# Open Geospatial System for LUCAS In-situ Data Harmonization and Distribution

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ODSE Workshop, 13. - 16. June 2022

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- LUCAS dataset introduction

- ST_LUCAS system

- Conclusions

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# LUCAS dataset introduction

- **Land Use and Coverage Area frame Survey** (LUCAS)

- Activity managed by Eurostat, https://ec.europa.eu/eurostat/web/lucas

- Started in 2000 to identify changes in land cover and land use (EU territory)

  - Such information aim to be used in: nature protection, forest and water management, urban and transport planning, agricultural policy, etc.

- In-situ surveys over Europe every three years since 2006

  - Series of 2006, 2009, 2012, 2015, and 2018 observations

  - Next survey planned for March-September 2022

- Real and unique ground-true data for land products validation and new models calibration

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# LUCAS dataset introduction

LUCAS spatial sampling

- Sampling density given by 2x2 km grid (1+ MIO points), https://ec.europa.eu/eurostat/web/lucas/data/lucas-grid
- Theoretical vs. surveyed GPS coordinates (OBS_DIST attribute)
- Total 1.3 MIO points

| Year | EU countries | Points |
|------|--------------|---------|
| 2006 | 11 | 168 402 |
| 2009 | 23 | 234 623 |
| 2012 | 27 | 270 272 |
| 2015 | 28 | 339 696 |
| 2018 | 28 | 337 854 |
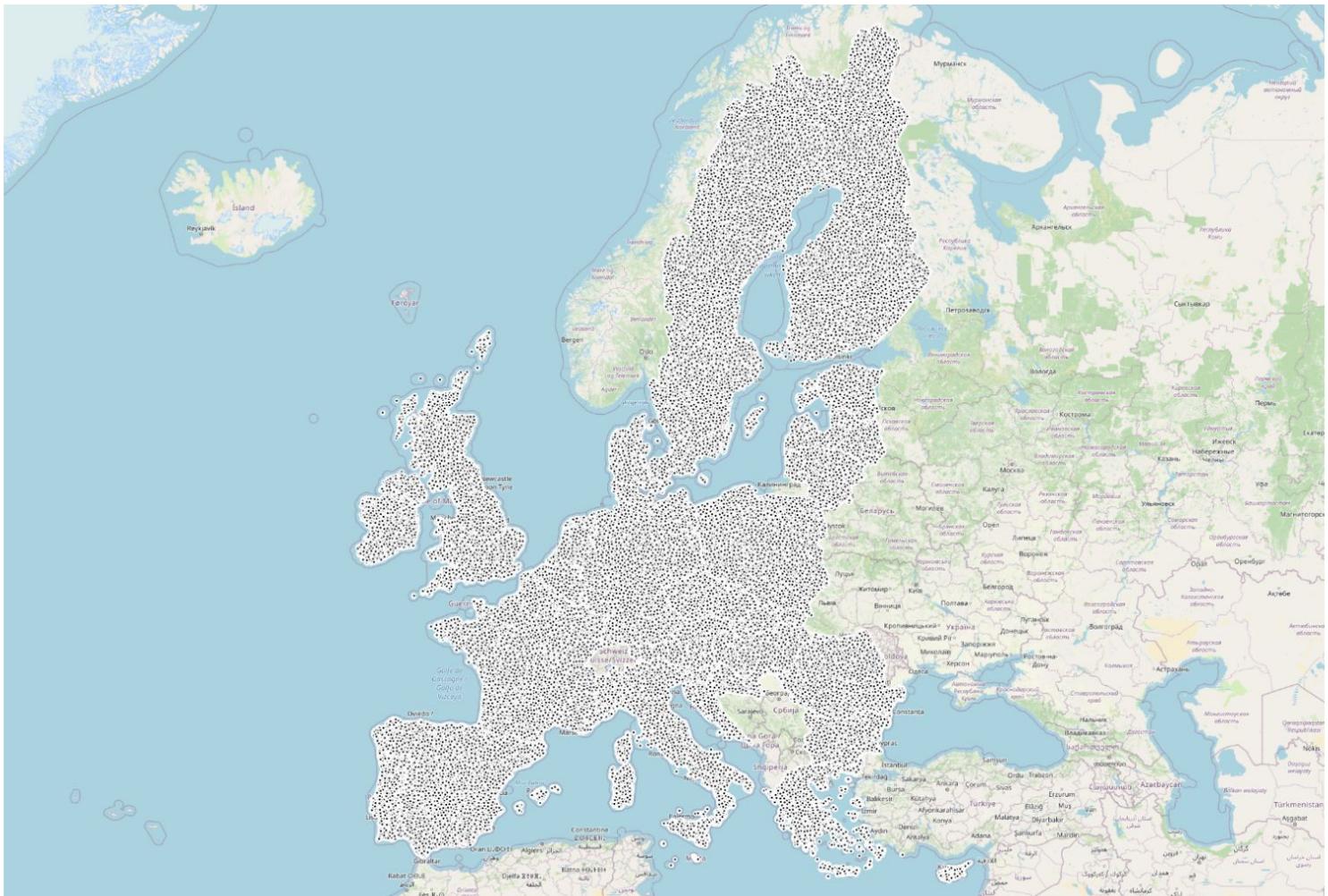
# LUCAS dataset introduction

LUCAS survey

- Examine land cover (76 classes) and land use (41 classes)

- Structural elements in the landscape

- Collect photos (facing + 4 directions)

- Evaluate agro-environmental information

- Take a 500-gram topsoil sample at one out of 10 points

- In 2018 Copernicus, INSPIRE and EUNIS attributes added
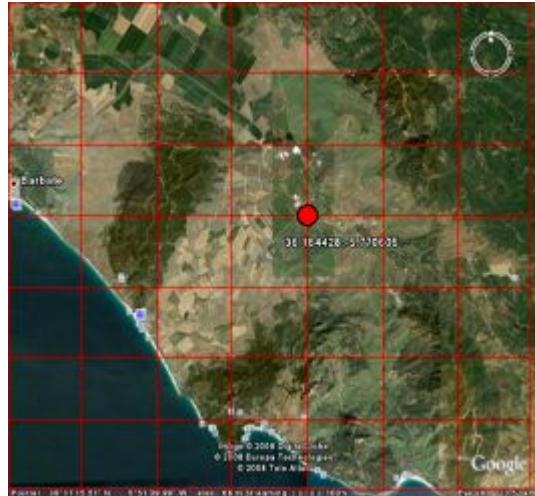




| Year | Number of attributes |
|------|----------------------|
| 2006 | 20 |
| 2009 | 44 |
| 2012 | 46 |
| 2015 | 59 |
| 2018 | 97 |

# LUCAS dataset introduction

LUCAS attributes evolution (2006-2018)

- 5 attributes <u>removed</u>

  - example: TRANSECT (2009 - 2015), removed in 2018

- 77 attributes <u>added</u>

  - example: LU1_TYPE (added in 2015)

- 24 attributes <u>renamed</u>

  - example: LAND_MNGT (2009 - 2015) vs. GRAZING (2018)

- 30 attributes affected by <u>different coding</u>

  - example (LC1):

    - C21 - Other broadleaved tree land (2006)

    - C21 - Spruce dominated coniferous woodland (2012 - 2018)

→ <u>Not analysis-ready dataset</u> for temporal change analysis

# LUCAS dataset introduction

LUCAS data distribution - state of the art

- Official CSV files (primary data) provided by Eurostat,

  https://ec.europa.eu/eurostat/web/lucas/data/primary-data


- 2006 (20 attributes)

  ```
  POINT_ID,X_LAEA,Y_LAEA,NUTS0,NUTS1,NUTS2,SURV_DATE,OBS_TYPE,GPS_PROJ,...,LU2
  44763016,4476000,3016000,CZ,CZ0,CZ04,13/05/2006,1,1,...,0000
  ```

  …

- 2018 (97 attributes)

  ```
  "POINT_ID","NUTS0","NUTS1","NUTS2","TH_LAT","TH_LONG","SURVEY_DATE"...,"PHOTO_WEST"
  47942920,"CZ","CZ0","CZ06",49.204903506,16.499028498,"02/08/18"...,1
  ```

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# ST_LUCAS system

Goals

- Provide harmonized space-time aggregated LUCAS dataset

- Fully automated harmonization process

  - Configurable & Extensible

- LUCAS data provided through OGC web service

- Python API for geospatial developers and scientists

- QGIS plugin for wider audience

- Translation method to provide LUCAS land cover data in other nomenclatures

- Allow user-defined analytics as e.g. the legend aggregation

# ST_LUCAS system

Objectives & Architecture

O1 persistent data storage

O2 automation of the harmonization

process & space-time aggregation

O3 standardized (OGC) web service

O4 client Python API & QGIS plugin

O5 land cover translation and

aggregation methods
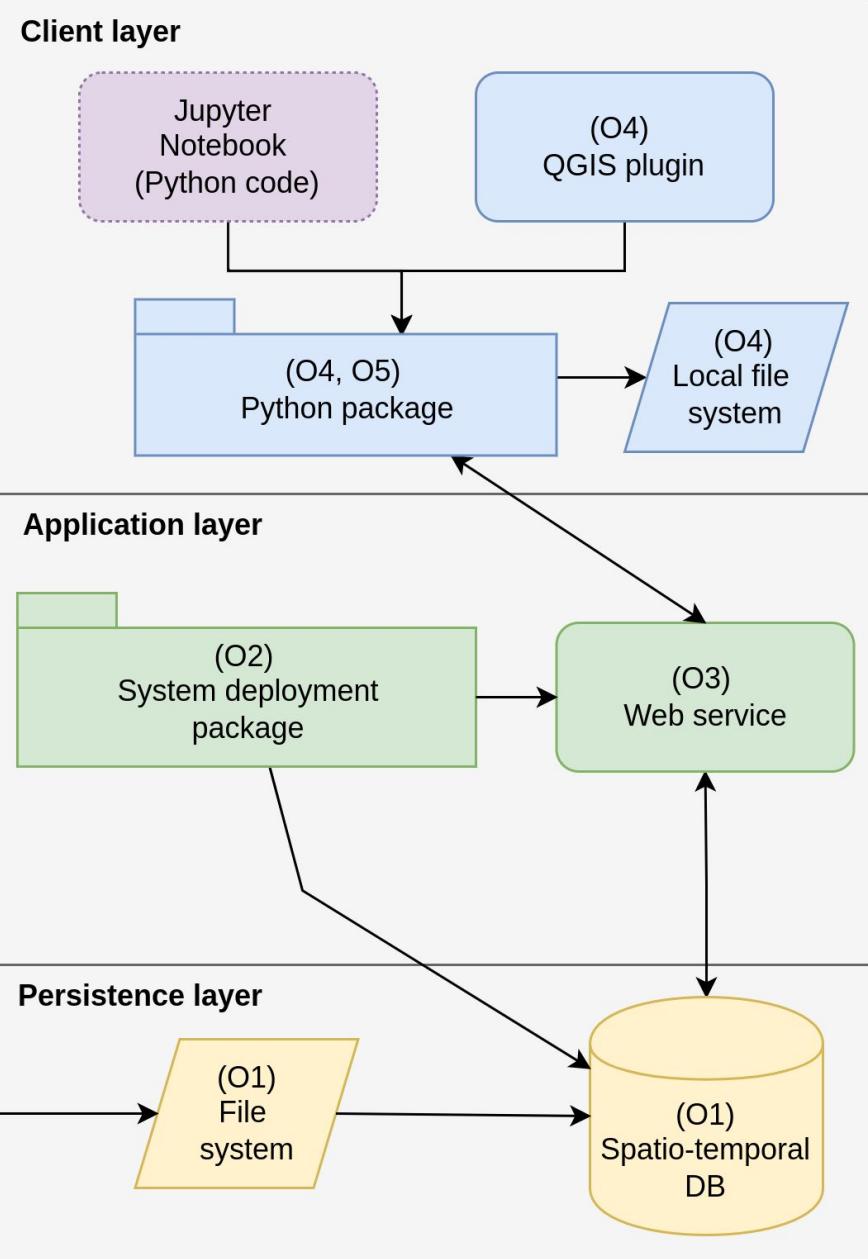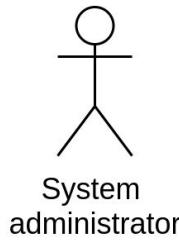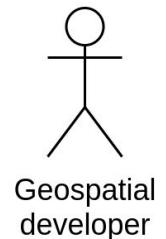
# ST_LUCAS system

Python API

```
request = LucasRequest()

request.countries = ['CZ', 'SK']

request.years = [2015, 2018]

request.group = 'LC_LU'


lucasio = LucasIO()

lucasio.download(request)

print(lucasio.count())


        Number of retrieved points: 17 078
```
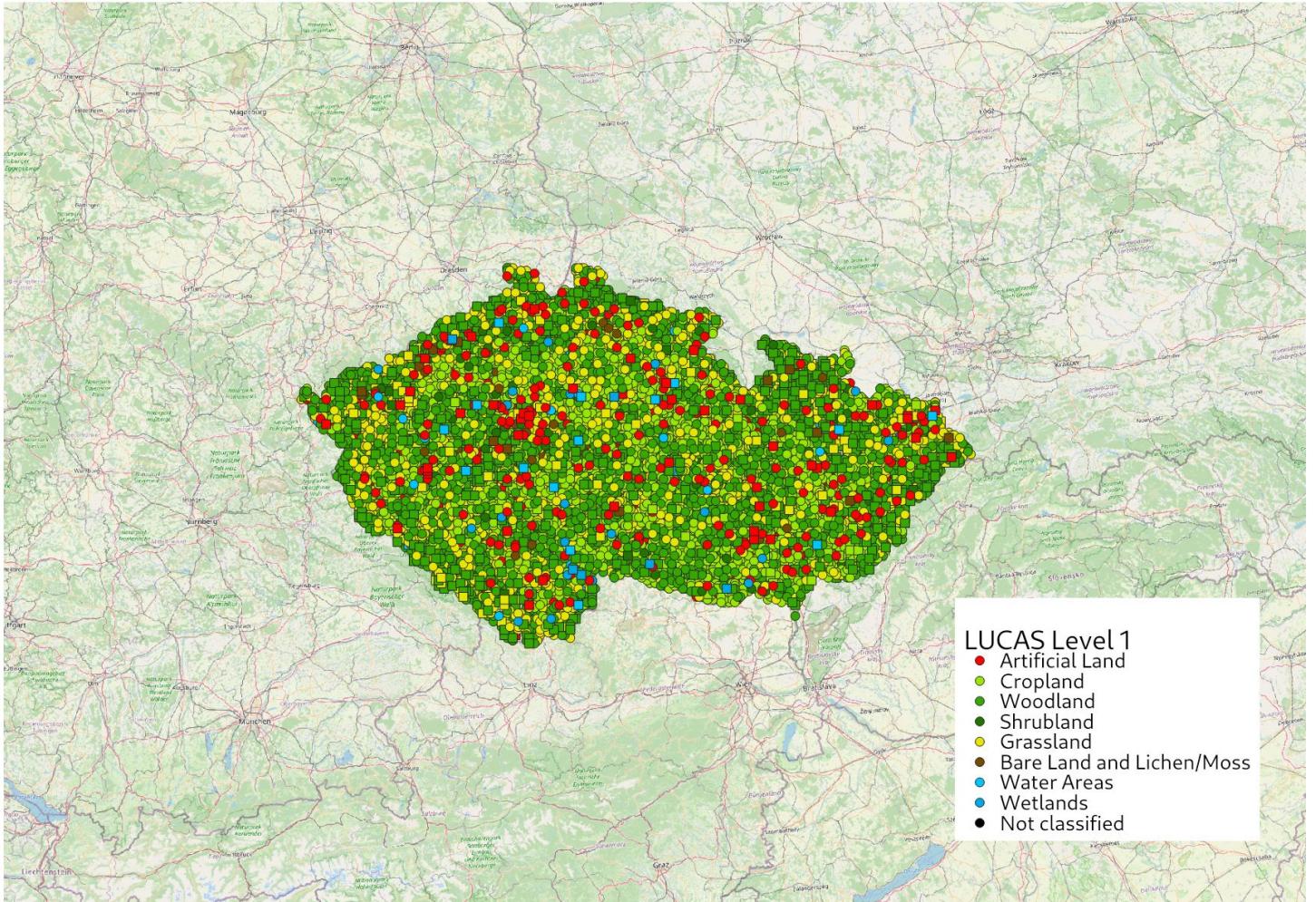


LUCAS Level 1
- Artificial Land
- Cropland
- Woodland
- Shrubland
- Grassland
- Bare Land and Lichen/Moss
- Water Areas
- Wetlands
- Not classified

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# ST_LUCAS system

Python API

```
request = LucasRequest()

request.countries = ['CZ', 'SK']

request.years = [2015, 2018]

request.group = 'LC_LU'

request.st_aggregated = True


lucasio = LucasIO()

lucasio.download(request)

print(lucasio.count())
```

Number of retrieved points: 14 472
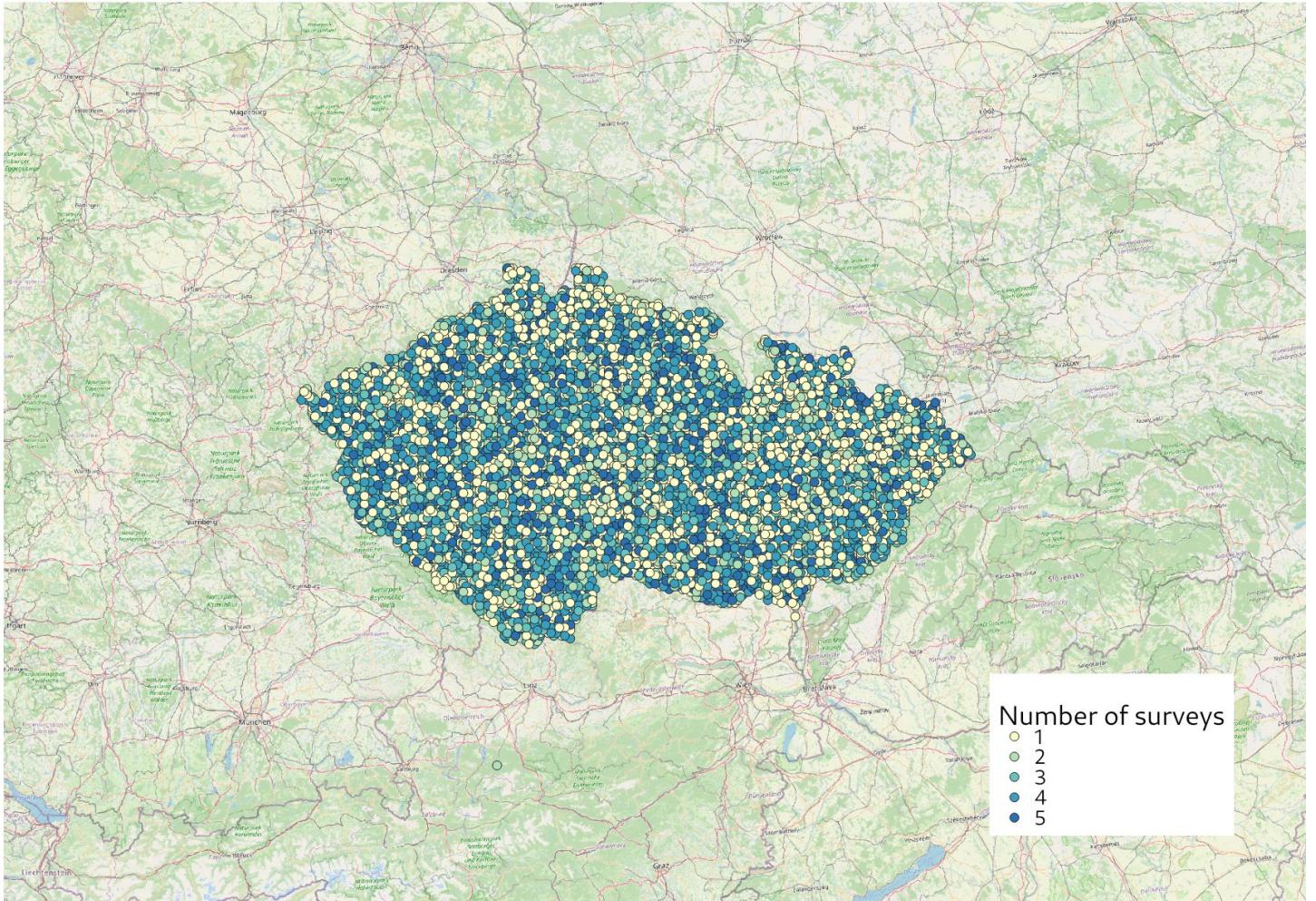
# ST_LUCAS system

QGIS plugin



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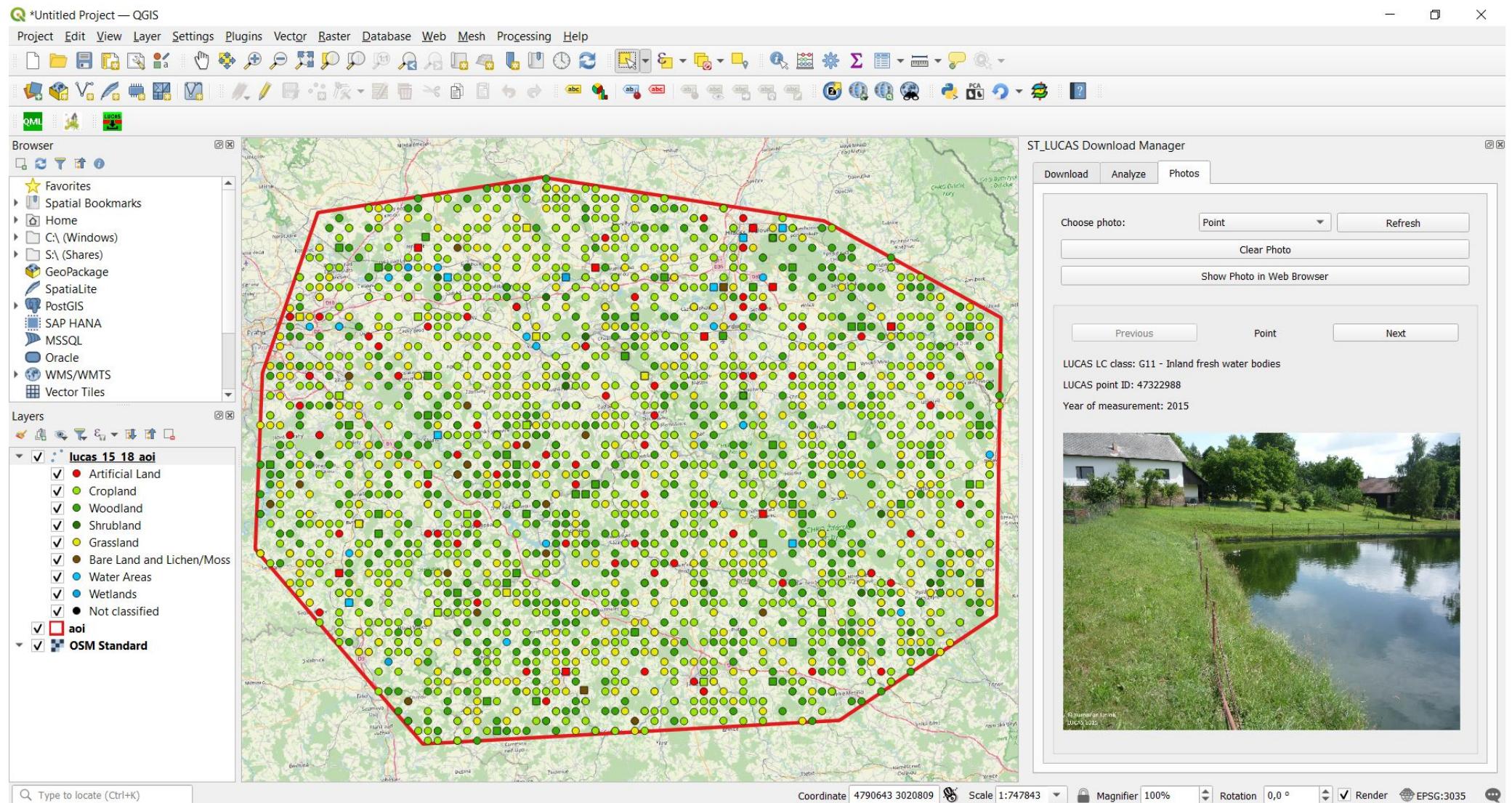
# Conclusions

Summary

- Harmonized and space-time aggregated LUCAS dataset

    - → Analysis-ready dataset

    - List of attributes online
- ST_LUCAS system released as open source software
    - System deployment package to automate LUCAS harmonization process (docker-based)
        - https://gitlab.com/geoharmonizer_inea/st_lucas/st_lucas-system-deployment
    - Python package
        - https://gitlab.com/geoharmonizer_inea/st_lucas/st_lucas-python-package
    - QGIS plugin
        - https://gitlab.com/geoharmonizer_inea/st_lucas/st_lucas-qgis-plugin


- ST_LUCAS demonstration at https://geoforall.fsv.cvut.cz/st_lucas

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# Open Geospatial System for LUCAS In-situ Data Harmonization and Distribution

Acknowledgement

Thank you for your attention!

[ODSE training session]

https://geoforall.fsv.cvut.cz/st_lucas

# ST_LUCAS QGIS Plugin

Demostration ([LINK](#))