

PECORA 21 • ISRSE 38

*Continuous Monitoring of Our
Changing Planet:
From Sensors to Decisions*



October 6-11, 2019

Baltimore, MD • Marriott Waterfront

Lessons Learned from using the Open Data Cube and Machine Learning Techniques for United Nations Sustainable Development Goals

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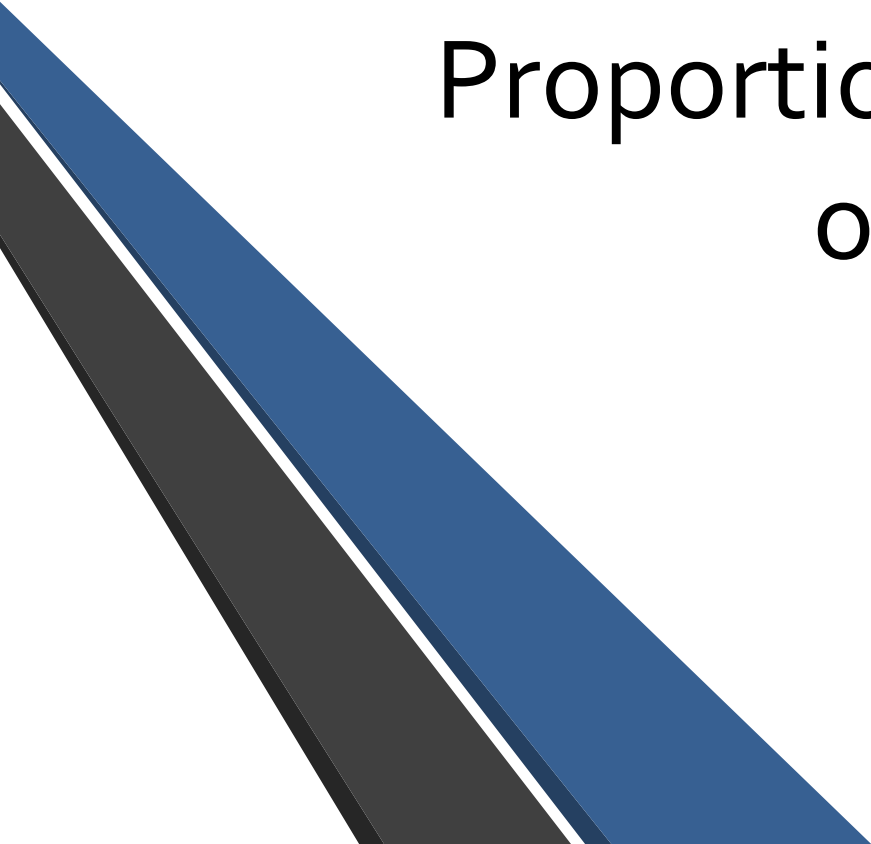
SUSTAINABLE DEVELOPMENT GOALS

17 GOALS TO TRANSFORM OUR WORLD



UN SDG 15.3.1

Proportion of land that is degraded
over total land area

A decorative graphic in the bottom-left corner consisting of several parallel diagonal stripes in shades of blue and dark grey.

Structure of the Notebook

Load	Load data •Load land classification data •Load EO data
Train	Train a Random Forest Classifier (RFC) to predict land classifications from EO data
Visualize	Visualize the area for the beginning and end of the time range
Visualize	Visualize land classifications for the beginning and end of the time range
Visualize	Visualize predicted land classes and true land classes
Visualize	Visualize land change frequency
Show	Show Change Matrix



Burkina Faso

Nigeria

Benin

Togo

Côte d'Ivoire

Ghana

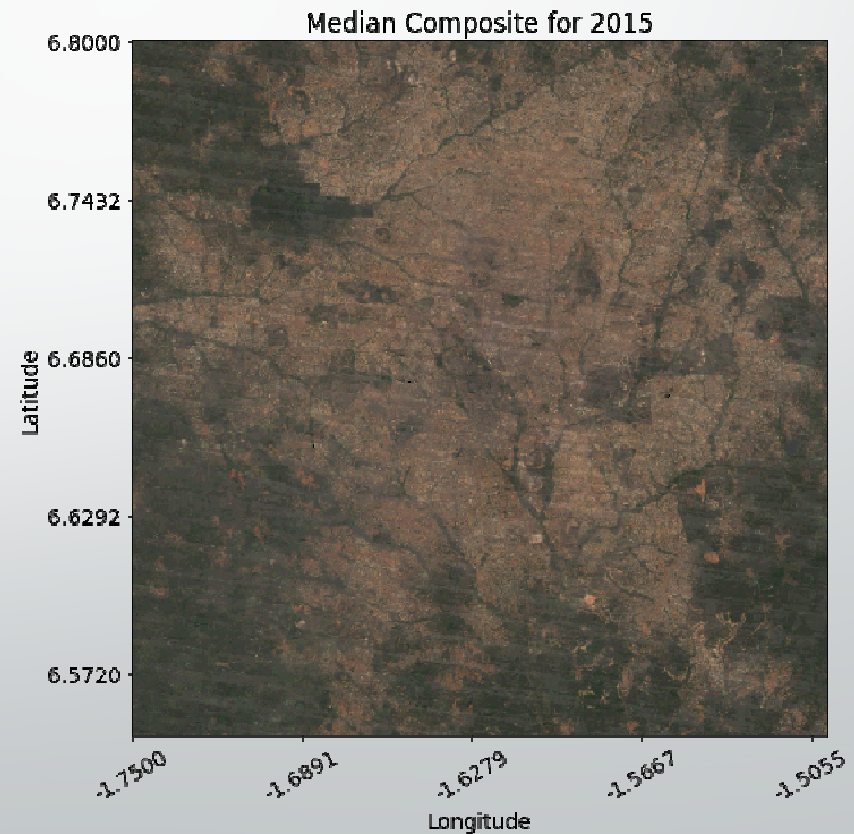
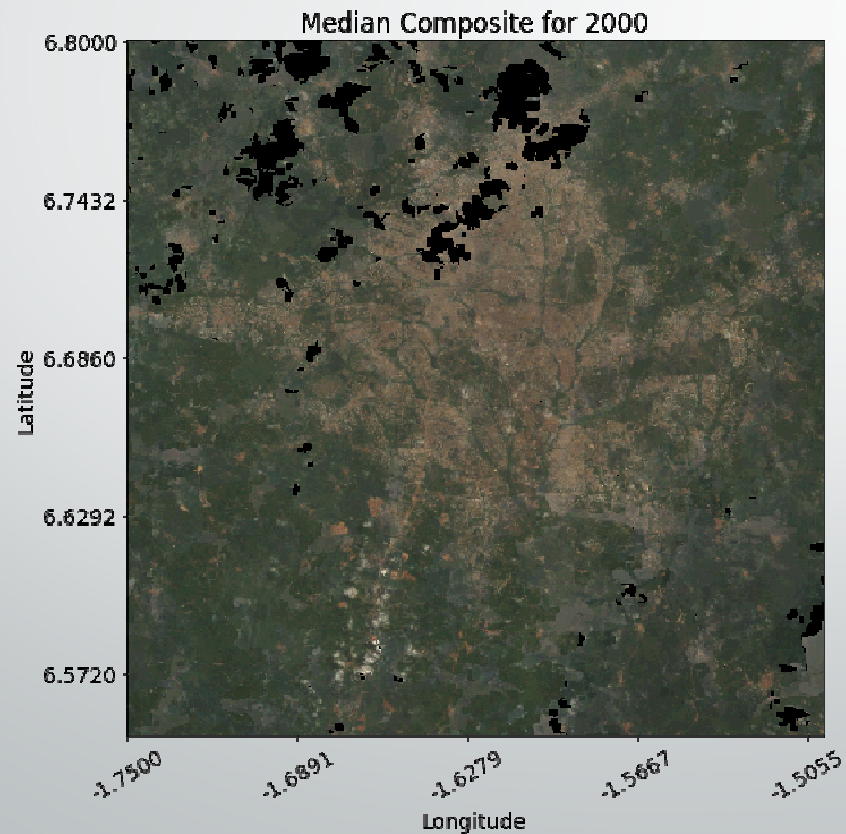
Liberia

Kumasi,
Ghana

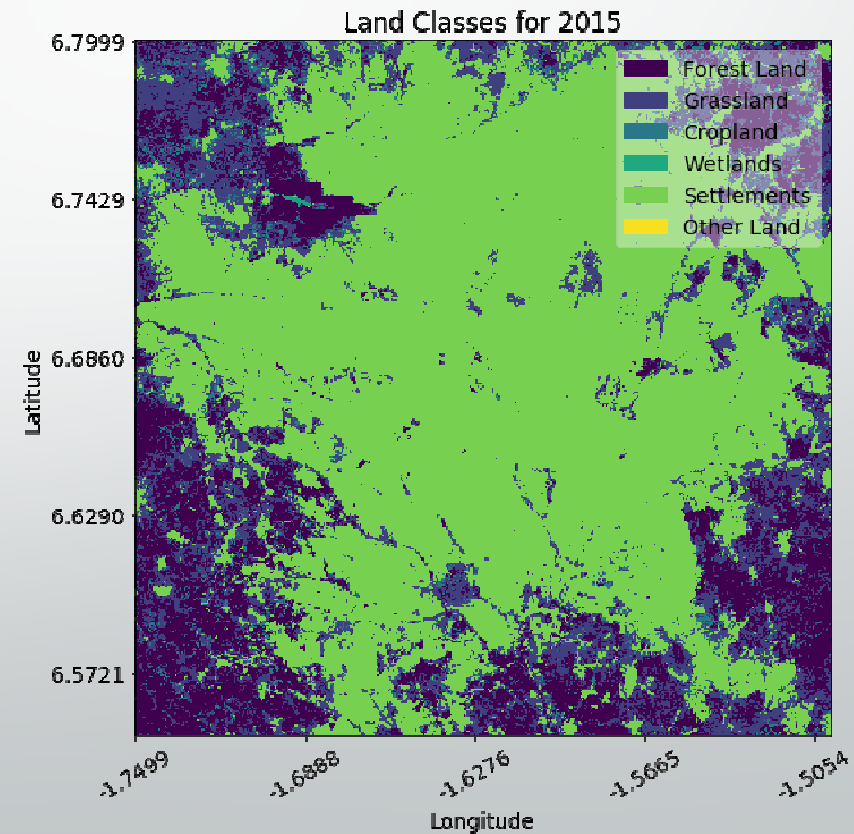
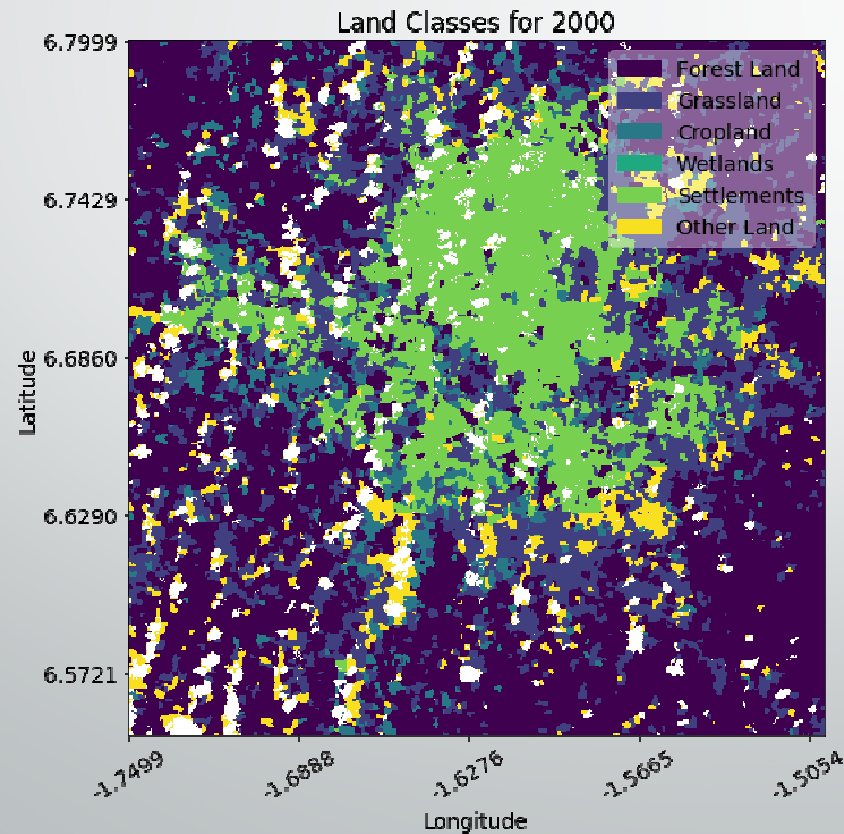
Gulf of Guinea

Equato
Guine

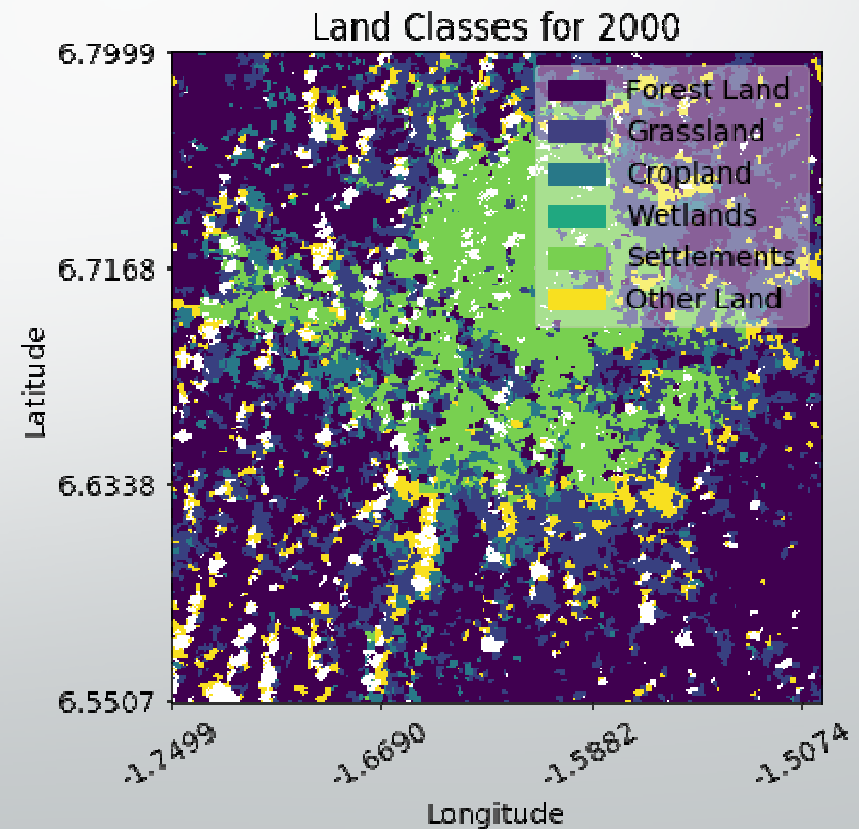
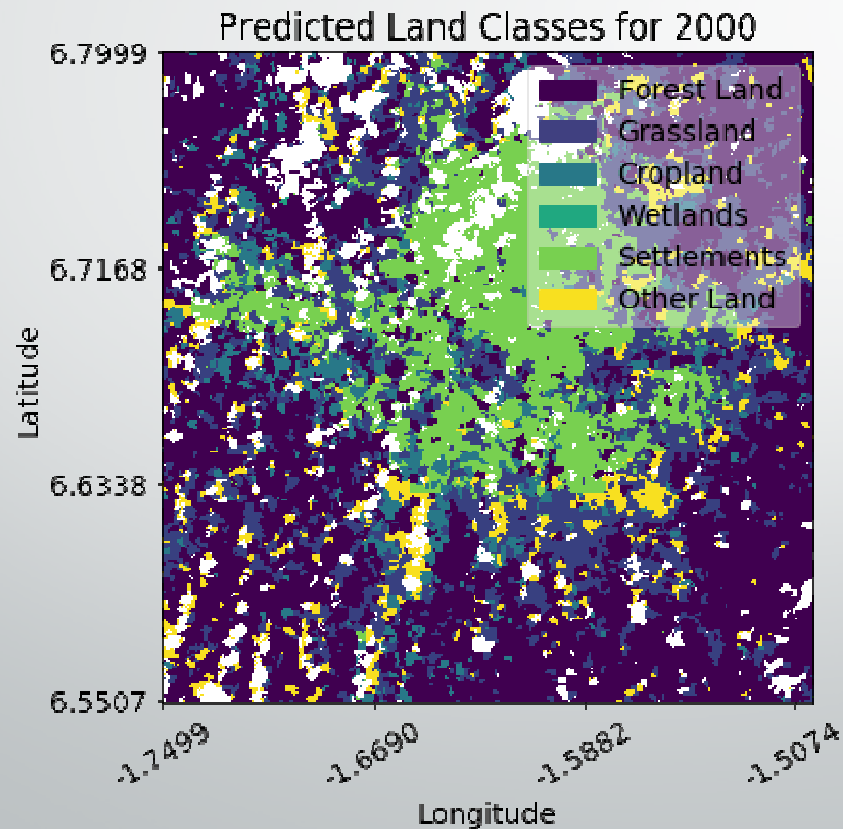
Visualize the Area (Kumasi, Ghana, 2000 and 2015)



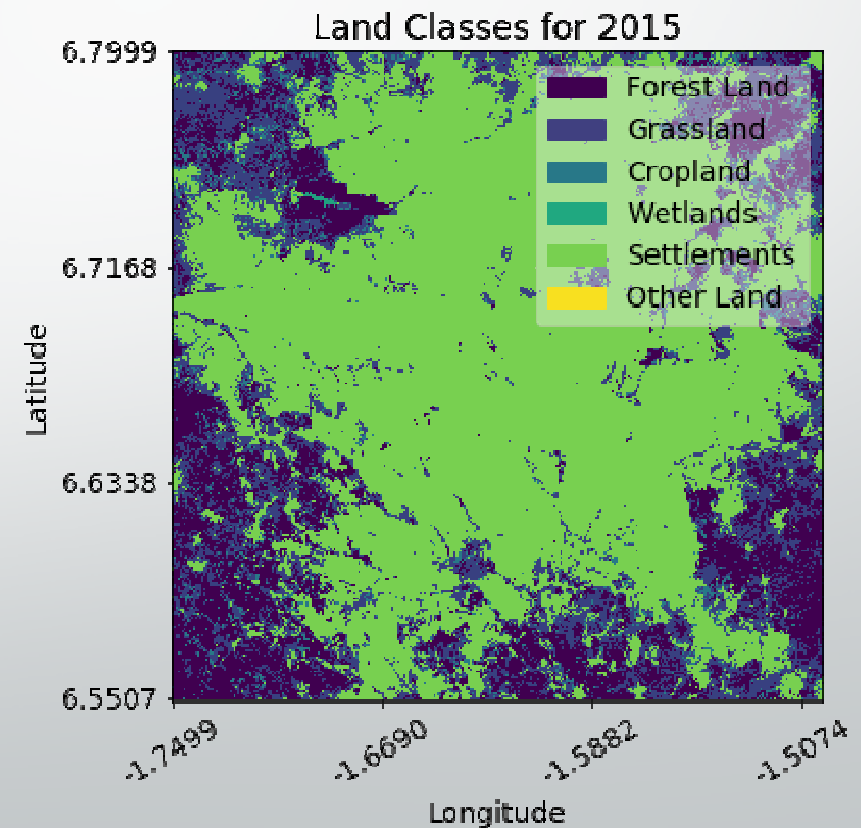
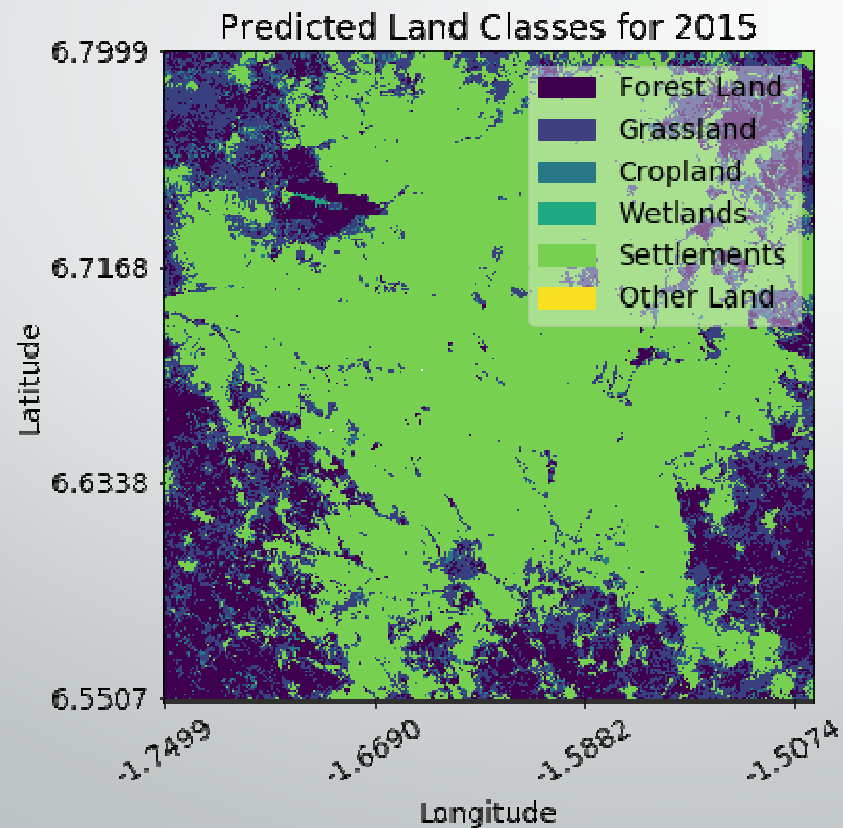
Visualize Land Classifications (Kumasi, Ghana, 2000 and 2015)



Visualize Predicted Land Classes and True Land Classes (Kumasi, Ghana, 2000)



Visualize Predicted Land Classes and True Land Classes (Kumasi, Ghana, 2015)



Lessons Learned: Ensure the Data is Good!

We tried two (2) data sources for land classifications:

1. ESA CCI LC (European Space Agency Climate Change Initiative Land Cover)
1. FROM-GLC (Finer Resolution Observation and Monitoring – Global Land Cover)

ESA CCI LC

- The Good

- A resolution of 300m x 300m is enough and convenient for satisfying reporting requirements for an entire country.
- It is the approved default dataset of the Good Practice Guidance document.
- Has data for all years from 1992 to 2015.

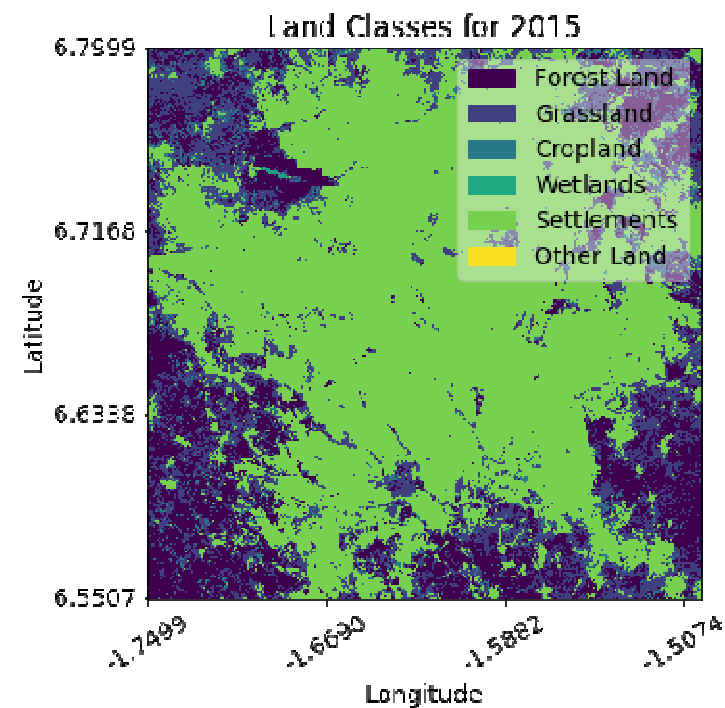
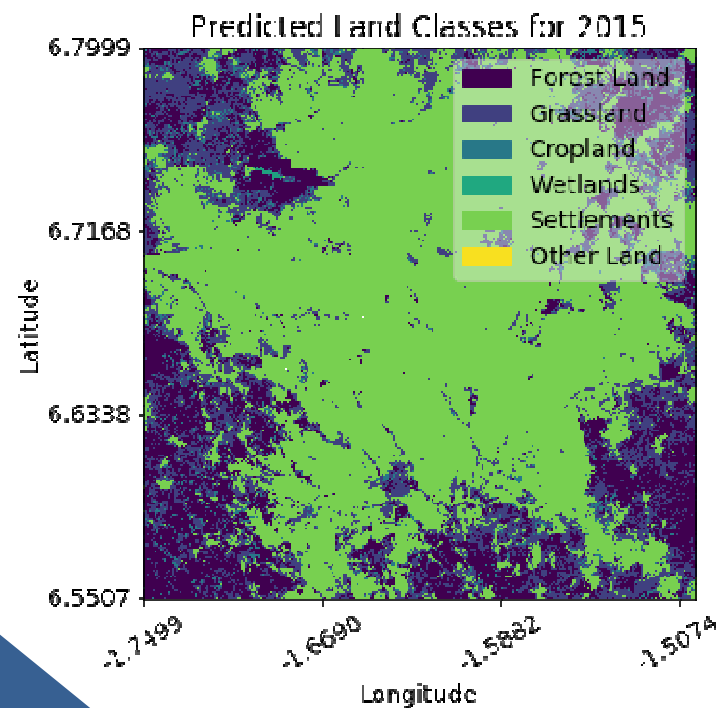
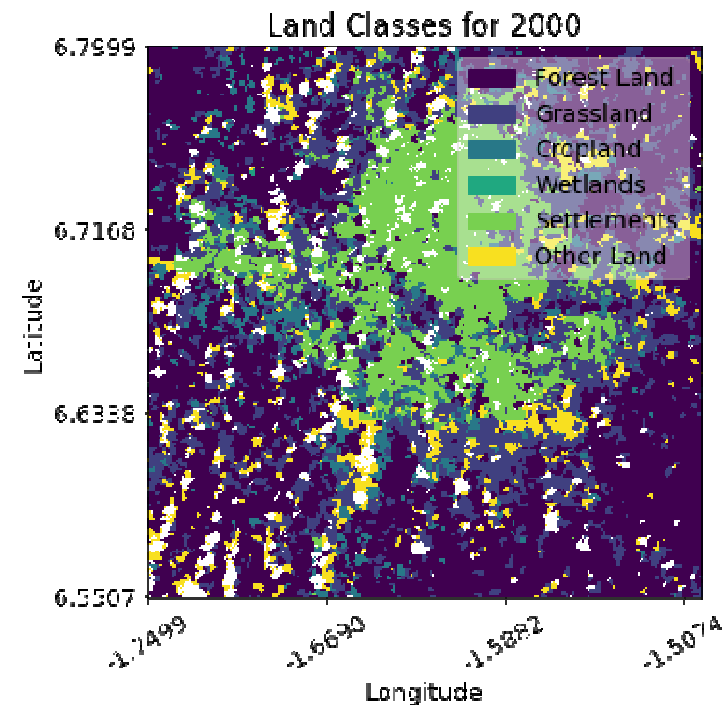
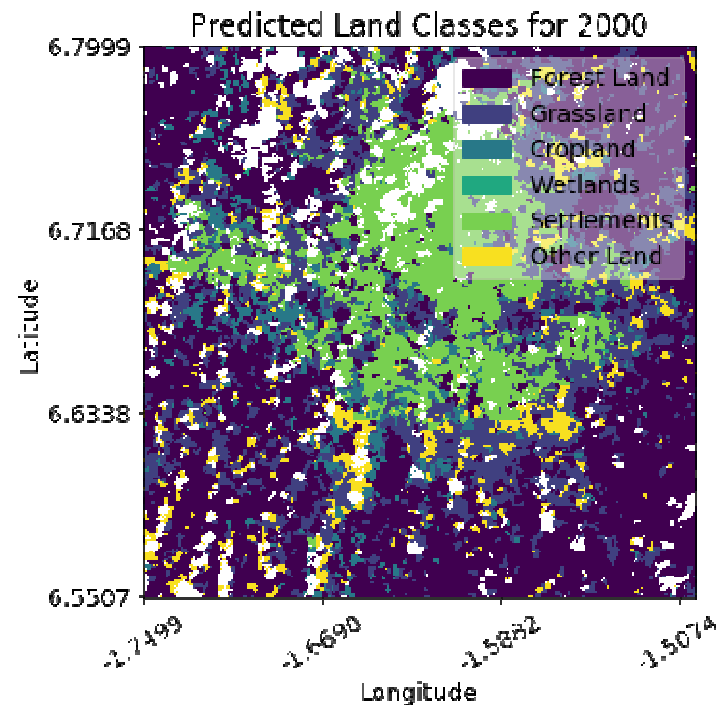
- The Bad

- There are issues in several areas such as Samoa (usually too little change).

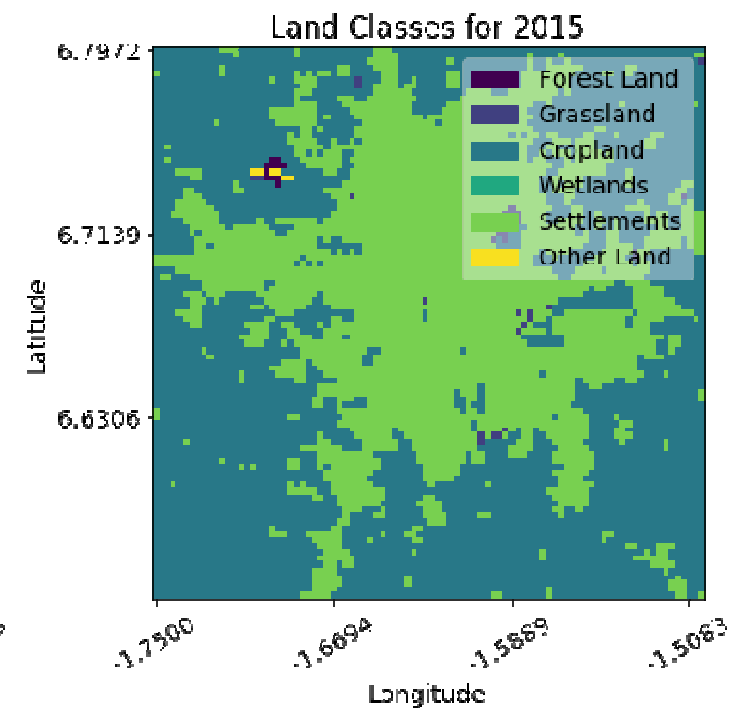
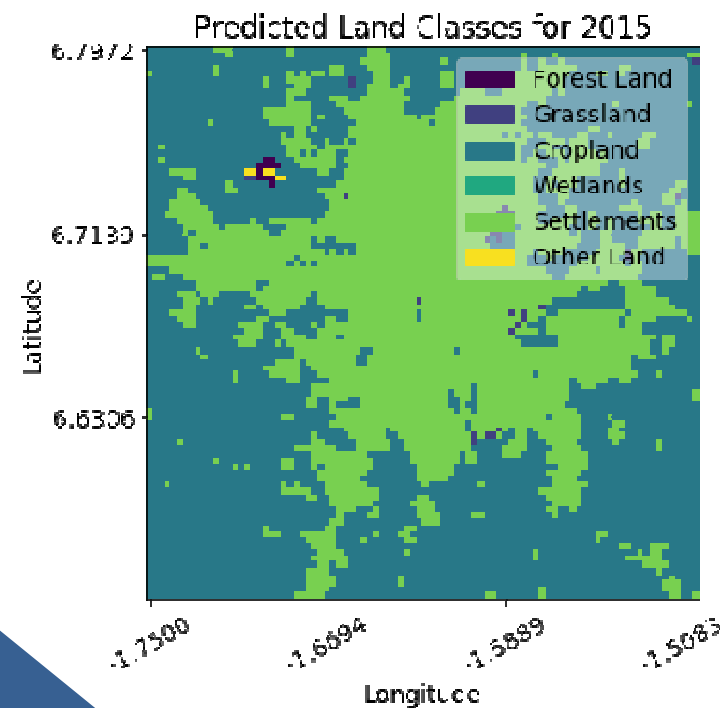
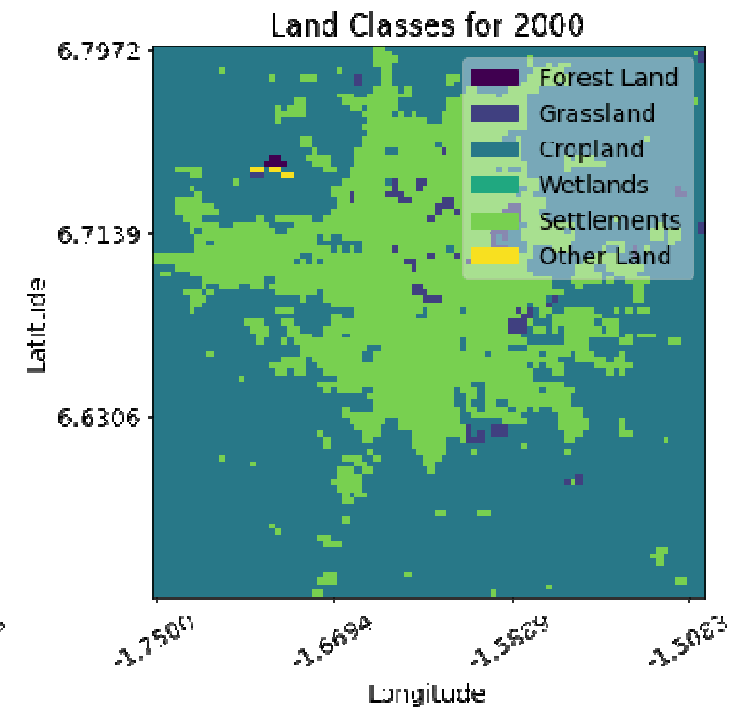
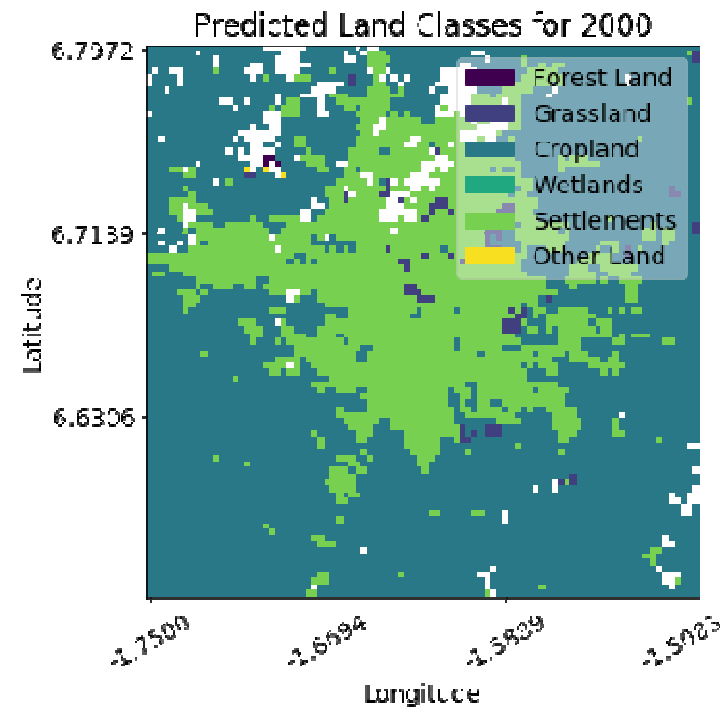
FROM-GLC

- The Good
 - A resolution of 30m x 30m is good and exactly matches Landsat resolution.
 - The changes between 2000 and 2015 seem to be much more accurate than the ESA CCI LC data.
- The Bad
 - A high-resolution dataset is more cumbersome to manage in several ways – notably requiring increased storage space, load time, and processing time.

ESA CCI LC VS. FROM-GLC



ESA CCI LC VS. FROM-GLC



UN SDG 6.6.1

Change in the extent of water-related
ecosystems over time

The WOfS Model

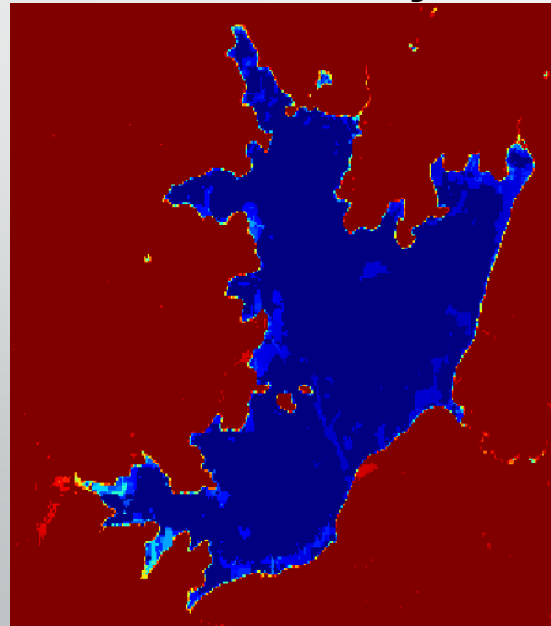
- WOfS: Water Observations from Space
- Developed by Geoscience Australia
- A decision tree classifier trained on water bodies in Australia from 1987 onwards as seen by Landsat
- Works well on clear water bodies, but not on highly polluted ones

The WASARD Model

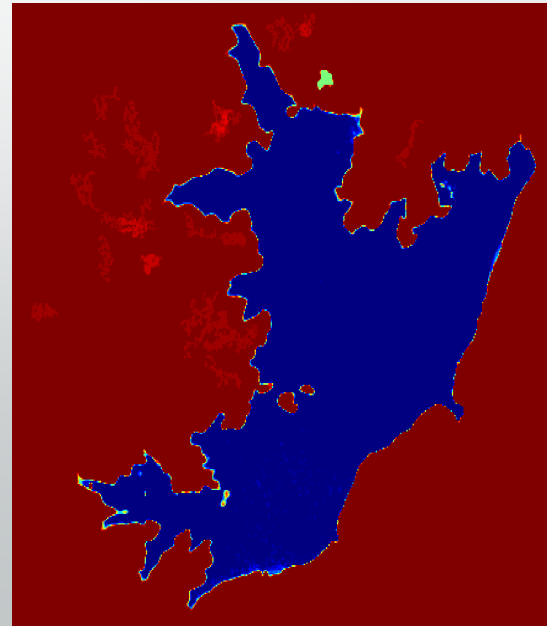
- WASARD: Water Across Synthetic Aperture Radar Data
- A transfer model from WOFS
- Used to detect illegal mining in ARDC countries

Weja Reservoir, 2016-2018

WOFS



WASARD





Structure of the Notebook

Analyze Single Time Period:

- Load Landsat data from the Data Cube
- Get Water Classifications (WOfS)
- Visualize the minimum and maximum water extents
- Visualize water extent change



Structure of the Notebook

Analyze Two Time Periods:

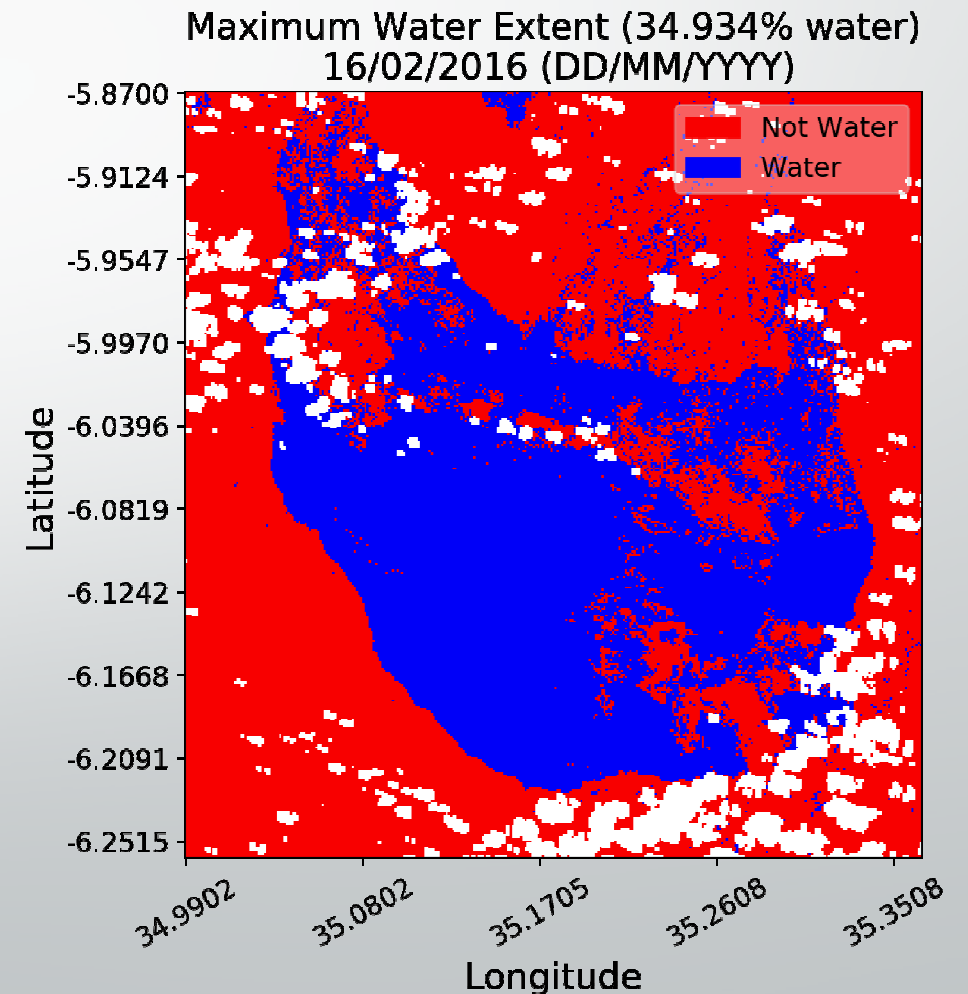
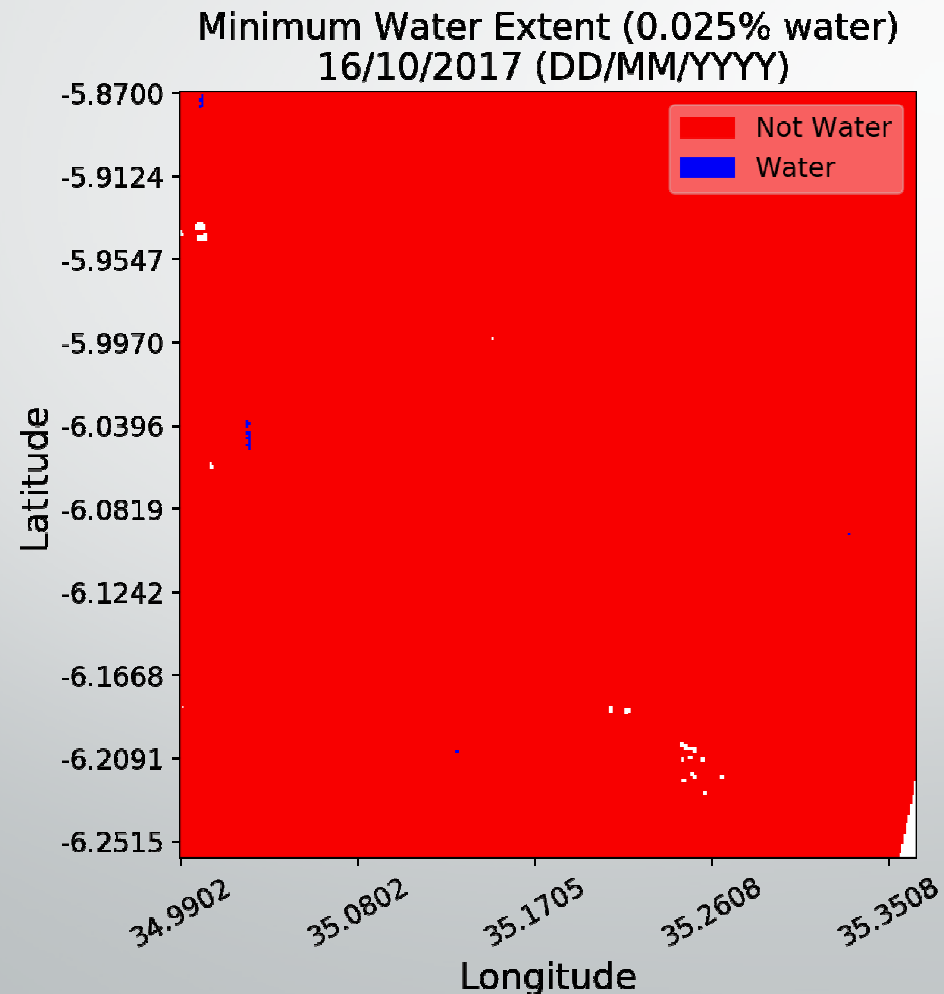
- Load Landsat data from the Data Cube
- Get Water Classifications (WOfS)
- Visualize water extent change between the two time periods



Lake Sulunga, Tanzania

Single Time Period

(Lake Sulunga, Tanzania, 2016-2017)



Important Links

Open Data Cube: www.opendatacube.org/

Github: www.github.com/opendatacube

Documents: www.github.com/ceos-seo/data_cube_ui/tree/master/docs

Notebooks: www.github.com/ceos-seo/data_cube_notebooks

User Interface: www.tinyurl.com/datacubeui

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Questions?

Thank You!