Pan-European call for international research projects on biodiversity dynamics: developing scenarios, identifying tipping points and improving resilience

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| **Project title :** | Congo basin forests: tipping points for biodiversity conservation and resilience of forested social and ecological systems |
| **Short name / Acronym :** | **CoForTips** |
| **Proposal number :** | BiodivERsA2012-68 |
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# 1. Project Description

## Content

# 1.A. Detailed description of the research plan

## Hypothesis, theories and research questions

The loss of rainforest is an emerging issue in the Congo Basin (see Scholes and Biggs, 2010). The forests of the Congo Basin have been identified as part of the 10% of the wildest areas on Earth (Sanderson et al., 2002). They have been classified as globally outstanding for their biodiversity[1], and until now, the level of threat on biodiversity is comparatively low compared to other eco-regions in Africa, as human pressures are low, the rates of endemism are low, and the areas of distribution of species are large (Burgess et al., 2006).

However, Leadley et al (2010) have proposed projections of global change impacts on biodiversity (biodiversity scenarios) over the 21st century for 11 biomes including West Africa and the Miombo woodlands. On both cases, the authors foretell large scale conversion of forests to other uses (agriculture and mining) driven by population increase, globalization and increased access, with detrimental impacts on biodiversity and associated ecosystems. These scenarios suggest that the forests of the Congo basin would find themselves under considerable pressure on both ends of their area of distribution.

Research conducted in other rainforest areas illustrates the importance of modeling future scenarios. Recent models suggest the Amazon Basin could be fast approaching a tipping point, with large scale dieback and forest to savanna conversion as a result from the combined effects of deforestation and agricultural expansion, climate change, and modified fire regimes (Nepstad et al., 2008). Empirical reconstruction of the basins of attraction of forest cover suggest similar patterns of forest/savanna/barren transitions across South America, Africa and Australia (Hirota et al., 2011). With decreasing precipitations, the resilience of forests decreases and the system can easily tip over to a savanna, in response to a perturbation such as logging or fire.

Taken together, these results imply that the 21st century could mark a transition for the biodiversity of the Congo Basin, with forests approaching the limits of their resilience as climate change modifies the precipitation patterns (Malhi and Wright, 2004), and direct human drivers[2] push the ecosystems to other basins of attraction, through agriculture, forestry and other land uses activities, including large-scale deployment of biofuels.

The CoForChange project demonstrated patterns of tree species distribution in the semi-evergreen forests of south-east Cameroon, south Central African Republic (CAR) and north Republic of Congo were strongly associated with the geological substrate, and to a lesser extent with human disturbance and climate. At larger spatial scales, the influence of climate should be more important in determining forest structure, composition and function. Land use change is the dominant driver of biodiversity changes in terrestrial ecosystems (Dawson et al., 2011). Agricultural expansion, logging, overexploitation and invasive alien species are the main drivers of the loss of vertebrate species (Hoffmann et al., 2010). However, it is expected that as the century unfolds, climate change will become increasingly important in dictating species extinction and habitat loss (Dawson et al., 2011).

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[1] The term “biodiversity” is used in a broad sense as it is defined in the Convention on Biological Diversity to mean the abundance and distributions of and interactions between genotypes, species, communities, ecosystems and biomes (Leadley et al., 2010). We add to this that it is understood as one of the attributes of the SES we will describe. For the definition of terms Ecosystem Services, Governance, Well-Being, Policy, Practice and Resilience, we refer to the framework of the Program on Ecosystem Change and Society (PECS) webpage: http://www.icsu.org/what-we-do/interdisciplinary-bodies/pecs.

[2] These include the Indirect Land Use Changes (ILUC) described in the scientific literature (see Lapola et al., 2010)

Models of biodiversity and their relationship with ecosystem services can now be used to understand the drivers of biodiversity dynamics in response to global change and integrate a wide array of socio-economic, political and biophysical processes. They cannot predict future states but allow researchers and policy makers to explore plausible futures. However, models linking biodiversity and ecosystem services remain subjective to their designer's perception, and a scientific challenge (Pereira et al., 2010) as the evaluation of trade-offs and the comparison between scenarios depends on how different stakeholders differently define and assess their quality of life (Zorondo-Rodríguez et al., 2012).

Recent scenarios indicate that there is a wide range of possible futures for forest and biodiversity depending on policies and societal choices and that differences between future pathways may be greater than anticipated (Pereira et al., 2010; Wise et al., 2009). Choices and management strategies can have an impact on future biodiversity, but most global assessments are not well suited to demonstrate the entire scope of options offered to decision makers in managing biodiversity (Leadley et al., 2010).

An environment conducive to the emergence of alternative modes of management is critical for fostering social innovation aiming at sustainable management of forested Social and Ecological Systems (SES) (Biggs et al. 2010). Dialog between key stakeholders is seen as decisive in the establishment of such an environment. We propose that more informed, integrated models of the future of biodiversity in the Congo Basin over the next few decades, embedded in the decision making processes, can improve the resilience of the SES of the region and ensure the continued delivery of the ecosystem services thus contributing to local and global well-being.

Our purpose is thus to promote better management of the forests of the Congo Basin, by bringing to the policy makers plausible scenarios of biodiversity and fostering dialogue. We will develop a framework for collaboration between social and natural sciences, between stakeholders and researchers, using integrative modeling platforms as common ground to describe the world. These platforms, based on existing models such as GLOBIOM (http://www.iiasa.ac.at/Research/FOR/globiom.html) developed by IIASA and MIMOSA (http://mimosa.sourceforge.net/index.html) developed by CIRAD, will be used to construct scenarios of biodiversity for the Congo Basin for the coming decades. The scenarios will explicitly address different management and policy options and be framed as conditional predictions at well-defined geographical scales,

In doing so, we will address 3 broad research questions:

1) Can we identify stable states of biodiversity and its different dimensions in the SES of the Congo Basin? What are the parameters that shape the resilience landscape of the forests of the region? How will different direct drivers (social, economic, governance) interact and contribute to push the system from one basin of attraction to another?
2) What is the contribution of biodiversity to the well-being of the affected communities and how do we measure the quality of life in meaningful ways for local populations? How can we tease out the generation of ecosystem services from their delivery to the stakeholders and the consequent contribution to their wellbeing?
3) Under which conditions can the construction of scenarios of biodiversity foster dialog between decision makers and the civil society, be used to reframe the present situation away from one of conflict to one of common interest and become a tool for ecosystem management transformation?

## Scientific objectives

Our purpose is to foster a better management of the Congo Basin forests through a better understanding of the dynamics, regime shifts and tipping points of biodiversity and a better definition of the conditions of resilience of social and ecological systems. We thus

have three specific objectives, each one being addressed in a thematic Project Component detailed bellow:

I. **Identifying Tipping Points** in the Forests of the Congo Basin SES, mapping biodiversity resilience, identifying stable states and tipping points focusing on tree communities and keystone wildlife species and identifying drivers and potential impacts of policy and management decisions on biodiversity and on the SES ability to provide and deliver ecosystem services.
II. **Constructing Scenarios of Biodiversity**, integrating social, economic, governance, ecological and geophysical processes in a platform able to simulate regional trajectories including sensitivity analysis and levels of uncertainty and incorporating feedback loops based on coping strategies developed by stakeholders as evidenced by locally relevant participatory modelled scenario;
III. **Fostering Resilience**, embedding the results of our research in the decision making process at the regional and national levels, through well-defined impact pathways involving policy makers and the civil society since the inception of the project, through participatory construction of scenarios, fostering innovation in forest and biodiversity policy and management.

In addition to these three thematic components, we propose a fourth one - Component 0: **Managing the Project** - devoted to project management and scientific coordination.

## Work plan

Each component of the project is further subdivided into work packages (WP), and then tasks, outlined in this section.

## Component 0: Managing the Project

### WP. 0: Administrative and scientific coordination

CIRAD will be responsible for the project coordination, with Claude Garcia as leader of the project and of this work package.

This work package aims at ensuring the project runs smoothly and stays on tracks to deliver its outputs, and also to construct and define baseline cross-cutting methods and protocols that will enable collaboration across disciplines and sites. It will also cover our scientific communication program, to complement the targeted communication activities designed for impact under Component III.

#### *Task 0.1. Administrative Coordination*

Teams will be organized to work on the various tasks in each WP, with clear responsibilities outlined, and clear targets (milestones, outputs) distributed. Here we will also resolve eventual disputes between members/partners.

The coordinating team will be responsible for setting up the Steering Committee and organizing its annual meetings. For details, refer to section Project Management.

We will setup internal communication between the partners of the project, including a restricted section of the project website, with a discussion forum and a sharing folder restricted to members. The project will set up an internal mailing list.

Annual reports on research progress and financial aspects will be made available to the steering committee and the donors. The last annual report will double as final report and will be provided to the same.

*Task 0.2. Scientific coordination and site selection*

This task aims at developing a database, construct a common glossary and create, improve and refine the questionnaires needed to conduct data collection in the study sites. All methods will be shared within the project network. A kick-off workshop with representatives of all partners will lay the foundations of the project; develop guidelines and share responsibilities for every task, with identified milestones and outputs.

During the kick-off workshop, we will select 3 study sites along a gradient of human interventions on forests, following the forest transition curve (Mather 1992). We will use the forest typology developed by CoForChange and other variables including forest cover, human density and availability of long-term data. We propose to select sites in the Mobaki region, the Ngotto region and the Batéké tablelands, as these three regions exhibit contrasting human pressure yet similar geological substratum (see figure 1). The three sites will benefit from data generated through the previous CoForChange and Makala projects.

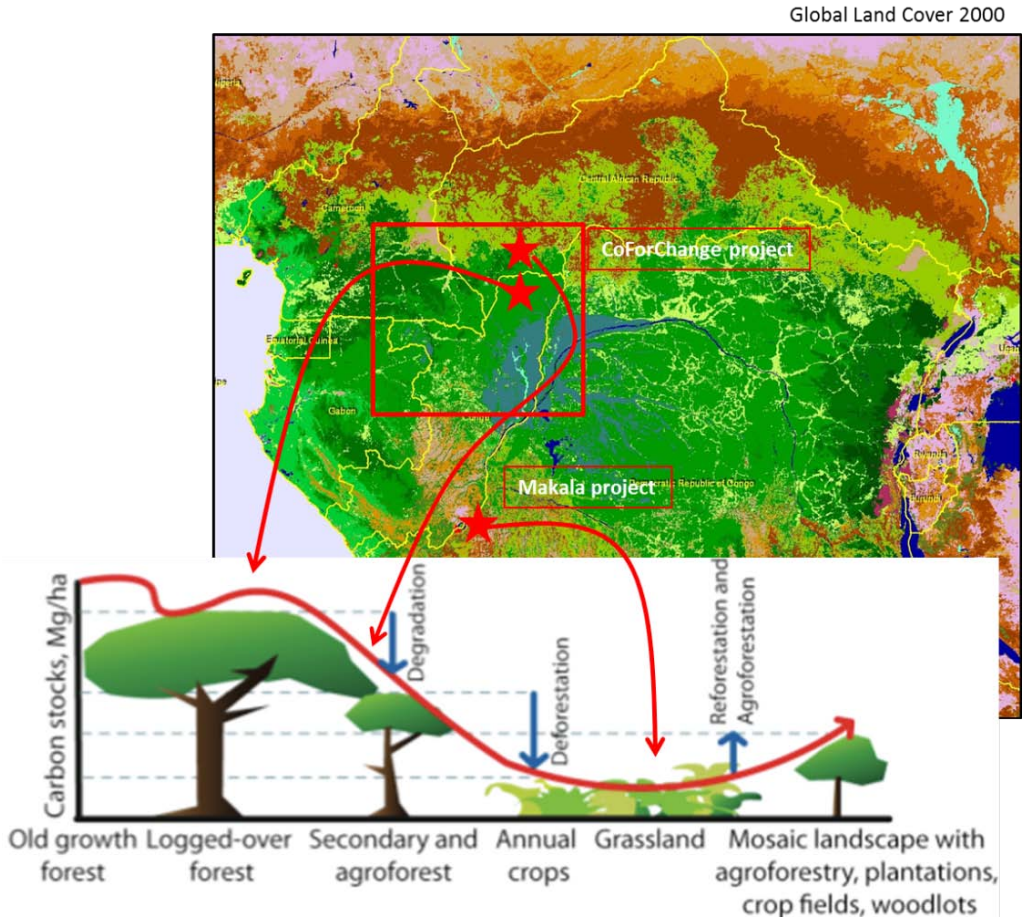


**Figure 1: Location of the study sites and situation on the forest transition curve (source: http://www.cifor.org/crp6/research-portfolio.html)**

The coordination team will organize the field-work and data collection in order to make sure that all the data needed to build and tests scenarios of biodiversity dynamics will be available under the right format. We will also prepare a form with the list of secondary information that will be collected in the different WP, in order to be sure that all the partners collect that data and put it in a format that is compatible.

A database will be developed at the very beginning of the project, in which all the data produced during the project can be easily and properly stored. In particular, data collection

from the study sites must be done using the same methodologies, and directly stored under the same format, in order to allow comparisons and avoid loss of information.

#### *Task 0.3. Communication and outreach*

The coordination team will ensure the communication within and outside the project. We will create a logo and an acknowledgment package. We will set up a project mailing list and an outreach mailing list. To provide information to a large audience, the team will develop and update a website for the project, linked to a social-media feed and a newsletter. These tools will provide information on the objectives, methods and results of the project, as well as links and updates on relevant partner projects and activities, to generate traffic and increase outreach. The social media feed will allow observers and stakeholders to react to our results and interact with our teams with low transaction costs.

## Component I. Identifying Tipping Points

### WP. 1. Biodiversity and resilience landscapes

CIRAD and IRD will be co-responsible for this work package, with Sylvie-Gourlet Fleury (CIRAD) and Raphaël Pélissier (IRD) as leaders.

In this WP, we propose to extend the floristic studies led in CoForChange to the CoForTips study area, and to improve our understanding of both degradation and deforestation and their impact on the structure and diversity of tree communities. We will use several definitions of biodiversity in order to establish links with models of WP3, and we will construct a biodiversity resilience landscape based on relevant definitions of biodiversity.

#### *Task 1.1. Compiling floristic inventories of the Central African forests*

We will rely on the forest inventories used in the CoForChange project and we will gather forest inventories in west Cameroon, Republic of Congo, Gabon and south DRC. Inventories will be sources from logging concessions and from research institutions willing to collaborate.

#### *Task 1.2. Definition of biodiversity and link with functional groups*

To extrapolate the floristic composition and biodiversity from inventory data gathered (Task 1.1), we will need to cross environmental determinants with remote sensing analysis (Task 1.3). Such an extrapolation will be possible only for a limited number of functional groups of species or Plant Functional Types (PFT), which will be used in models of WP3. Here, we will study the links between these PFT and the diversity of species, genus, and services delivered, and we will decide which metrics of biodiversity to map in Task 1.3.

#### *Task 1.3. Mapping the floristic composition and biodiversity of the Central African forests*

We will rely on the database gathered by Task 1.1, on a nested sampling with passive optical remote sensing data at a range of spatial resolutions (from metric to kilometric) and on the temporal (phenology) information given by MODIS products on terra-firme moist forest, completed with ALOS-PALSAR data for swamp forest, to produce a unified vegetation map covering the studied region. Floristic composition and biodiversity will be extrapolated from areas where inventory data were available through models linking composition/biodiversity with environmental factors and remote sensing signals. The output will strongly contrast with existing maps in terms of its level of detail on forest composition (comprising PFTs proportion), its biodiversity (comprising PFTs diversity) and its regional spatial extent.

#### *Task 1.4. Mapping vegetation changes during the last decades*

We will map short-term vegetation changes during the last decades. Short-term changes in forest cover (including deforestation and afforestation), as well as degradation will be

estimated with a time-series of satellite images (MODIS, LANDSAT, SPOT). Degradation will be quantified, in particular, through the spatio-temporal evolution of roads, according to the methodology developed in the CoForChange project.

### *Task 1.5. Construction of the resilience landscape*

We will analyze the effect of anthropogenic pressure (identified in Task 1.4) on the structure and diversity of tree communities (identified in Task 1.3). We will then construct the basins of attraction for biodiversity by linking the observed distribution of PFTs to the probability of occurrence and thus to resilience. This will generate the resilience landscapes of biodiversity in the Congo basin forests (Hirota et al., 2011).

## WP.2. Drivers of change at sub-global and local scales

Gembloux will be responsible for this work package, with Cédric Vermeulen as leader.

The creation of the Observatory for the Forests of Central Africa (OFAC), and the production of the reports on the State of the Congo Basin forests (de Wasseige et al., 2012) resulted from a great effort of information compilation and data sharing among regional stakeholders and institutions working on the policy framework of forestry in Central Africa. We will build on this framework and conduct a set of activities aiming at obtaining empirical data on the link between components of biodiversity and the provision of meaningful ecosystem services. We will look at trends in land use changes, their drivers, and their consequences on the ability of the SES to provide ecosystem services and preserve biodiversity.

### *Task 2.1. Analysis of the SES in the study cases*

In this task, we will analyse the social ecological systems, including a) landscape analysis, b) land uses and activities using natural resources socio-economic analysis, c) stakeholders' trajectories and strategies.

We will describe the landscape, the visible land uses and the signs of current and past activities (such as infrastructures, agricultural landscaping). We will underline the specificities and commonalities of the three SES studied.

We will then analyse the activities based on the valorisation of ecosystem services and products, their outcomes for both livelihoods and the environment, and their current evolutions. We will based this on surveys of the local stakeholders (including group discussions and individual interviews), and participatory observation. The dynamics of change in these practices we be analysed, looking specifically at their intensification and the impact of this trend on the ability of the SES to provide ecosystem services on the long term.

We will develop a typology of the stakeholders, based on social and economic criteria and going from national decision makers to minorities, including the private sector and NGOs. Individual life trajectories of representatives of the various categories of stakeholder will enlighten the individual strategies driving decisions on economic activities and land uses. The relationships between the various stakeholder categories will be analysed, to enlighten power relations and the constraints and opportunities they generate for each individual decision-making. We will specifically look at how the degree of security of access to land and forest resources affects the people's management of these resources, and as a consequence affects forest cover and biodiversity.

### *Task 2.2. Analysis of the drivers of land use change*

We will analyse the commercial and non-commercial pressures on land, such as conservation concessions, agro-industrial plantations, logging, mining, urbanization, and agriculture expansion. We will link international trends to sub-regional, national and local

ones, through the actors involved in these various scales. A sketch locating the main threats on natural resources and the stakeholders will be prepared.

Based on a stakeholder analysis, we will describe power relations and influences among actors, mapping out their networks and their impact on forest management, from sub-regional stakeholders to local ones.

#### *Task 2.3. Conceptualization of the SES*

Mirana (Aubert et al., 2010) is both a conceptual model and a simulation model for assessing the impact of a multiplicity of regulations on ecological, economic and sociological sustainability. The previous tasks will not only identify the institutions and their mode of regulations, but also the interactions between the actors, particularly in terms of power relationships. The aim of this task 2.3 is to integrate decision-making system of institutions and actors, power relations between stakeholders in order to assess their effect on the management of resources and territories, extending and refining the Mirana conceptual model. The model will be further used in the ComMod approach in WP4 and provide inputs to policy scenarios run under WP3.

## Component II: Constructing Scenarios

### WP. 3. Integration of Processes and modelling

IIASA will be responsible for this work package, with Michael Obersteiner as leader.

In this WP we will integrate the resilience landscapes mapped out in WP1 with the drivers identified in WP2. The platform will thus incorporate biophysical, ecological and socio-economic drivers and processes. It will address the trends in policies of land allocation, forest preservation and exploitation, as well as on local dynamics of land use practices in forestry, agroforestry and agriculture. WP 3 will develop computing tools allowing inferring, predicting and mapping dynamics and processes at the regional and national scale taking into account uncertainties of the input data and models.

#### *Task 3.1. Interlinking global models*

Taking over the definition of the Plant Functional Types (PFT) derived from WP1, this task will predict the distribution and dynamics of these PFT in response to land-use change and policies at global scale, taking into account uncertainties on the parameters of the models. The concept of PFTs will be further extended by the formulation of specific agricultural and forestry management practices within each PFT.

The task will integrate three models: GLOBIOM (GLObal BIOsphere Management Model) model (www.globiom.org), G4M (Global Forestry Model) (Havlik et al., 2011; Kindermann et al., 2006) and a vegetation model. GLOBIOM is a global recursively dynamic partial equilibrium model integrating the agricultural, bioenergy and forestry sectors with the aim to give policy advice on global issues concerning land use competition between the major land-based production sectors. G4M is a geographically explicit agent-based model that simulates decisions made by virtual land owners on deforestation, afforestation and forest management taking into account profitability of forestry and agriculture. The vegetation model is an outcome of the CoForChange project allowing the prediction of space-time evolution of functional forest types according to geophysical variables and management options.

Once fully interlinked, the Vegetation/G4M/GLOBIOM model will allow predicting the impact of given land uses practices and policies, on the dynamics of functional diversity in the forest of Congo Basin.

### *Task 3.2. Managing uncertainties through stochastic frameworks.*

This task will develop unified inference approaches allowing propagating the various sources of uncertainties. The integrated Vegetation/G4M/GLOBIOM model cluster will be defined using a hierarchical Bayesian framework, mixing in a coherent probabilistic approach the epistemic uncertainty that reflects an incomplete knowledge of a parameter, and the random uncertainty characterizing the fluctuating states of nature (Parent et al. 2009).

Simulation-based procedures will play an essential role through the entire process of managing uncertainties. Bayesian algorithms associated to recent advances in meta-modeling via statistical tools like 'kriging' (Fu et al. 2012) will be used to quantify model prediction error (Bayarri et al. 2007), constructing credibility intervals. Conditional simulations will also be used to predict non-linear responses and to build confidence or credibility intervals around these predictions (Lantuejoul, 2002).

These methods will inform decision support tools with uncertainties when exploring scenarios, directly feeding WP5. Unconditional simulations of uncertain inputs will also play a crucial part in model validation, as we will use them to assess the consistency of fitted models outputs with existing data or *a priori* knowledge.

Finally, the calibration and simulation work made during the inference and validation procedures will also feed global sensitivity studies (Saltelli et al. 2000) in due time, enabling us to produce a hierarchy of the sources of uncertainties yielding impacts on decision-making; these results will highlight the input variables that need further studies, establishing a feedback in the modeling process.

### *Task 3.3. Prediction of biodiversity outcomes of various governance options*

Policymakers, industry, NGOs and other stakeholders require estimates of biodiversity outcomes with associated uncertainties to help inform land-use and development decisions. We will apply a recently developed matrix-calibrated species-area model (Koh & Ghazoul 2010 ; Koh et al. 2010) over a broader range of species to explore the consequences of land use and land cover changes projected in WP2. This new matrix model accounts for not only the amount of forest remaining in the landscape but also the quality of the resultant land uses that now comprise the matrix. Not only can this model produce more accurate predictions of biodiversity loss from land-use change, it can also predict potential biodiversity recovery from improvements in the quality of the matrix of the Congo Basin area.

## WP.4. Participatory design and analysis of scenarios

CIRAD will be responsible for this work package, with Claude Garcia as leader.

In this WP, we will evaluate the potential of the SES to be affected by the plausible futures outlined in WP3, as well as their capacity to adapt. Factors affecting vulnerability, such as demographic, economic, policy and cultural and institutional characteristics are needed for different types of impact modelling and research (Moss et al., 2010). Some of these factors can be modelled and applied at regional or national scales but for most part data at finer spatial resolutions are required (van Vuuren et al., 2007). Using an integrated model derived from WP2 'Mirana II' platform and a Companion Modelling (ComMod) approach, we will downscale, qualitatively and quantitatively, the trends outlined by WP3, embedding the factors identified in WP2. We expect constant feedbacks between the different tasks of this WP, each step contributing to refine or open new avenues for the others.

### *Task 4.1. Constructing a locally relevant integrated platform.*

We will adopt the Companion Modelling (ComMod) approach (Campo et al., 2010) to construct a conceptual integrated model with the stakeholders and through an iterative process. This platform, drawing heavily on the WP2 Mirana II model, will be translated into a

Role Playing Game (RPG) to enable the stakeholders to explore a range of scenarios through the model and elicit their strategies. The platform will be adaptive, enabling the research team to take into account emerging issues derived from the results of WP1, 2 and 3. The model will also be implemented using the Mimosa platform to run larger numbers of simulations and provide inter-scenarios comparisons.

#### *Task 4.2. Outlining the scenarios*

Using WP3 simulated trajectories as inputs and additional insights from WP2 stakeholder surveys, we will outline scenarios of biodiversity and governance of forest resources. These scenarios will be relevant to the local scale and span several decades, allowing stakeholders to take the medium and long term into account when devising their strategies. Such scenarios will consider the resource interests and needs, access rules and the distribution of power between stakeholders.

#### *Task 4.3. Unfolding the scenarios*

Through workshops organised in the selected study areas, typically involving up to 20 stakeholders, the RPG developed in task 4.1 will be used to run simulations based on the outlines developed in task 4.2. During these workshops, the research team will present the stakeholders with decisions to take regarding the management and governance of forest resources. The modelled impact on biodiversity over time will then fuel discussions on desirable outcomes and plausible futures. The coping strategies developed by the actors will emerge based on the individual and group decisions made by the participants of the workshops and will be segregated by gender, location, social and economic category. Such coping strategies will be re-injected as feedback loop in the WP3 integrated platform.

## Component III: Fostering Resilience

### WP.5. Embedding our results

CIRAD will be responsible for this work package, with Alain Billand as leader.

The models and scenarios developed in Component II will provide conditional predictions of the consequences of specific policy options at well defined spatial and temporal scales enabling the capture of all relevant effects. However, simply inviting key stakeholders and policy makers to meetings where our results are presented is insufficient for achieving the dialog that will allow new ideas to emerge (Biggs et al., 2010).

This WP will thus develop a strategy to ensure our model outputs match key indicators used in decision making, and that the biodiversity scenarios are relevant to the policy and practice of biodiversity governance across scales. This will embed the knowledge generated by the project into the decision-making system, bridging the gap between policy makers, managers and scientists.

#### *Task 5.1. Outlining impact pathways*

This task will outline impact pathways for our research, based on the Participatory Impact Pathways Analysis (PIPA) approach (Douthwaite et al., 2007). An impact pathway is a narrative that describes how knowledge and research results must spread and create favorable institutional environments for innovation to emerge. An impact pathway deliberately designs a strategy to influence the actions of the stakeholders. Our impact pathways will help the research team to be pro-active in the production of outcomes beyond knowledge generation.

#### *Task 5.2. Strengthening policy relevance*

As the impact pathways are fleshed out, we will identify key personalities whose involvement can contribute to increase the policy relevance of our research. We will invite the

resource persons (no more than 8) to constitute the Advisory Group for CoForTips. Their role will evolve with the project. They will contribute to the definition of the problems addressed in Component I, ensure the relevance of the biodiversity scenarios devised in the Component II, and act as champions for the project in the Component III activities, identifying and prioritizing key scientific information needed for policymakers at appropriate scales.

The Advisory Group will convene once a year, and will function as a loose network of allies of the project between meetings.

### *Task 5.3 Engaging stakeholders*

A subset of stakeholders will already have been engaged in the research through the participatory development of scenarios (Tasks 2.3; WP4). In order to broaden the scope of our results and improve the reach of the biodiversity scenarios constructed in Component II, the scenarios will be presented to a range of stakeholders during a perception survey. We will request respondents to order the scenarios by preference, and will ask the reasons behind their preferences.

Perception surveys will be conducted in the studied SES, and among national and sub-global categories of stakeholders, such as trans-national industries, international donors, state administration, NGOs, and decision makers. Surveys will be conducted on the ground in the study sites, and by email and phone for the sub-global categories of stakeholders. Results will be segregated by gender, location, social and economic categories. This will help us quantify the acceptability of our proposals and strengthen our position in the last task of the project, knowledge sharing.

### *Task 5.4 Reframing perspectives*

We will organise one workshop with the Advisory Group, invited experts and decision makers, to generate the “take home message” emerging from the analysis of the scenarios (Tasks 3.3 & 4.2), the coping strategies exhibited during the simulations (Task 4.3), and the social acceptability of the options outlined (Task 5.3).

To discuss the scenarios, the strategies and their impacts and support policy formulation, we propose to use a politically-informed framework for analyzing trade-offs in Ecosystem Services management through a multidimensional vulnerability approach (Ravera et al., 2011) to outline winners and losers.

### *Task 5.5. Sharing knowledge*

Task 0.3 will organise the scientific and outreach communication program of the project. Through the dedicated webpage, social media feed, newsletter and mailing list, we will have created awareness and interest since project inception. In addition to that set of activities, in a further effort to reach out and through the involvement of the Advisory Group members acting as champions and the project partner networks, we will organize 5 informative presentations to formally submit our results to the local councillors and the people’s representatives (Parliament) of the target countries.

Oral restitutions will be made to local actors in the studied sites, and via local radio programs, outlining the scenarios developed through narratives aiming at making the futures tangible.

In addition, a one day high profile roundtable with the Forest & Environment Ministers of the region (or their representatives) will be organized to present and discuss the results of the project, and our policy recommendations, eventually as part of a side event of an international relevant conference (COP, CBD). This roundtable will be followed by the final workshop of the project partners, where we will draw final conclusions from our work. This round table may benefit from additional funding to be secured during the final year.

## Relevance for policy application

Impact pathways and a strategy to ensure our results are relevant for policy and management of biodiversity in the forests of the Congo Basin are internal part of the project design, and not mere add-on activities. We thus refer to the Component III of the project for details on how we plan to close the gap between knowledge production and action.

We will simply highlight here the fact that the partners of the consortium have established long standing partnerships with scientific institutions and policy arenas in the Congo Basin. Alain Billand (CIRAD) for example is part of the Observatory for the Forests of Central Africa (OFAC), an initiative of multiple members of the Congo Basin Forests Partnership (CBFP), aiming to pool the knowledge and available data necessary to conserve biodiversity, to ensure the well-being of the populations that depend on it, and allow to the forest to play a stronger role in national economic development for the countries of Central Africa. The involvement of the FORENET network in CoForTips similarly ensures local forest research institutions are aware of the project and will generate local ownership of the research methods and outputs.

Through similar links CoForTips will be connected to the Commission of Central African Forests (COMIFAC) and other CBFP members, including ministries responsible for forest management and the environment, private companies, protected areas managers, and NGOs involved in the sustainable management and conservation of the forests of the Congo Basin.

## European added value of the proposed research

Our results will be of interest to the regional partners but also to the European Union, as European countries 1) are net consumers of African tropical timber, 2) own most of the logging companies in the region, 3) are highly concerned by the capacity of TMF to serve as carbon sinks, 4) strive to uplift the living standards of marginal communities (Lisbon declaration of the EU-Africa Summit), and 5) want to contribute to biodiversity conservation (Working Program on Forest Biological Diversity).

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## 1.B. Communication plan

We have designed an entire project component (Component III: Fostering Resilience) to ensure the project delivers impacts. Knowledge sharing is an integral part of our intended impact pathway, and thus specific tasks (Task 0.3 and 5.5) have been specifically designed to ensure knowledge transfer to a series of stakeholders, drawing inspiration from the communication model of the CRP6 Forest Trees and Agroforestry. We have two elements of communication, the first one (task 0.3) to cover scientific dissemination of the project highlights, and the second (task 5.5) to specifically target policy makers.

We propose to nest the project in the centre of a network of concentric circles, from close allies of the advisory group, scientific associates and knowledge sharing partners such as the OFAC, managers, practitioners and NGOs, donors, policy makers and finally the larger media and society.

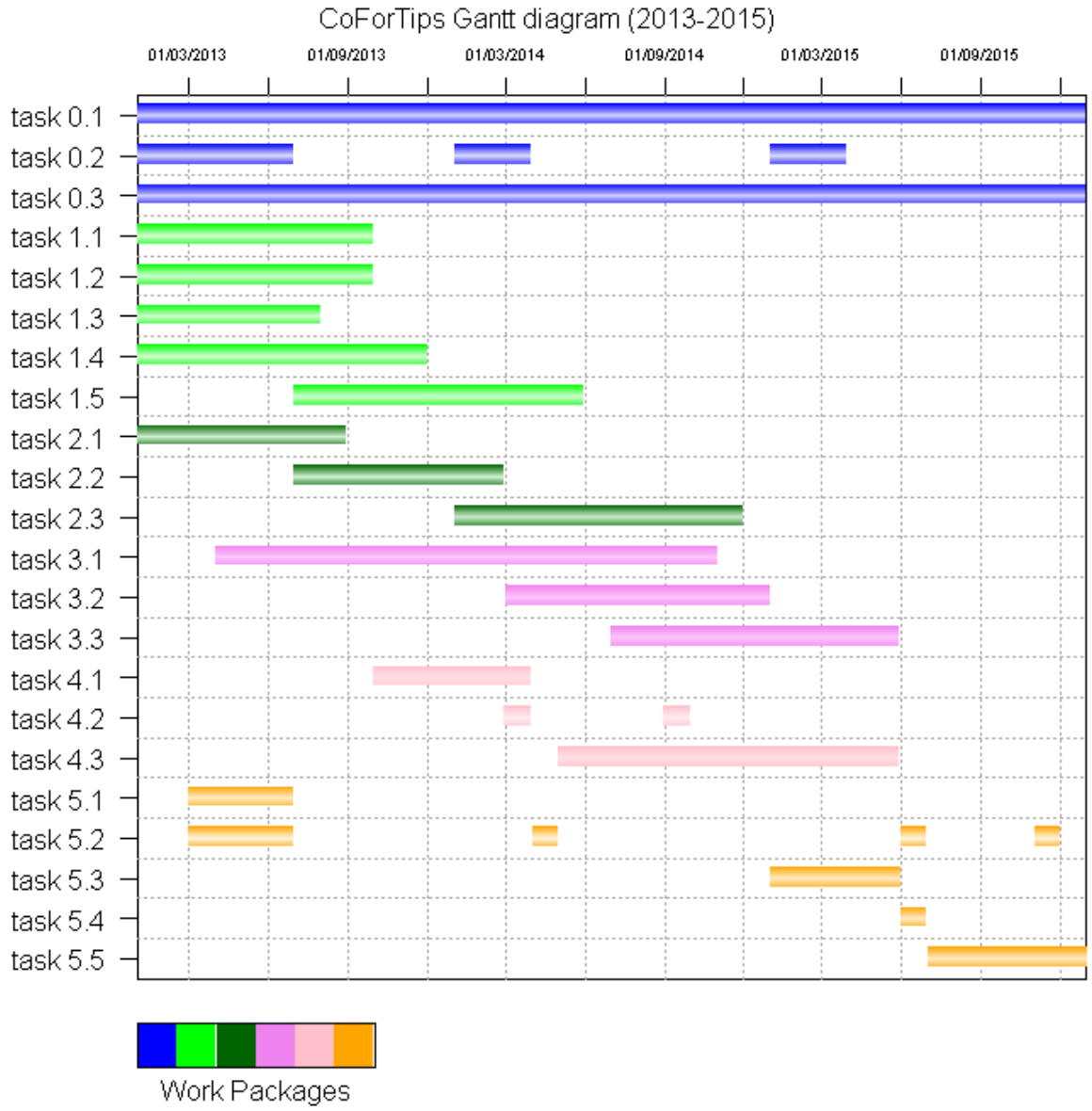
We will begin by creating a logo and an acknowledgment package that partners can use in their communication for the project, ensuring consistency in how CoForTips is displayed. A simple yet effective way to attract interest is the creation of a mailing list, that we will use to send monthly short bilingual French/English updates on the project, expanding the reach of the project as it unfolds, and creating the awareness that will allow us to be heard when our policy recommendation are finally ready to be formally presented. The project will develop a simple webpage but with links to relevant initiatives by partners and allies, and a regular news feed to generate traffic. This will be associated to a social media feed (Facebook or assimilated), these medias are increasingly present in the target area, and provide thus a low-cost, yet very effective way to draw traffic and attract interest. Recognising however that internet connectivity can be a chokepoint for some partners in the region, we will also develop a simple biannual one-page bilingual French/English newsletter, and we will propose its dissemination through ***Bois et Forêts des Tropiques***, reducing costs for the project and yet benefitting from the excellent reach of this journal published by CIRAD.

Scientific papers, with a focus on open access journals, and communications in international conferences will address scientific dissemination of our results. Workpackages 1 to 4 will produce at least one scientific paper co-authored by the corresponding research team of the WP, in a peer-reviewed journal with impact factor. WP1 and WP2 are expected to submit theirs at the end of the second year of the project. WP3 and WP4 shall submit theirs later. Target journals include PLoS ONE, Ecology & Society, Global Environmental Change and related journals. These papers will be published in open access, with funds allocated for the purpose. A fifth paper outlining the biodiversity scenarios, our policy recommendations and our impact pathways will be framed as a 'policy forum' article co-authored by the entire research group and prepared on par with the development of WP5 activities. This paper will be submitted in the last semester of the project to a high profile journal (e.g. Science).

We have allocated enough funds to travels to ensure the project will be able to be present in at least an international conference per year. Our policy will be to fund only if an oral presentation is accepted at the conference. For posters, we will look for alternative funding sources, as we want to maximize the impact with limited resources. The decision on what conference to attend will be taken by the coordination team as part of the activities of task 0.3.

For policy oriented communication, we will follow the impact pathways outlined in Task 5.1. We have budgeted resources to organise meetings with local decision makers and also plan ahead for a high profile final roundtable. We will also benefit from several networks of communication of each of the partners, including the 'Francophonie' arena, the CGIAR agricultural research network and the associated Global Forum for Agricultural Research (GFAR), and the long-term presence of regional coordinations of CIRAD and IRD in Central Africa.

## 2. Time schedule and working programme.



# 3. Description of project management

## 3.A. Project governance:

The project is lead by Dr. Claude Garcia, (CIRAD), acting as project director. He is assisted by Dr. Laurène Feintrenie (CIRAD) as deputy director and by the project secretary, Annie Molina (CIRAD).

There are three bodies that will orchestrate the project governance.

The first one is the Project Management Unit (PMU), comprised of the project director, the deputy director, and a member of each partner institution. The PMU will take responsibility for Task 0.1, the administrative coordination of CoForTips.

The second one is the Steering Committee, comprised of the Management Unit, representatives of the donor agencies (ANR, FWF and Belspo), and representatives of the self-funded partners and sub-contractors.

The third one is the Advisory group, whose composition and role are outlined in WP5.

## 3.B. Project cycle

We detail in this section how we will organize the various components of the project to achieve all of the project goals and objectives under the constraints of scope, time, and budget. CIRAD being the lead institution and in agreement with the partners, the CIRAD format and procedures for administration and finance will be used. All the details outlined here will be integral part of the WP0 (Task 0.1 – Administrative Coordination). We address the four phases of the project cycle:

### Contract management

CIRAD is used to manage various types of contractual documents that will be used as models to develop those required for the project. We will develop consultancy contracts with the sub-contracted partners and Memorandums of Understanding (MoU) with the two self-funded partners based on pre-existing formats. Internship contracts and fixed-term employment contracts likewise are standard and will allow seamless integration of temporary staff in the research team.

### Project Start Up

Partners are already aware of the CoForTips proposal. During start-up, all administrative units that will be working on or with the project will be notified of its inception and of their respective roles in the project's management. One of the particular challenges posed by BiodivERsa call is that is involves three different national donor agencies with three different sets of rules channelling the funds to each partner on nationality basis. The start-up process will ensure that all commitments with the donor, i.e. financial, technical or narrative reporting, along with key deliverables are clearly defined for tracking.

The PMU with the donors will define and schedule the key deliverables at start-up, in order to insure efficient and effective administration, as well as to meet donor's expectations. A project dashboard (hosted in the restricted section of the webpage of the project) will identify those deliverables (and resource persons) that have been reached as well as those that are lagging behind.

### Project Progress Monitoring and Reporting

The Steering Committee will convene every semester to check the progress of the project against the proposed action plan. In an effort to reduce the carbon footprint of the project and manage costs, we will maximise the use of videoconferences. All partners (including self-funded) have such facilities available, and for short duration business

meetings, even low-key video-chat services (such as Skype) can suffice if the team members located in the Congo Basin cannot access videoconference equipment.

These meetings will be useful to identify difficulties impeding progress and to come up with practical solutions.

We plan to host annual CoForTips meetings that will coincide with scheduled meetings of the SC and of the Advisory Group. The first such general meeting will take place at the headquarters (HQ) of CIRAD (Montpellier). The location of the others will be decided as the project unfolds, and will factor in the possibility to secure additional funding.

Reporting will be centralised by the PMU, and the same annual report will be sent to the three contributing donor agencies.

In the life of the project, changes may come in various forms (staffing, permits, opportunities to seize and risks to avoid or mitigate). When the donor's written approval is required, an official request will be sent by the project director. CIRAD internal procedures will ensure ample advance notice is given to donors for delayed project reporting or deliverables.

### Project budget and financial management

The Project Leader will monitor very closely project expenses against planned budget to avoid under and over spending. In order to have assistance in this task, the PL will be able to use CIRAD internal financial reporting system online to access online the budget and expenditures in real time. However, the PL will not be able to see the budget of each partner similarly, and these will have direct links with their own national donor agency. It will be thus up to the PMU (with representatives of each partner) to collate the financial information on regular basis, to ensure proper management of funds.

### Project Closure

The project will last three years (unless extended). At the end of this period, the PMU will ensure that all donor commitments are met. Spill over of certain activities (in particular scientific publications) is expected, but the final report and all committed deliverables by CIRAD and the partners will by then be completed and accepted by the donors. These include financial accounting to be resolved as per the requisites of each donor agency to their particular partner, and all project data and related materials being archived and/or made available appropriately as per the suggestions of the Advisory Group. Archive persistence will be ensured through the existing archive wiki of CIRAD UR "Goods and Services of Tropical Forests Ecosystems" and mirror sites in the partners' dedicated webpages.