

Remote Sensing and Verification of Forest Growth

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Project Objectives

The project aims to investigate vegetation changes in Singapore, from the period of 2016 to 2021, using remote sensing methods and Sentinel-2 (S2) satellite images provided by the European Space Agency. There are three parts to this project. In the first part, three cloud removal methods were explored and compared as a step to pre-process the satellite images. In the second part, three change detection methods were adopted and compared to analyse vegetation changes in Singapore. In the last part, the effects of vegetation change on the temperatures of certain areas in Singapore were investigated. The study of vegetation changes in Singapore hopes to provide valuable inputs to authorities which may be able to help them better evaluate their positions when it comes to tree reforestation or deforestation.

Cloud Removal Methods

QA60, s2cloudless and Fmask were implemented on S2 datasets. s2cloudless was found to be the most ideal cloud removal method among the three for S2 images.



Cloud detection using s2cloudless

Conclusion

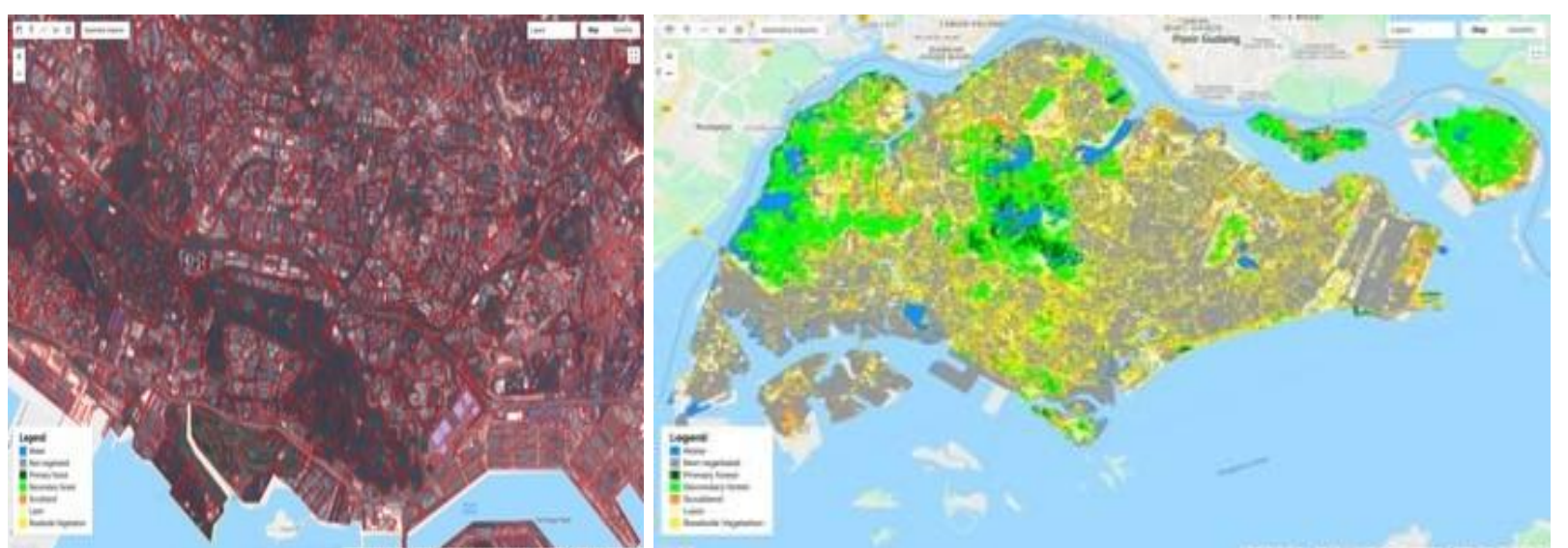
- s2cloudless is the most ideal cloud removal method
- Object-based classification gave better accuracy than traditional pixel-based classification
- Areas such as Tengah, Western Water Catchment, Sembawang, Punggol and Changi were found to have experienced significant vegetation changes

Change Detection Methods

The three change detection methods explored were: Image Differencing, Post-Classification Comparison and a combination method of the two.



The Post-Classification Comparison method involved a land use classification process. The use of a novel object-based classification approach which involved the use of Simple Non-Iterative Clustering (SNIC), and Grey Level Co-Occurrence Matrices (GLCM) algorithms gave a classification accuracy of 85.8%.



Top-right: Image Differencing method **Bottom-left:** SNIC algorithm **Bottom-right:** Land use classification map for Post-Classification Comparison method