

Satellite Monitoring for Forest Management (SMFM) Project

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Main progress:

1.1 Develop a detailed work plan for the SMFM project; review after 12 months

The month of February 2018 saw preparations for missions to the project partner countries by the Consultant team. Two workshops on (i) informing partner country stakeholders about the SMFM project and its technical progress and (ii) planning partner country implementation activities have been conducted in Mozambique (21-23 February) and Zambia (26-28 February).

In the running up to the two country workshops, agendas have been developed and coordinated jointly with the World Bank country offices in Mozambique and Zambia, and participating institutions have been identified and contacted. Both workshops were organised as 2-day events with a first day on SMFM progress and expectations from country stakeholders, and a second day for planning and budgeting of implementation activities. A third day was reserved in each country for additional meetings with selected institutions.

The implementation activities discussed and planned for during the two country workshops will help inform the upcoming review of the overall SMFM project work plan in May 2018. For each Country, a Mission Report that summarises workshops' activities and key notes has been produced.

1.2 Coordinate with activities / resources already committed in partner countries

In the course of the in-country workshop in Mozambique, a number of opportunities to synchronize with or build upon existing country activities were identified. First and foremost, the SMFM project would contribute significantly to the Emission Reduction Payment Agreement, which Mozambique is about to sign. The agreement has been approved on condition that Mozambique can show how it is going to address monitoring of forest degradation, one of the key outputs of the SMFM project. As a consequence, the FNDS and the DINAF are particularly interested in the development and use of SMFM EO tool number/activity 2 and 3.

Regarding data collection for tool calibration and later validation of results, progress has been made on the network of permanent sample plots (PSPs) and towards a related data collection protocol maintained by the Mozambique Institute of Agricultural Research (IIAM)¹ could potentially be used for the SMFM implementation activities.

¹ Although invited to the workshop, the IIAM was not able to send representatives due to conflicting events. The team met with the IIAM on the 3rd day of the country mission to discuss potential involvement of the IIAM in the SMFM implementation activities.



The data collection protocol is expected to be available by end of March 2018 and can then be assessed by the SMFM team for suitability.

The SMFM in-country workshop in Zambia revealed interesting options for complementing ongoing country activities. For instances, the Zambia Forestry Department needs nation-wide biomass data support 2016 FREL scenario with data and, similar as in Mozambique, the preparation of Emission Reduction Payment Agreements requires information on forest degradation, which the SMFM project could help provide.

The National Remote Sensing Centre (NRSC), on the other hand, is mandated with establishing LU/LC maps for the Commissioner of Lands. So far, the NRSC acknowledges that the LU/LC maps it produces are mostly “static” maps that fail to reflect ongoing changes. The NRSC is therefore interested in the development and use of the SMFM EO tool 3 that may allow identifying change in near real-time. The potential use of radar data in tool 3 would allow the NRSC to acquire complementary technical capacity.

Technical update:

2.1.1 Semi-automated pre-processing of Sentinel-2 data for LULC Classification

- In early February, the WB provided results on an early independent testing of the development STAGE OF tool 1 carried out during December 2017 and January 2018.
- The technical experts of the consultant team reviewed the results and suggestions and started addressed some of the suggested improvements. The code now supports parallel processing for atmospheric correction, allows specification of directories as well as “.SAFE” file format and individual tiles. Other suggested usability improvements have also been implemented. The team also made a start on error checking and confirmation of outputs, and will complete this once the tool operation is finalised.
- The Sentinel-1 mosaicking tool has been further developed. The user interface is now identical to the Sentinel-2 tool, it now supports parallel processing, and gives more options to modify the processing chain (e.g. speckle filtering, multi-looking, and mosaicking options). WB feedback on the Sentinel-2 tool has also been incorporated into the function of the Sentinel-1 tool. Documentation will follow shortly.

2.1.2 Annual Forest Biomass Change and Degradation Mapping using ALOS PALSAR Mosaic

- During the month of February 2018, main focus was set on the development of the biomass tool.
- The scripts are now functional for the download, pre-processing, filtering, production of AGB maps, classification of AGB change, and generation of indices



of landscape fragmentation for years 2007 – 2010 of the ALOS mosaic. Further updates to functionality will follow the co-development together with country partners.

- The change detection and attribution algorithms have been further developed. The user can now specify an AGB threshold for forest/non-forest, a minimum change proportion, and a minimum area of contiguous change to reduce the impact of false positives resulting from noise.
- The Python library (biota) has been restructured to make it more user friendly. Example outputs are shown in Fig. 1, and the script required to generate it shown in Fig. 2.
- The tool has been apply to research tasks at the University of Edinburgh testing and evaluation purposes. For example, the tool was recently used to rapidly generate an AGB map of the Bateke Plateau savannah ecosystem in Equatorial Africa (Fig. 3)
- Further development will focus on incorporation of ALOS-2 data (2015 – 2016), and the user-specification backscatter-AGB calibrations.

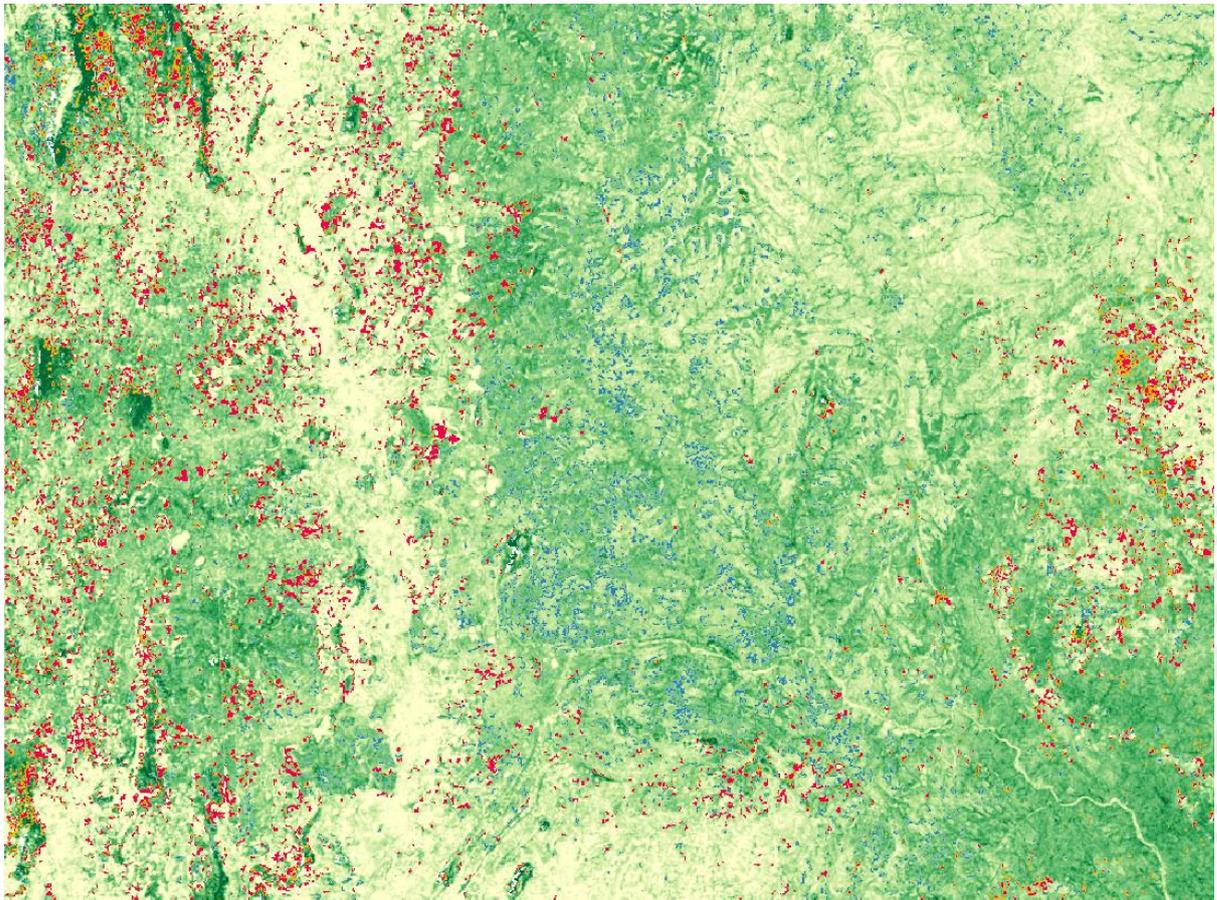


Fig 1 AGB and AGB change map for a test location in Mozambique adjacent to the Gorongosa National Park. Red pixels show areas of deforestation, orange indicates degradation, and blue indicates (re)growth for the period 2007 – 2010. The basemap is an AGB map for 2007, where darker greens show higher biomass. Areas of suspected moisture change around rivers are masked out.

```
import biota.calibration as cal
import biota.change as change

data_2007 = cal.ALOS('~\DATA/', -18, 33, 2007)
data_2010 = cal.ALOS('~\DATA/', -18, 33, 2010)

AGB_t1 = data_2007.getAGB(output = True)
AGB_t2 = data_2010.getAGB(output = True)

data_2010.updateMask('rivers.shp', buffer_size = 750)

change.getChange(data_2007, data_2010, F_threshold = 15, C_threshold =
0.25, min_area = 2.5, output = True)
```

Fig 2 Script required to generate the AGB and AGB change map shown in Fig. 1. We have designed the module to be as accessible to new users of Python as possible.

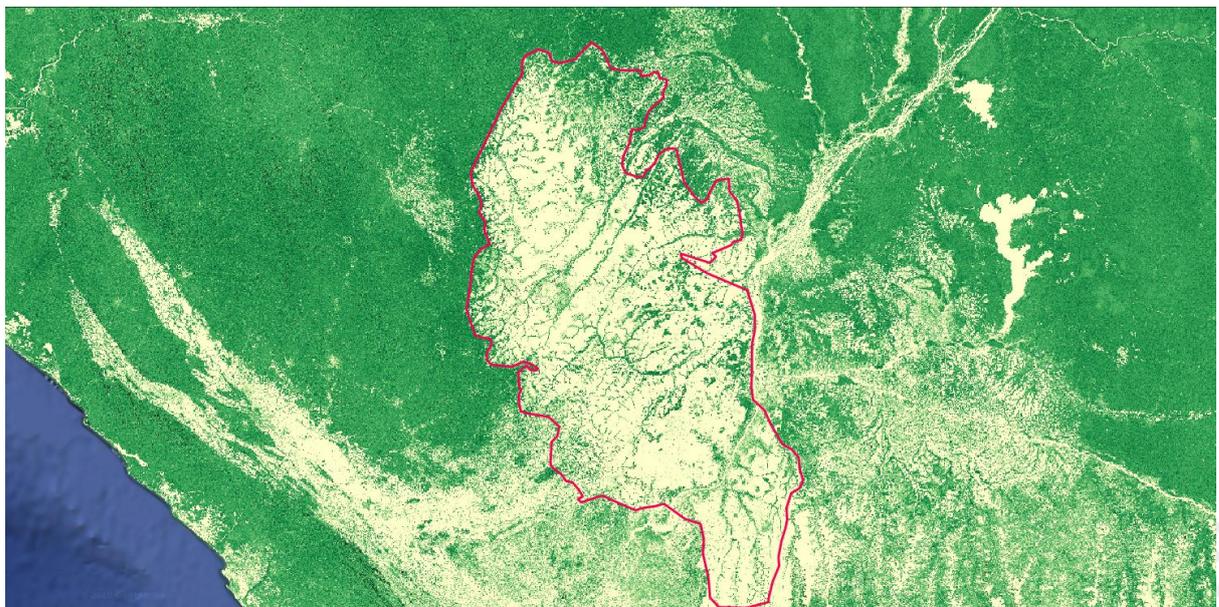


Fig. 3 We are testing the ALOS mosaic tool on a range of research tasks at the University of Edinburgh. Shown is an AGB map of the Bateke Plateau in equatorial Africa generated with the biota tool. Courtesy of Paula Nieto Quintano.

2.1.3 Utilising dense Time-Series of Sentinel-2 data for Continuous Change Monitoring and Proxies of Forest Change

- Further development will follow stable function and documentation of tools 1 and 2. We anticipate development to continue in April/May.

2.1.4 Developing a method for identifying causes of forest change

- Will follow completion of 2.1.3 and field data collection in Mozambique.

2.3 Obtain / collect in-situ datasets for validation

In both partner countries, sites for field work and data collection have been identified (3 sites per country) and periods for data collection have been agreed with partner country institutions.

Logistics for field work have been discussed and the composition of field teams has jointly been decided. Field work and data collection in Mozambique is currently planned for a period of 6 weeks starting in May 2018. Fieldwork in Zambia will take place during June and July 2018. Both field campaigns will be preceded by 3-4 days of training, during which also the data collection protocols will be developed, tested and fine-tuned.

3.1 Prepare draft ToR (incl. training plan) for implementation

During both in-country workshops participants from partner country institutions jointly developed a work plan for implementation of SMFM activities in the course of 2018. Objectives, results and activities were defined, responsibilities assigned and a time table including deadlines was agreed. This forms the basis for the Terms of Reference for country implementation. Draft ToR have been developed and are now updated with the contents elaborated during the workshops. The ToR, together with the work plan and the proposed budget will then be submitted to the WB.

Issues and potential bottlenecks:

2.1 Design new or enhanced satellite EO methods

Partner country institutions participating in the Zambia workshop suggested that the SMFM EO tools should not only be developed in form of code and scripts (for easy integration into online platforms), but also with a Graphical User Interface (GUI) to allow for easy use by non-specialists.

Development of a GUI considerably differs from developing algorithms and process chains. A user-facing front-end software development exceeds what can be developed under the SMFM project. Tailoring a GUI to the expectations of individual countries or even institutions would probably contradict the spirit of developing sufficiently generic tools for global application.

Seen from the country perspective, the request for a GUI is certainly valid and might be considered by the World Bank if the SMFM EO tools prove successful.



Additional Updates:

On February 2nd, the team presented the technical developments of the SMFM tools at a Forests Monitoring Side Event within the [Data.Space2018](#) conference in Glasgow (1-2, February 2018). The progress of the four tools, as well as preliminary outputs and challenges encountered, were presented and discussed to an audience that included government agencies (DFID), private sector, and academia (University of Edinburgh, University of Leicester), which contributed to the global project outreach. Our project work has relevance to the UK Space Agency's [Forest2020](#) project and we have had continued discussion with the implementing agency, Ecometrica, particularly around development of tools related to forest monitoring. However, their project focus is aimed at dense moist forests. Discussions were also held with ESA, through Eric Monjoux (Head of Copernicus Ground Segment and Data Managements), who presented an update on the DIAS platform. This has now been full contracted out by ESA and it was mentioned that further documentation around DIAS will be released in March 2018 and tangible outputs/example of DIAS available from June 2018. The team will try and follow up with the implementation company/consultancy for the DIAS platform.

Additionally, the LTS team screened and assessed available services for building and hosting a SMFM project website that could serve as a platform for keeping stakeholders updated on activities, events and progress. This will be developed and a beta version released created towards the end of March 2018. Additional to this, the team will also look at logo options to help promote and market the project work and activities.

