Capacity building

In the first project phase, the current interest and usage of GIS, EO in the project area have been reviewed. The results from the user survey confirmed the enormous potential of EO and GIS technologies. However, these results demonstrated that most of the participants have low GIS and statistics skills, and no EO skills. It is evident that local capacity building is required, which is an integral part of REDDiness.

Based on the user requirements analysis and EO research activities, a specific plan for training and capacity building has been developed. This plan ensured the uptake of REDDiness developments, mainly through the participation of local agents to field missions (use of gps, data integration into a GIS, field evidence of forest degradation...). Moreover, two training sessions of one week in GIS and remote sensing will focus on the basic principles of image processing (acquisition, correction and classification of images) and the practical use of software (open source or commercial according to national requirements).

Consortium

The consortium consists out of a highly qualified team. It is composed out of academic institutions, SME's, NGO's and governmental organizations. This way it combines specific expertise in remote sensing with expertise of specialists in forests management in African countries. Additionally an advisory board will provide concrete advice to the consortium.

EUROSENSE

IRD Institut de recherche pour le développement

ITC UNIVERSITY OF TWENTE. FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

CNIAF Centre National d'Inventaire et d'Aménagement des Ressources Forestières et Fauniques

EAUX ET FORETS

OSFAC

In addition, the consortium receives advices from an advisory board expert in forestry.

UCL Université catholique de Louvain

WORLD RESOURCES INSTITUTE

EUROPEAN COMMISSION DIRECTORATE-GENERAL Joint Research Centre

More information

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REDDiness

Support EO-driven forest monitoring in Central Africa

Context and objectives

REDD+ aims at decreasing carbon losses from the forest sector through five activities: reducing deforestation, reducing forest degradation, forest enhancement, sustainable management of forests, and forest conservations. Obtaining compensations due to REDD+ presupposes the development of a robust, reliable and transparent forest monitoring system and requires an accurate measuring, reporting and verification (MRV) system at the national level. REDDiness offers support in the definition and set up of this system in **Republic of Congo** and **Gabon**. While regional or large remote sensing projects already exist in the region, REDDiness decided to focus on one specific topic less addressed by other initiatives : the **monitoring of forest degradation**

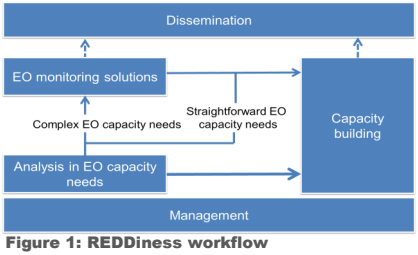


Figure 1: REDDiness workflow

REDDiness, funded by the European Commission, aims to support forest monitoring centers in the Republic of Congo and Gabon in their efforts to implement the MRV system in the context of REDD+. This support began with a thorough analysis of user requirements in terms of forest monitoring by remote sensing data. Based on the results of the analysis, remote sensing research and capacity building activities have been identified.

Users requirements analysis

A quantitative survey has been carried out in Republic of Congo and Gabon to measure awareness and interest in EO-based products, REDD+ and forest monitoring. Among the 44 questionnaires distributed in the two countries, 26 questionnaires (59%) were completed and collected. Despite a large interest in REDD+ and EO training for implementing the MRV system, only 8 end-users have a minimum technical understanding to learn these techniques.

Results of this survey showed that the personnel skills and technical resources to work with GIS and EO techniques are very limited in both countries. As shown in the figure 2 below, the results of this survey helped us to define the thematic REDD+ topic for research activities.

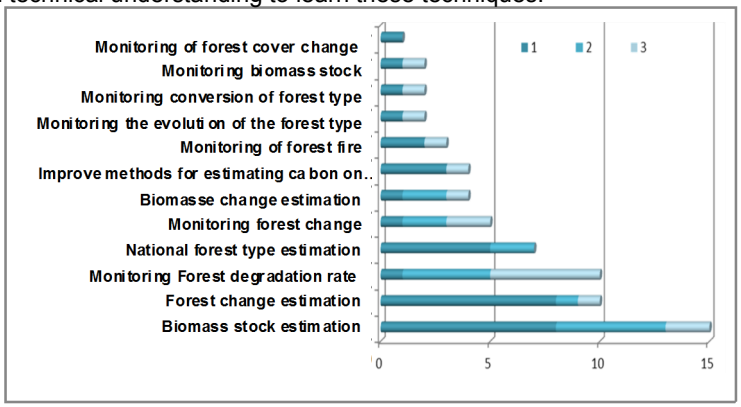


Figure 2 : Results to the question: « What are the 3 most important EO techniques in your national REDD+ strategy?»

EO monitoring : research and development

Introduction

The project specifically aims to improve methods for detecting forest degradation using various remote sensing data. To overcome the problems of the utility and availability of optical data due to persistent cloud cover in the Congo basin, the potential of active sensor were studied. Two types of satellite data were used to assess their potential for monitoring and detecting small forest degradation features (canopy gaps, narrow logging roads) : high and very high resolution of optical and radar data.

Study sites and data

REDDiness focuses its research activities on two study sites, one in the South of Congo (Youbi) and one in Gabon (Koulamoutou) (Figure 3). Four criteria were determinant for their selection :

* presence of human settlements,
* national road,
* forest concession,
* availibility good quality images.

Three types of data were acquired :

* optical : Landsat, QuickBird and WorldView;
* radar : ENVISAT ASAR, PALSAR, RADARSAT, TerraSAR-X.
* field data: georeferenced pictures.

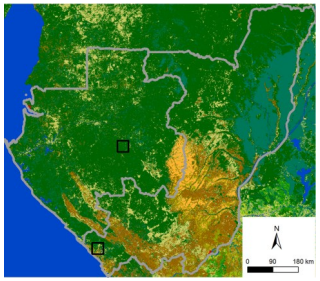


Figure 3: Location of study sites in Gabon and Congo.

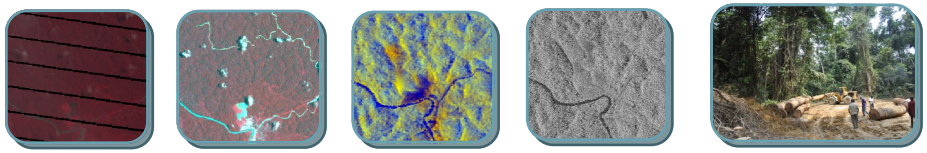
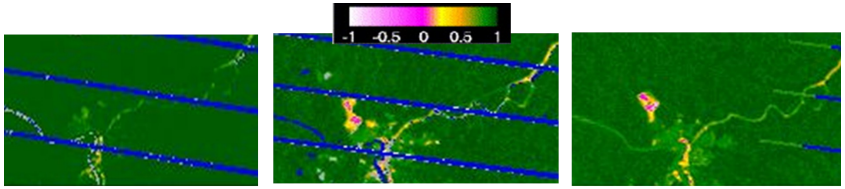


Figure 4 : Illustration of data acquired and used in Gabon. From left to right: Landsat, QuickBird, PALSAR, TerraSAR-X and a picture taken on the field.

Optical : *NDFI* analysis

The Normalized Difference Fraction Index (NDFI) is a method of spectral mixture analysis successfully applied in the Brazilian Amazon to identify and distinguish forest degradation caused by selective logging and forest fires associated with other natural disturbances. The potential of this technique was tested in both study countries.



Landsat 2009 Landsat 2010 Landsat 2011

Figure 5 : Illustration of NDFI results for 2009, 2010 and 2011 for the study site of Gabon.

Optical : Degradation and forest changes detection

Based on very high resolution data, the object-based classification and multi-date segmentation techniques were tested to provide a system for monitoring small forest degradation features (< 1ha) and evaluating the rate of forest degradation. The figures 6c and 6d below show the two levels of segmentation created respectively for 2010 and 2012 to detect forest degradation. Level 1 objects (large objects) aggregate small degradation features information to highlight five level of forest degradation whereas smaller level 2 objects show the extent and the exact location of these small features. Figure 6e illustrates the level of forest degradation for each large object between 2010 and 2012.

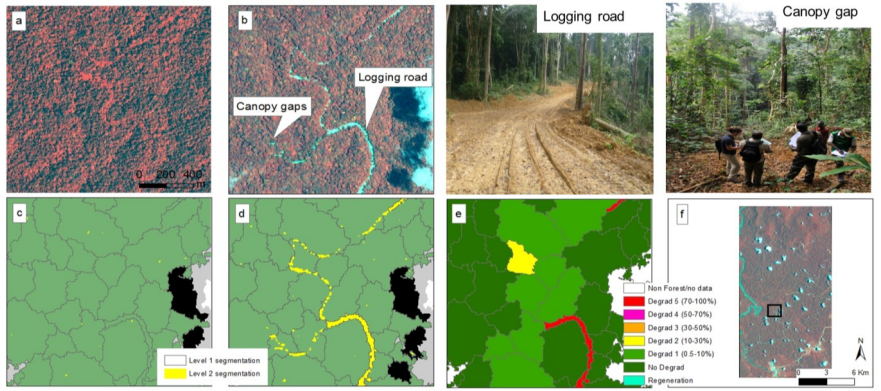


Figure 6: Input data used to create the forest degradation map between 2010 and 2012 where: a) is the Quickbird imagery from 2010, b) the Quickbird imagery from 2012, c) shows the two levels of segmentation resulting from Quickbird 2010, d) the two levels of segmentation resulting from Quickbird 2012, e) the degradation map showing the percentage difference of small patches of bare soil per level 1 object between 2010 and 2012, f) shows the image subset extent.

Radar : Mono– and multi-temporal visual analysis

The main objective of this analysis is to assess the potential and limitations of radar data in detecting forest degradation. The first, tedious, step was the preprocessing of all images acquired. The principal component analysis is a visual comparison of radar images with evidence of degradation based on very high resolution images and field data. An example of such a comparison is shown in figure 7 below.

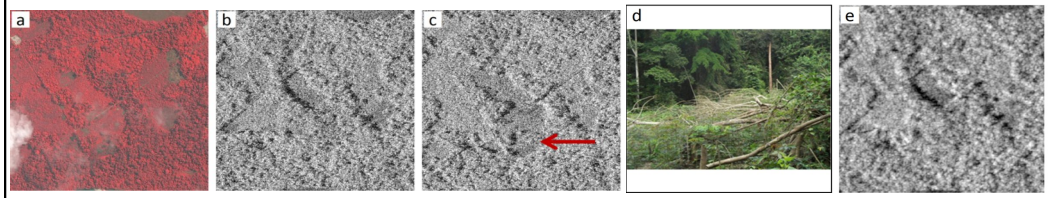


Figure 7: Expansion of cassava fields in a secondary forest through shifting cultivation practices. a) QuickBird - July 2012, b) TerraSAR StripMap - June 2010, c) TerraSAR StripMap - May 2012, d) photo taken during fieldwork showing recent clearings - August 2012, e) RADARSAT-2 scene at 34.8° incidence angle - March 2010, f) same geometry RADARSAT-2 image - March 2012, g) overview image with black box indicating location of subsets. The red arrow in the 2012 SAR images indicates new fields that were still forest in 2010.