DEVELOPMENT OF A METHODOLOGY FOR FOREST DEGRADATION AND DEFORESTATION MONITORING USING HIGH RESOLUTION DATA

Naila Yasmin*, Remi D'Annunzio*, Inge Jonckheere*

*REDD+ Team, Forestry Department, Food and Agricultural Organization of the United Nations
Remi.DAnnunzio@fao.org
Inge.Jonckheere@fao.org

UN-REDD PROGRAMME

Introduction

Forest degradation is a global phenomenon and significant indicator in forest monitoring and a precursor to further forest loss. Carbon emissions due to degradation should be accounted in national reporting within the frame of the REDD+ mechanism of the UNFCCC and other international reporting frameworks (e.g. FRA). FAO Forestry is working on the development of a methodology for forest degradation and deforestation monitoring using satellite data to help REDD+ countries. The ForMosa project was developed with two partner organizations, i.e. Planet and Wageningen University. Satellite data from different sensors, namely Landsat, Sentinel-2 along with high resolution data was used in this project to enhance the temporal coverage of AOI.

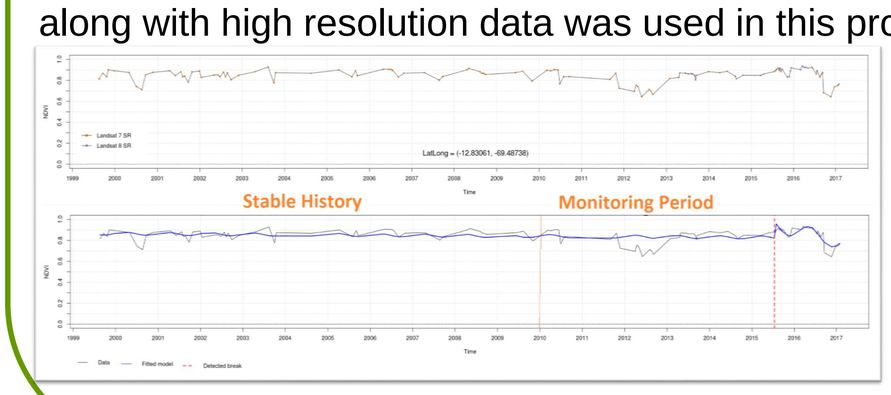


Figure 1; BFAST real time example over one of the plot located in Peru

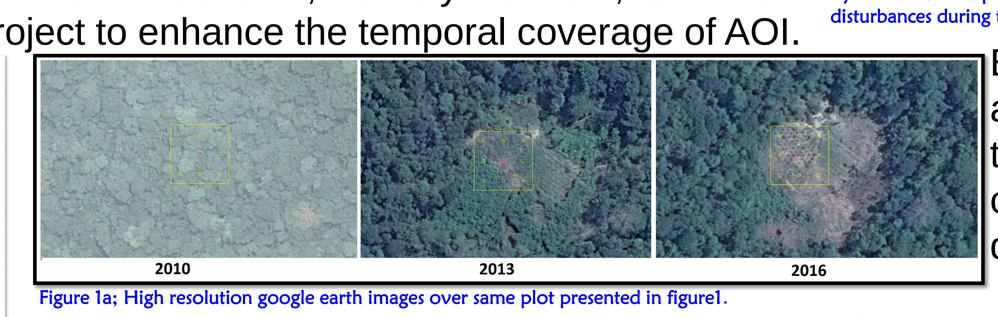


Figure 1a; High resolution google earth images over same plot presented in figure1.

BFAST iteratively estimates the time and number of abrupt changes within time series, and characterizes change by its magnitude and direction.

Figure 1 and 1a are showing real time example of BFAST, point is located AOI in Peru, where NDVI time series is shown for stable and monitoring time period and break is detected by algorithm, which is further validated with high resolution image in google earth (figure 1a).

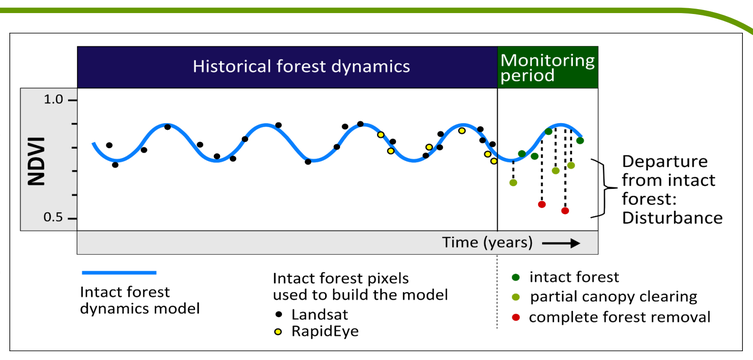


Figure 2; Schematic representation of the forest disturbance mapping algorithm. A forest dynamic model is produced using historical data, which serves as a base for assessing disturbances during the monitoring period.

Research Methodology/Methodology

Forest degradation and a deforestation product was developed using BFAST [3] approach of the Wageningen university. A project based algorithm for forest disturbance was developed and this is applied on a forest mask to produce a forest dynamic model using historical data. This serves as a base for assessing disturbances during the monitoring period. The methodology is tested by Open Foris [1] accuracy assessment application to ensure the target accuracy. The methodology is tested at three selected test sites (Kafa Tura in Ethiopia, Madre de Dios in Peru, and Bac Kan in Vietnam). Results of one site are selected for discussion in this poster.

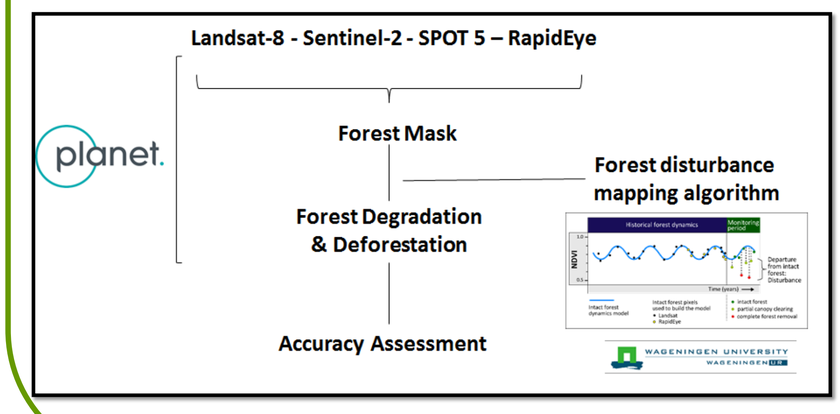


Figure 3 : An Outline of Disturbance product Methodology

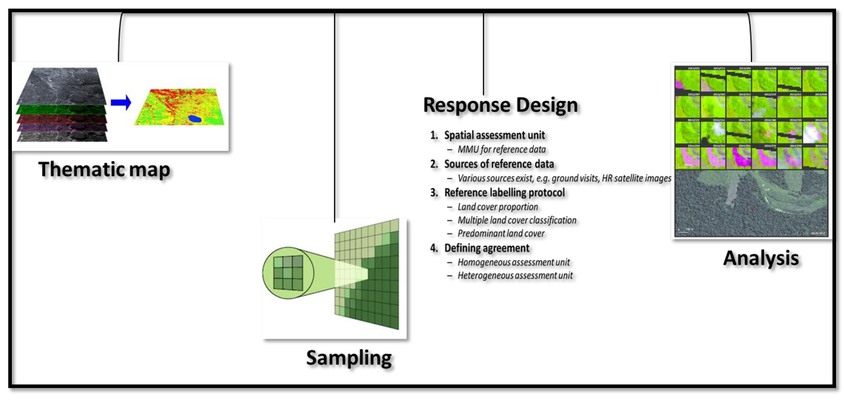


Figure 4 : An Outline of Accuracy assessment Methodology

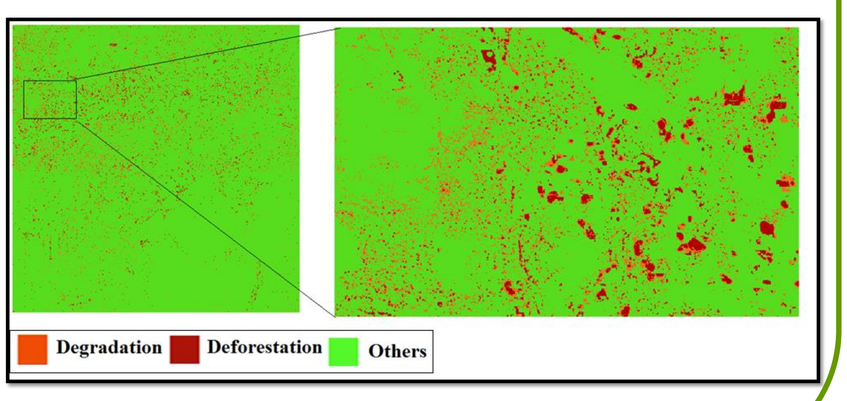


Figure 5 : Overview of disturbance Product- ForMosa

Accuracy Assessment

- **Sample design: Core , Periphery, buffer**

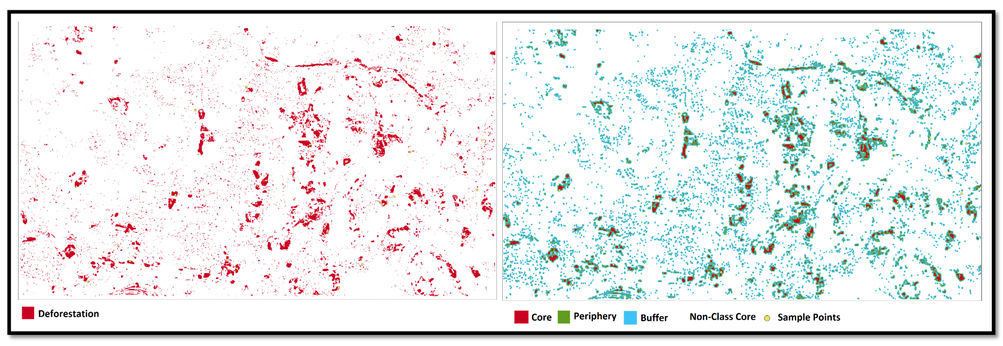
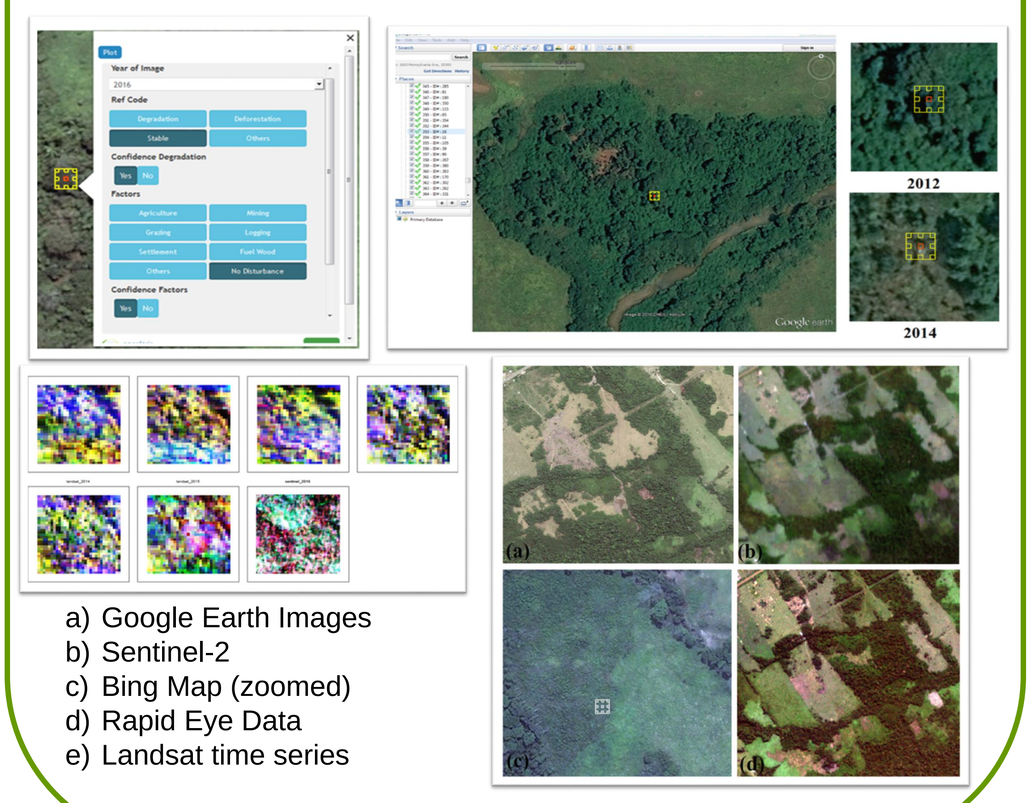


Figure 6 : Sample design used for Formosa Project

- **Reference Data Collection**



a) Google Earth Images
b) Sentinel-2
c) Bing Map (zoomed)
d) Rapid Eye Data
e) Landsat time series

Figure 7 : Sources of Reference data collection

Results

- **Degradation Class, Peru**

Confusion Matrix		Reference class		
Map class	Class	class	non class	UA
	Core	34	59	36.56%
	Periphery	18	54	25.00%
	Buffer	9	78	89.66%
	non-class core	8	87	91.58%
	PA	11.49%	96.44%	

Agreement | Omission | Commission

	class	Non class
Sample-based area (ha)	22,618.47	217,481.53
95% conf. interval (ha)	11,214.79	11,214.79
Map area (ha)	10,349.73	229,750.27

- **Deforestation Class, Peru**

Confusion Matrix		Reference class		
Map class	Class	class	non class	UA
	Core	66	21	75.86%
	Periphery	39	50	43.82%
	Buffer	14	82	85.42%
	non-class core	7	83	92.22%
	PA	9.96%	98.98%	

Agreement | Omission | Commission

	class	Non class
Sample-based area (ha)	21,245.48	218,854.52
95% conf. interval (ha)	12,504.00	12,504.00
Map area (ha)	4,341.60	235,758.40

Conclusion

- The algorithm captured well changes over large areas and deforestation over small areas, but assessment of degradation was quite scarce.
- In-situ data input based on country conditions to train algorithm are needed.

Way Forward

The project concluded with some recommendations to be incorporated in the algorithm to make it more suitable for different landscapes/conditions. An updated version of code is available under STEF package of R[4].
FAO/REDD+ Team had also developed a BFAST user interphase in collaboration with Wageningen University on the FAO cloud platform SEPAL[5].

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For details and questions:
Naila.Yasmin@fao.org

[1] http://openforis.org/
[2] http://www.formosa.global/about/
[3] http://www.wur.nl/en/Expertise-Services/Chair-groups/Environmental-Sciences/Laboratory-of-Geo-information-Science-and-Remote-Sensing/Research/Integrated-land-monitoring/Change_detection_and_monitoring.htm
[4] https://github.com/hamun001/STEF
[5] sepal.io