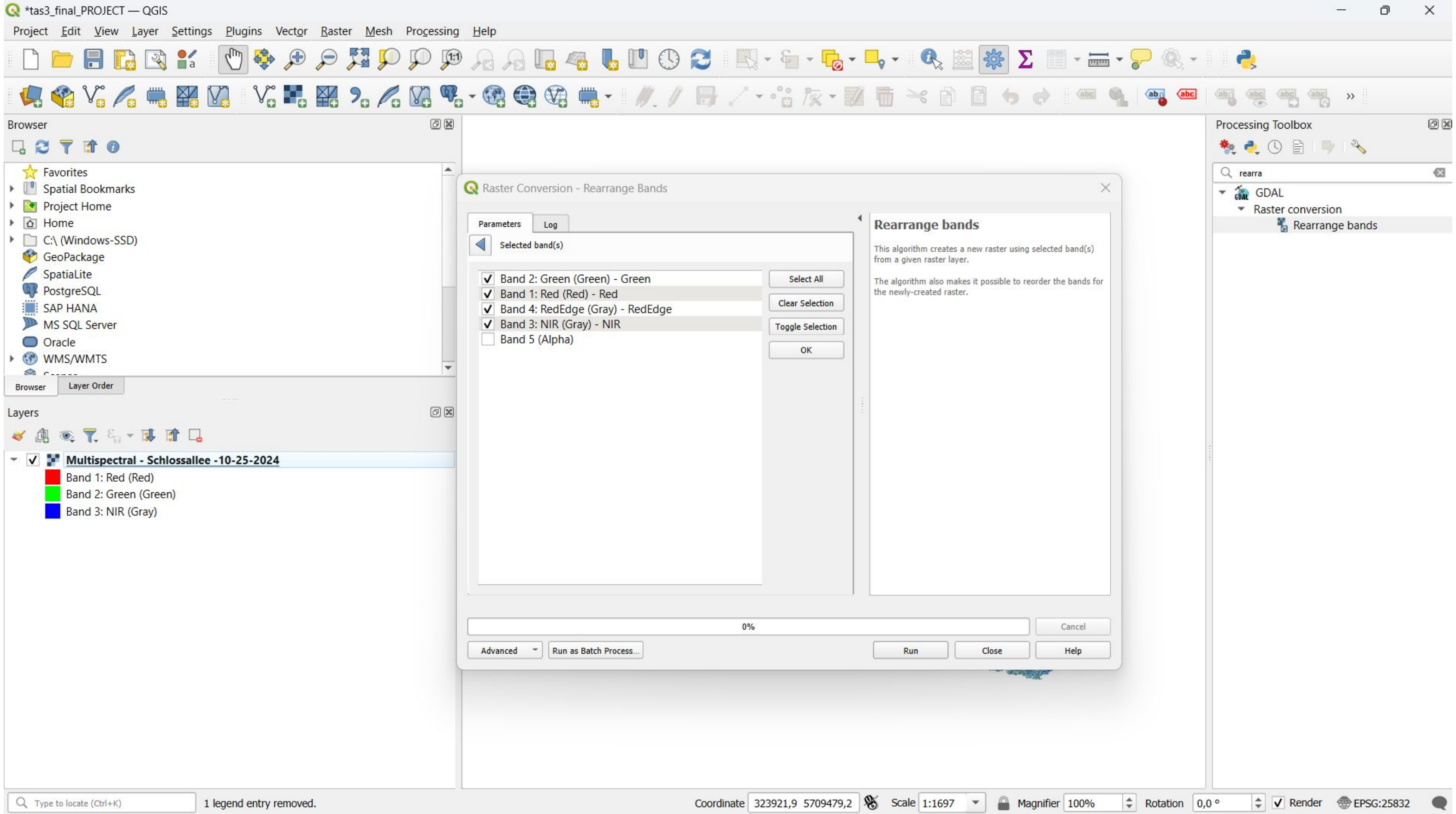
TASK 3 Supervised Land Cover Classification

3.1 Download and install OTB as explained the following link. Notice the differences according to your operative system!

3.2 Once installed you have to go into QGIS and enable the plugin and make sure to set the paths pointing to your OTB installation as described in this link

3.3 If you haven't done that yet. You should download the multispectral orthorectified of the survey area that your group generated and import it in QGIS as a raster layer.

Task 3.4 Rearrange the bands such that they are in the order (Green, Red, Red-Edge, Near-Infrared).



*tas3_final_PROJECT — QGIS

Raster Conversion - Rearrange Bands

Selected band(s)

- ☑ Band 2: Green (Green) - Green
- ☑ Band 1: Red (Red) - Red
- ☑ Band 4: RedEdge (Gray) - RedEdge
- ☑ Band 3: NIR (Gray) - NIR
- ☐ Band 5 (Alpha)

Rearrange bands

This algorithm creates a new raster using selected band(s) from a given raster layer.

The algorithm also makes it possible to reorder the bands for the newly-created raster.

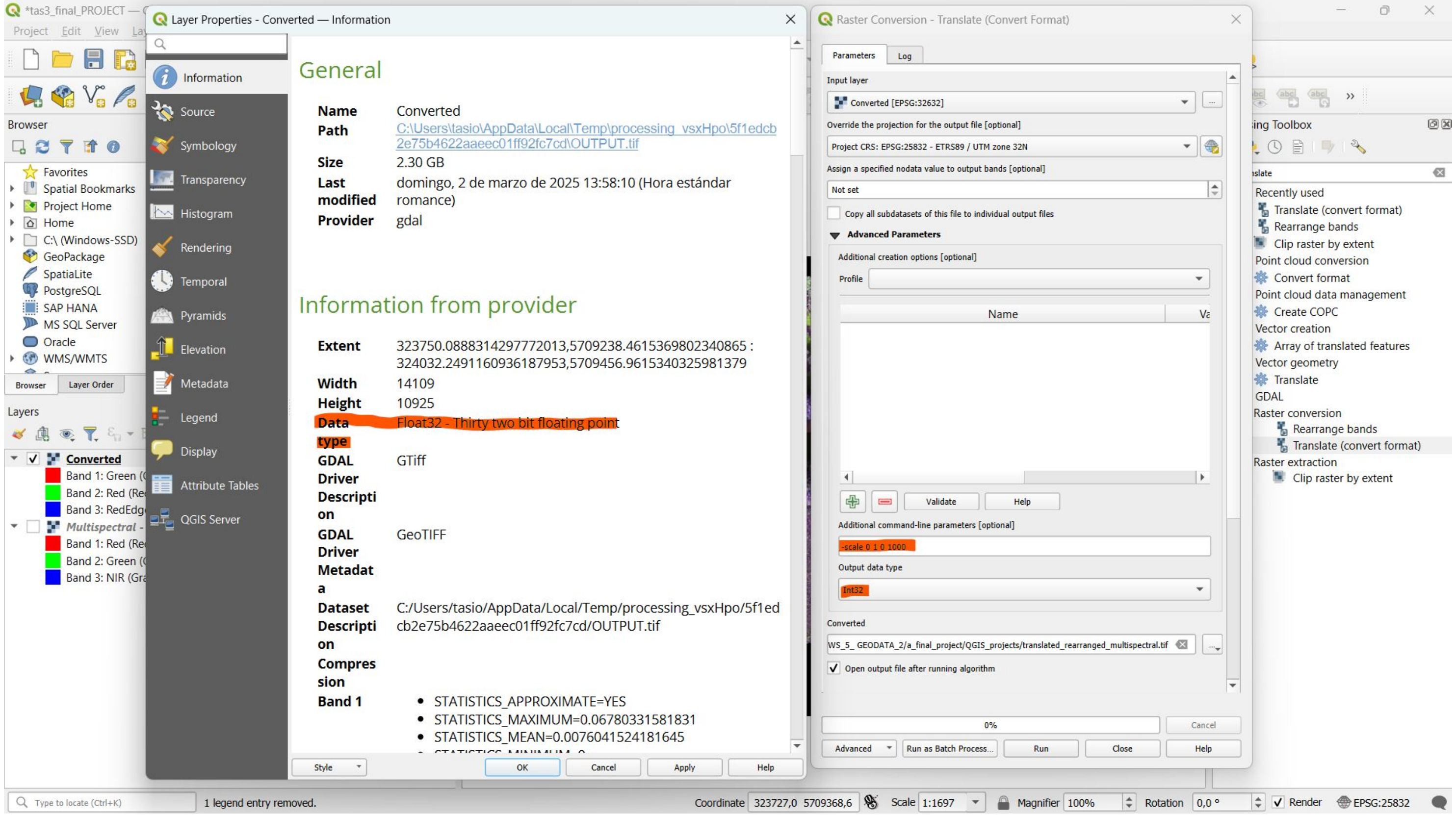
Processing Toolbox: rearra — GDAL > Raster conversion > Rearrange bands

Layers: ☑ Multispectral - Schlossallee -10-25-2024
- 🟥 Band 1: Red (Red)
- 🟩 Band 2: Green (Green)
- 🟦 Band 3: NIR (Gray)

1 legend entry removed.

Coordinate 323921,9 5709479,2 Scale 1:1697 Magnifier 100% Rotation 0,0 ° ☑ Render EPSG:25832

Task 3.5 Converting floating values into integer using the GDAL Translate tool.



General

Name	Converted
Path	C:\Users\tasio\AppData\Local\Temp\processing_vsxHpo\5f1edcb2e75b4622aaeec01ff92fc7cd\OUTPUT.tif
Size	2.30 GB
Last modified	domingo, 2 de marzo de 2025 13:58:10 (Hora estándar romance)
Provider	gdal

Information from provider

Extent	323750.0888314297772013,5709238.4615369802340865 : 324032.2491160936187953,5709456.9615340325981379
Width	14109
Height	10925
Data type	Float32 - Thirty two bit floating point
GDAL Driver Description	GTiff
GDAL Driver Metadata	GeoTIFF
Dataset Description	C:/Users/tasio/AppData/Local/Temp/processing_vsxHpo/5f1edcb2e75b4622aaeec01ff92fc7cd/OUTPUT.tif
Compression	
Band 1	• STATISTICS_APPROXIMATE=YES • STATISTICS_MAXIMUM=0.06780331581831 • STATISTICS_MEAN=0.0076041524181645 • STATISTICS_MINIMUM=0

Input layer
Converted [EPSG:32632]

Override the projection for the output file [optional]
Project CRS: EPSG:25832 - ETRS89 / UTM zone 32N

Assign a specified nodata value to output bands [optional]
Not set

☐ Copy all subdatasets of this file to individual output files

Advanced Parameters

Additional creation options [optional]
Profile

Name	Va

Additional command-line parameters [optional]
```
-scale 0 1 0 1000
```

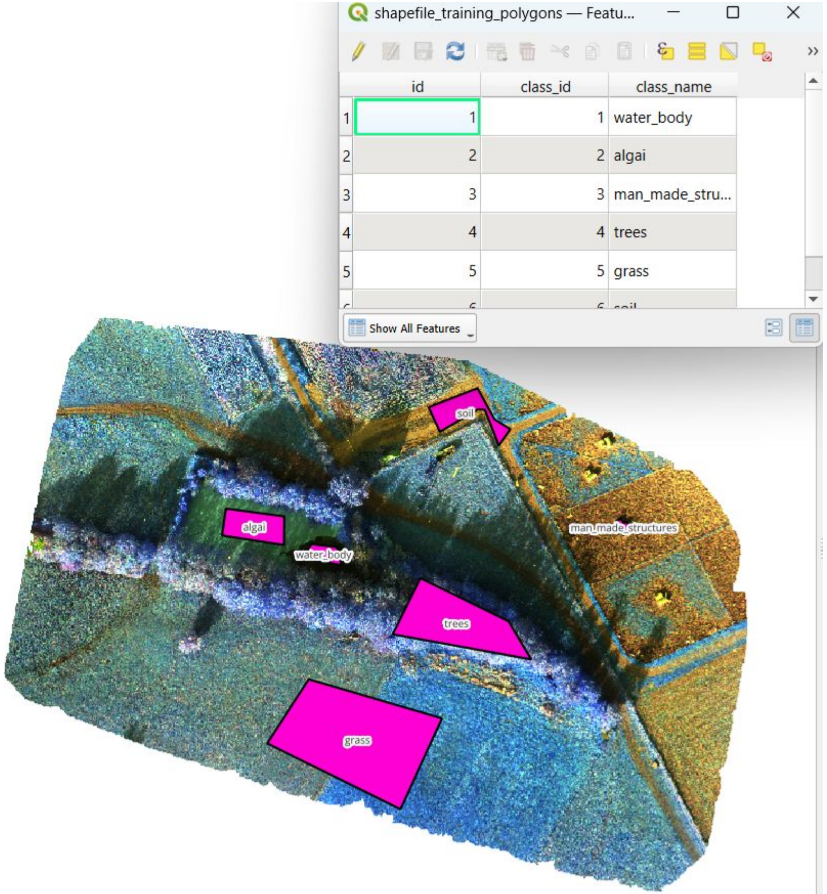
Output data type
Int32

Converted
WS_5_ GEODATA_2/a_final_project/QGIS_projects/translated_rearranged_multispectral.tif

☑ Open output file after running algorithm

The command is to rescale all values across all bands. They are all getting multiplied by 1000 so they don't get rounded to 0 or 1 during the conversion from float to int.

Task 3.6 Land Cover Classification

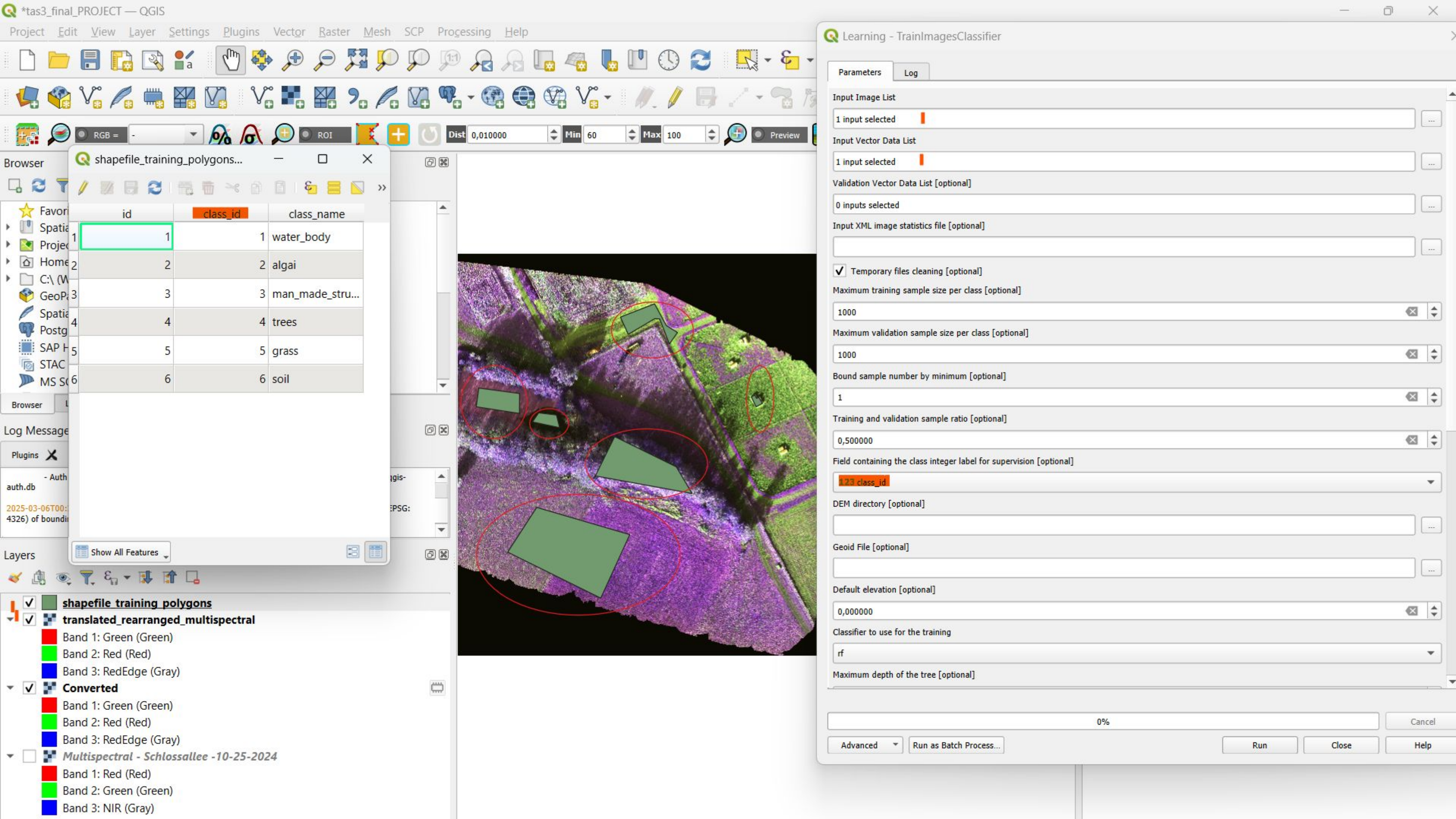


	id	class_id	class_name
1	1	1	water_body
2	2	2	algai
3	3	3	man_made_stru...
4	4	4	trees
5	5	5	grass
6	6	6	soil

Assigning polygons a class so that i can use the train image classifier function.

1. A vector layer was created representing each one of the classes.

2. OTB’s TrainImageClasiffier tool is trained with this vector layer and the produced (rearranged and translated) multispectral layer.



shapefile_training_polygons...

	id	class_id	class_name
1	1	1	water_body
2	2	2	algai
3	3	3	man_made_stru...
4	4	4	trees
5	5	5	grass
6	6	6	soil

Learning - TrainImagesClassifier

Input Image List

1 input selected

Input Vector Data List: 1 input selected

Validation Vector Data List [optional]: 0 inputs selected

Input XML image statistics file [optional]:

☑ Temporary files cleaning [optional]

Maximum training sample size per class [optional]: 1000

Maximum validation sample size per class [optional]: 1000

Bound sample number by minimum [optional]: 1

Training and validation sample ratio [optional]: 0,500000

Field containing the class integer label for supervision [optional]: 123 class_id

DEM directory [optional]:

Geoid File [optional]:

Default elevation [optional]: 0,000000

Classifier to use for the training: rf

Maximum depth of the tree [optional]

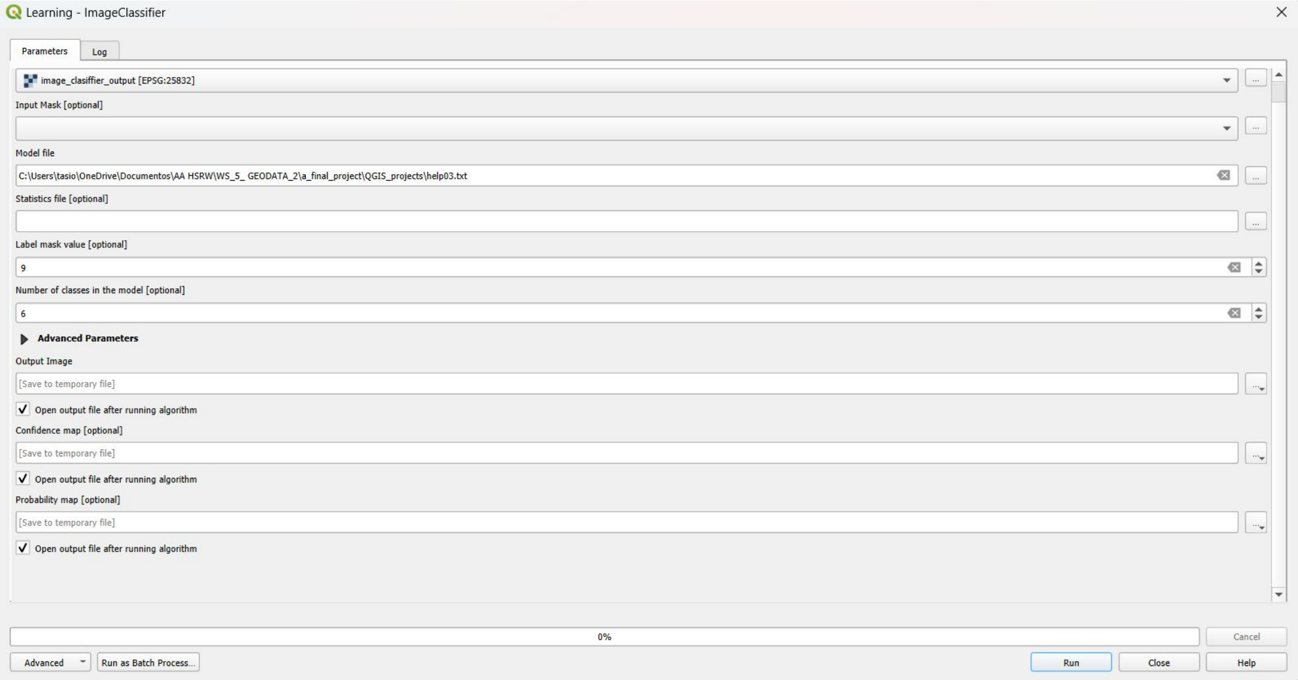
0%

- Auth auth.db
2025-03-06T00: ... 4326) of boundi... gis- ... EPSG:

☑ shapefile_training_polygons
☑ translated_rearranged_multispectral
- 🟥 Band 1: Green (Green)
- 🟩 Band 2: Red (Red)
- 🟦 Band 3: RedEdge (Gray)

☑ Converted
- 🟥 Band 1: Green (Green)
- 🟩 Band 2: Red (Red)
- 🟦 Band 3: RedEdge (Gray)

□ Multispectral - Schlossallee -10-25-2024
- 🟥 Band 1: Red (Red)
- 🟩 Band 2: Green (Green)
- 🟦 Band 3: NIR (Gray)



image_clasiffier_output [EPSG:25832]

Input Mask [optional]

Model file

C:\Users\tasio\OneDrive\Documentos\AA HSRW\WS_5_ GEODATA_2\a_final_project\QGIS_projects\help03.txt

Statistics file [optional]

Label mask value [optional]

9

Number of classes in the model [optional]

6

▶ Advanced Parameters

Output Image

[Save to temporary file]

☑ Open output file after running algorithm

Confidence map [optional]

[Save to temporary file]

☑ Open output file after running algorithm

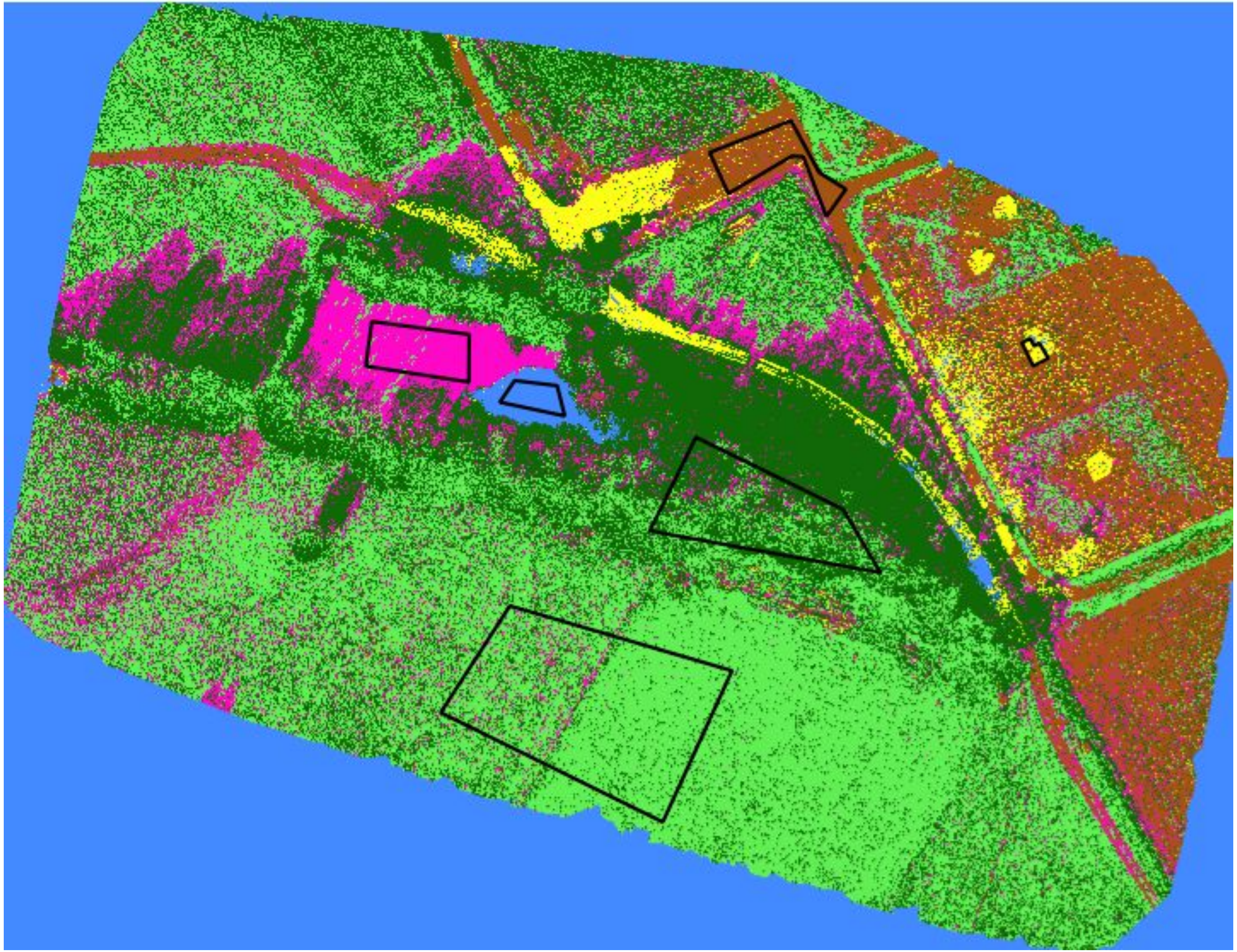
Probability map [optional]

[Save to temporary file]

☑ Open output file after running algorithm

0%

The TrainImageClasifier outputs a text file with the model that has to be given to the Image Classifier. After running this tool you get a classified raster layer according to the classes in your vector layer and a confidence map.

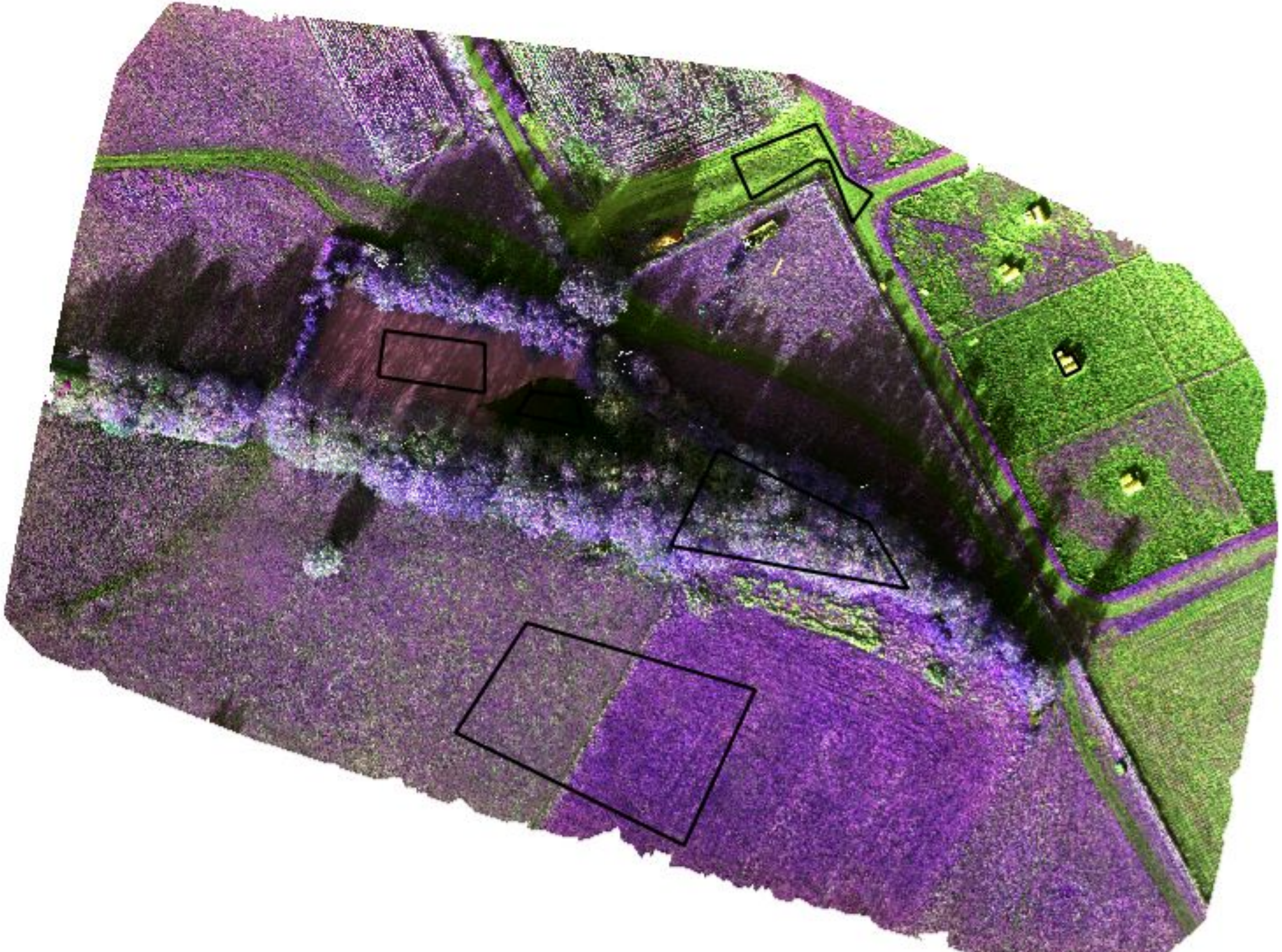


1. Lake → blue
2. Algae → pink
3. Grass → light green
4. Trees → dark green
5. Soil → brown
6. Man-made-structures → yellow

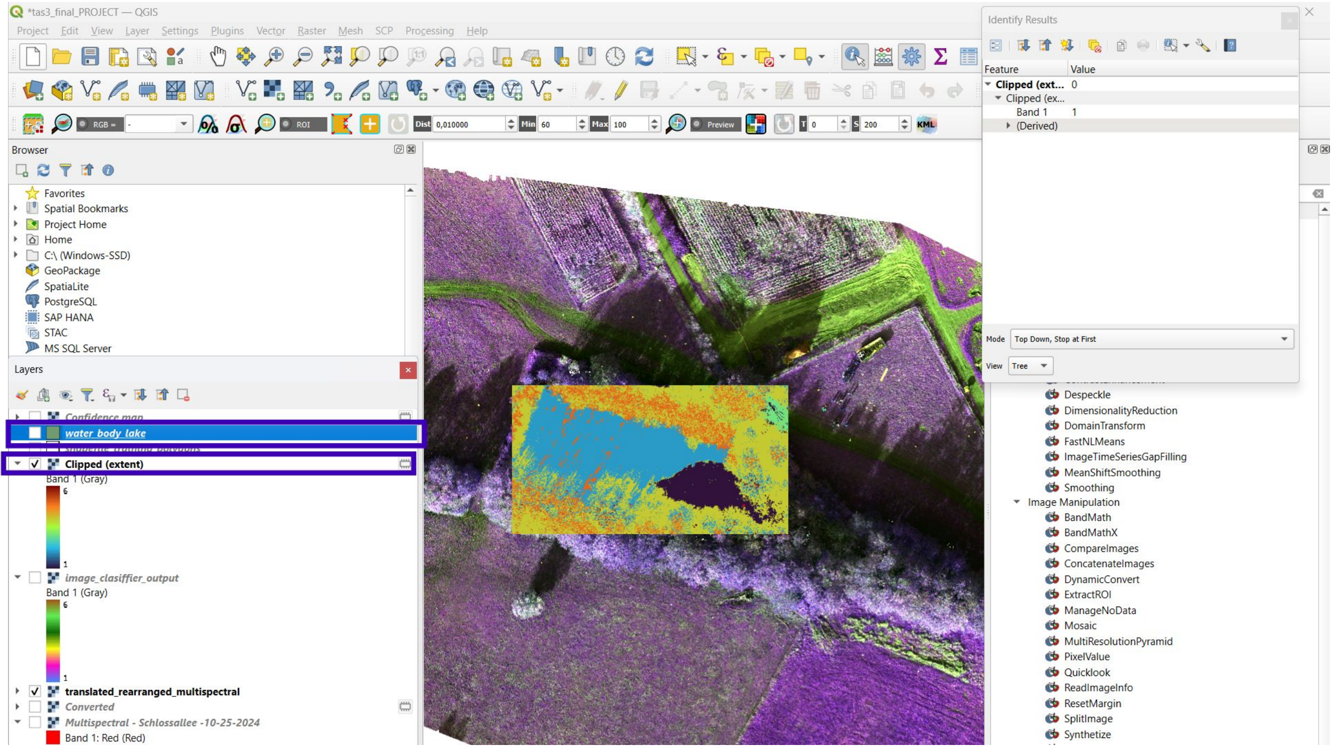
3.7 Assessment of the classification

Visual Inspection (Qualitative Assessment)

- **Where the Classification is Good:**
    - The algae in the lake were correctly identified, which means the spectral signature of algae was well captured.
    - Other major land cover types (trees, water, soil) were detected, though with some blending.
- **Where the Classification Struggles:**
    - **Grass misclassified as algae:** Likely because they have similar spectral reflectance in certain bands (e.g., NIR and Red-Edge).
    - **Mud roads classified as man-made structures:** Could be due to brightness disimilarity with other soil surfaces where the model was trained, most likely attributed to shadowing effects.



3.8 How much area of the lake is the algae covering?



RGB = - ROI Dist 0,010000 Min 60 Max 100 Preview T 0 S 200

Feature	Value
Clipped (ext...	0
Clipped (ex...	
Band 1	1
(Derived)	

Mode Top Down, Stop at First

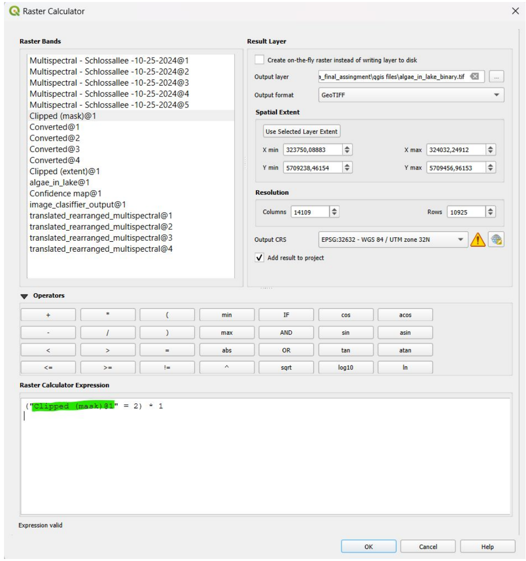
View Tree

1. A raster extraction by the extent drawn on the map canvas was performed on the image classified raster in order to get rid of the algae pixels outside of the lake.

2. Then a vector layer containing the lake extent was imported and the raster was clipped with this mask layer.

This creates a **binary raster** where:

- **Algae pixels = 1**
- **Everything else = 0**



Raster Calculator

Raster Bands

Multispectral - Schlossallee -10-25-2024@1
Multispectral - Schlossallee -10-25-2024@2
Multispectral - Schlossallee -10-25-2024@3
Multispectral - Schlossallee -10-25-2024@4
Multispectral - Schlossallee -10-25-2024@5
Clipped (mask)@1
Converted@1
Converted@2
Converted@3
Converted@4
Clipped (extent)@1
algae_in_lake@1
Confidence map@1
image_clasiffier_output@1
translated_rearranged_multispectral@1
translated_rearranged_multispectral@2
translated_rearranged_multispectral@3
translated_rearranged_multispectral@4

Result Layer

□ Create on-the-fly raster instead of writing layer to disk

Output layer: a_final_assingment\qgis files\algae_in_lake_binary.tif

Output format: GeoTIFF

Spatial Extent

X min: 323750,08883 | X max: 324032,24912
Y min: 5709238,46154 | Y max: 5709456,96153

Resolution

Columns: 14109 | Rows: 10925

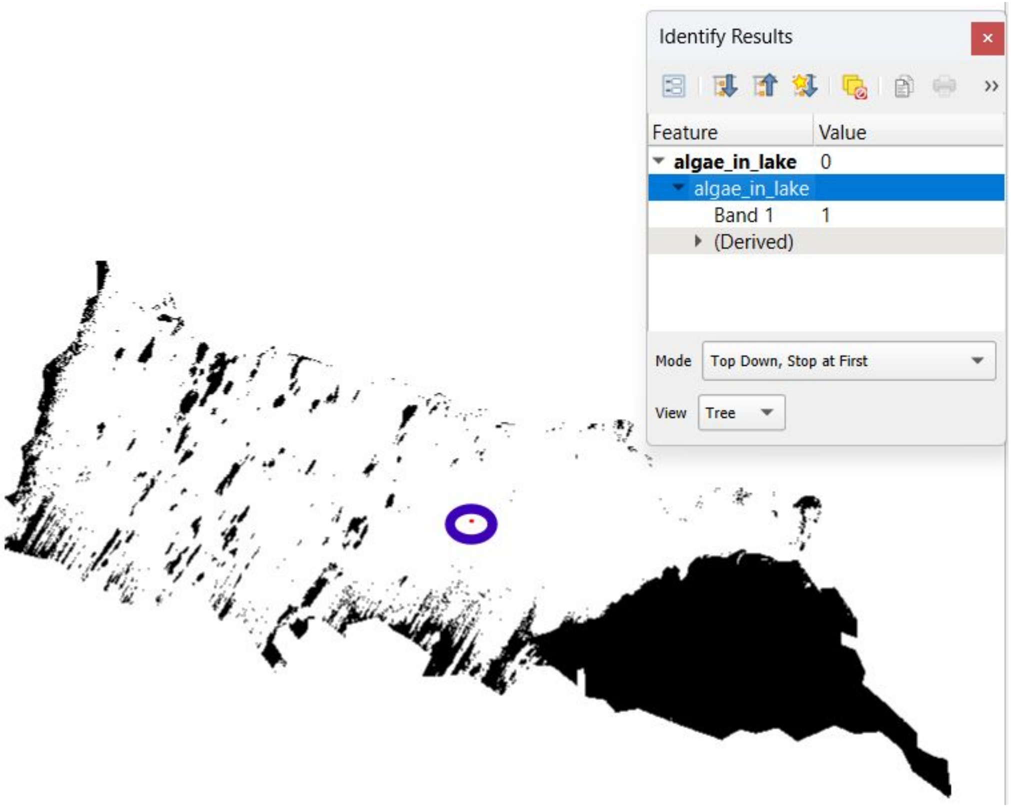
Output CRS: EPSG:32632 - WGS 84 / UTM zone 32N

☑ Add result to project

Raster Calculator Expression

```
("Clipped (mask)@1" = 2) * 1
```

Expression valid

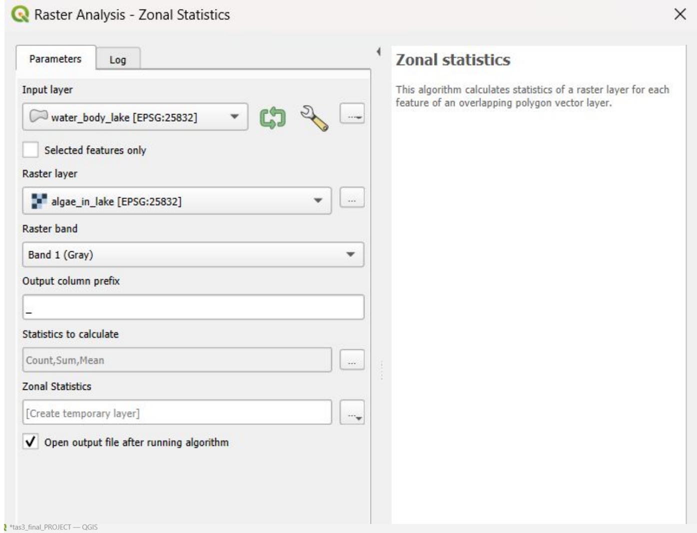


Identify Results

Feature	Value
algae_in_lake	0
algae_in_lake	
Band 1	1
(Derived)	

Mode: Top Down, Stop at First

View: Tree



Raster Analysis - Zonal Statistics

Input layer: water_body_lake [EPSG:25832]

☐ Selected features only

Raster layer: algae_in_lake [EPSG:25832]

Raster band: Band 1 (Gray)

Output column prefix: _

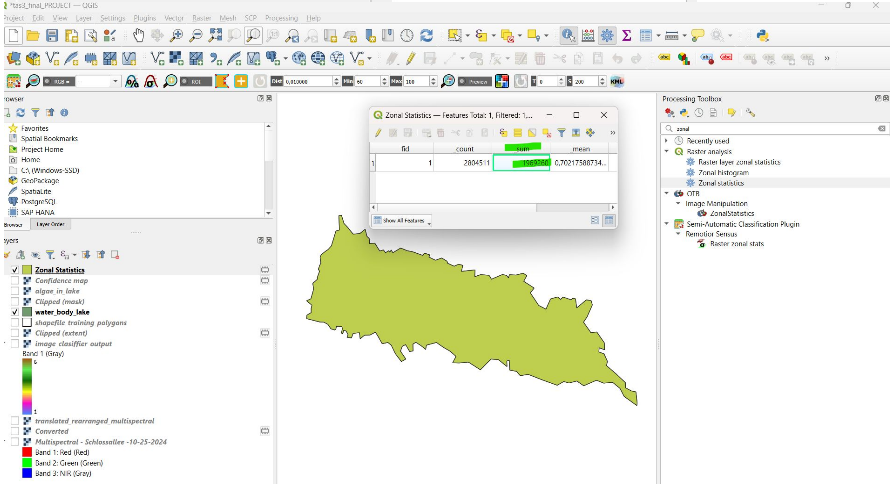
Statistics to calculate: Count,Sum,Mean

Zonal Statistics: [Create temporary layer]

☑ Open output file after running algorithm

Zonal statistics

This algorithm calculates statistics of a raster layer for each feature of an overlapping polygon vector layer.



Zonal Statistics — Features Total: 1, Filtered: 1,...

	fid	_count	_sum	_mean
1	1	2804511	1969260	0,70217588734...

- The Zonal Statistics was used in order to count the number of pixels with a value 1 in the previously created binary layer.

- The Sum represents the number of pixels inside the lake that were classified as algae.

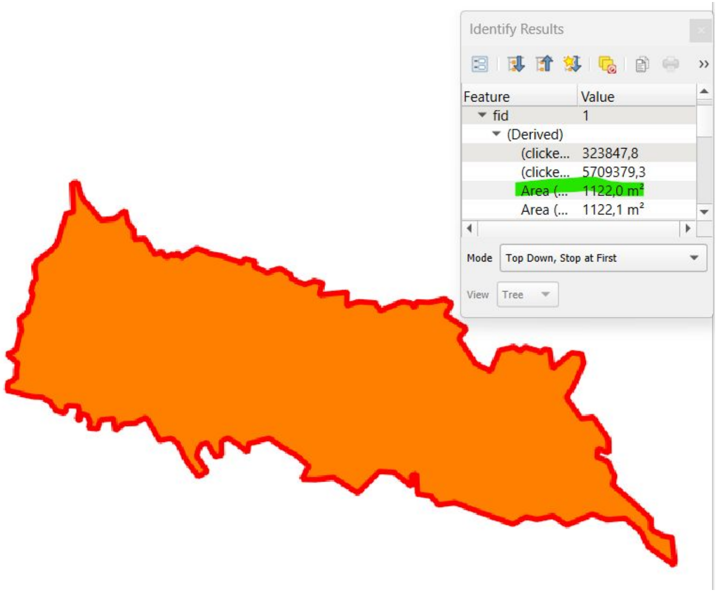
Results:

Algae Area = Sum of pixels×(pixel size) =

1969260 * (0.0199986 *0.0199999) =

1969260 * 0.00039997 = 787.56m^2

This results make sense since the whole area of the lake is 1122m^2.



Feature	Value
fid	1
(Derived)	
(clicke...	323847,8
(clicke...	5709379,3
Area (...	1122,0 m²
Area (...	1122,1 m²

Mode Top Down, Stop at First

View Tree

32375: Your Personal View

- Biggest challenges?

The biggest challenge for me was working drone images (multispectral layers) in QGIS since it was the first time we ever did that and there were no resources on moodle on how to approach this kinds of tasks.

- Lessons learned?

Since there were no resources available I had to do a lot of online research in order to complete the tasks and that taught me a lot about spectral indices and how to use qgis for classifying land covers according to your inputs.

- Whatever you want to say related to coure

32375: Self-Assessment, Part 1

- What is your role in the group?

  QGIS guy

- Which (sub)tasks are you responsible for?

  Task 1 and Task 3

- With whom have you been cooperating?

  GIS course

  Chat gpt

  Geospatial School (youtube)

32375: Self-Assessment, Part 2
(On a scale from 1 (poor) to 5 (very good))

- What is your personal knowledge gain?

4

- How do you rate your commitment?

5

- How difficult is your task?

4 (difficult)

32998: Your Personal View

- Biggest challenges?

    Using the jupyter notebook provided for Task 2

- Lessons learned?

    Using QGIS and PgAdmin

- Whatever you want to say related to course

32998: Self-Assessment, Part 1

- What is your role in the group?
- Collaborator
- Which (sub)tasks are you responsible for?
- Task 2 and task 1 and 2 in the assignment
- With whom have you been cooperating?
- Tasio Rodriguez (teammate), QGIS (For GeoData representations)

32998: Self-Assessment, Part 2
(On a scale from 1 (poor) to 5 (very good))

- What is your personal knowledge gain?
- [1-5]
- How do you rate your commitment?
- [1-5]
- How difficult is your task?
- [1-5]
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