

## REDD+ for the Guiana Shield

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



### Terms of Reference

### SAR Technical Workshop for Forest Mapping

### Session 2 - Applications

***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» aims at providing information and tools at the regional level to be used by countries to establish sound monitoring and science-based policies, in the framework of the 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) and the Conseil Régional de la Guyane. 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 modelling 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 Maps that appropriately monitor the current situation of the forest being considered in the project. Remote sensing methods using optical and/or synthetic-aperture radar (SAR) imagery are the most efficient ways to produce this type of maps. However, the frequent and widespread cloud cover of the Guianan moist forest region represents a challenge for the use of optical satellite images, because it requires the acquisition and processing of many different images for the same area.

Between November 2014 and January 2014, a first one-week training session on SAR was successfully performed in each forest services involved in the project. This session was an opportunity for up to 25 participants in each country to learn the basics of SAR theory and processing methods using open source software. Given the high interest of the participants and the demonstrated need of the forest services for integrating the use of SAR data in their MRV system for REDD+, the project team proposed during the last steering committee meeting to organize a SAR workshop to consolidate the operational use of acquired knowledge.

The next sections describe the objectives, activities and detailed program for this workshop.

## **WORKSHOP OBJECTIVES AND MAIN ACTIVITIES**

The main objectives of the SAR technical Workshop Session for forest mapping are:

1. To Improve and strengthen the knowledge and skills acquired in SAR processing during the SAR training sessions through practical exercises
2. To highlight and discuss about all difficulties encountered by trainees when trying to process SAR imagery in an operational way

3. To better identify the needs of the partners in terms of SAR imageries and processing outputs
4. To improve and reinforce the photo-interpretation and processing skills of SAR imageries by comparing the response and outputs obtained with high to very high resolution optical images but also with ground-truth
5. To better understand the added value of SAR imagery for detecting specific features or activities related to the Guianan ecoregion
6. To combine SAR-based output products with optical-based ones

The activities proposed to be carried out for this workshop in order to fulfil the above-mentioned objectives are organized in two phases: a first workshop preparation phase that will need to be achieved by each partner's team (composed of 4 persons) before the workshop with the training coordinator support, and a second phase that will consist in the workshop itself.

The first phase (workshop preparation) is mandatory to fulfil objectives 1-2-3. The main activities for each phase are listed below with detailed explanation and/or recommendations.

#### Phase 1: Workshop preparation

This phase requires the active involvement of each partner's team before the workshop. It aims at helping the participants to start with the processing of SAR imagery in an operational (autonomous) way using the tutorials shared during the first training session. This first phase will be an opportunity for the participants but also for the trainers to (i) test, in real situation, the quality and operational use of the tutorials, (ii) assess the understanding of the processing steps and (iii) identify the processing steps that hinder the operational implementation of the methodology by the team. During this process, the trainers will be available (distant helpdesk) to support participants.

Beyond the technical preparation that is further detailed below, countries will be asked to identify 4 trainees that already attended the first RADAR training session.

*Selection of an in-country study site for which SAR imagery will be processed and compared with additional data (high to very high optical images, field data...)*

A study site will have to be identified by forestry services and shared with the training team for discussion and advice. Thanks to this site, it will be possible to better illustrate SAR images answer, and to highlight added value and complementarity compared to optical images.

Sites will be selected by the countries based on the following criteria:

It should represent an emblematic situation in the country, as well as in the Guiana shield, for example small-scale gold mining activities or highly dynamic mangroves on the coastal line, degraded forest, etc.

Countries' partners must explain what are their objectives and needs in terms in SAR imagery for this study site, i.e. what is the deforestation activities they would like to perform on it such as Gold Mining or deforestation detection, discrimination of specific land cover classes, etc.

Study sites must have already been processed and analyzed using optical imagery.

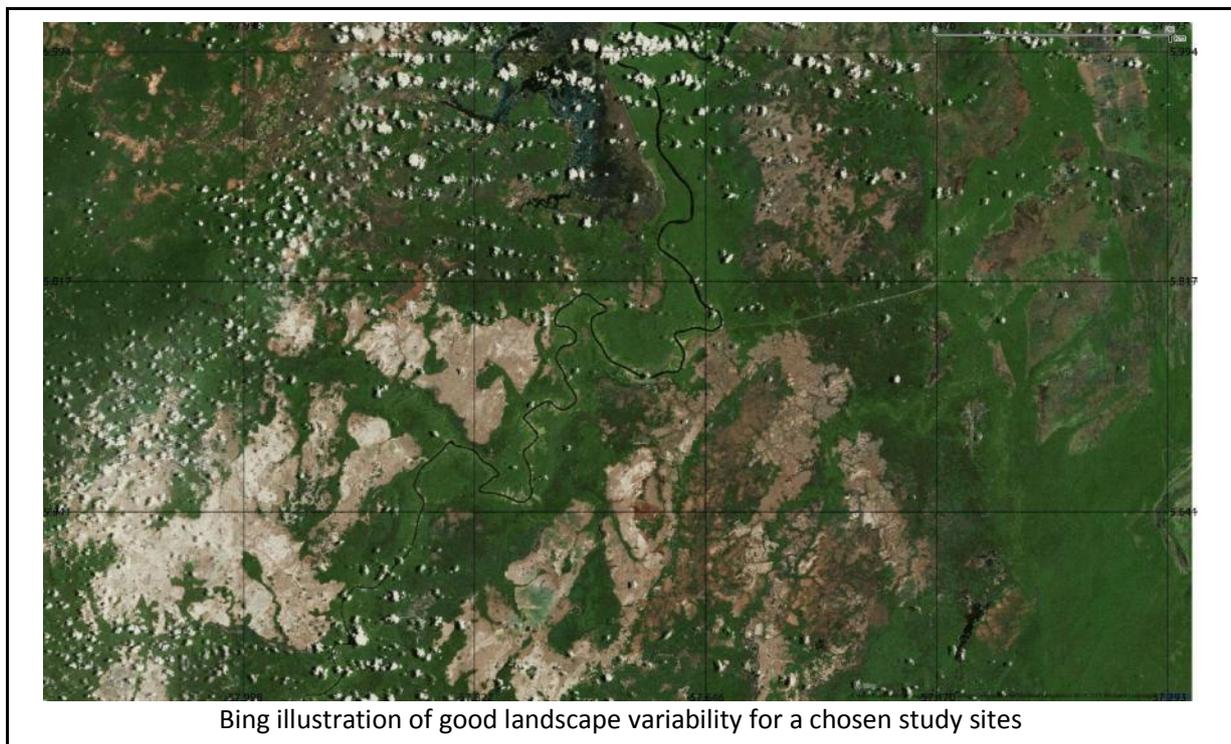
Study sites must be well known by the country participants (clear understanding of what is the coverage on the site and as far as possible, a good understanding of the site history).

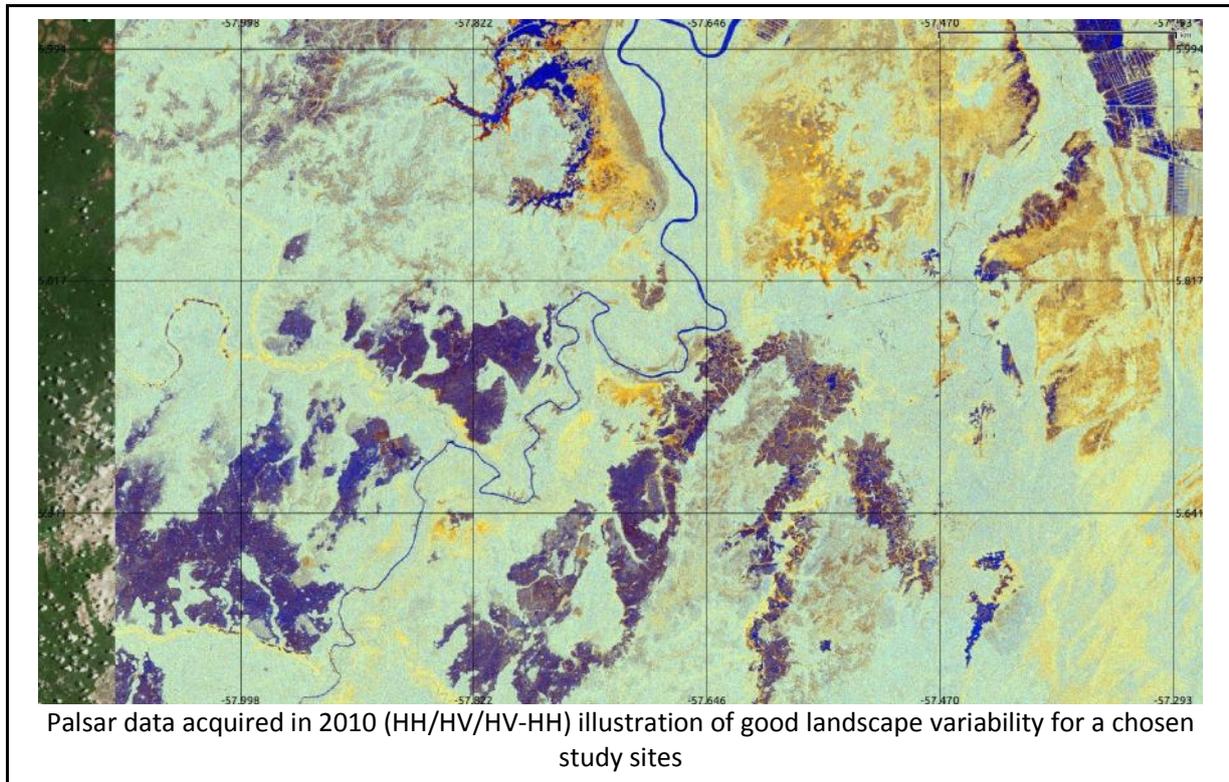
Area need to be lower or equal to 40x40km

Land should be covered with various classes: Dense Forest, other forest classes (Flooded Forest, degraded forest), low vegetation area such as Savannah, Swampy areas, small no forest area (1ha), water and settlement area, etc. The figure below illustrates a relevant area in terms of coverage diversity.

Some information and data must be available for this site and should be summarized within a synthesized document to be sent to trainers:

- Short summary of the land-use and land-cover changes over the last 10 years
- Optical data with its acquisition date
- Existing processed forest map (based on optical images),
- If available GPS point with photo,
- Some ancillary data if available.





#### *Selection of appropriate SAR data*

For each of the chosen study site and based on the discussion between the training team and the country forestry services, the training team will define the best suited data and methodology to answer the country needs in terms of remote sensing monitoring (i.e. what they would like to detect using SAR images, what is the added value of SAR images for the study site situation, what remote sensing application could be performed using SAR images).

Providing those information before the training is important because, as for Optical data, the choice of best suited SAR data is a complex task. Data selection will depend on:

- Forest discrimination capabilities (L band as Palsar or Alos 2 or C band of Sentinel 1)
- Data availability (Past, Present and Future): for example Palsar cover every year from 2007-2011, ALOS 2 Will cover every year (5-9 times per year the tropical area), Sentinel 1 will probably cover all the world every year.
- Price: ALOS 1 data cost 36€ but Jaxa Palsar Mosaic is free for non-commercial use. ALOS 2 cost 2200€ for one scene and Sentinel 1 is free
- Processing level: We can order basic level processing which need to process orthorectification but we can also order orthorectified data.

Those data will be used during Session 3 of the workshop. Process of data selection and collection will also be detailed to participants in order to build their capacity on this important step of a project.

*Core-processing of SAR imagery that covers the study site using the video tutorials delivered during the first SAR training session.*

Based on the location of the chosen study site, the participants will use the 2010 Jaxa mosaic given during the first radar session, clipping this mosaic to the selected study site. Based on the previous RADAR training session, participants will perform the core-processing steps (namely photo-interpretation and classification processes) on which they have already been trained and for which they have tutorials. Targeted final output is - for each country - a first map discriminating as much land covers as possible using the learned classification tools (SVM classifier).

This step will be the opportunity for the participants to identify the processing steps that might hinder their operational implementation of the method but also to strengthen their interpretation of SAR imagery. The difficulties encountered by the participants during this process will be discussed during the workshop with the trainers and all participants. The program of the workshop described below will aim to provide solutions and improved understanding of SAR interpretation and processing. Prior use of SAR images and tutorials developed during the first training session are a must to attend this second SAR workshop.

A 10 to 15 minutes presentation should be prepared by each country in order to present the study site, as well as first results and possible difficulties encountered by participants during this processing phase.

### Phase 2: Workshop program

The training week will be organized around four different sessions, each having specific objectives. The agenda itself is further detailed in this document. All those sessions will build upon the capacities acquired during the previous RADAR training session and the workshop preparation phase.

#### *Session 1 – SAR imagery interpretation and processing methods*

This session will focus first on results obtained and difficulties encountered by each participating team during the preparation phase. Each country will be invited to present their preliminary results in order to feed the discussion around difficulties linked to SAR imagery interpretation, processing methods and around added or non-added values of SAR imagery compared to optical data.

Through discussions and practicing, this session also aims at providing answers to participants on difficulties they encountered and at improving interpretation and classification results. In order to give participants an additional opportunity to practice basic processing tasks several times, with the support from trainers, a new dataset will be shared by the training team. This dataset will focus on a site - selected with the hosting country - that will be visited on day 3.

#### *Session 2 – Field mission for better understanding the SAR response*

Day 3 of the workshop will be dedicated to ground truthing points collection during a field visit in a

location previously processed using SAR images (day 2 - see session 1). Objectives of this field visit is - beyond the capacity that will be built in terms of ground-truthing points collection using GPS and tablets - to improve interpretation capabilities of SAR images by observing in the field answers visible in the images.

#### *Session 3- Radar imagery processing applied to specific forest monitoring activities*

SAR images can be of added value to forest monitoring activities. Some specific features (e.g. flooded or swamp forests) or activities (e.g. gold mining) are worth being discriminated using SAR images. A set of processing methodologies will be presented and discussed during the workshop. They will then be applied by trainees to their own study site, based on dataset given by trainers and with active support from the training team.

#### *Session 4 - Combination of SAR and optical data to improve mapping process*

The training team will show and explain how the output of SAR processing could be combined to optical ones in order to improve (e.g. by detecting of specific features such as flooded forests) or to fill gaps (such as clouds and shadows) of the optical mapping results. Such a combination process will be presented and realized during the workshop. Practical examples and synergies with other project activities will be illustrated and used as examples of possible combination, including the “cloud/shadow mask” achieved in the framework of the “Monitoring the Impact of Gold Mining on the Forest Cover and Freshwater at the Guiana Shield Regional Scale” study.

## **WORKSHOP ORGANIZATION**

### **I. Location**

Following decision made during the last Steering Committee Meeting, the Workshop will take place in Macapá.

### **II. Expected Participants**

Each country is invited to name 4 staff members that will attend this second SAR Workshop. Trainers have to be selected among the staff that has already been trained during the RADAR training session. They should be actively involved in the remote sensing activities in the country.

### **III. Software Used**

Files: PDF, PPT

Open source software: Nest, Polsarpro, Mapready, OTB, QGIS

Dataset: Optical data provided by each country and other radar data in the same area

### **IV. Equipment Required**

Room with datashow and a minimum of 1 computer per 2 participants

Hardware:

Computer with CPU dual core

Ram: 4Gb minimum

Hard disk with a minimum of 20 Gb free space

### **V. Training team**

The training will be provided by one RADAR expert from ONF INTERNATIONAL, with the assistance from Prof. Jean-Paul Rudant and Prof. Pierre-Louis Frison, from the University of Université Paris-Est Marne-la-Vallée.

## CALENDAR OF ACTIVITIES

**Based on trainers' availability, proposed week for this SAR Technical Workshop for Forest Mapping is the April 13th to 17th 2015 week.** Exact dates will depend on up-dated flight schedules to be sent by companies.

Suggested calendar for preparation and workshop phases are detailed below.

### I. Workshop preparation phase

#### A. **Information to be sent to trainers - 1 month before training:**

Identified study site with informations (see aforementioned criteria and details on the chapter dedicated to Preparation phase)

List of 4 participants

#### B. **Processing SAR imagery on the study site** (by identified staff participants) - with helpdesk support from trainers if needed - **Once study sites have been selected and before Workshop session**

Using Jaxa Palsar Mosaic provided during first radar session

Based on the experience acquired during the first RADAR training (first classification results)

To be summarized within a PPT (including informations on the study site) that will be presented during the workshop

#### C. **Preparation of the workshop by trainers - once informations are sent by countries and before the workshop**

Based on selected study sites and on discussion with countries, trainers will identify appropriate methodologies, tools and dataset that will be used during session 3.

In order to ensure continuity, trainers will define processing methodologies based on same tools than the ones shown during the previous radar sessions.

### II. Workshop Week

#### A. Day 1

Presentation of study site by country (Location, LULC, available data)

Presentation of the processing results by country and discussion

Presentation of the field visit site. for field visit

Processing demonstration on study site close to the workshop and using data given by the trainers (all together)

#### B. Day 2

Processing demonstration on study site close to the workshop and using data given by the trainers (all together)

Discussion of results and comparison with optical imagery

Relevant Radar data: How to acquire it, application and price

Main Radar forest activities for Guiana Shield

- Gold Mining
- Biomass estimation
- Forest stratification
- Forest coastal Dynamic
- Deforestation

### C. Day 3

Field visit on a selected and accessible study site in the hosting country

- Responses comparison of overlapping Radar and optical images for different land cover types
- Use of mobile tools for demonstration (tablet, smartphone) using OruxMap android applications to display in real time and with geolocation the different data (One rugged tablet per country to be provided by the project).

### D. Day 4

Processing methodologies for Gold Mining, Forest stratification, Forest coastal and deforestation

Each country will process the data given by the trainer in their own study site (supervised by trainers)

Presentation of results and discussions.

### E. Day 5

Comparison and combination of Radar mapping with Optical mapping results (how to improve optical-based results? how to fill the gaps (clouds and cloud shadows) with Radar-based results, etc.)

Discussion and perspective

## BUDGET

Total budget needed to organize this SAR Technical Workshop is 58,300€, including :

- 47,500€ for expertise and logistics - to be allocated to Working Group Meetings budget line (2.b)
- 10,800€ to buy SAR images that will be used in the framework of this workshop - to be allocated to the Technology transfer budget line (3.b)

The total budget is detailed in the table below. See the Budget decision-making tool to see the impact on the total available budget.

Item	Amount (€)	Budget line
Expertise for preparation (ONFI)	14 000	2.b
UPEMLV expertise for Workshop	3 500	2.b
ONFI expertise for workshop	5 600	2.b
Experts fees	4 400	2.b
Material	10 800	3.b
Regional workshop logistics	20 000	2.b
<b>TOTAL</b>	<b>58 300</b>	

Budget dedicated to material includes:

Radar imagery Alos 2 ≈9,000€:

Usage: forest monitoring

One Scene for each country

HH/HV mode at 10 m resolution with 70x70 km of cover

Acquisition date adapted to country study site requirement

300 000 JPY cost per scene

Mobile tools for fieldwork ≈2,000€

Rugged android tablet for field work

Model: Samsung Galaxy Tab Active 8" SM-T360 16 Go

Price≈ 400€

One for each country and one for the training staff