Modelling land use change in Cameroon

2000–2030

A Report by the REDD-PAC project

UNEP WCMC

IIASA

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Land use is a crucial factor in both economic development and the environment. Land dedicated to agriculture allows regular production which benefits nearby populations, meeting their food needs, and potentially benefits the economy as a whole. On the other hand, agricultural land has a much lower carbon content than forest land and is generally poorer in biodiversity. Land can be used in different ways to achieve different goals and it may be difficult to achieve all goals at the same time, which means making difficult choices when designing policies.

Cameroon is often called « Africa in miniature » because of its large diversity of geography and climate, which brings benefits in terms of both agricultural production and biodiversity. Forests occupy about 35 million hectares including 19 million hectares of dense humid forests. One third of the humid forests are under exploitation, and Cameroon is the second largest timber producer in the region. Despite the strong potential of the agricultural sector, 20 % of rural population does not have enough food. Farmers' livelihoods have also deteriorated since the beginning of the 90s. Cameroon is committed to reducing emissions from deforestation and forest degradation, plus the conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks (REDD+), with more than thirty projects related to REDD+ are currently being implemented.

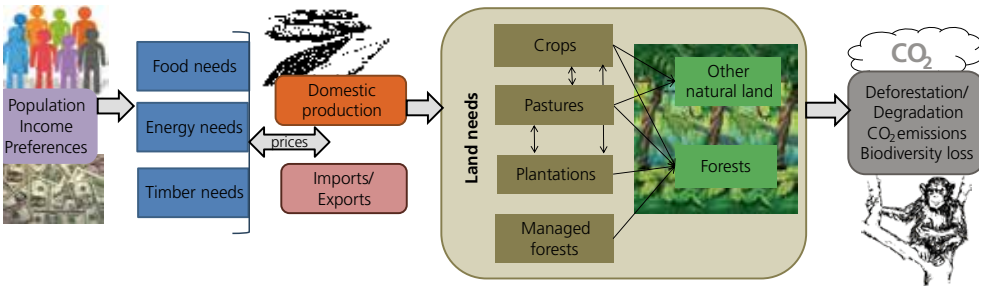
This study is intended to assist institutions involved in REDD+ and the planning of National Strategies and Action plans for Biodiversity in Cameroon. It identifies the areas under the greatest conversion pressures in the future and the consequences in terms of agricultural production, greenhouse gas emissions and biodiversity loss.

FOTOS: ALINE SOTERRONI

A modelling approach

Models make it possible to explore the consequences of future changes in a simplified context. The REDD-PAC project adapted the GLOBIOM (www.globiom.org) model to the Congo Basin context. The GLOBIOM model is a global economic model which represents land use competition between the agricultural sector, the forestry sector and the bioenergy sector. The simulation period is 2000–2030, the first 2000–2010 period enables testing of the model's capacity to reproduce past trends.

Deforestation is modelled on the basis of changes in production and consumption for all countries at the same time. Thus, we can more easily verify the validity and consistency of estimates and avoid an artificial increase in future deforestation unrelated to changes in demand. The spatial resolution of the results allows for consistency in deforestation calculated at sub-national level with deforestation calculated at national level, as well as enabling heterogeneity of carbon and biodiversity to be taken into account.

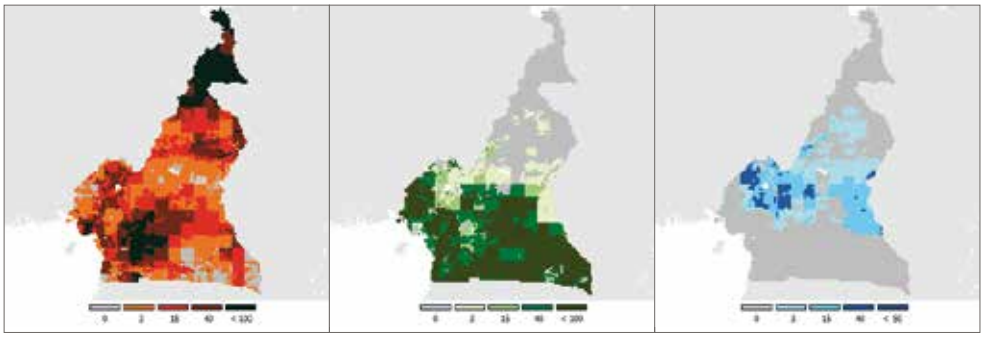


Overview of the GLOBIOM model

Adaption of the GLOBIOM model to Cameroon

Cameroon forms part of the COMIFAC region in the model. Cameroon can trade with other COMIFAC countries and with other regions of the world. Agricultural production and the changes in land uses are represented in 240 spatial units.

In order to develop high quality models it is important to have a good representation of the starting situation. Whilst agriculture is the main reason for deforestation, there is considerable uncertainty as to the current location of agricultural land among existing land cover maps. A hybrid map has been created using the best existing land cover maps after consulting with local experts and available agricultural statistics. Agricultural statistics availability and quality is better in Cameroon than in the other central African countries.

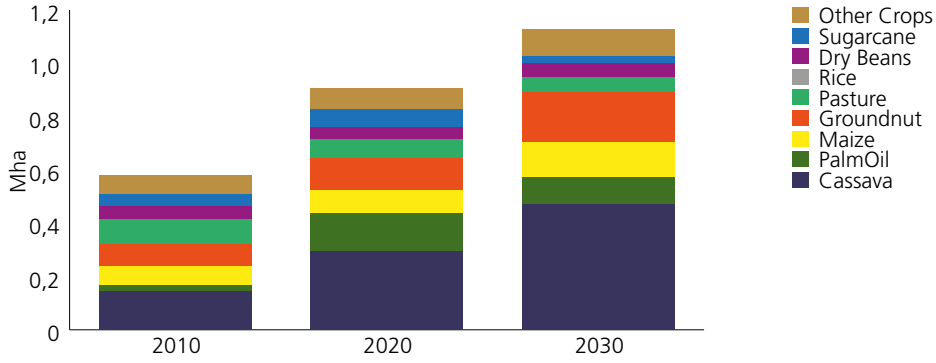


Hybrid vegetation map: share in % of units occupied by cultivated land (on the left), dense forests excluding flooded forests (in the centre) and dry forests (to the right)

Future deforestation

According to conservative projections, close to 28 million people will be living in Cameroon in 2030, with a strong increase in urban populations and average per capita GDP. A larger and richer population generates an increase in local consumption of agricultural products which is translated into an increase in cultivated areas.

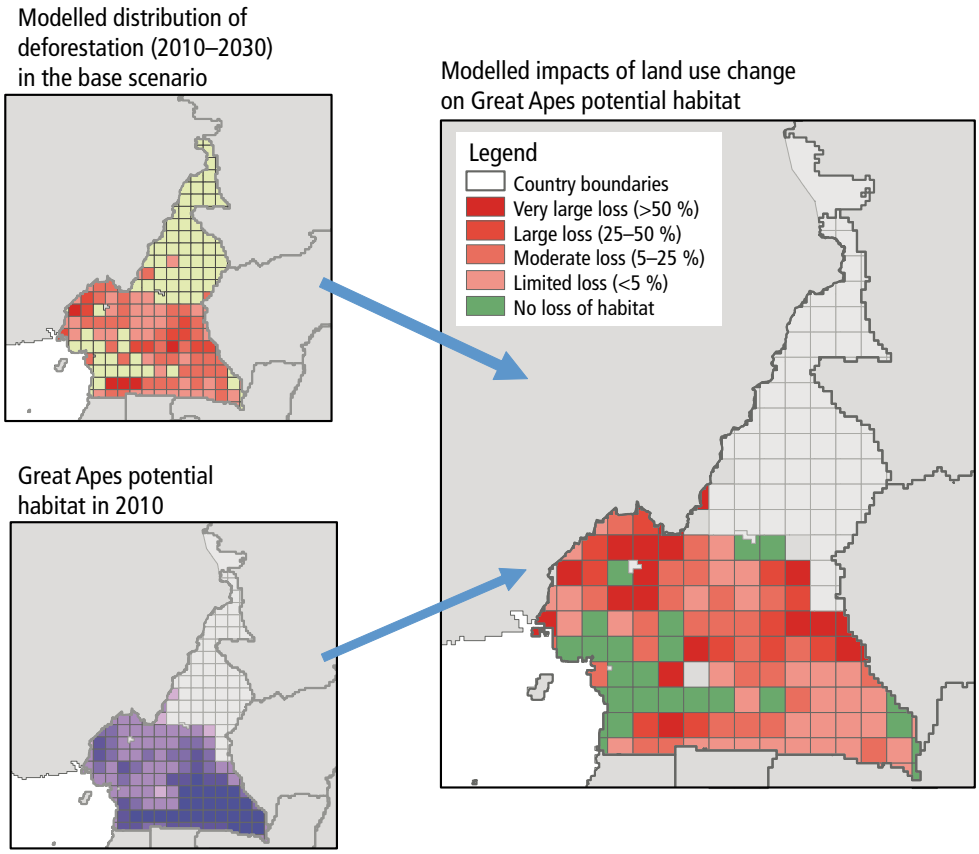
Our results show increasing deforestation from 58 000 hectares per annum over 2000–2010 to 113 000 hectares per annum over 2020–2030. This leads to the emission of 1.8 gigatons CO_2 over 2010–2030. Almost two thirds of the calculated deforestation is explained by the expansion of cassava, maize and groundnuts and the fallow land associated. Oil palm explains 12 % of total deforestation. Cameroon is the only net exporter of agricultural products in the region. Agricultural exports to neighbouring countries strongly increase over 2010–2030 in our simulations.



Trend in deforestation by cause in Cameroon between 2010 and 2030 in the base scenario.

Impacts on biodiversity

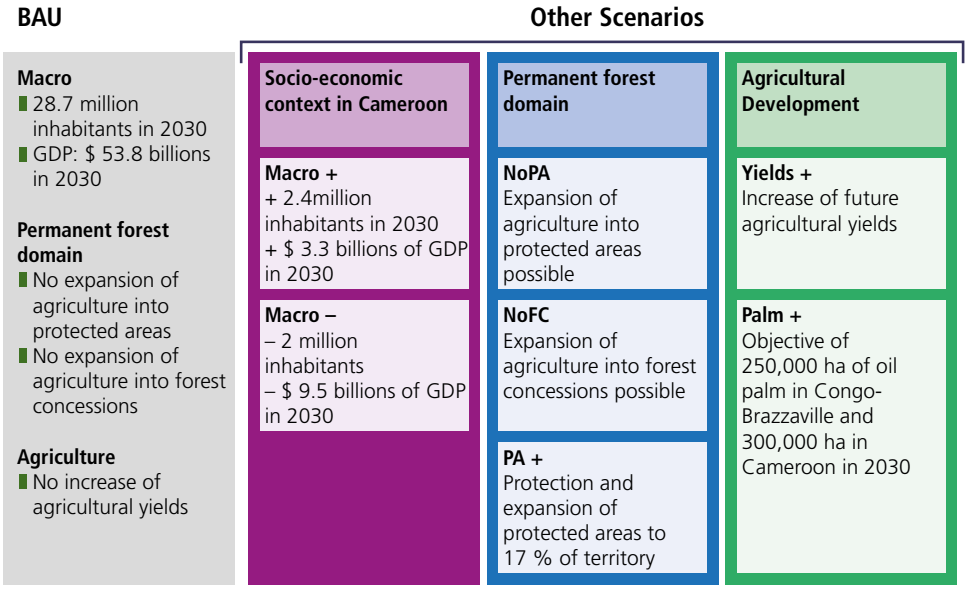
Cameroon is home to two species of Great Apes, the chimpanzee and the lowland gorilla, which are very dependent on the presence of natural forests for their habitat. They are also species that are potentially a great attraction for the development of eco-tourism. The model forecasts a particularly substantial loss of habitat for Great Apes in the south west, centre and east of Cameroon. In addition to the direct loss of habitat, the expansion of agricultural areas will lead to an increase in contacts between wildlife and human thus increasing poaching risks.



Modelling of the impact of deforestation on the potential habitat for Great Apes

What factors can reduce or increase future deforestation?

Cumulated deforestation over the 2010–2030 period varies between 1.4 and 2.2 million hectares in the scenarios retained versus 2 million hectares in the base scenario. Improved crops yields, an increase in protected areas and reduced growth in population and GDP could reduce deforestation, whereas expansion of uncontrolled agriculture in protected areas or forestry concessions, and a stronger increase in population and GDP increase deforestation in relation to the base scenario.



The main hypotheses within the Base scenario are described on the left and changes made to these assumptions in each scenario are presented on the right (one scenario by white box).

What factors can reconcile several objectives?

Because of its status of net agricultural goods exporter, a reduction in demand and/or an improvement in production conditions in the other COMIFAC countries lead to a reduction in agricultural production in Cameroon. This explains why we observe a reduction in calories production and an increase in agricultural exports in the scenario with higher population and economic growth. The non-controlled expansion of agriculture into the permanent forest domain causes a deterioration of all indicators considered. For the other policies which are tested, we observe gains for biodiversity conservation but losses for agricultural production.

Comparison of scenarios in respect to their contribution to several objectives (the green colour indicates progress towards the achievement of an objective whilst the red indicates a greater distance from the objective

	Economic Development and Food Security		Climate Change mitigation		Conservation and sustainable use of biodiversity	
	Calories produced by inhab.[a]	Net agricultural imports[b]	Total emissions[c]	Emissions from deforestation[d]	Loss of habitat of large primates[e]	Number of species losing >10 % of their habitat[f]
BAU	2303	266	2444	1785.0	10.9 %	675
+MACRO	–2,2 %	15,2 %	9,3 %	8,4 %	11,1 %	23,0 %
–MACRO	–0,5 %	–21,6 %	–5,8 %	1,0 %	–5,1 %	–15,4 %
No PA	–0,6 %	–14,0 %	5,1 %	6,0 %	10,0 %	18,1 %
No FC	–0,4 %	–8,5 %	8,0 %	9,4 %	11,5 %	16,3 %
+ PA	1,3 %	–7,0 %	2,6 %	–2,8 %	–18,0 %	–41,9 %
+ Yields	–2,2 %	–60,0 %	–36,7 %	–33,2 %	–14,7 %	–58,2 %
+ Palm	1,4 %	–3,1 %	5,6 %	1,9 %	2,3 %	6,2 %

a) production of calories in kcal per inhabitant per annum in 2030 on the basis of the crops represented in the model, b) value of imports of agricultural products in 1000 USD in 2030 on the basis of the crops represented in the model, c) total emissions from the agricultural sector and changes in land uses in Megatons CO_2 between 2010 and 2030, d) total emissions from deforestation in Megatons CO_2 between 2010 and 2030, e) proportion of the area of the potential habitat of large primates converted to other uses between 2010 and 2030, and f) number of species, among 1367 species considered, that lose more than 10 % of their potential habitat within the country between 2010 and 2030..

Conclusion

The results of this study show that deforestation in Cameroon could double in 2030 compared to historical deforestation over 2000–2010. This leads to the emission of 1.8 gigatons of CO_2 and 675 species to lose more than 10 % of their potential habitat within the country, including 55 threatened species.

Cameroon has often higher crop yields than other countries in the COMIFAC region and an agro ecological diversity that allows a wider variety of agricultural products. Thus, if agricultural yields will not increase rapidly in Cameroon, the pressure on forests due to the increase of the population may be amplified by the increase in demand in neighboring countries. Part of the investments in the context of REDD+ should support efforts to increase agricultural productivity, ensuring minimum impacts on forests. An accompaniment of urban elites who are increasingly interested in investing in agriculture in Cameroon could also be a factor of intensification in the coming years.

The results of this study show the importance of effective management of the current permanent forest domain. The lack of resources for the management of existing protected areas poses a significant risk to the habitat of many species. Our results also show that logging concessions can be an important barrier to deforestation. Efforts have been made to move towards a low- impact logging in most forest concessions in Cameroon, and these efforts must be continued. Preventing poaching in forest concessions can increase their contribution to reducing species extinction, which is an objectives of Convention on Biological Diversity's strategic plan 2010–2020.

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www.redd-pac.org

CREDITS

The REDD-PAC Project Team

COMIFAC: Martin Tadoum, Chouaibou Nchoutpouen, Peguy Tonga, Adeline Makoudjou, Didier Bokelo Bile, Roland Gyscard Ndinga

IIASA: Aline Mosnier, Michael Obersteiner, Florian Kraxner, Johannes Pirker, Géraldine Bocqueho, Petr Havlík

UNEP-WCMC: Rebecca Mant, Blaise Bodin, Andy Arnell, Valerie Kapos

Institutions

COMIFAC: Central African Forest Commission

IIASA: International Institute for Applied Systems Analysis

UNEP-WCMC: United Nations Environment Programme, World Conservation Monitoring Centre

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