Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

based on a decision of the Parliament of the Federal Republic of Germany

REDD-PAC

(REDD+ Policy Assessment Centre)

This project is part of the International Climate Initiative. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supports this initiative on the basis of a decision adopted by the German Bundestag.

19 October 2012

Project Duration	Nov 2011 – Nov 2015 (4 years)
Coordinating Organization	International Institute for Applied Systems Analysis (IIASA, Austria)
Partner Organizations	United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC, UK)
	Instituto Nacional de Pesquisas Espaciais (INPE, Brazil)
	Central African Forest Commission (Yaoundé, Cameroon)

1. Background

Reducing Emissions from Deforestation and Forest Degradation, plus conservation and enhancement of forest carbon stocks and sustainable management of forests (REDD+) has become a major component of continuing negotiations under the United Nations Framework Convention on Climate Change (UNFCCC). REDD+ aims to achieve sustainable and efficient emissions reductions through the generation of measurable, reportable and verifiable (MRV) REDD+ credits that are linked to a robust financing regime. Policies for implementing REDD+ will potentially have major impacts on land use, which in turn are likely to affect economic returns and ecosystem services such as biodiversity conservation. Hence, understanding land use change processes and how different REDD+ policies are likely to influence land use change is essential for enabling development of REDD+ policies that ar economically efficient, socially acceptable, can safeguard and enhance ecosystem values, and help countries to meet the objectives of the UN Convention on Biological Diversity (CBD).

Implementation of REDD+ potentially requires a wide range of policies and activities. Such REDD+ programmes have the potential to deliver multiple benefits, including ecosystem services and social benefits, and also carry some social and environmental risks. Recognition of these has prompted the UNFCCC to put in place safeguards for REDD+, which highlight some specific risks and include a request to 'enhance other social and environmental benefits' (UNFCCC 2010). An increasing number of countries are interested in planning for multiple benefits from REDD+, and in anticipating its potential impacts, including on biodiversity.

Currently, there is a lack of capacity and technical know-how on issues that will ensure the efficiency, effectiveness and environmental integrity of REDD+ implementation, ranging from the development and implementation of methodologies for identifying reference emissions levels for REDD+ to basic planning for multiple benefits and the operationalisation of safeguards. Consequently, there is a need for support to countries on REDD+ and land use planning in relation to biodiversity objectives. This includes assistance in undertaking initial spatial analyses on potential benefits, as well as in developing high quality, spatially explicit assessments of the impacts of REDD+ policy options, in relation to the safeguards negotiated under the UNFCCC and the objectives of the CBD.

REDD-PAC will help support countries in REDD+ planning by refining a global land use model (GLOBIOM) for use in scenario analysis of land use changes under different REDD+ policies, with a focus on Brazil and the member countries of the Central African

Forests Commission (the Congo Basin). Brazil and the Congo Baisn encompass 60% of the total tropical forest area but their deforestation profiles are quite different. Brazil has experienced a high historical deforestation level but the recent trend is a reduction of the deforestation rate. The Congo Basin has experienced a low historical deforestation level but the recent trand is an increase in the deforestation (and degradation) rate. Analyses will take account of existing land use policies and will assess the effects of incorporating biodiversity conservation priorities into REDD+ planning. The land use change outputs of the model will be used to assess the economic and biodiversity impacts of different REDD+ policy options, and their potential role in contributing to progress towards specific goals, such as the CBD's Aichi Biodiversity Targets, economic growth or food security.

Furthermore, the project will act as a global forum for sharing and improving global data on forests and deforestation drivers, developing methodologies for determining reference levels and best practices for national REDD+ modelling, as well as more general land-use planning. The project will also support work on multiple benefits from REDD+ with national partners in a further six countries (China, Ecuador, Peru, the Philippines, Uganda and Vietnam). This work will draw on spatial analysis of potential benefits from REDD+ and will be tailored to the specific needs of each country, and therefore will vary amongst them.

2. Broad scientific questions

Countries face several challenges in developing their REDD+ programmes. These challenges include establishing reference levels and understanding the likely impact of different policy options in order to identify appropriate REDD+ policies.

Regardless of the specific form of the REDD+ mechanism, the emissions reductions achieved by a country will need to be assessed against reference levels that estimate the likely emissions without REDD+ activities. Determining appropriate emissions reference levels presents a challenge for many countries. There are several possible methodologies for setting reference levels and the use of different options is likely to have implications for the climate effectiveness, cost efficiency, and distribution of REDD+ finance among countries. Options for setting reference levels include extrapolation of historical rates, adjustment to these rates based on economic development or position on the forest transition curve, and model-based estimates of forest loss under business as usual scenarios. Each of these approaches has its own advantages and difficulties.

As a wide range of different policies and actions could be implemented to achieve REDD+ outcomes, another challenge for countries is identifying their possible policy options. Countries need to choose not only how to balance their efforts amongst the five activities recognized within the UNFCC[1] but also how best to carry out those activities. Each of the different ways of implementing the activities is likely to have different impacts and effectiveness. Hence, there is a pressing need to assist nations with high quality assessments of the potential impacts of REDD+ policies. Understanding the impact of different policy options will help support countries in selecting specific REDD+ policies from among the many options. The economic, social and environmental implications of REDD+ are likely to be variable depending on the specific policy options chosen.

The choice of policies will depend on the countries' aims both for REDD+ emissions reductions and for wider benefits from REDD+ . Such potential benefits include socio-economic benefits such as poverty reduction and secured land tenure, and environmental benefits such as biodiversity conservation, protection of water resources and soil stabilisation. Specific REDD+ policies may be chosen to achieve specific benefits, for example by prioritising the conservation of forest carbon stocks in important watersheds in order to maintain water quality, or by facilitating adoption of new technology by farmers in order to reduce demand for new agricultural land.

Achievement of emissions reductions depends on the reference levels chosen, the objectives set and the effectiveness of the policy options selected. The use of the GLOBIOM model will allow an explicit representation of the trade-offs between different land uses through a multi-sectorial approach and the corresponding assessment of REDD+ opportunity costs. Land heterogeneity is taken into account through agriculture and forestry potentials based on bio-physical characteristics, market accessibility and carbon content. Application of an approach such as GLOBIOM for modeling business-as-usual land use change also avoids artificial inflation ("hot air") of deforestation levels. Furthermore, the global framework helps to resolve uncertainties on the potential impacts of different REDD+ policy options due to displacement of production between countries. Indeed, it ensures that external drivers of deforestation are taken into account since pressures on forests could be driven by external demand. For instance, deforestation in a first country may be a response to the implementation of a REDD+ policy in a second country, the demand for agricultural

[1] The five activities proposed for UNFCCC REDD+ are (i) reduced deforestation and degradation of forests, (ii) sustainable forest management, (iii) forest-carbon enhancement, (iv) forest conservation, (v) capacity building and ongoing monitoring.

or forest products in the second country being met by the supply from the first country Being able to identify the potential for such 'leakage' is critical to the development of effective policy options.

Economic development and poverty alleviation are priorities both in Brazil and the Congo Basin. As such, REDD+ policies must be analyzed in the context of the overall regional development.

REDD+ has the potential to help conserve forest biodiversity. However, the biodiversity impacts of REDD+ policies are likely to extend beyond forests, through intensification or displacement of certain types of land use and associated pressures. Such indirect impacts are a source of uncertainty in evaluating REDD+ policy options. They may increase pressures on low carbon forests and other ecosystems, including those valuable for biodiversity conservation (e.g. Cerrado in Brazil). Therefore, understanding the potential impacts on land use both within and outside REDD+ areas is essential for assessing REDD+ impacts on CBD objectives.

The need to promote and support the UNFCCC safeguards, as well as other international commitments including the CBD's Aichi Biodiversity Targets may also influence policy selection. Four of the Aichi Targets are particularly relevant to REDD+:

- **Target 5**: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
- **Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
- **Target 12:** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained
- **Target 14**: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

REDD+ policies may contribute to achieving CBD objectives, including these targets. However, assessing the potential for this is made more challenging by the lack of standardised ecosystem service and biodiversity data and methodologies.

REDD+ implementation also faces challenges at the international level in ensuring the equity and the transparency of the REDD+ architecture. More specifically, it is crucial that REDD+ credits are fairly allocated. Enabling access to high-quality, independent and globally-consistent methods for policy assessment could help ensure equity and

transparency. Additionally, equity and transparency may be increased if countries are enabled to share consistent data about deforestation patterns, key economic drivers, protected areas and biodiversity priority areas. There is also a pressing need for access to standardised methodologies for determining reference levels and leading national REDD+ policy assessments.

3. Expected outcomes

The output of the project will be a jointly developed cluster of fully integrated land-use models focusing on Brazil and the Congo Basin region. Data about land cover, land use, and biodiversity will be combined with physical and economic models in a globally consistent way so as to provide a spatially-explicit and multi-criteria assessment of a set of REDD+ policy options. In this section, we describe each of the components that will be produced by the project: the input database, the land-use models, and the scenario analysis.

3.1. Consistent database on land use, land-use change drivers and biodiversity in Brazil and the Congo Basin

REDD-PAC will act as a global forum for sharing and improving global data on forests and deforestation drivers. The data produced by the project will be disseminated using the applicable international standards for geospatial datasets. The project will leverage INPE's experience with TerraLib database to build the joint REDD-PAC database.

3.1.1. Land use

The land-use data will come from global maps adapted to the IIASA model cluster format and resolution. In a first step, INPE will provide IIASA with the Amazonia deforestation database. In a second step, the database will be extended to other Brazilian biomes. INPE will also use a time series of vegetation indexes derived from MODIS data to improve the land-use information. COMIFAC will provide OFAC/OSFAC maps for the Congo Basin.

Land can also have a legal status that impacts the way it is used, such as protected areas, indigenous reserves and, forest concessions. Data on land status will be included into the land use database. Land use status will be linked to specific use rules in accordance with legal constraints and, where possible, observed patterns. UNEP-WCMC will work with IIASA to develop classification rules related to different types of

protected areas. Remote-sensing data and local knowledge will be used to provide an assessment of the actual effectiveness of existing land statuses.

3.1.2. Land-use change drivers

The information on actual and future land-use change drivers will come from various sources. It will include information on:

Population and GDP- The population dynamics as well as the level and distribution of wealth among the population will influence the future demand and the resulting land use dynamics.

Connectivity- Numerous studies have highlighted the crucial role of transportation infrastructures in past deforestation. The connectivity structure is especially critical for a country of the size of Brazil or to a lesser extent of the Democratic Republic of the Congo.

Agriculture and Forestry- Most of the data currently used in GLOBIOM come from FAOSTAT (production, harvest area, cattle heads, prices, average crop yields, consumption...). Agricultural and forestry statistics at sub-national levels as well as additional statistics related to management (fertilizer use, machinery use, water use...) will be collected in each country and added to the database. One particular challenge is to get a better information on production costs in land based economic activities in Brazil and in the Congo Basin.

Mining- Gold, copper, diamonds, oil, and other important mineral resources are found in rainforests around the world. The extraction of these resources can be directly destructive of forests and also brings in migrants who place additional demands on surrounding land.

Bioenergy- The global bioenergy demand is expected to increase in the near future, and a the same time the need for land to produce the feedstock. Brazil is already the largest producer of sugarcane-ethanol in the world and the second largest producer of bioethanol. It is also one of the largest exporter of bioethanol. Congo Basin countries have also the potential to contribute to the global supply of bioenergy or bioenergy feedstock. For the moment, fuelwood is the most common source of household energy in the Congo Basin. Fuelwood also represents a significant share of the energy portfolio in Brazil.

3.2. Spatially explicit land-use models for Brazil and Congo Basin countries

Spatially explicit land-use models are relevant tools to help with planning for multiple benefits from REDD+. First, it is important to understand the state of knowledge on the spatial relationship between the carbon stored in ecosystems, biodiversity and other ecosystem services, and pressures exerted on ecosystems both at local and international levels. Second, it is crucial to account for international trade in a global assessment of REDD+ benefits because REDD+ activities will increase the pressure on low carbon forests and other ecosystems, including those valuable for biodiversity conservation (geographic leakage). Third, land-use models have the potential for broader benefits, including helping to generate national capacity for improved land-use planning and integrated policy development. Land use models can support intersectoral coordination, including policies for agriculture, forestry, nature conservation and bio-energy.

In the project, the spatially explicit land-use models will in fact be a cluster of models centered on an updated version of GLOBIOM, and run at the regional and national scale. GLOBIOM is a global, partial equilibrium model developed at IIASA which includes the agriculture, forestry and bioenergy sectors. For the Congo Basin and Brazil, regional versions will include the standard features of GLOBIOM, but the representation of land-use will be improved for the countries of concern. In the Congo Basin, four national versions will also be made available for 4 pilot countries.

The regional partners will be instrumental in co-developing the land-use models in collaboration with IIASA and WCMC teams, increasing their technical detail and applying them at finer geographic scales. Improvements to the GLOBIOM model will be made through refining the model components, developing improved input data, and validating the model through comparison with empirical data on land use change and with results of other regional studies. Regional partners will also contact technical staff in research institues and/or government institutions.

The main outputs of the regional land-use models will be for each scenario and each 10-year period:

- Land-use change at a 50x50km resolution
- GHG emissions from land-use change and agriculture
- Crop production at a 50x50km resolution by crop and management system
- Livestock production at a 50x50km resolution by animal type and management system
- National prices

- Bilateral trade flows
- National demand level

Econometric, cellular automata and agent-based models will be possibly coupled to GLOBIOM to downscale GLOBIOM results and increase their quality. Downscaling is valuable for public policy in Brazil, given the specific attention turned to regional inequality issues.

3.3. Policy assessment and scenario development

One important objective of the project is the assessment of the impacts of several REDD+ policy options on land-use change, economy, emission reduction and biodiversity by 2030 or 2050. These policy options will be included in different forward-looking scenarios. A 'No Additional Policy Scenario' (NAPS) will be designed to account for current policies and their actual effectiveness, as well as their implementation as anticipated for the next decade. The NAPS scenario will include projections of important parameters (drivers) over the next decades such as population, GDP, infrastructure network, or technological change. The selection of the most realistic assumptions will be based on i) the collection and comparison of the available information and ii) a broad consultation of stakeholders, national and international experts. A set of alternative scenarios will account for new policy instruments, especially in relation to REDD+, and taking account of biodiversity priorities. The drivers will most likely be similar to those defined in the NAPS scenario.

All partners will contribute to the definition of plausible policy options for REDD+ within the different regions, and to the assessment of the different policy scenarios.

For a maximum policy impact of the work undertaken within the project, close cooperation and consultation with national experts, including REDD focal points and decision makers interested in climate change and biodiversity conservation, is crucial.

3.4. Multiple benefits assessment in additional countries

In addition to the tool development work within Congo Basin and Brazil, the REDD-PAC project will assist six other countries with work on multiple benefits from REDD+.. The work will cover capacity building in Peru, Uganda, Philippines and China on spatial analyses of the relationship between carbon, biodiversity, ecosystem services and drivers of change. Such analyses are essential to underpin REDD+ scenario analyses

and the development of biodiversity indicators. Further targeted support will also be provided to Ecuador and Viet Nam, where initial spatial analyses have already been completed, but where results have not yet been applied to their full potential. For example, support may be provided in developing biodiversity indicators and monitoring systems and in broader spatial planning for climate change.