The Observatory for Forests of Central Africa

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Abstract – The Observatory for the Forests of Central Africa (OFAC), an initiative of multiple members of the Congo Basin Forests Partnership (CBFP), aims at pooling the knowledge and available data necessary to monitor the ecological, environmental, and social aspects of Central Africa's forests. The general structure of the Observatory is detailed, while a few examples in each thematic field (forest cover, logging and biodiversity) are presented. The Web site of the Observatory is http://www.observatoire-comifac.net

Keywords: Forests, Congo Basin, Observatory

1. INTRODUCTION

Central Africa contains the second largest area of contiguous moist tropical forest of the world. The Congo Basin in particular is occupied by vast and still undisturbed tracts of rainforests. It provides huge ecosystem services from the local scale to the global one, in various economic, social and ecological domains (tax revenues, employment, climate, water, biodiversity…).

Forest management and conservation issues in Central Africa are being debated since the mid 1990's. The COMIFAC, the "Central African Forests Commission", received mandate in 1999 from the Heads of state of 10 countries (Burundi, Cameroon, Chad, Congo, Central African Republic, Democratic Republic of Congo, Equatorial Guinea, Gabon, Rwanda and Sao Tome e Principe) to realise, coordinate and monitor the activities planned in the COMIFAC Convergence Plan, the common regional intervention strategy for the countries of the subregion and their international development partners (http://www.comifac.org).

The Congo Basin Forest Partnership (CBFP) was established in September 2002 at the World Summit on Sustainable Development (Johannesburg) as a non-binding Type II partnership and brings together some forty governmental and non-governmental organizations. The goal of the CBFP is to assist COMIFAC in implementing its forest strategy by improving information exchange and coordination between projects and policies in order to enhance the sustainable management of the Congo Basin forests and improve the standard of living of the region's inhabitants.

The Observatory for the Forests of Central Africa (OFAC in French for "Observatoire des Forêts d'Afrique Centrale"), an initiative of multiple members of the CBFP, aims to pool the knowledge and available data necessary to monitor the ecological, environmental, and social services provided by Central Africa's forests. The establishment of OFAC corresponds to one of the actions of the COMIFAC Plan de Convergence (Axis about resource knowledge and inventory). It provides COMIFAC and other CBFP members a powerful steering and data sharing tool to promote better governance and the sustainable management of forest ecosystems.

2. GOAL AND STRUCTURE OF THE OBSERVATORY

OFAC builds on existing initiatives in environmental information to gather meaningful knowledge databases and monitoring systems by putting in relation existing information from various sources. The approach adopted for the creation of OFAC, which relies on human resources in the region, makes the development of OFAC a true exercise in capacity building at both the national and regional level.

The principal data providers are COMIFAC and its regional partners (e.g. RAPAC), the ministries responsible for forest management and the environment, the private sector, protected areas management, forest management, NGOs, international projects, research institutions, universities, etc.

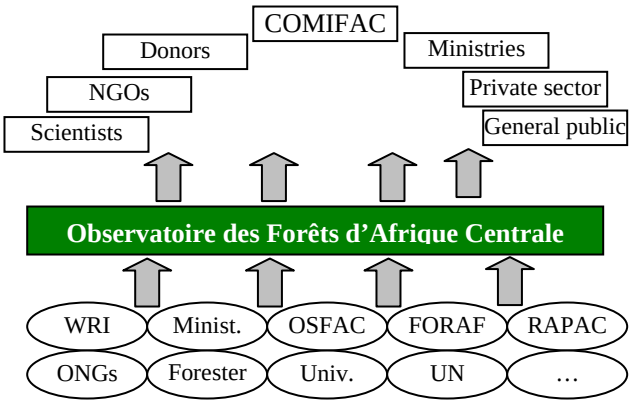


Fig. 1: Structure of the Observatory for Forests of Central Africa.

The Observatory seeks to provide a big variety of forestry operators a holistic vision along several dimensions:

– capacity building for the collection of baseline data through an pilot inventory of dense humid forest and of socio-economic

dynamics associated with the use of forest resources in Africa. Knowledge databases in the environmental field (geology, soils, climate, vegetation, wildlife habitats), in socio-economic domain (population, development, and institutions) are being established (http://www.observatoire-comifac.net).

– development of thematic monitoring systems of the natural environment and socio-economic for sustainable management of forest ecosystems. Monitoring systems will give an overview of deforestation, forest logging and biodiversity conservation. Monitoring systems include indicators collected on the field and by remote sensing at two scales: national level and in selected territorial units (logging concessions, protected areas, hunting zones, community forests, landscapes…).

3. FOREST COVER

The global ecosystem services provided by the Congo Basin Forests appear prominently through the REDD (Reducing Emissions by Deforestation and Forest Degradation) initiative of the UN Convention on Climate Change. For implementing a mechanism accepted by all the parties, COMIFAC countries need reliable, consistent and updated estimates of their forest cover area and change, as well as change in the Carbon stocks due to degradation (see chapter 4).

3.1. Forest-cover area and distribution

Recent vegetation maps are compiled and cross-validated by OFAC partners. The GLC2000 map is shown in Fig. 2 for the central part of COMIFAC countries. In the rest of the paper, we will concentrate on the dense humid forests. A promising approach, soon available, is the combination of medium-resolution maps (Landsat-derived) which gives the best detail possible of the forest-non forest interface and coarse resolution maps (SPOT VEGETATION and MODIS-derived) which are able to depict the ecological types depending on the seasonality. These types differ by their carbon content.

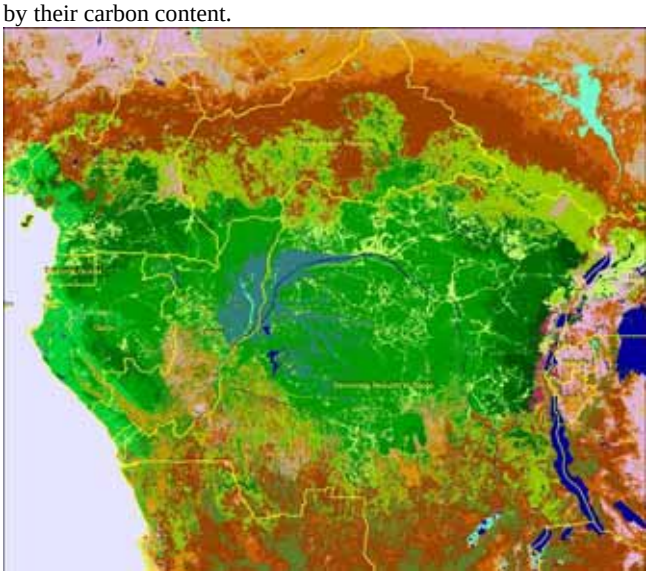


Figure 2. Land cover of the Central African countries (source GLC2000). Note that Chad and Sao Tome are not completely covered on this map. The different tones of green correspond to different forest types (www.observatoire-comifac.net).

The total area is calculated on the COMIFAC countries, excluding Chad, Sao Tome e Principe, Rwanda and Burundi.

Land cover class (LCC)	Area (x1,000ha)	% subregion
Closed evergreen lowland forest	155,615	38.5%
Submontane forest (900-1500m)	11,192	2.8%
Montane forest (>1500m)	2,354	0.6%
Swamp forest	13,298	3.3%
Mangrove	194	0.05%
Total humid forests	**182,652**	**45.1%**
Mosaic forest/croplands	30,916	7.6%
Mosaic forest/savanna	54,492	13.5%
Closed deciduous forest	20,682	5.1%
Deciduous woodland	63,089	15.6%
Open deciduous shrubland	30,122	7.4%
Others	22,635	5.6%
Total Land area	**404,588**	**100%**

Table 1. Area by land-cover class for the six Congo Basin countries derived from GLC2000 map.

The two principal land uses in the Congo Basin subregion are logging concessions (563,446 km^2) and protected areas (458,238 km^2). The third largest land use, shifting cultivation, is not easily detected using low resolution satellite imagery but could be estimated as a first approximation at 294,683 km^2

3.2. Forest-cover change

Two recent studies (Duveiller *et al.*, 2008; Hansen *et al.*, 2008), both based on different methods, have produced reliable and consistent estimates on the deforestation in the humid domain between 1990 and 2005.

The first estimates of forest changes between 2000 and 2005 are derived from a combination of multi-temporal and multi-resolution satellite data. The authors report a forest loss rate of 0.76% for 5 years (0.15%/yr), which is very close to the 0.16%/yr reported for 1990-2000 and represents an area of about 14,000 km^2

Country	Net deforestation	Net degradation
Cameroon	*0.14%*	*0.02%*
Gabon	*0.09%*	*0.07%*
Congo	0.02%	0.01%-
C.A. Republic	0.06%	0.02%
D.R.Congo	0.20%	0.12%
Central Africa	**0.16%**	**0.09%**

Table 2. National deforestation rates measured by Duveiller et al. (2008). Note the low reliability of estimates of countries in italic.

These observed forest-cover changes are by far the lowest of the pan-tropical belt, with a net deforestation rate two times higher in South America and four times higher in South-east Asia. It is important to note however that deforestation is not a uniform process. Some areas (Figure 3) show a dramatic increase of deforestation due to agricultural encroachments, particularly in regions affected by human conflicts (e.g. Kivu) and at the fringes of the Basin (Northern Equateur, Kasaï), whereas others remain almost untouched.

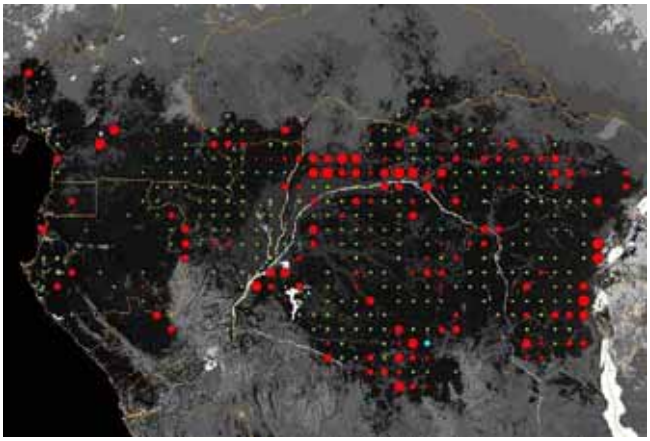


Figure 3. Deforestation rate measured by sample (the green dots represent samples with no deforestation, while the red dots are proportional to the deforested area).

4. FOREST EXPLOITATION

With more than 8 million cubic meters of timber produced by the formal forest sector, the exploitation of forest resources can generate important revenues for countries as well as employment for many workers. The economic fallout and impacts on employment mainly benefit rural areas which are often very poor, and where forestry is practically the only economic activity. However, the implementation and monitoring of management plans by logging companies, under the supervision of forest administrations, is a necessity to maintain not only the revenues generated by timber harvest in the long-term but the other ecosystem services as well for the local population (fruit, meat, medicine) and the entire region (biodiversity, water balance, carbon storage…).

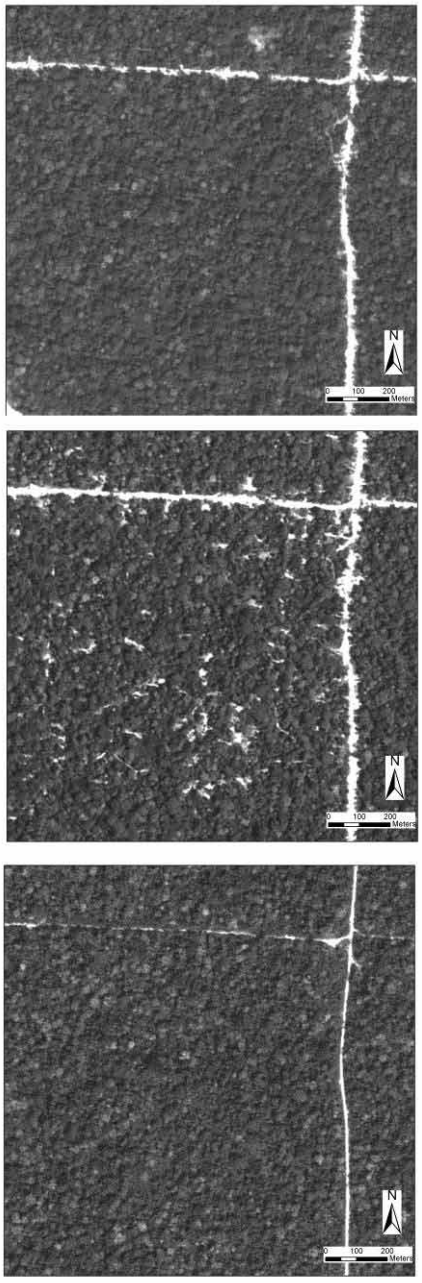
Several COMIFAC countries are now negotiating Agreements with the European Union in the frame of FLEGT (Forest Law Enforcement for Governance and Trade). Such agreements also require the setting up of clear monitoring systems. This effort to gather available data in an Observatory is more important than the different national forest statistics systems, which currently lack in certain countries in the Congo Basin.

The assessment of the services provided by forest logging has three entry points:

- 72 Indicators at the national level, gathering data on employment, production, timber industries, forest management, certification…
- The indicators given by the companies and validated by the ministries in charge of forests are compiled in a central database. About 100 concessions have currently given more than 50 economic, ecological and social indicators;
- Remote sensing images could be used to check the compliance of the exploitation with the forest management plans, by detecting logging tracks or measuring holes in the canopy.

Some phenomena linked to the informal exploitation of forest can difficultly be taken into consideration by quantifiable indicators. Therefore, the Observatory also provides monographic studies on these issues, like the illegal operations conducted by small loggers. It must also be signaled that the recent global economic crisis has drastic consequences on the logging companies. OFAC is just starting a study on the impact of the financial crisis on the timber sector in Central Africa, taking advantage of all the information collected in the last years.

Figure 4:
This succession of SPOT images at 2.5 m spatial resolution allows for measuring the impact of forest logging on the canopy (all images © CNES.
The upper image was taken in ***January 2005*** in the Congo Basin one month before the exploitation (for confidentiality reasons, we can not locate the exact concession). Only the left part of the image was open for exploitation.
The second image was acquired in ***March 2005***, one month after the logging operations. The holes in the canopy are clearly visible (lights tasks), while the right part of the image is intact (no exploitation).
The third image was acquired in ***January 2007***, about two years after the logging. The canopy is nearly closed and the logging operations conducted by the company seem comply with the management plan.



5. FOREST BIODIVERSITY

The biodiversity contained in Congo Basin forests is extremely high, with some flagship species like great apes, elephants, buffalos. The main political frames are several international conventions (CBD, CITES, RAMSAR, GRASP). In the region, a dense network of protected areas is coordinated by RAPAC (Réseau des Aires Protégées d'Afrique Centrale), which relies on OFAC for geospatial information.

The OFAC biodiversity monitoring system is also structured at national scale, with collection set of 57 indicators, and by territorial unit (protected areas). Forty three indicators are collected by the protected areas' managers (+27 for hunting zones) and validated by RAPAC. Monographic studies are conducted on

the other ecosystem services, like the access to Non Timber Forest Products and the pressure on bush meat.

Ecological Landscapes

CBFP partners have also developed, at the instigation of CARPE, the concept of "landscapes", vast territorial units including protected areas, logging concessions, villages…, in order to propose a holistic of the biodiversity conservation, in phase with activities directly related to poverty reduction. In the landscapes, conservation NGOs are regularly collecting indicators in the landscapes and producing every two years a synthesis by landscape included in the report "State of the Forests".

CARPE partners are also measuring at fine resolution the forest cover change from Landsat data in 1990 and 2000 (2005 when available). The figure 5 shows an example in the landscape Maringa-Lopori-Wamba. Full documentation is available on http://carpe.umd.edu. The deforestation measured is extremely low in the landscapes, in particular in the protected areas.

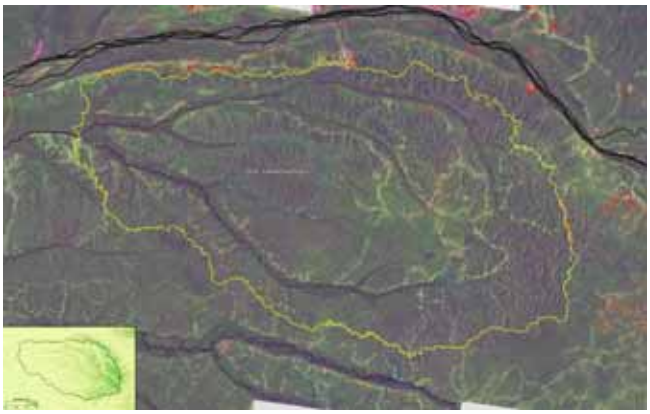


Figure 5: Colour composite of Landsat data of the Maringa-Lopori-Wamba landscape. Deforestation is represented in red (1990-2000) and blue (2000-2005). Digital Elevation Model is in the left angle.

6. TOWARDS A REGIONAL OBSERVATORY

These first examples presented in the different thematic fields covered by OFAC highlight the enormous potential added-value for decision-makers of geospatial information in a region where accessibility is limited and networks of ground-based observations are (at best) deficient. However, for fully playing this role, some practical conditions must be realized:

- A receiving station of satellite images at medium resolution (10-30m) must be installed in the region, in order to maximize the possibility of acquiring cloud-free images, in particular in the coastal part. Discussions are currently on-going on that issue.
- Ground-based information, like forest inventories or biodiversity observations, must be better combined with satellite-based information in meaningful databases that could be exploited by the different users in simple information portals.
- New initiatives take profit of the new spatial technologies, such as lidar. In order to reduce the gaps and avoid any overlap, the Observatory can play the role of platform for these new initiatives, in particular on the evaluation of ecosystem services and in the REDD issues.
- A stronger connection with regional and national training institutions in Central Africa. The human capacities are present in Central Africa, thanks to much collaboration with training institutions, but sometimes underexploited by lack of adequate facilities and structure. A strong effort on strengthening regional expertise is necessary and could build on existing growing points.

On the other hand, a full ownership by the different stakeholders of the Observatory is important to guarantee the durability of this instrument. Some conditions are also necessary in this field.

- Regular deliverables of high quality are a good vehicle for increasing the appropriation. The State of the Forests 2006 (COMIFAC, 2007) was a book unanimously recognized as a fantastic source of information. One of the reasons was the high number of contributors. The State of the Forests 2008 (COMIFAC, 2009) is focusing on the ecosystem services and is now in press.
- The collective validation of the different elements of the Observatory (selection of indicators, data collection, validation of reports…) through regular workshops is a key-element of the ownership.
- In order to guarantee the trust among stakeholders, a legal frame is necessary and was created by OFAC. It relies on the generally agreed system of the Creative Commons, which privileges the large diffusion of information, but gives the freedom to the information providers to define the degree of access to the information he provided to the Observatory.

7. CONCLUSIONS

The Observatory is clearly a fundamental element of the forest policies conducted by the members of the Congo Basin Forest Partnership. The information, coordinated with the capacity-building activities, can feed the specific forest policies in economic valorization, carbon sequestration and biodiversity conservation. OFAC will continue to serve these different policies because the Congo Basin forests are unique and can fill in these different roles.

OFAC is a young initiative, based on a voluntary partnership, reproducing the CBFP structure. It has clear advantages of flexibility, but with some limitations: it assumes a full spirit of co-operation of all partners and can be disconnected from the political institutions. The durability of the Observatory will then require a solid connection with COMIFAC, which guarantees the use of the information in the decision processes and gives the legitimacy to the Observatory.

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