Norway grants

Enhancing the user uptake of Land Cover / Land Use information derived from the integration of Copernicus services and national databases "InCoNaDa"



# Hierarchical approach for land cover mapping using Sentinel-2 data

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# Land cover classification based on Sentinel-2



Pixel-based land cover classification based on a time series of Sentinel-2.

Examine non-parametric machine learning algorithms:

- 1. Random Forest (RF)
- 2. Support Vector Machine (SVM)
- 3. Convolution Neural Network (CNN)

The land cover classes refers to Copernicus Land Monitoring Service legend:

- 1. sealed surfaces,
- 2. woodlands broadleaved,
- 3. woodland coniferous,
- 4. shrubs,
- 5. permanent herbaceous (i.e. grassy areas)
- 6. periodically herbaceous (i.e. arable land),
- 7. mosses,
- 8. non-vegetated,
- 9. water,
- 10. snow and ice (only in Norway) Land cover map for 2018 and 2020, Land cover change 2017 - 2021

# Study area



#### Poland – Łódź province





# Data and methods

### Data:

Poland and Norway: Sentinel-2 time series, from April to September.

## **Reference datasets:**

- Poland:
  - BDOT10k -- topographic database (scale1:10 000),
  - Land cover classes from LPIS (Agency for Restructuring and Modernisation of Agriculture (ARMA)),
  - BDL Forest Data Bank (scale 1:50 000).
- Norway:

- AR50 - land resource dataset.

## Land cover classification:

- is carried out in Python environment,
- is iteratively repeated 100 times to asses models stability,
- is performed in cloud computing platform, Amazon Web Services (AWS).







# Flat and hierarchical classification scheme





#### Accuracy and model stability

#### Flat classification

Hierarchical classification





	UA	PA
sealed surfaces	0,63 - 0,82	0,79 - 0,82
woodlands broadleaved	0,77 - 0,89	0,76 - 0,83
woodland coniferous	0,94 - 0,99	0,92 - 0,98
shrubs	0,15 - 0,74	0,38 - 0,77
permanent herbaceous	0,65 - 0, 80	0,73 - 0,81
periodically herbaceous	0,94- 0,96	0,90 - 0,94
mosses	0,32 - 0,67	0,55 - 0,79
non-vegetated	0,18 - 0,76	0,50 - 0,89
water bodies	0,90 - 0,99	0,92 - 0,99





#### Hierarchical classification

#### Flat classification





### Visual comparison of hierarchical and flat classification



#### Hierarchical classification







### Visual comparison of hierarchical and flat classification



#### Hierarchical classification





### Final RF classification for 2018 and 2020 - overview





### Hierarchical approach:

- + Higher classification accuracy.
- + More accurate results.
- + Higher accuracy for individual classes.
- + Addition layers:
  - Imperviousness map,
  - > Tree cover map,
  - > Water bodies map.
- More time consuming
- Approach requires experimentation with subdividing land cover classes into appropriate levels of detail
- More complex classification process

### Flat approach:

- + Faster classification.
- + Easier classification process.

- Lower classification accuracy.
- No additional layers.
- Higher differences in accuracy of individual classes.

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# First classification result of Norwegian study area



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# Land cover change 2017-2021



2020



Analysis are carried out in Google Earth Engine in JavaScript based on differences in spectral indices:

- Normalized Difference Vegetation Index (NDVI)
- Normalized Difference Water Index (NDWI)
- Normalized Burn Ratio (NBR)



2021



Change 2020-2021



# Land cover change 2017-2021



2020



2021



Change 2020-2021







# Thank you for your attention!

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