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LARGE SCALE FOREST CHANGE MONITORING USING SATELLITE DATA

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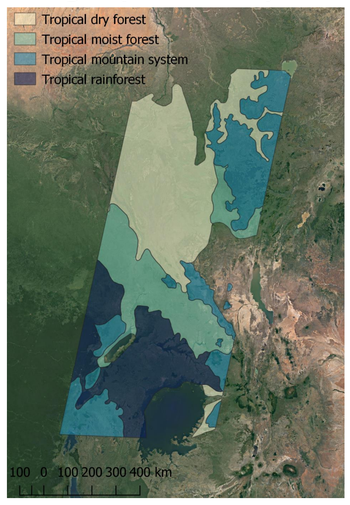
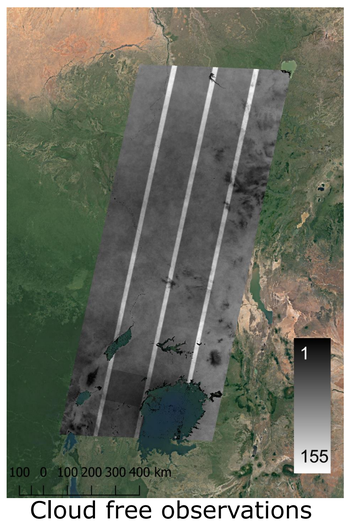
Background

In the last decade, due to freely available satellite imagery, time-series analysis of satellite data has been established as a tool for detecting and monitoring forest change at small land scale. My research aims to develop methods that advance time series forest change detection techniques from local, to regional and national scale usage, to the point where they can be used as tools for international reporting such as that required by the United Nations Framework Convention on Climate Change (UNFCCC).

Area of interest (East Africa)



Forest types



Cloud free observations (2000-2017)

Algorithm parametrization using artificial intelligence decision making to account for large-scale variation

Most studies on forest loss detection focus on specific study areas, concentrating on developing the methodology of the algorithms and less on their applicability at large scale [1]. It is anticipated that the spatial heterogeneity of large-scale time-series analysis will yield issues when predicting forest loss. Our aim is to replace the selection of algorithm parametrization [2] based on expert knowledge with artificial intelligence decision making to account for inherent large-scale variation of forest type, data availability, and deforestation drivers.

Research Question

How can artificial intelligence improve time-series analysis algorithm parametrization to account for large-scale inherit variation?

Multi-sensor time series to improve forest loss detection at large scale

As with any optical wavelength satellite sensor, cloud contamination compromises global Landsat image usability for land surface studies. At large scale, there is a high possibility to have very clouded areas, for which, a higher temporal resolution of satellite images can improve [3], or can be critical to forest loss detection using time-series analysis. Opportunity:

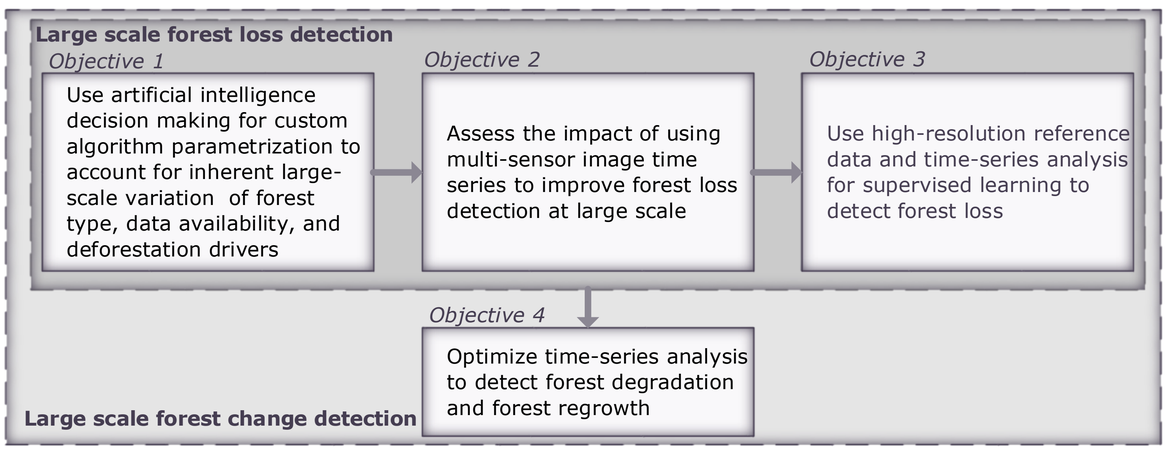
- combine satellite data from Landsat (TM, ETM, and OLI) and Sentinel (2A and 2B) sensors to increase opportunities for more frequent cloud-free surface observations due to variable cloud cover at different satellite overpass time and dates.

Research Question

What is the effect of combining Sentinel-2 data with Landsat data on time-series analysis for forest loss detection at large scale?

Objective

Our focus is to identify and manage the problems associated with larger scale forest loss detection using time series analysis, and to evaluate possible options to improve forest change detection at large scale.



Supervised learning using high resolution reference data and time-series analysis to assess forest loss detection

Supervised classification methods that require labelled reference data for learning models are more and more used for mapping and monitoring dynamic processes over extended areas [4]. In the remote sensing context, reference data refers to either in-situ measurements or to other collected data of known or presumed better quality than the assessed data quality. Using high resolution imagery (e.g. Planet Labs) and in-situ data for supervised learning is presumed to increase the quality of forest loss detection, but it has not been tested thoroughly, especially on large areas where the impact might be significant.

Research Question

What is the added-value of using high resolution reference data for supervised learning together with time-series analysis to detect forest loss?

Detect forest degradation and forest regrowth using time-series analysis

Forest degradation and forest regrowth detection presents more challenges than forest loss detection. While forest degradation and regrowth can sometimes be dismissed as insignificant at small-scale, they are recognized by FAO's REDD+ programme as being significant on a large-scale. Challenges:

- forest degradation and forest regrowth analysis are terms used rather liberally with various definitions across research literature.
- degraded and regrowing forest do not differentiate easily from healthy forest in a spectral dimension.

This research is aiming to further existing research with new methods to detect forest degradation and forest regrowth by trying to adapt forest loss detection algorithms.

Research Question

How to adapt forest loss detection algorithms to detect forest degradation and forest regrowth?

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