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Land Cover Mapping through Remote Sensing and Machine Learning for Indonesian Census of Agriculture 2023

APCAS29

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Geospatial for Agricultural Census

2013

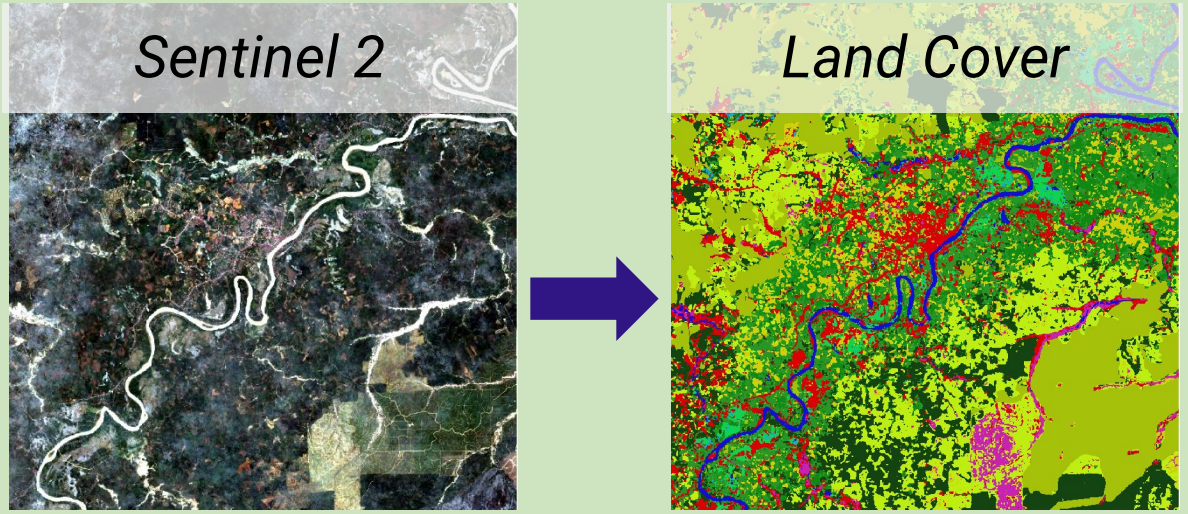
- Delineating the Enumeration Area

2023

- Delineating the Enumeration Area,
- Geotagging the geographic location of agricultural households,
- Identifying the potential agricultural lands through Land Cover Mapping.
- The potential agricultural lands help in designing the enumeration methodology (*snowball* or *door to door*).

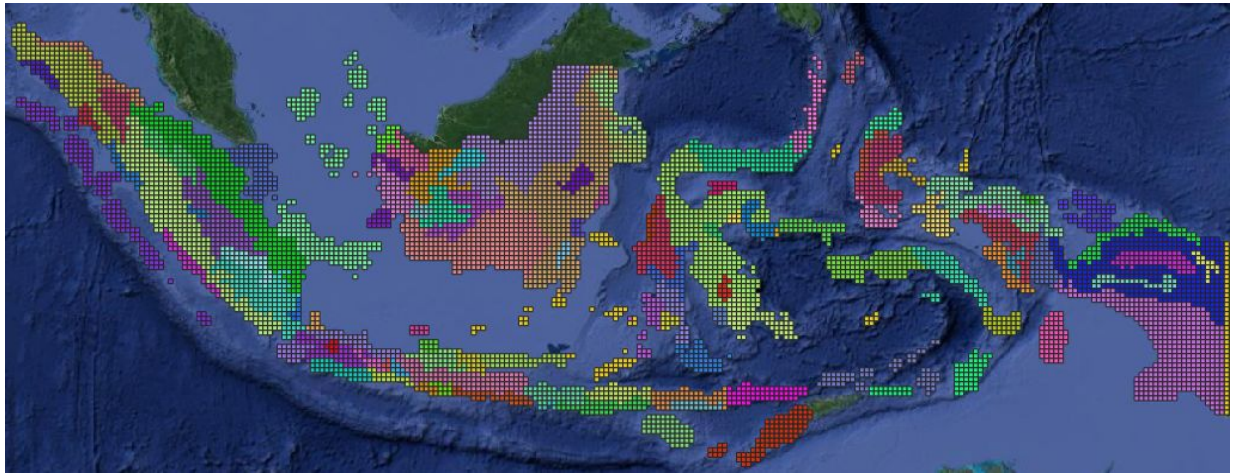
Land Cover Mapping for Agricultural Census 2023

- Agriculture is one of most applicable remote sensing application.
- Remote sensing has become an important tool for monitoring and identifying in agriculture project.
- Machine learning algorithms have been used in the remote sensing since decades.



Challenges

- Diverse characteristic of land cover among region.
- Thick cloud accompanying cloud shadow in remote sensing images.
- Mountainous topography affecting the distortion of the real reflectance value of satellite imagery.



Tools

1. Data Acquisition

GEE

Google Cloud Storage

3. Classification

Jupyterlab & Google Cloud Processing

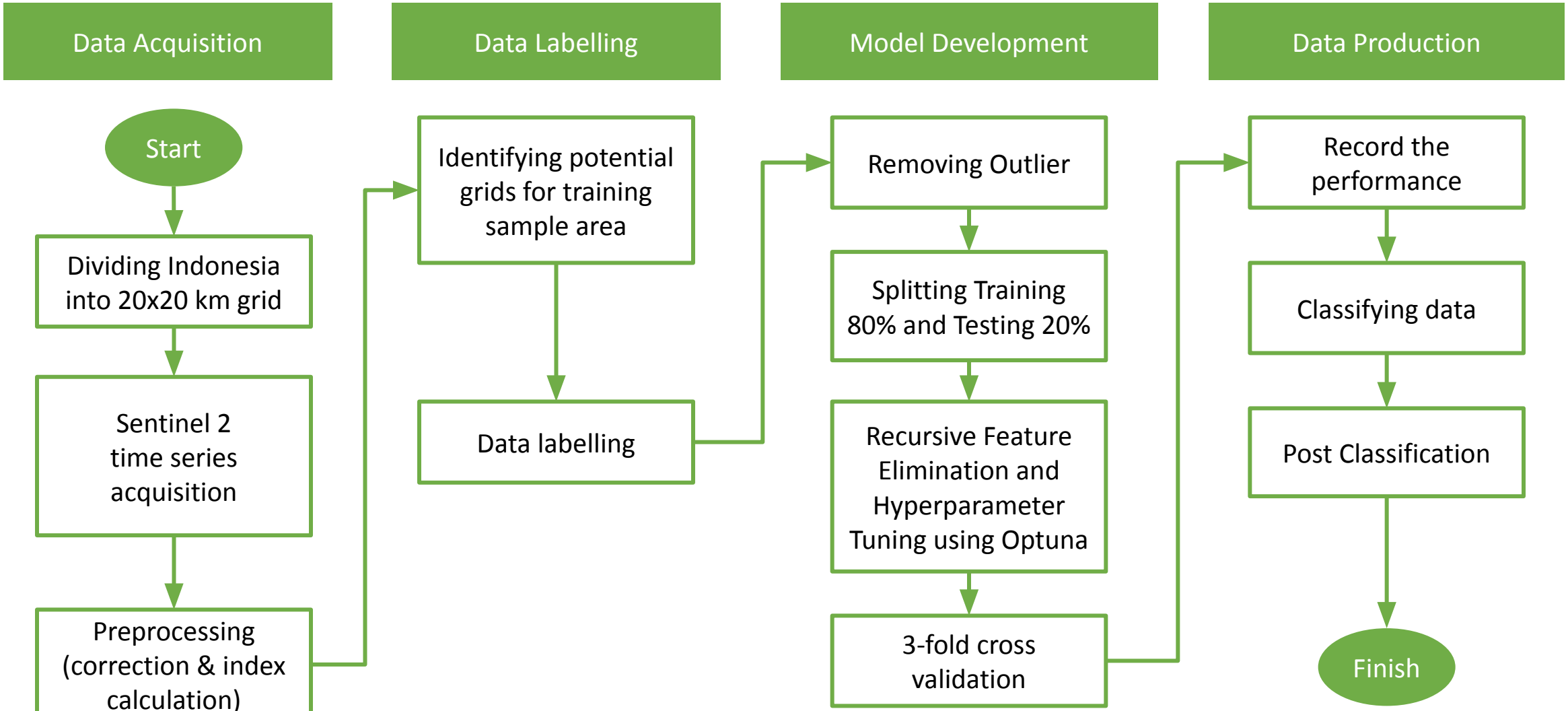
Ground Data (rice fields)

2. Data Labelling

QGIS

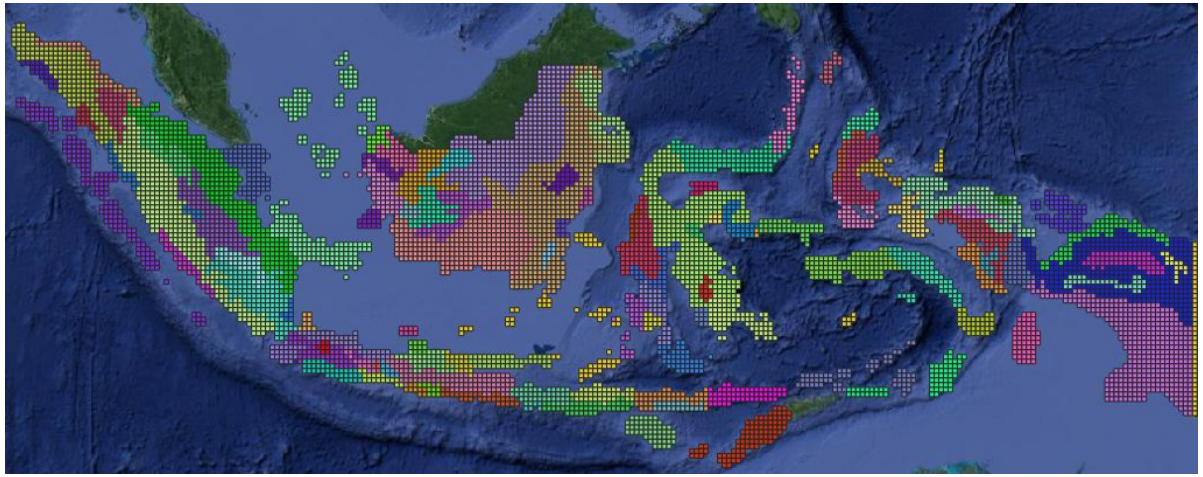
Highres satellite imagery

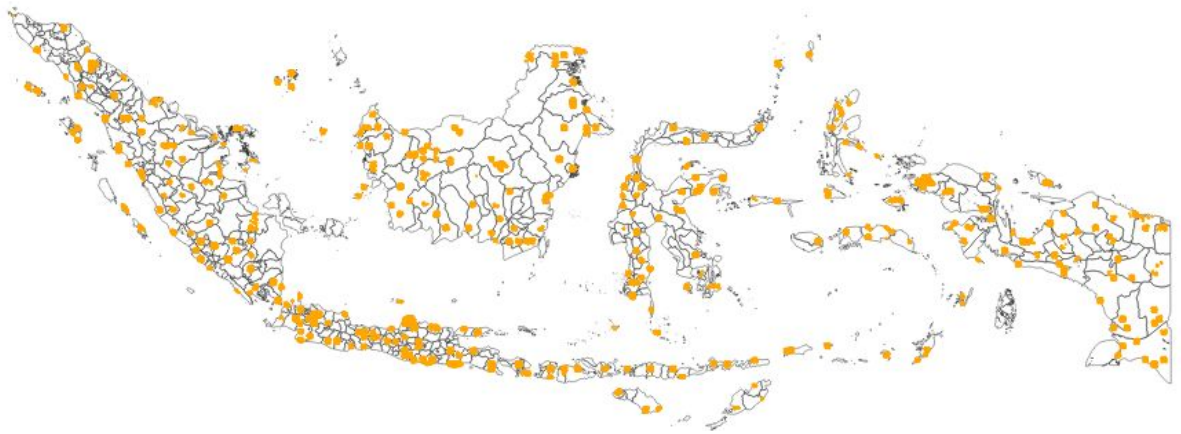
Map Production Pipeline



Data & Volume

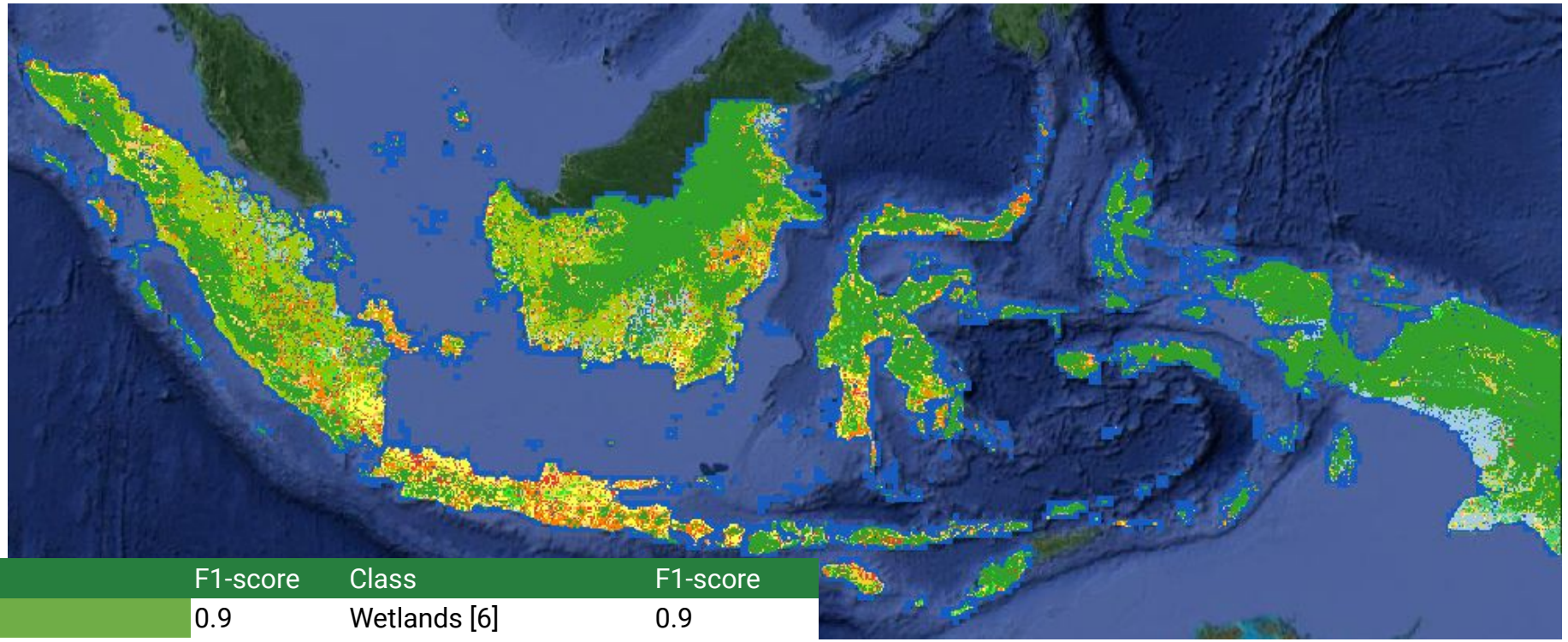
- Sentinel 2 with 10 m resolution.
- **1**-year time series.
- **7,197** grid by 20x20 km
- **4.67** TB total volume
- **355** sample grid (7.2%)





Ground Samples of Rice Fields

Results

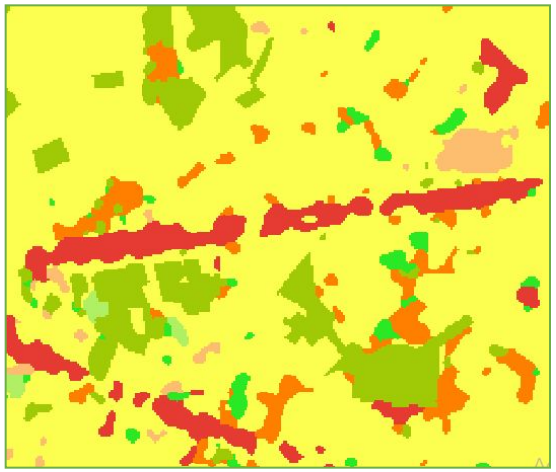


1 Rice Fields
2 Non-irrigated crop
4 Mixed plantations
5 Forest
6 Wetlands
7 Shrub
8 Pastures
9 Artificial Surfaces
10 Pond
11 Water Surface
12 Others
31 Palm plantations
32 Sugarcane plantations
33 Tea plantations
34 Other annual plantations

Class	F1-score	Class	F1-score
Rice Fields [1]	0.9	Wetlands [6]	0.9
Non-irrigated crop [2]	0.86	Shrub [7]	0.87
Palm plantations [31]	0.89	Pastures [8]	0.86
Sugarcane plantations [32]	0.86	Artificial Surfaces [9]	0.91
Tea plantations [33]	0.87	Pond [10]	0.85
Other annual plantations [34]	0.86	Water Surface [11]	0.96
Mixed plantations [4]	0.78	Others [12]	0.87
Forest[5]	0.95		

Overall Accuracy 93.6%

Results



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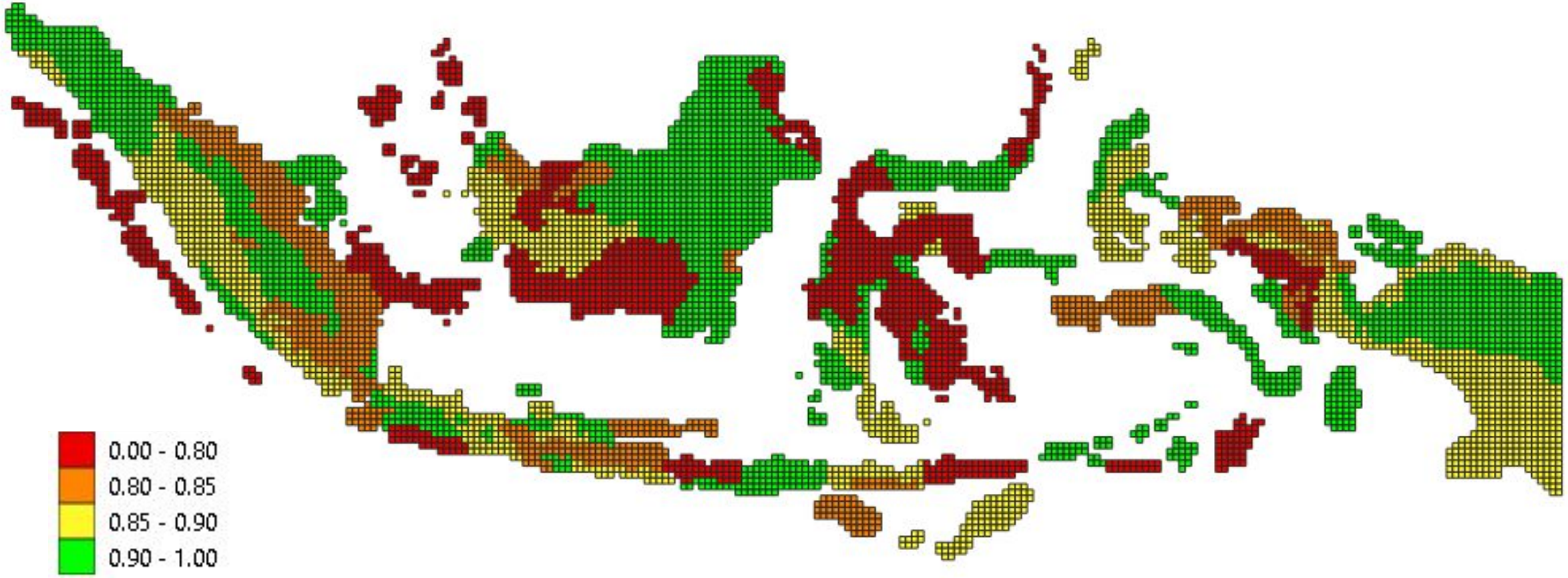
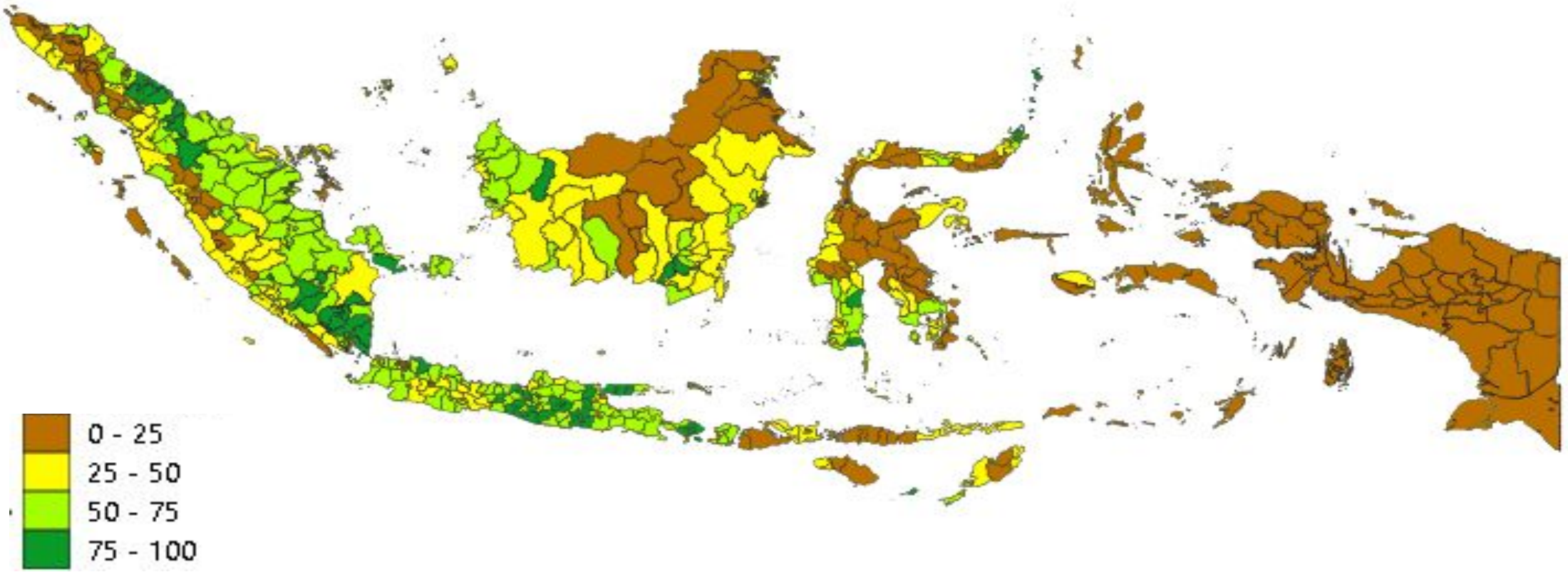
F1 Score Distribution

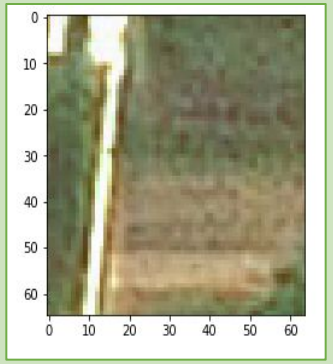


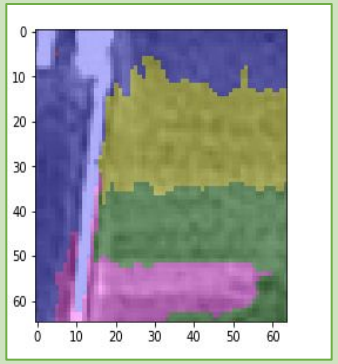
Percentage of Agricultural lands by District/City



Shortcoming in 2022

- Conducting a massive field survey to collect the ground samples of each class.
- Implementing segmentation algorithm to automate the delineating process of training sample.
- Enhancing the algorithms and revising the strategies to get higher performance and accuracy





Conclusions

- Estimation of agricultural lands trough remote sensing increases the effectivity in designing the agricultural census methodology.
- Rice fields presented the best results of the classification.
- Ground data collection is an important step on obtaining a good quality of data training.
- High variation of crops in the same area which occurred in “Mixed plantations” lands yield to low accuracy.

Thank you!

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