



# THE FRENCH INITIATIVE FOR THE CONGO BASIN



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# The French Initiative for the Congo Basin



- **Background**
- **Provision of SPOT Data**
  - Overview of data provided
  - Controls performed on data
  - Status of data availability
  - Data access policy
- **Additional components**
  - Forest mapping
  - validation of forest mapping
  - Support to national authorities
  - Capacity building

# BACKGROUND

## Framework agreement between AFD & Astrium

in Copenhagen, December 2009 (COP15):

French cooperation to finance the coverage of the Congo Basin Tropical rainforest with SPOT satellite images

### Project objectives

- Provide an exhaustive coverage with recent images (>2008), and regular updates
- Access to archive images of satellites SPOT 1, 2, 3, 4, 5
  - Products at basic level (1A) or ortho-rectified
- some forest mappings

Open access to data for REDD+ users: public entities, research institutions, universities, NGOs, private companies) upon approval of REDD+ licence

within the 6 countries: Cameroon, Gabon, CAR, DRC, Congo, Equ. Guinea

### A consortium was set to coordinate the programme

IGN-FI, CNES, IGN, IRD

# Overview of Data provided



## Coverage

- Exhaustive coverage of the tropical rainforest over the Congo Basin:  
2 millions sq.km
- 6 beneficiary countries: Cameroon, Gabon, CAR, DRC, Congo, Equ. Guinea

## SPOT images

- multispectral mode, images with cloud coverage <20%
- SPOT 4 (20m) & SPOT 5 (10m)
- Locally (for now, Central African Republic): very high resolution, i.e. 2.5m orthomosaics



## Recent data + archive data

- 2010 reference dataset** (+/- 2 years): archives + acquisitions 2008-2012
- Access to all SPOT archives
- Continuous data acquisition over areas of interest (current financing programme => 2015)

## Data access

- <http://bassinducongo.reddspot.org/>

# Controls performed on images

## Technical control

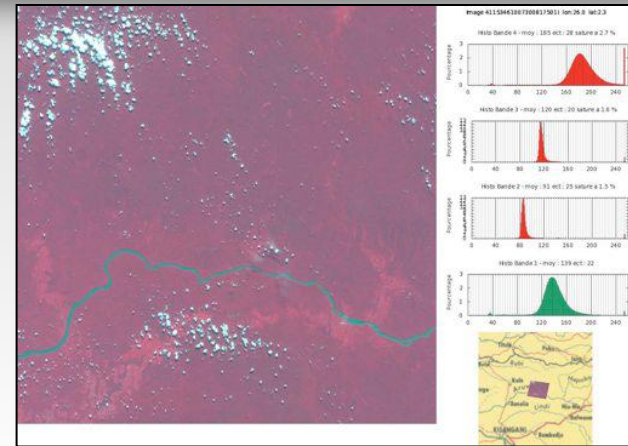
- Conducted by IGN satellite experts.
- Result in rejection / acceptance / warning
- Production of a summary sheet per image:

## Thematic control

- Performed by forest thematicians
- Decide whether images are relevant and usable (date, season, clouds, haze...)

## Results so far

- about 80 images rejected for coverage redundancy (the « best » has been kept)
- Few images rejected because of veil / clouds
- 900+ images delivered => **820 validated** (for the 2010 reference dataset +/-2 years)



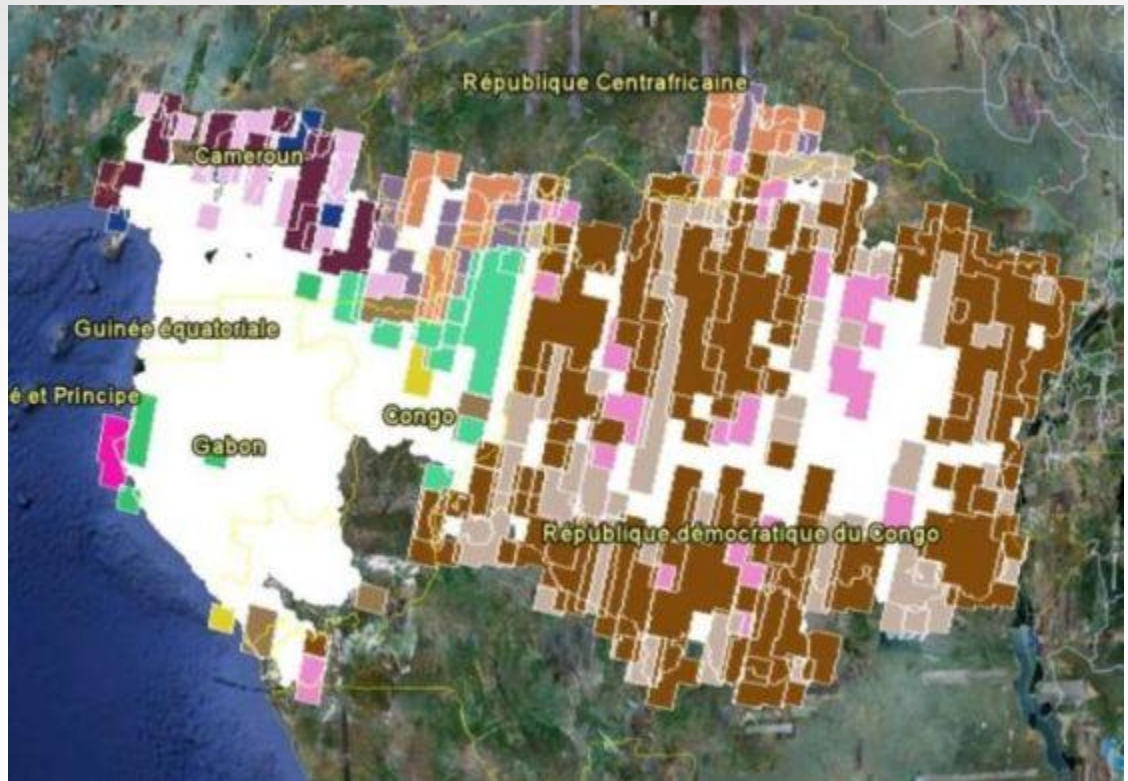
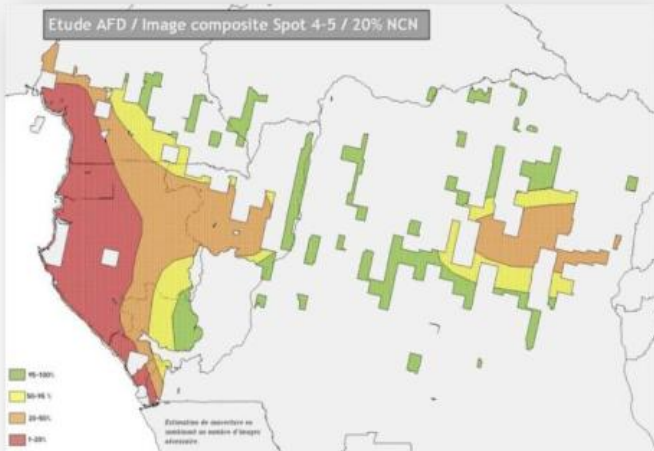


# Status of data availability

Status end 2010 (beginning of the programme):

Status of recent images (2008-2010) available

Where acquisition programing has been prioritized:

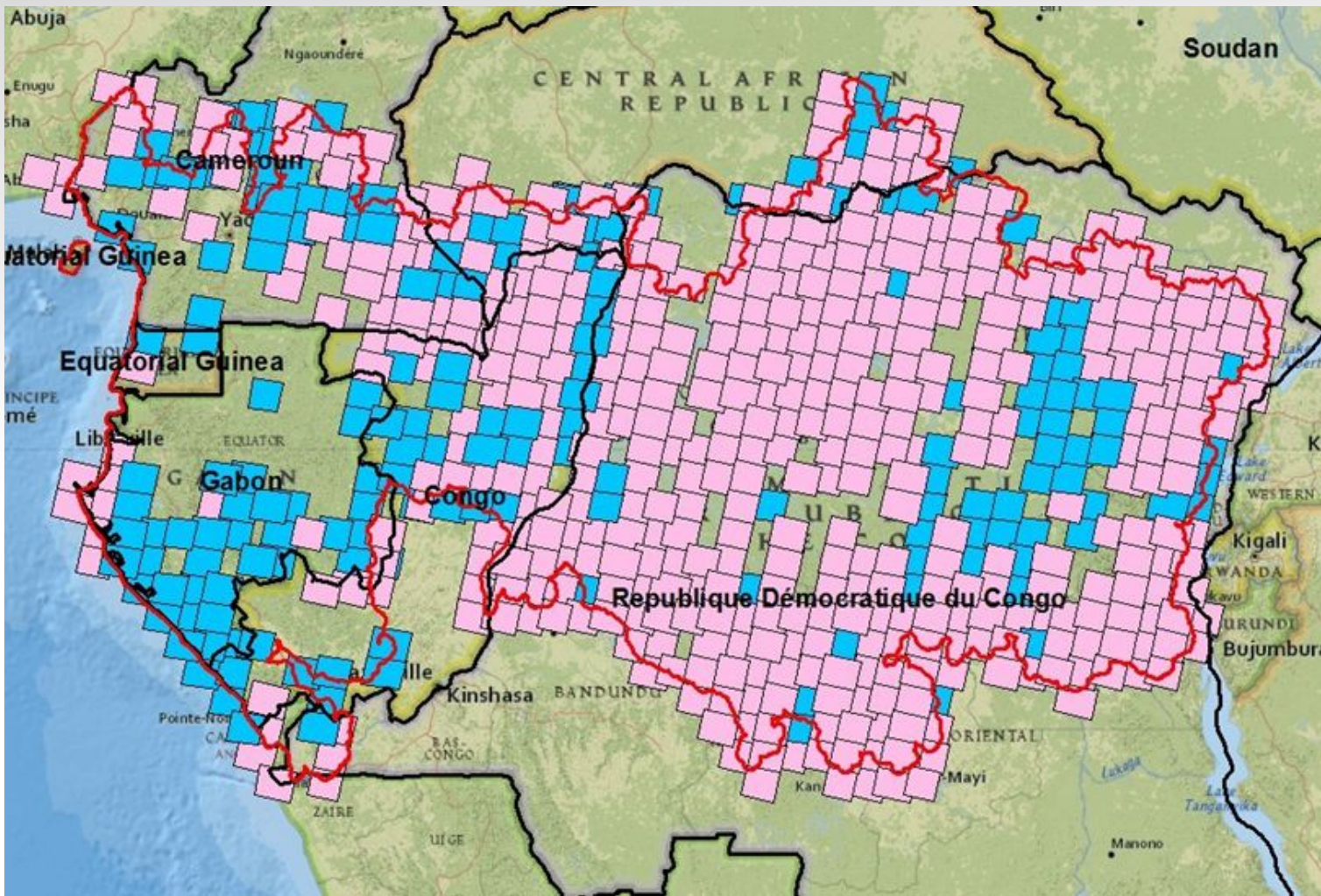




# Status of data availability

Status end 2011  
2010 +/- 2 years  
Coverage of  
images available  
& validated

■ SPOT 4 / 20m  
■ SPOT 5 / 10m





# Status of data availability

Status end 2012

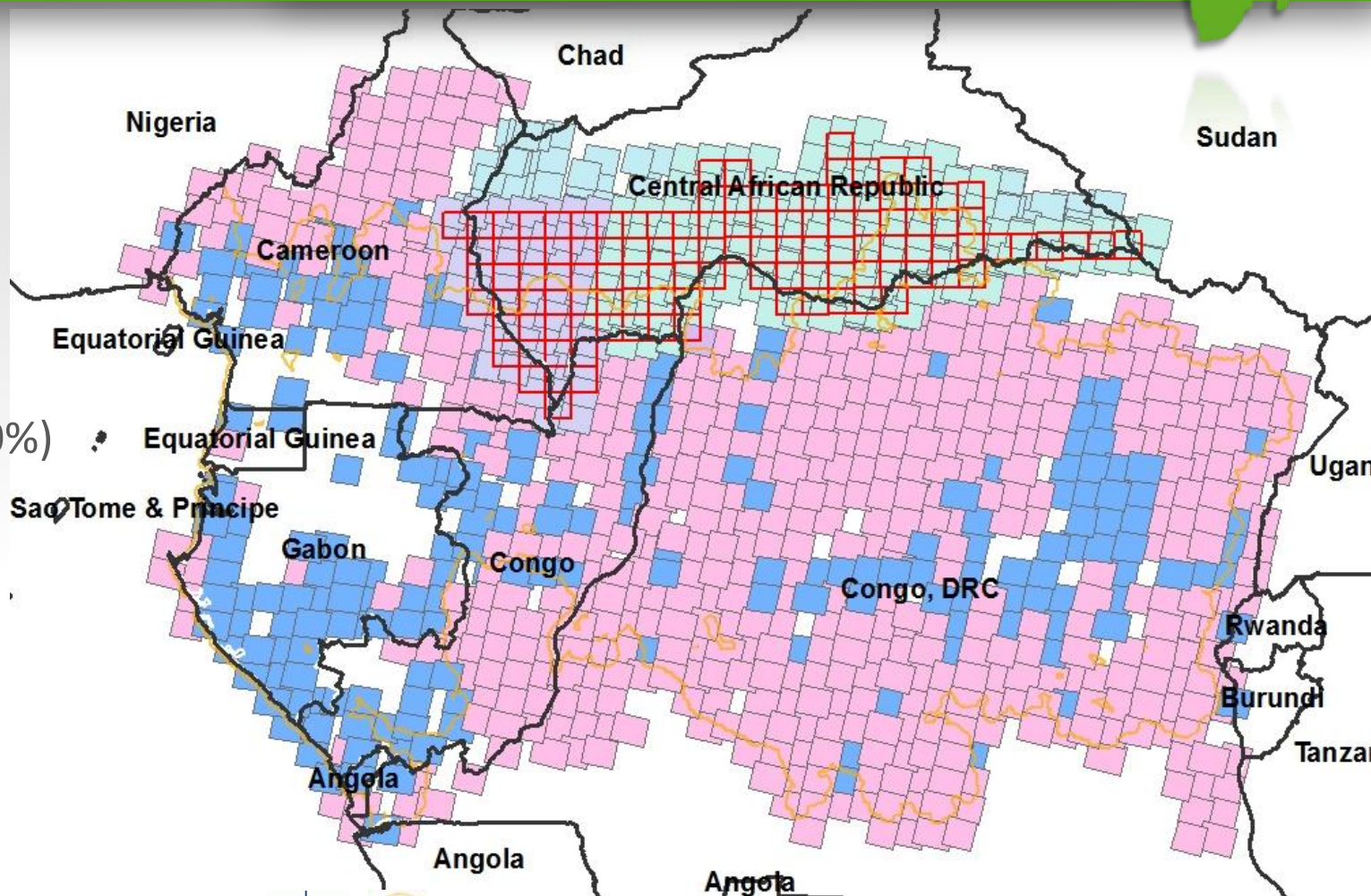
2010 +/- 2 years

Coverage of images available & validated

(cloud cover <20%)

SPOT 4 / 20m

SPOT 5 / 10m








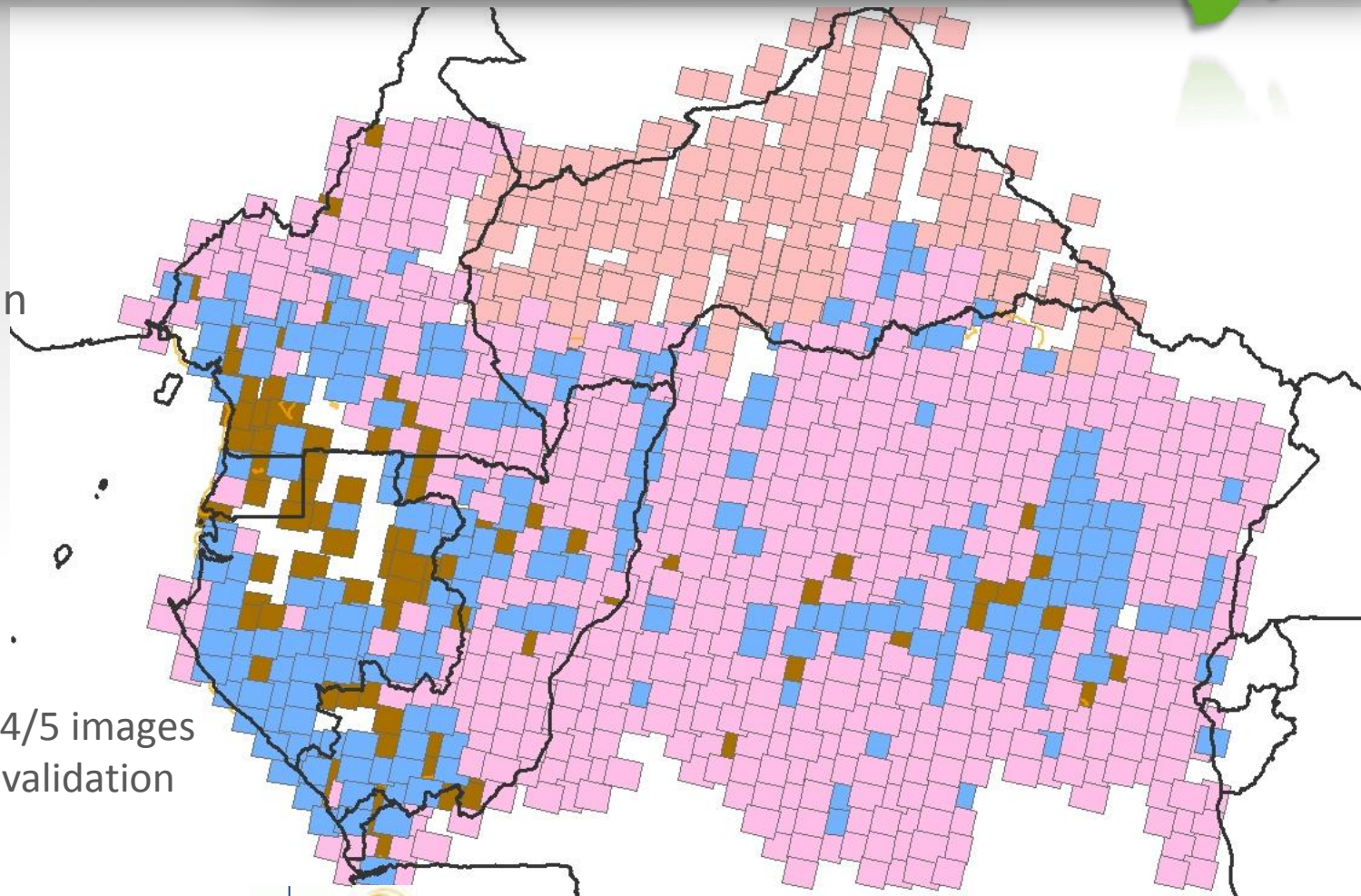


# Status of data availability

Status  
January 2013

Images acquired in  
2010 +/- 2 years

-  SPOT 4 / 20m
-  SPOT 5 / 10m
-  Additional SPOT4/5 images currently under validation



# Status of data availability



## What's next?

- Orthos: all 820 images validated so far have been ortho-rectified => will be available soon for users
- Further data acquisition:
  - Start in 2013 a new exhaustive coverage over Congo Basin?  
2015 +/- 2 years (start in 2013)
  - Or regular coverage (yearly?) over some identified areas
  - Include SPOT 6 images ? (conditions still to be discussed...)

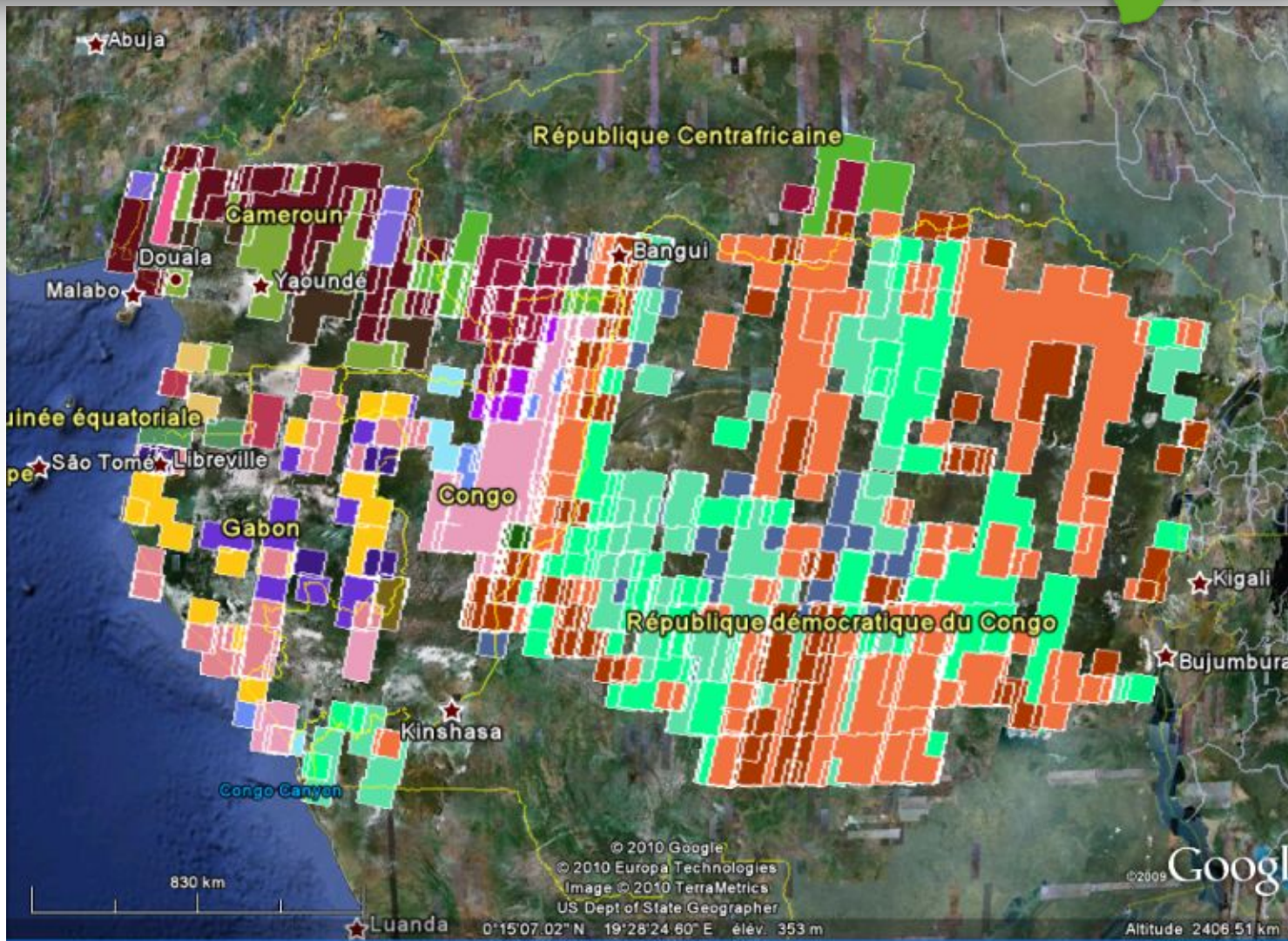


# Status of data availability

Other data available:  
all SPOT archive data

e.g.  
2000 +/- 2 years coverage

Images available  
cloud coverage <20%



# Data access policy



A specific SPOT « REDD license » has been created

## Principle

**Free Access**, Sharing and Usage provided on SPOT Products to REDD End Users within the frame of REDD projects approved by National REDD authorities.

Any project can be eligible, providing it is within one of the REDD+ fields of application, i.e

- (a) Reducing emissions from deforestation;
- (b) Reducing emissions from forest degradation;
- (c) Conservation of forest carbon stocks;
- (d) Sustainable management of forests;
- (e) Enhancement of forest carbon stocks.

## Definitions

**REDD user** = Public agencies, municipalities, ministries, NGO's, Universities, private companies including their offices within the country and their countries of origin

**National REDD authority:** Public agency of Ministry in charge of REDD project validation at national level receiving the right to distribute the SPOT Products

**REDD license:** Multi user license agreement applying to Products and Value Added Products allowing to REDD End Users participating to REDD projects approved by the National Authority to access to Products.

# Data access policy

- **Authorized usages**

- **National Authorities** are allowed to:

- (a) **Install and copy** PRODUCTS for authorized usages;
- (c) **Use** PRODUCTS for REDD PROJECT;
- (d) **Produce, use, share** VALUE ADDED PRODUCTS;
- (f) **Distribute** the PRODUCTS and VAPs to the REDD project partners accepting in written the terms of the REDD End User License agreement
- (g) **Print, advert and Publish** with the appropriate © CNES and ASTRIUM Distribution rights mentioned (NB: size limitation for images or extracts published on the web)

Before sharing PRODUCTS, the NATIONAL AUTHORITY will have to mention in Written to ASTRIUM :

Name, address of Each REDD ESER USER / Details of the REDD PROJECT related to the demand of access

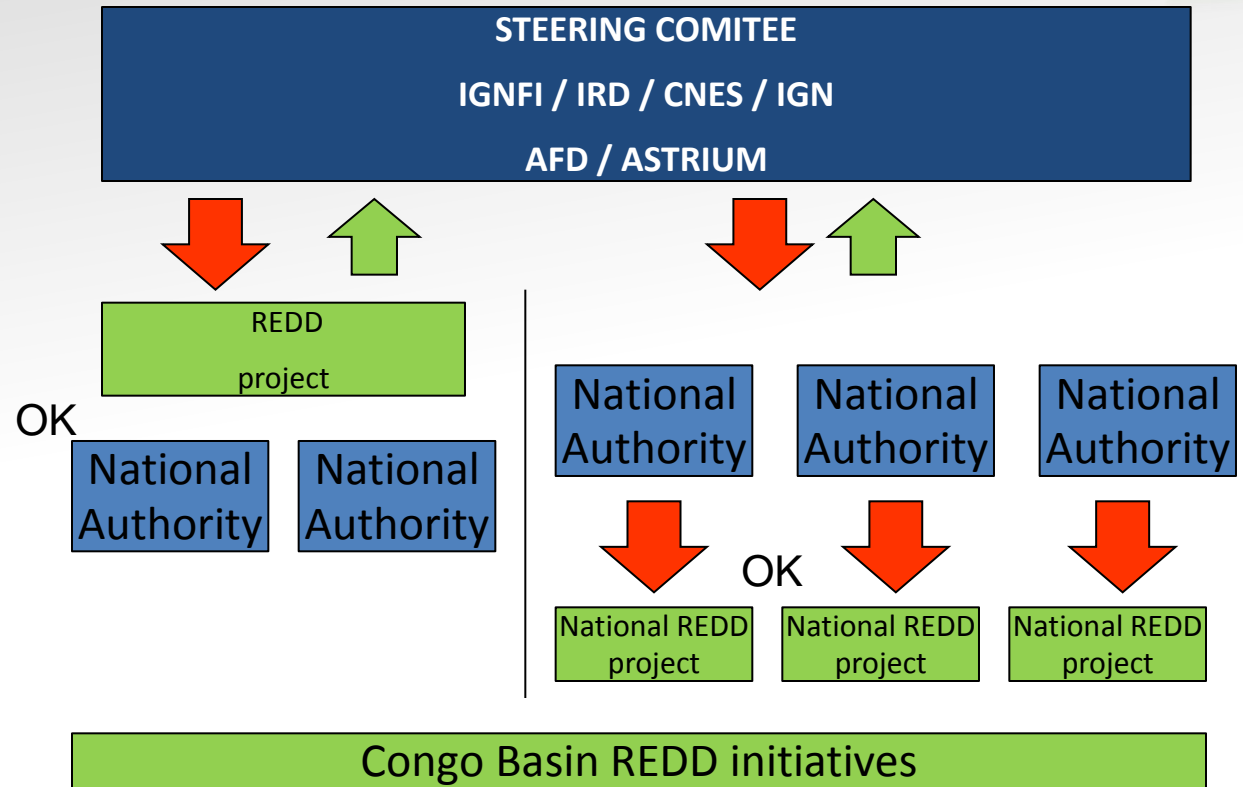
The NATIONAL AUTHORITY will be responsible for the respect of terms of the REDD END USER License

- **End Users** are granted with the **same rights** with the exception of the capacity to Distribute

- **Non Authorized usages:** all other usages including **commercial activities**

# Data access policy

SPOT « REDD license »



# Data access policy



## LICENCE REDD AUTORITE NATIONALE

### MULTILICENCE REDD AUTORITE NATIONALE

LICENCE D'UTILISATION NON-EXCLUSIVE  
DES PRODUITS SATELLITAIRES ET CARTES THEMATIQUES SPOT  
ENTRE SPOT IMAGE ET L'AUTORITE NATIONALE

Par l'accomplissement de l'un des actes suivants, l'AUTORITE NATIONALE signifie son acceptation des termes du présent Contrat de Licence d'Utilisation non exclusive des Produits et Cartes Thématiques SPOT (« la Licence ») : (a) l'ouverture de l'emballage du PRODUIT; (b) le téléchargement et/ou l'installation et/ou la manipulation du PRODUIT sur tout ordinateur; (c) toute mise à disposition du PRODUIT; (d) la mise à disposition de tout TRAVAUX DÉRIVÉS; (e) la dégradation ou la destruction du PRODUIT; (f) la conservation du PRODUIT pendant plus de sept (7) jours suivant sa réception.

#### ARTICLE 1 - DÉFINITIONS

« **AUTORITE NATIONALE** » : désigne soit la personne agissant en son nom propre, soit l'entité commerciale légale, y compris ses éventuels bureaux et/ou succursales dans son pays de résidence, soit l'organisme public, à qui est fourni le PRODUIT et qui accepte la présente Licence. Si le PRODUIT est fourni à un organisme public (agence publique, collectivité locale, ministère, ...), l'AUTORITE NATIONALE sera considérée comme étant uniquement l'entité de l'organisme public domicilié à l'adresse à laquelle le PRODUIT est livré, sauf en cas d'accord préalable écrit de Spot Image.

« **INITIATIVE REDD** » : désigne l'initiative menée par l'Agence Française de Développement dans le cadre du Programme REDD au profit de plusieurs AUTORITES NATIONALES.

« **PRODUIT** » : désigne le(s) produit(s) satellite(s) fourni(s) par Spot Image à l'AUTORITE NATIONALE et/ou à l'UTILISATEUR REDD dans le cadre du PROJET REDD.

« **PVA** » : désigne tout produit développé par l'AUTORITE NATIONALE contenant des données images provenant du PRODUIT et entraînant une modification substantielle du PRODUIT par des manipulations techniques et/ou l'ajout d'autres données.

« **PROGRAMME REDD** » : désigne le programme mondial de réduction de la déforestation et de la dégradation des forêts diligenté notamment par l'ONU.

## Status of licences signed:

### Signature of National Authority licenses :

- in Durban (December 2011): **DRC / Congo / CAR**
- in Yaounde (June 2012): **Cameroon**
- in Libreville (January 2013): **Gabon**

### Sub-licences signed by National authorities yet (local projects):

- in DRC
- in Congo
- in Cameroon

### Sub-licences signed by IGN FI (regional initiatives):

- with JRC
- with CIRAD

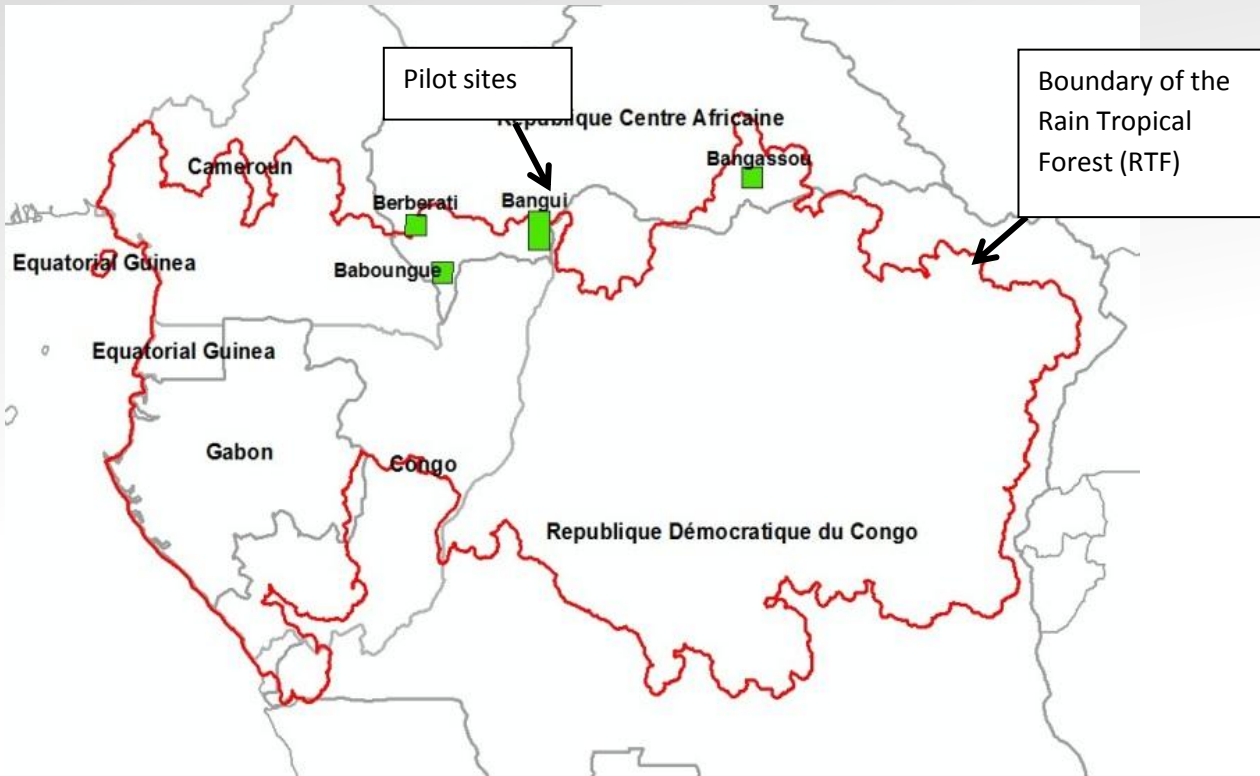
# Forest mapping

- **Work started in Central African Republic**
  - Methodology implemented over 4 pilot areas
  - Current: mapping of 290,000 sq.km over RCA
- **Methodology based on several principles:**
  - Consistency with national strategies
  - Consistency with international recommendations (IPCC)
  - Adaptation to local methodologies
  - Adaptation of methods to existing forest maps
- **In addition, to ensure quality**
  - Implementation of a **verification** methodology
  - Implementation of a **validation** methodology



# Forest mapping

## First: Selection of 4 pilot sites to test the method



- High variability of the classes of land cover;
- Presence of reference database data and/or field data;
- Homogeneous and good distribution within the Central African Republic RainForest
- Presence of a set of complex class of land cover such as: woodland, degraded forests, savannas, cultures, etc.
- Archives data available

# Forest mapping

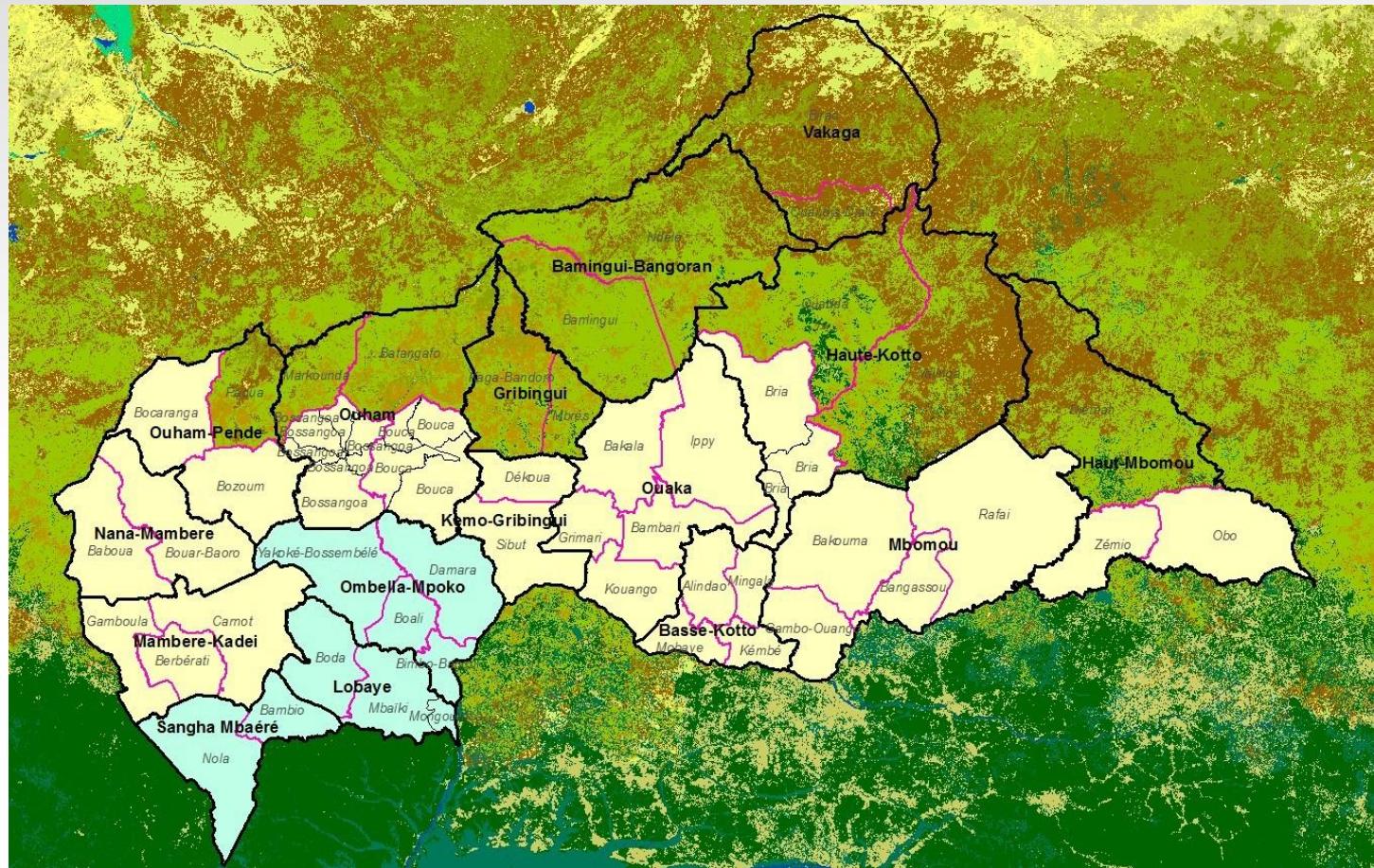
- Production of forest mapping over 290,000 sq.km in CAR:

Ongoing

⇒ May 2013:

290,000 sq.km  
being produced  
(in yellow)

(70,000 sq.km  
produced by REDDAP  
project, light blue)

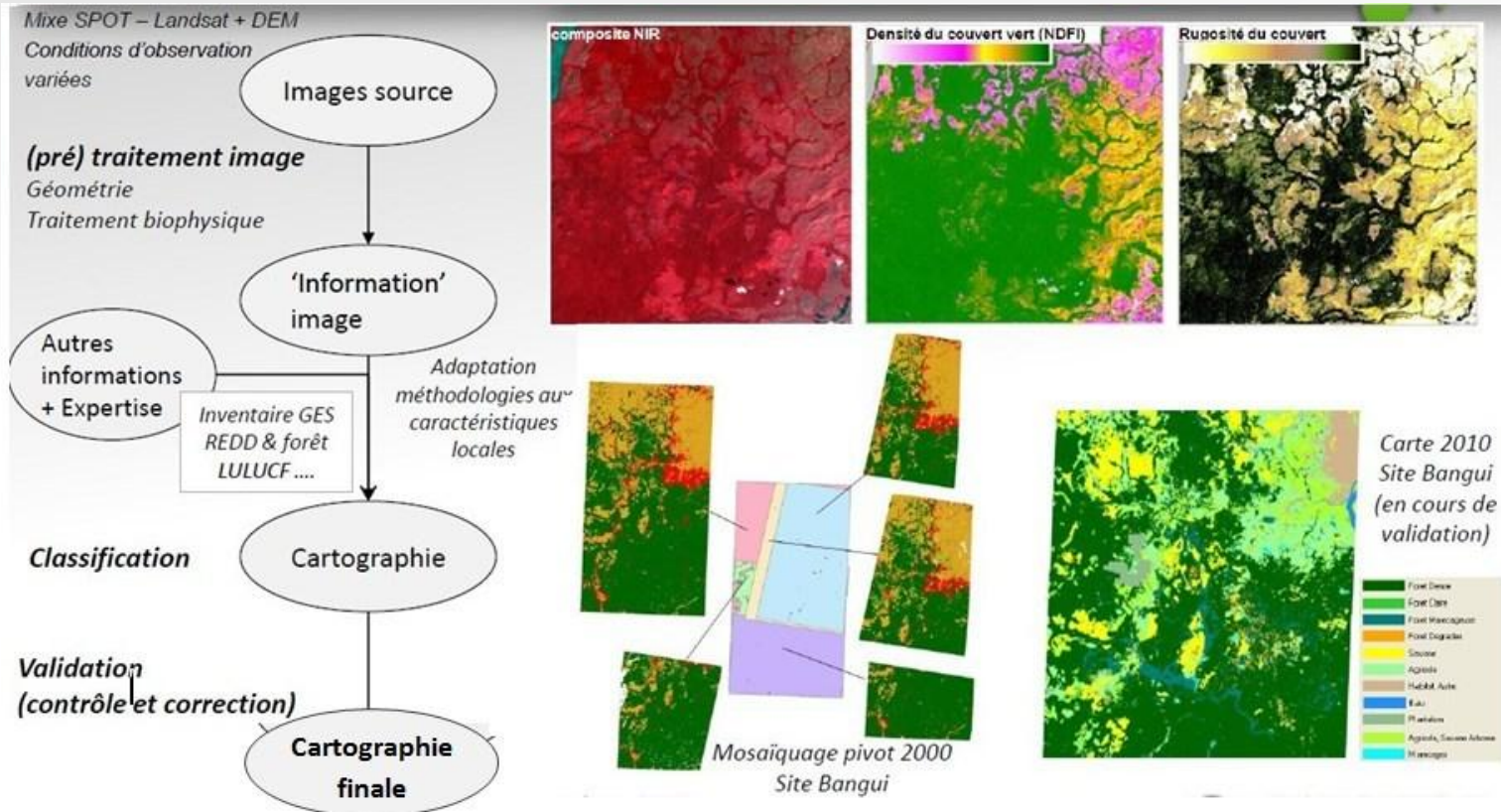


# Forest mapping

Automatic classification of satellite images based on **decision trees principle**:  
 Using OVERLAND software  
 Including following parameters:

*Canopy density,*  
*roughness,*  
*NDFI, (Normalized*  
*Difference Fraction*  
*Index)*  
*soil index...*

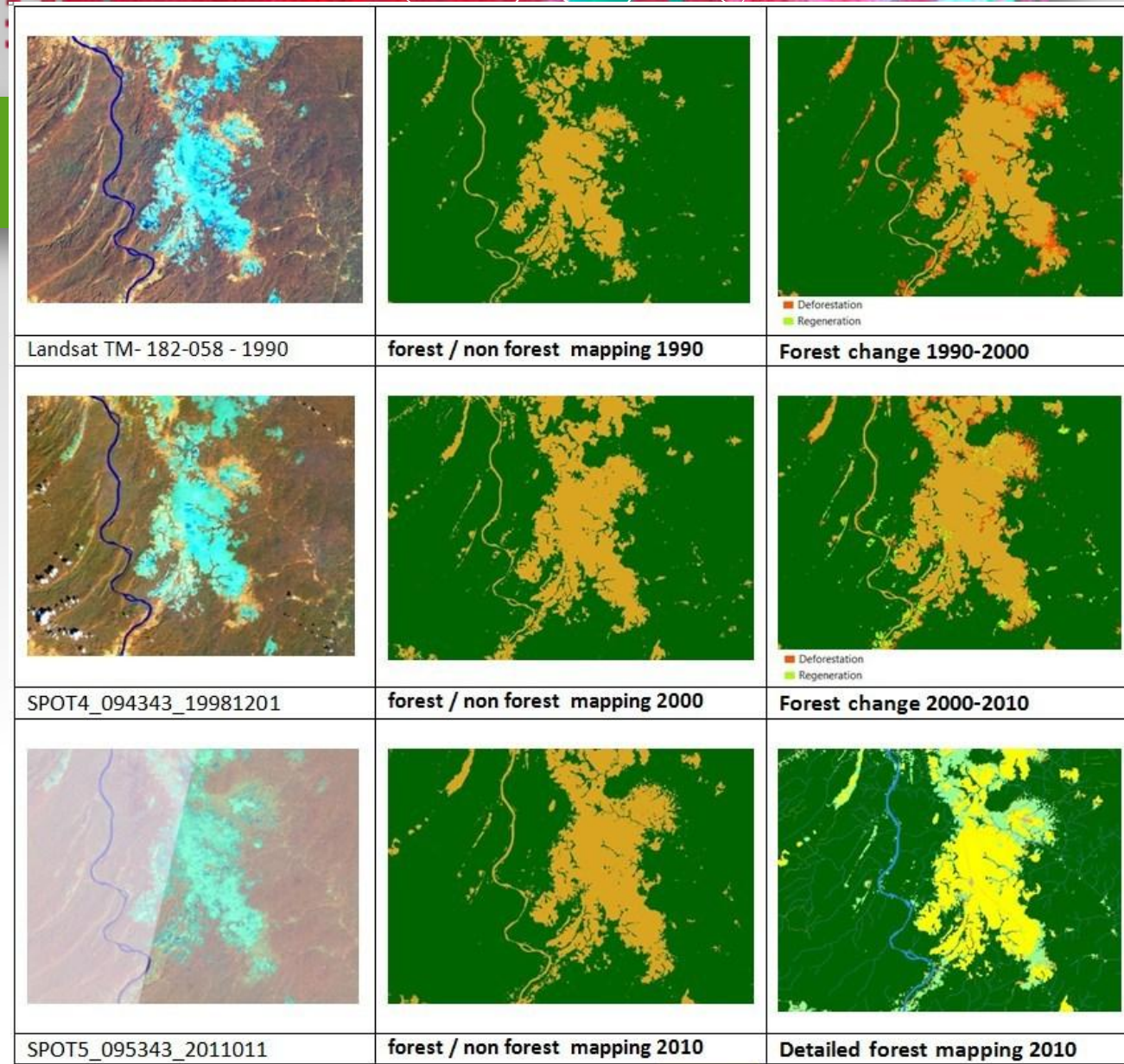
MMU: 0.5 to 1ha



# Forest mapping

## Products:

- forest/non-forest maps – 20m
  - 1990
  - 2000
  - 2010
- changes maps – 20m
  - 1990 / 2000
  - 2000 / 2010
- detailed reference map 2010 – 10m
  - Dense forest,
  - swamp forest
  - Degraded forest
  - Forest plantation
  - Savannah
  - Tree savannah
  - Agricultural cropland (mosaic cropland / semi-natural area)
  - Wetlands
  - Villages, towns
  - Water...



# Forest mapping



- **Reference: VCS Methodology VM0015**

- 1990, 2000 & 2010 Binary map Forest / no forest : **90%** correct classification in each class
- Forest changes maps : **80%** correct classification in each class
- 2010 detailed forest map: **80%** correct classification in each class

- **Implementation of a QA / AC procedure**

- Verification of the results
  - to correct and improve the quality & accuracy of products
  - To ensure homogeneity between products
- Validation of the methods (implemented with the help of external expert, statisticians)

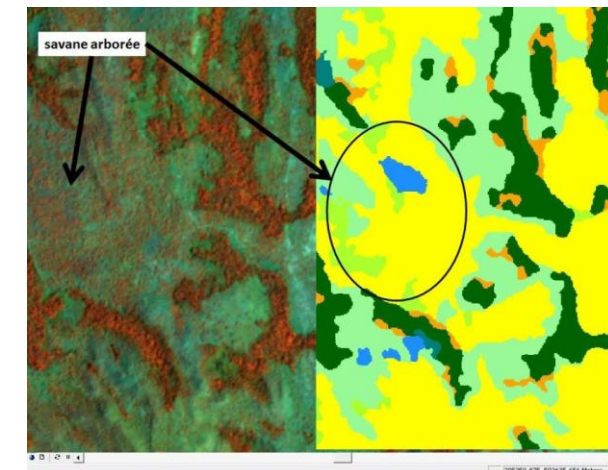
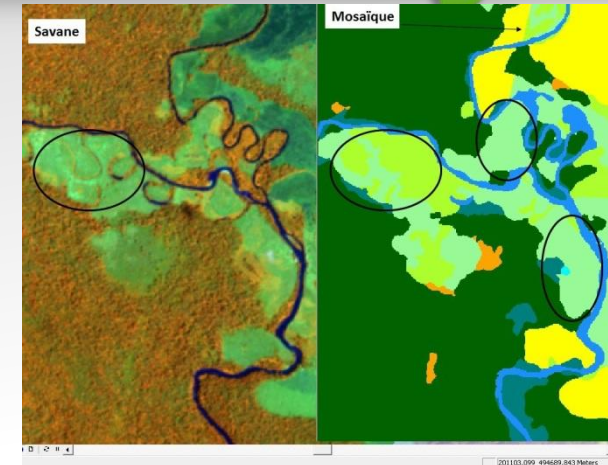
# Validation of Forest mapping

## Verification phase

- To **correct** and then **improve** the thematic quality of the products
- to ensure the homogeneity of the overall maps
- Finally, the last objective is to obtain a standard product which will reach the requested accuracy.

The verification must be:

- Exhaustive & representative
- Focused on the parts of territory or of specific classes of interest
- Based on the same data used during the production (satellite image or ancillaries data)
- Corrective & homogenization conservatism
- Verification is being conducted over about 10% of global areas mapped

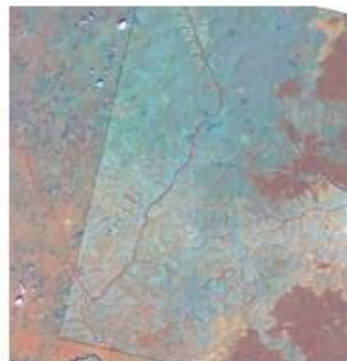




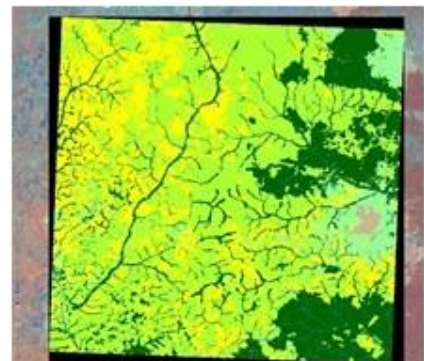
# Validation of Forest mapping

## Validation phase

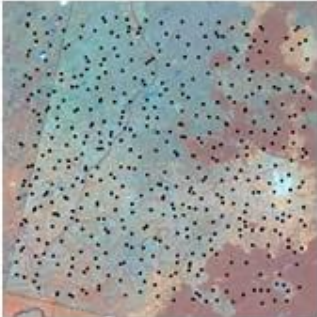
Specific validation methodology for the detailed forest mapping



Satellite images SPOT5- 2010 Berberati



Detailed forest map -2010 -Berberati



Validation point spread over the site area:

$$n_h = \frac{p_h(1 - p_h)}{\sigma_h^2}$$

	21	25	24	26	27	28	29	30	31	Total Classif_2010
21	466	20	20	4	5	1				527
23	7	15	1					1		24
24			7		2					9
26	7	1	2	104	21	1		2	11	144
27	2		8	9	99			2		120
28					2	13				15
29							4			4
30								3		3
31	3		1	18	12	1			19	34
Total valid_2010	480	36	47	135	141	16	4	10	31	905
Flexibilite [%]	97	52	75	77	80	81	100	70	83	

Example of validation Matrix obtained

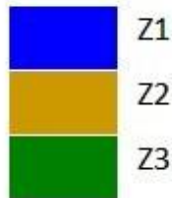
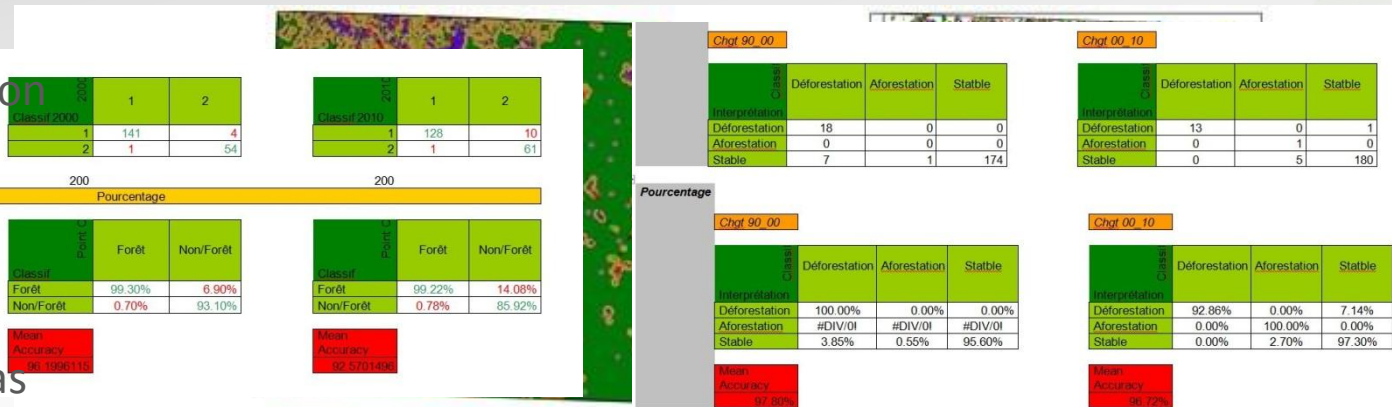
# Validation of Forest mapping



Validation methodology for the historical and changes forest mapping:

Sampling method based on the creation of 3 "risk of error" areas, which the density of control points will be modulated in:

- Z1: changes areas (risk+++)
- Z2: 500m buffer around changes areas (risk++)
- Z3: other areas (risk+)



- Control point in Z1 area
- Control point in Z2 area
- Control point in Z3 area

We have to take into account: omissions and commission of change.

We focus directly on forest change & area where a strong pressure would exist

The goal is to obtain the accuracy of real deforestation

Validation point spread over the history forest map: Baboungue



# Capacity building

## **GEOFORAFRI**

CAPACITY BUILDING AND ACCESS TO EARTH OBSERVATION DATA  
FOR MONITORING FORESTS IN AFRICA



# GEOFORAFRI

## PROJECT OBJECTIVES

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- The specific objectives of the project is to facilitate the adoption of earth observation techniques and ensure the methodological and technological know-how within Central and Western African countries, which will enable local institutions to carry out forest cover monitoring according to the international guidelines required to participate and benefit from the REDD+ mechanisms and funding
- Funded by the French Global Environment Facility (FFEM)
- Coordination – Institut de recherche pour le développement (IRD)

# GEOFRAFRI

## PROJECT MAIN COMPONENTS

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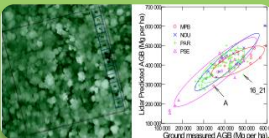
Ensure the provision of earth observation satellite data and processing tools in a sustainable way, based on to the central African countries' needs to implement national forest monitoring according to the REDD+ guidelines and requirements



Strengthen the capacities of public/private institutions and civil society organizations, which have developed internal capacities in the use of earth observation satellite data and are willing to contribute to information production required in terms of forest monitoring



Support the production of forest cover and forest cover change maps in several central African countries in relation to their needs for the implementation of MRV systems in the framework of REDD+ mechanism, and in relation to the ongoing initiatives and programs in this domain



Support the definition of applied research programs in the field of earth observation and the strengthening of research institutions networks, and facilitate north-south and south-south partnerships



Contribute to the coordination of existing and emerging initiatives in the field of earth observation for REDD+ in central Africa, and facilitate the participation of these countries to the major international initiatives, such as GEO and GMES for Africa



# Thank you for your attention

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