CoForChange Newsletter
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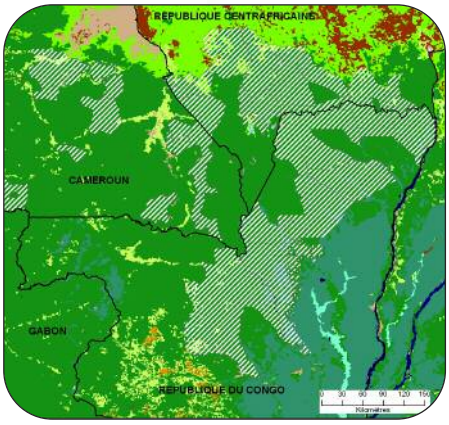
PREDICTING THE EFFECTS OF GLOBAL CHANGE ON FOREST BIODIVERSITY IN THE CONGO BASIN

Predicting the effects of global change on forest biodiversity in the Congo Basin

A challenge for CoForChange



Study area. Dark green: dense forests; green striped: logging companies' zone.

Land conversion, mining, logging, an increasingly dry climate: the future of the forests of the Congo Basin, the second largest tropical forest area in the world after Amazonia, looks uncertain. These forests are a major source of income, goods and services for local people, and also for the international community (biodiversity and carbon). Can we now determine the main ways in which they are likely to change? This is the challenge to be taken up by CIRAD, associated with eight European partners, five African organizations and an international research centre, through the CoForChange project, which has just been launched.

Past and present situations will be analyzed so as to suggest scenarios for future change. The investigations will centre on the forest region known as the "Sangha River Interval", which straddles three countries: Cameroon, Congo and the Central African Republic. The zone, which covers several million hectares, saw periods of savannization in the past that have made it a model area for gaining a better understanding of the relations between environmental pressure and changes in forest vegetation. However, the results of the project will be of interest for the Congo Basin as a whole, since besides providing a comprehensive map of the current vegetation in the region, it should also shed light on how forest species react to global change.

The variability of these forests in terms of structure and floristic composition, and the causes of that variability, are to be studied in detail. In particular, our aim is to elucidate whether it is determined by water availability, which depends on climate, topography and soil properties, or by changes in exposure to light as a result of human activity.

To this end, the researchers involved are planning to compare the characteristics of forest vegetation with a series of data on the physical environment: topography, geology, soils and rainfall patterns governing soil water availability. They will also be looking at the disturbances that have occurred over the past four millennia. Ancient disturbances will be assessed by studying pollens, phytoliths and charcoal. More recent disturbances will be characterized by cross-analyses of satellite images and available maps.

Experiments will be conducted to determine the degree to which the main species found in the region are light demanding and drought tolerant, because these properties interact with water and light availability in the field, to shape their spatial distribution.

(cont'd p. 4)

Sylvie Gourlet-Fleury

CoForChange workpackages

1. Coordinate, communicate, and disseminate
2. Map and characterise tree communities and environmental factors
3. Map soil water availability and its sensitivity to rainfall pattern
4. Analyse past changes in vegetation, disturbance and environmental variables
5. Characterise drought tolerance, light requirements of tree species
6. Evaluate the ongoing development of tree communities
7. Integrate, predict, and provide decision-making tools

The project is launched

The CoForChange kick-off meeting was held in Montpellier, from 3 to 6 February 2009.
It was dedicated to sharing information, discussing scientific topics, outlining the road map for scientific and administrative activities, securing the budget, and making decisions on the communication plan. Thirty colleagues, from most of the 14 partner institutions, attended this first meeting.
Three working groups met to discuss and coordinate the following; collection of environmental information, planning of paleoenvironmental studies, and seed collection and transport to Congo for the production of seedlings.
Besides promoting discussions between colleagues, the meeting helped strengthen the scientific logic of the project. The next meeting is planned for the end of November.

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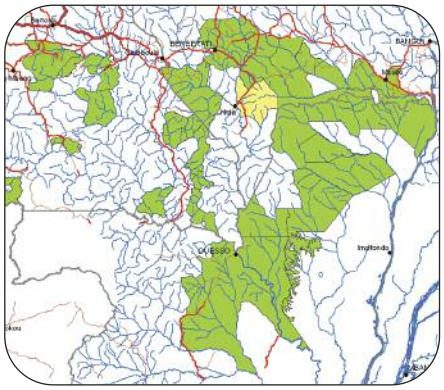
Montpellier, 3 to 6 February 2009. CoForChange kick-off meeting.

Building a spatial database, a first step

Tropical forests of Central Africa have been little described. Although vegetation maps were established in the Central African Republic, Cameroon and Congo thirty years ago, the methods used (scale and descriptors) are not homogenous and thus comparisons are not possible. Recent maps realized from the analysis of satellite imagery describe forest structure and stand characteristics but they do not provide any information on the presence of tree species. A detailed description of tree communities in this region is thus needed. In the CoForChange project we aim to map the tree communities identified from the analysis of forest inventories conducted by logging companies in the Congo Basin. We will then relate tree species associations to environmental factors (climate, soil and disturbance) thanks to information extracted from existing maps and the analysis of satellite imagery.

We began our tasks by developing a geographical information system. The data collected include species abundance in the forest inventories and various environmental descriptors on geology, soils and topography, climatic variables such as annual rainfall, number of dry months, dry season starting date, but also country borders, main cities, and roads. Data resulting from the analysis of satellite imagery SPOT, MODIS and LANDSAT will be later added. Species botanical names were first actualised. The unified database compiles species abundance on more than 100,000 sampling plots of 0.5 ha each, inventoried in the Congo Basin.

Because of the dataset size, several computational problems arose. We first worked with a restricted dataset, which enabled us to establish the methodology needed to detect tree species associations, groups of plots with a similar species composition.



Study area.
Green: logging companies' zone;
blue: rivers network.

Two types of statistical analyses were carried out in parallel: one to detect tree species associations based on dominant species, the other to emphasize minor species distribution, both of them bringing information on vegetation patterns. A method to detect species with strong ecological requirements was also established.

The next steps will be to apply the methodology to the unified dataset, to identify spatial patterns of tree species associations, and, finally, to link tree species associations to environmental factors (soil, climate and disturbance), in order to determine the relative importance of light (disturbance) and/or water availability (climate and soil) on the structure and composition of Central Africa tropical moist forests.

Adeline Fayolle

Focus on

The Forest Typology Team

CIRAD, Montpellier, France

Adeline Fayolle is an agronomist and holds a PhD in population biology and ecology. In the CoForChange project, she analyses tree species spatial patterns from forest inventories conducted by logging companies in the Congo Basin. Her work consists in defining a typology of these tropical forests and evaluating the effects of water availability and human disturbance on the structure of tropical tree communities.
adeline.fayolle@cirad.fr

Fabrice Bénédet holds a PhD in biology and a Master's degree in informatics. He specialises in multimedia and information systems. He joined CIRAD in 2008 to supervise information systems in ecology and forest dynamics. In the CoForChange project, he is in charge of the Internet and Extranet websites and he will compile all the experimental data which will be recorded throughout the project. He already homogenised species abundance data from forest inventories.
fabrice.benedet@cirad.fr

Nicolas Fauvet received training in forest management. Working at CIRAD since 1984, he specialises in mapping and geographical information systems. In the CoForChange project, he is in charge of mapping the environmental factors (climate, soil and disturbance) needed for the study.
nicolas.fauvet@cirad.fr

Focus on

The Seedling Nursery Team

CRDPI, Pointe-Noire, RDC

Aubain Saya holds a PhD in plant physiology. He is head of the research unit "Genetics – Improvement – Diversity" and deputy director of scientific activities at CRDPI. In the CoForChange project, he coordinates the activities linked to the nursery set-up and the seed sowing experiment. He is also involved in CoForChange management.
aubinsaya@yahoo.fr

Mélanie Toto is a rural development engineer from the University of Brazzaville in Congo. She joined CRDPI to work on the nursery project. In the CoForChange project, her activities include seed sowing, application of watering and shading treatments, and both data collection and analyses.
totomelanie@yahoo.fr

Guy Kazotti is also a rural development engineer and holds a Master's degree in plant biology from the University of Brazzaville in Congo. He is responsible for the CRDPI seed bank. He works along with Mélanie in the CoForChange project.
guykazotti@yahoo.fr

Setting up a seedling nursery in Pointe-Noire

Light requirements and drought tolerance vary among tropical tree species and strongly influence species spatial patterns. Main strategies developed by tropical plants to deal with light availability have been previously identified but have not been fully described yet. In addition, drought tolerance of tropical plant species remains little studied compared to temperate or Mediterranean species.

A seed sowing experiment is being conducted by CoForChange to quantify the response of major species to light and water availability. The project also aims to identify biological indicators of these responses easily measurable in forests.

In a first step, seeds of a large number of species occurring throughout the Congo Basin were collected. This fieldwork was performed by several teams: the University of Bangui, the French funded projects to carry out forest management plans (PARPAF) and to sustain forest research (ARF) in the Central African Republic, the University of Marien Ngouabi in Congo, and Gembloux Agricultural University (FUSAGx). The University of Yaounde I, will also send seeds from Cameroon, in the next weeks.

Collected seeds were sent to the Pointe-Noire experimental station located in Congo. A seedling nursery was recently renewed by the Research Centre on Sustainable Production of Industrial Plantations (CRDPI) with the financial support of CoForChange. The seedling nursery can carry up to 58,000 plants. Shading and watering treatments will be applied to test species response to light and water availability.

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Erythropleum suaveolens *seedlings*.

From the end of March to the end of June, more than 10,000 seeds from 48 species have been made available already and 2000 of them were sown to quantify both germination timing and rates. As many as 150 robust and well grown seedlings are needed per species to conduct the experiments on drought tolerance and light requirements. To supervise this experimental work, a postdoctoral fellowship was recently attributed to Sabrina Coste from the University of Aberdeen.

Aubain Saya
Mélanie Toto
Guy Kazotti

Pots ready to receive seedlings.

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(cont'd from p. 1)

Additional forest inventories will be conducted to examine the ongoing vegetation dynamics, in particular at the frontier between different types of forest vegetation like *Marantaceae* forests, semi-deciduous forests or *Gilbertiodendron dewevrei* forests. The knowledge produced by those activities will be integrated into a vegetation model and it will help to produce decision-making tools for outlining national, regional and European conservation and management strategies of these forests.

The CoForChange project, supported by three research funding European agencies within Era-Net Biodiversa, is planned for four years (2009-2012). It is located under the official umbrella of the Commission for the Forests of Central Africa (COMIFAC), and it will bring key elements to several of the strategic axes of its *Plan de Convergence*. The knowledge and tools provided by CoForChange will serve decision-making in several regional European funded projects, in particular the Observatory for the Forests of Central Africa (FORAF/OFAC) project.

sylvie.gourlet-fleury@cirad.fr

Past disturbances

Prospections in Cameroon

Long-term ecological and anthropological records are essential to understand past responses of vegetation to climate change and human activity. In the tropical moist forests of Central Africa, the dramatic changes that occurred over the last millennia have raised the debate on whether climate or humans are at their origin.

In order to determine the chronology of climate change and human occupation at the regional scale since 4000 BP (before present), the team began prospecting in Lobéké National Park along roads. Upon reaching Djembé on the Sangha River, they discovered archaeological structures, with pot shards, wood coals, towels and slags. This is the first iron furnace site discovered in this region.

In addition, the team noted between Kika and Mouloundou a meander of the Ngoko River (Moukounounou Lake) and considered it as an interesting site to perform sediment coring so as to analyse pollen and carry out isotope measurements. A German team from the University of Frankfurt and working for the ReSaKo project was already prospecting on the site. They sampled 500-cm-long cores, revealing sediments dating from 1200 BP (inlet section of the meander) and 938-892 BP (outlet section).

A collaboration has been initiated as these data will be very useful for geochemical and paleoecological studies. They will allow to produce a fine-grain temporal reconstruction (with a resolution better than 10-years) of the environmental and climatic variability of the last millennium, which will help to assess further the causes for the main changes experienced by these forests.

richard.oslisly@orange.fr
ilhem.bentaleb@lsce.ipsl.fr

Dissemination

www.coforchange.eu is online

The English version of the CoForChange Internet website is online. The French version should be available by the end of August. It informs on the project objectives, main activities and achievements, and disseminates the biannual newsletter. Working documents (protocols, species lists, references and results) are made available to all the project partners via limited access to CoForChange Extranet.

The site is developed with the eZpublish content management system and is hosted by a CIRAD server.

fabrice.benedet@cirad.fr

Editor in chief: Sylvie Gourlet-Fleury
Graphic design and layout: Cathy Rollin
Editing: Corinne Cohen, Marie-Cécile Maraval