REDD+ for the Guiana Shield

Technical and Regional Platform for the Development of REDD+ in the Guiana Shield

Terms of Reference
SAR Technical Training for Forest Mapping

Project Owner: Office National des Forêts (ONF) at French Guiana

*Partners: ONFI and Région Guyane (France) / GFC and OCC (Guyana) /
IEF-AP and SEMA-AP (Brazil) / SBB and NIMOS (Suriname)*

*Donors: Program INTERREG Caraïbes of the European Union / Fonds Français pour
l'Environnement Mondial (FFEM) / Conseil Régional de la Guyane (Région Guyane) / ONF*

CONTEXT

The project **«REDD+ for the Guiana Shield - Technical Regional Platform for REDD+ Development in the Guiana Shield»** at providing information and tools at regional level to be used by countries to establish sound monitoring and science-based policies, in the framework of REDD+ mechanism, to tackle deforestation and forest degradation. The project is financed with an amount of 2,7 million euros by the Fonds Européen de Développement Régional (FEDER), the Fonds français pour l'Environnement Mondial (FFEM) the Conseil Régional de la Guyane and ONF. It involves forestry

departments from the State of Amapá in Brazil, Suriname, Guyana and French Guiana, which in sum cover a large share of the Guiana Shield eco-region.

Through a series of activities (working groups, training sessions, creation of regional tools), the project has the following objectives:

- Strengthen the capacity, knowledge and expertise on REDD+ in the forest services of different partner countries. The targeted topics are the evaluation and monitoring of forest cover and carbon stocks, evaluation and monitoring of drivers of deforestation and modeling of future deforestation;
- Encourage and facilitate the dialogue in the region on the technical issues cited above, in order to create a common understanding of the challenges of reducing deforestation in the ecosystem of the Guiana Shield;
- Develop tools to support the implementation of REDD+ and land use in the region.

In order to support the implementation of REDD+ initiatives, there is a need to develop a Forest Cover and Land Use/ Land Cover Map that appropriately monitor the current situation of the forest being considered in the project. Remote sensing using optical or synthetic-aperture radar (SAR) imagery are the most efficient ways to produce this type of map. Unfortunately, the characteristics of this region include frequent and widespread cloud cover, which represents a challenge for the use of optical satellite images for remote sensing, because it demands the acquisition of many different images for the same area, which all combined will eventually allow to remove the clouds gaps in a aggregate image.

Consequently, SAR imagery is a suitable solution to complement Optical data, due to its insensitivity to cloud cover. Furthermore, radar acquisitions through satellites such as ERS, ENVISAT, JERS, RADARSAT, or PALSAR, have resulted in continuous observations in the microwave domain since 1991. SAR sensors also acquire radio data, such as the RADARSAT-2 and recently launched Sentinel 1 (launched in April 2014) and PALSAR 2 (launched in May 2014). Finally, the ESA BIOMASS mission will be launched around 2020, consisting of a SAR sensor at P band, whose images will improve forest monitoring over dense tropical forests.

Moreover, the availability of several open source tools provided by ESA (Nest, PolSarPro), Alaska Satellite Facility (MapReady), CNES (Orfeo Tool Box) or Qgis, allows to significantly simplify the processing of SAR images for the production of Land Use/ Land Cover map focused on forests. Advanced image processing requiring sophisticated knowledge on SAR remote sensing can also be used to produce Biomass Maps and monitor forest degradation, such as exemplified by CESBIO research (http://www.cesbio.ups-tlse.fr/index_us.htm).

In this context, **we propose to focus on learning through practice on SAR to provide tools and documentation for the main SAR sensors**, in order to facilitate the production of a Land Use/ Land Cover map for forest monitoring. The main goal is that participants build capacity to produce their

own maps from radar images. The second goal is to initiate collaborative work to produce coherent and unified maps at a regional scale over all the Guiana Shield.

These goals are described in more detail in the following "Training Methodology" and "Planning and Predicted Calendar" sections. Special attention is placed on learning through practice for data processing of existing SAR images. Consequently, computer-based data processing will be programmed for most part of the training (around 4.5 days), while the rest of the time (about 0.5 days) will be dedicated to initially provide the theoretical basis needed to understand data processing.

MAIN OBJECTIVES

The SAR technical training session for forest mapping has the following objectives:

- Improve regional technical capacity on the processing of SAR images;

- Produce a first Land Use Land Cover Map for each country;

- Initiate collaborative work to produce coherent and unified maps over all the Guiana Shield at a regional scale.

TRAINING METHODOLOGY

i) Learning Content

- *Theoretical component*

    1. Introduction
        a. Illustration of SAR and Optical imagery
        b. What is SAR?
        c. Wavelength sensitivity
        d. Coherent wave
        e. Illustration of SAR imagery
    2. SAR geometry
        a. Range geometry
        b. Resolution
        c. Relief effect
    3. Speckle
    4. SAR derived indices
        a. Intensity data
            i. Intensity
            ii. Pseudo entropy
            iii. Texture

  b. Polarimetric SAR
    i. Intensity
    ii. Some Polarimetric indicators
    iii. Texture
5. Sensors Review
  a. ERS
  b. JERS
  c. Envisat
  d. Radarsat
  e. Palsar
  f. Sentinel 1
6. Basis on classification (Optical and SAR imagery)

- ***Practical component***

Data file and folder management rules

1. Pre-processing
  a. Software overview (NEST, Mapready, Polsarpro, OTB, QGIS)
  b. Data and metadata extraction (Nest/Polsarpro)
    i. ERS/JERS/SENTINEL/PALSAR
  c. Speckle filtering (Neast/Polsarpro)
  d. Ortho-rectification (NEST/Mapready)
  e. Indices extraction (Polsarpro/Nest)
2. Photo-interpretation and definition of main study classes
3. Classification (QGIS/OTB)
  a. Build shape files for ROI (Region Of Interest)
  b. Supervised classification (Support Vector Machine)
4. How to optimize classification
5. Rules to harmonize different classification to mosaics or temporal analysis
6. *Discussion*

ii) Expected Participants

Maximum 20 participants with basic knowledge of GIS and remote sensing imagery.

iii) Software Used

- *Files:* PDF, PPT
- *Open source software:* Nest, Polsarpro, Mapready, OTB, QGIS
- *Dataset:* Open source Sample file for main sensors and Palsar Mosaic

iv) Equipment Required

- Room with datashow and a minimum of 1 computer per 2 participants
- Hardware:
  - Computer with CPU dual core
  - Ram: 2Gb minimum (4Gb recommended for Windows XP and Ubuntu) / 4Gb minimum for Windows 7 and 8
  - Hard disk with a minimum of 20 Gb free space

v) Experts Involved

The training will count with the presence of Dr. Cédric Lardeux, expert in RADAR from ONF INTERNATIONAL and with the assistance from Prof. Jean-Paul Rudant and Pierre-Louis Frison, from the University of Université Paris-Est Marne-la-Vallée.

PLANNING AND PREDICTED CALENDAR

i) Location and Other Logistic Issues

The training will take place at three different locations, in order to overcome linguistic barriers and provide the same level of training for each partner involved. Therefore, parallel trainings will take place at Guyana, Amapá, and Suriname. French Guiana participants will be invited to join the training session in Suriname.

Partner forestry services are expect to contribute to logistical aspects, within possible. This support would be most relevant for: providing a venue for the training (preferably within their premises); ensuring that the necessary equipment as indicated in the previous section will be available to the participants (i.e. a datashow and at least 1 computer per 2 participants); assisting with the catering organization.

Translation will be provided by the project, as appropriate for each country.

ii) Budget

The project will be responsible for financially supporting this work. The total estimated is EUR 73,500. This value covers the expenses resulting from the organization of the training sessions in Guyana, Amapá and Suriname and the associated expertise from ONFI (32,800€) and from Pierre-Louis FRISON and Jean-Paul RUDANT (8,750€) from Université Paris Est Marne La Vallée (UPEMLV).

See detailed budget below.

Expertise	hj	coût total	TOTAL
ONFI	41	32,800 €	41,550 €
UPEMLV	25	8,750 €	
Per diems			
ONFI		6,810 €	16,310 €
UPEMLV		9,500 €	
Achat matériel		600	
Frais logistiques divers		15,040 €	**73,500 €**

iii) Calendar

Each project partner is invited to confirm by email the availability to host/participate in the training sessions on the dates proposed below. Please send this confirmation by email to the project team **until 22 September**. If any of the dates proposed are not suitable to one of the partners, the project team will articulate with that partner directly in order to circumvent eventual agenda restrictions.

Below are listed the suggested dates to perform the SAR Technical Training for Forest Mapping:

- Suriname and French Guiana: 10 to 14 November 2014
- Guyana: 17 to 21 November 2014
- Amapá: 12 to 16 January 2015

The project team will subsequently confirm the definitive dates, based on the responses from the project partners.

WORKING GROUP MEETING ON RADAR

Following the delivery of the SAR Technical Training for Forest Mapping at the three planned locations, this activity will be combined with another of the project activities, the Working Group (WG) Meetings, in order to consolidate and advance this technical discussion at regional level. Therefore, a WG meeting will be organized, ideally in February 2015, under the topic of RADAR. It is intended that this meeting will also allow to further explore the potentialities and specifications of RADAR in the context of a MRV system for REDD+. By validating this ToR, the Steering Committee members will also be agreeing on the principle of having a WG meeting focused on RADAR.