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REDD Reference Levels and Drivers of Deforestation in Congo Basin Countries

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Sources

This paper is based on discussions held during a workshop organized by COMIFAC and the World Bank from November 16 to 18 in Douala, at which the mid-term results of the regional study on "Economic Growth and Deforestation in the Congo Basin – Modeling of Development Trajectories" were presented. In particular, preliminary results from modeling work by the research institute IIASA[1] using the GLOBIOM model were presented at the workshop. The paper is also based on the work of institutions involved in OSIRIS, the ONF International, and the Geography Department of the Catholic University of Leuven on Deforestation Trends, various types of economic models, and a considerable amount of expert reflection on a REDD mechanism and its impact on the Congo Basin forests. It also incorporates the latest discussions on reference levels in the REDD negotiations, particularly Non-Paper 18 (Bangkok 7th session LCA, Part II) and Non-Paper 39 (Barcelona 7th session LCA, Part II), all other relevant SBSTA and AWG-LCA texts, along with background materials from the UNFCCC workshop on Reference Levels held in Bonn in March 2009.

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Introduction

Greenhouse Gas Emissions (GHGs) resulting from land use change represent 20% to 25% of total anthropogenic emissions (IPCC, 2007). Most of these emissions result from the deforestation and degradation of forests in developing countries. In order to reduce these emissions, a mechanism aimed at "Reducing Emissions linked to Deforestation and forest Degradation" of forests (REDD) is being negotiated since 2005 under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). Implementing a REDD mechanism would encourage emission reductions in countries that are not included in Annex 1 of the Convention.

Despite a historically low rate of deforestation, Congo Basin countries strongly believe in the opportunity provided by a REDD mechanism. They consider such mechanism as a land management tool that facilitates the development of national sustainable development strategies that are based on a low – or at least reduced – impact of economic development on the forest. Thus, the Congo Basin countries' joint submission to the Subsidiary Body for Scientific and Technical Advice (SBSTA) in February 2009 stated that "the implementation of a REDD strategy is ... much more than forest protection because it goes along with the recognition of the global value of forest resources in the context of the economic and social development of participating countries."

Within this context, in July 2008, negotiators from the Congo Basin countries identified the principal phases in – and the support required for – preparing their countries for the REDD process and for a better understanding of the emerging mechanisms that enables political decision making. The program identified three major working blocks, namely: (i) establishment of an overview of deforestation and degradation in Congo Basin countries; (ii) developing reference scenarios for GHGs emissions linked to deforestation and degradation, taking account of past and future drivers on the Congo Basin forests, and (iii) assessing the potential impact of REDD policies on the development of Congo Basin countries. This paper provides initial responses to these three questions, in particular to the issue of reference levels.

The Kinshasa Declaration by the ECCAS-COMIFAC Ministers states on the issue of reference levels: "The ECCAS-COMIFAC countries, having a substantial forest cover, should be rewarded for their low historical deforestation. It is essential that reference levels should take account of their forest capital but, even more importantly, of the future economic and social development policies of the sub-region." Thus, reference levels must factor in the countries' development needs. More concretely, according to the position paper prepared by experts from the region in Kinshasa , "given that a reference level based on the historical rate of deforestation will not benefit the region, it is fundamental that an adjustment factor be applied to take into account the future threats to the forest cover."

Until now, the argument in favor of adjusting reference levels calculated based on historical deforestation has been based on the concept of forest transition, even though this concept is not describing a mandatory course of events. This paper therefore aims to put forward more forceful arguments to support the argument for adjusted reference levels as the Copenhagen Conference of the Parties (COP) approaches. Beside supporting the negotiation on reference levels, this note also aims to help countries to decide on the strategies that will allow them to effectively combat deforestation drivers on the Congo Basin forests by better identifying these drivers.

After briefly summarizing the context for the REDD negotiations, this paper concentrates on the threats to the region's forests. It does not aim to predict the future of the Congo Basin forests, but it does develop possible scenarios, taking account of the various drivers, particularly external drivers, that may have an impact on the forest over the next 20 years. This analysis underlines the problems of using historical reference levels for Congo Basin countries as these do not reflect future threats to the region's forest. Furthermore, it is necessary to clarify the causes that are likely to lead to future deforestation before calculating any reference levels. In its second part, this paper describes the implications of using historical reference levels for Congo Basin countries as well as on the environmental and cost effectiveness of a REDD mechanism on a global level. Finally, in a third part, this paper assesses the debate over reference levels within the framework of international negotiations on the future REDD mechanism, and offers a brief analysis of the alternative methods of constructing reference levels.

[2] Kinshasa Declaration on the common position of the Ministers for the Environment, Forests, and Country Planning of the ECCAS-COMIFAC on the preparation of negotiations for the new post-Kyoto climate regime 2012 (September 2009).
[3] COMIFAC Countries' memorandum in negotiations for the new climate regime, Kinshasa, September 2009.

1 Context: REDD negotiations and reference levels

1.1 State of REDD negotiations before Copenhagen

To mobilize the full potential for forest emission reductions and removals, an effective, efficient, and equitable international REDD mechanism must be put in place without further delay. Such mechanism will need to be based on a system that allows developing countries to access financial resources in return for generating climate benefits that are measurable, real, and sustainable. The setting of credible reference levels, of monitoring, reporting, and verification (MRV) systems, and of international financing and support mechanisms, is thus at the core of international REDD negotiations.

Current REDD negotiations within the UNFCCC framework focus on:

- The creation of appropriate incentives for REDD in developing countries;
- The establishment of new (or reformed) funding mechanisms;
- The need for appropriate and predictable financial support for REDD+ (see Box 1) and other mitigation activities, and the structuring of access to these funds by developing countries; and
- The formulation of standards and technical criteria that guide the development of MRV systems and allow the setting of reference levels.

« Methodological issues for creating reference levels will be discussed after Copenhagen. »

Setting reference levels is essential for the success of a REDD mechanism since (i) it sets the reference scenario against which GHG reductions are calculated, (ii) it will have an impact on the amounts and costs of emission reductions obtained, and (iii) it thus determines the overall success and integrity of the system.
A political declaration from Copenhagen could include a short section focused on the objectives, scope, and principles of REDD, and separate COP decisions could deal with methodological issues and immediate action. The technical matter of the methodology needed to set reference levels at the international level may be referred back to SBSTA for further deliberations in the follow-up to Copenhagen.

Box 1: Scope of REDD – Developments over recent years

REDD is discussed under the UNFCCC Ad-hoc Working Group for Long-term Cooperative Action (AWG-LCA). While discussions on creating incentives for reducing emissions from the forestry sector in developing countries began by considering emissions from deforestation only, the 13th session of the Bali Conference (COP 13) expanded, mainly at the request of the countries of the Congo Basin, the scope of the discussions to include degradation. However, the Parties continued to push for an expanded scope for REDD, and COP-14 agreed that REDD would consider all emissions and stock enhancements from the forestry sector. Thus, item §1b(iii) in the Bali Action Plan agenda concerns "policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries."

REDD has thus officially become REDD+ and now covers all changes to forest carbon stocks but excludes agriculture or other land-use linked emissions. While incentive mechanisms for REDD+ are still under consideration, REDD+ can potentially credit a much broader range of activities than simply avoiding further deforestation, including replanting trees, forest restoration, rehabilitation, sustainable forest management, as well as afforestation and reforestation.

Change in:	Reduced negative change	Enhanced positive change
Forest area (in hectares)	Reduced deforestation	Afforestation and reforestation (A/R)
Carbon density (carbon per hectare)	Reduced degradation	Forest restoration, rehabilitation, and sustainable management of forests
No change	No change	Continuous support for conservation

1.2 Concepts linked to the reference scenario

The objective of this section is to define the concept of "reference levels" as used in this paper and the context of the UNFCCC, and to underline remaining differences between business as usual (BAU) levels, reference levels and crediting levels.

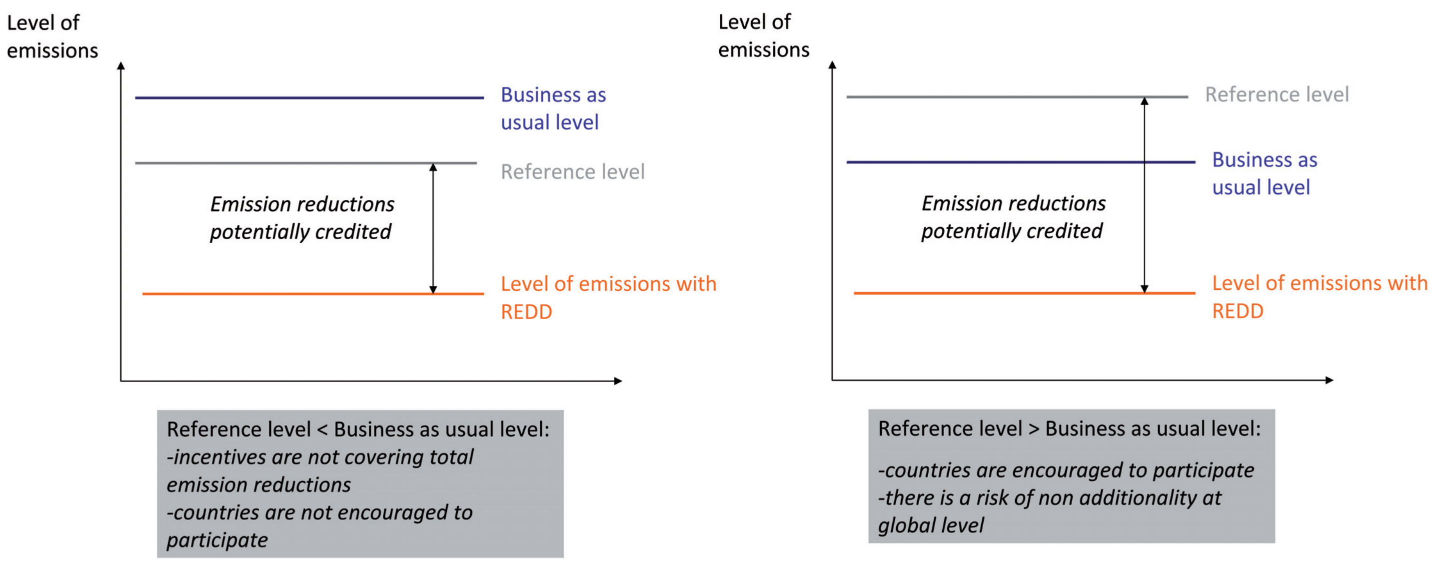
« The objective of setting reference levels is to ensure optimal and additional emission reductions while securing the participation of as many forested nations as possible. Reference levels will dictate the ultimate effectiveness (in terms of overall emission reductions) and the distribution of payments among REDD+ countries. »

In the context of REDD+, the term "reference level" describes the gross/net emissions and removals from a geographic area during a specific time period. This includes changes from deforestation and forest degradation, conservation, sustainable forest management, and enhancement of forest carbon stocks. The reference level is a tool for determining a country's emission reductions. These are equivalent to the difference between monitored, reported, and verified emissions and the reference level. The simplified equation is:

Emission reductions = Reference level – Verified level

Establishing reference levels is important not only for determining emission reductions but also as a basis for REDD funding mechanisms. Countries reducing emissions below the reference level may be entitled to rewards through funds or market mechanisms. The reference level attempts to get as close as possible to business as usual emissions, but since these emissions are by definition unknown, the reference level in most cases will differ from the business as usual level. Furthermore, when countries agree to combat climate change by contributing to emission reductions without international support and by their own effort, the reference level must be distinguished from the crediting level, which is used as a basis for international compensation mechanisms. In that case, the reference level is used to estimate emission reductions and the crediting level calculates emission reductions that will be converted into REDD credits and will therefore be supported by international financing.

Figure 1: Business As Usual levels and reference levels



[4] Within the framework of a REDD mechanism limited to emission reductions from deforestation or degradation, an emission reference level would refer to emissions from a given geographical area over a specific period of time.

Determining reference levels that reflect as closely as possible the business as usual is a challenge. Fixing reference levels below business as usual levels will discourage countries to take part in a REDD mechanism since they will get no incentives for the full reduction of emissions (even if they do not wish to contribute to the cost of emission reductions). Thus reference levels that are too low will reduce incentives for cost effective emission reductions. On the contrary, reference levels set above the Business As Usual scenario REDD credits could flood a potential market, increase the costs of GHG reductions, or dilute funding-based efforts (see Figure 1[5]).

The final outcome of the process leading to the setting of reference levels must result in a tradeoff between the international climate agenda (environmental integrity and rapid emission reductions) and national sustainable development objectives.

Reference levels could be approved under the UNFCCC on a country-by-country basis (per the COP decision) or be negotiated in one block. Either decision may include the setting of an international reference level to ensure "global additionality" that caps total available REDD credits to no more than projected emissions from expected global deforestation and forest degradation under a BAU scenario (global reference level = sum of countries' reference levels). This would prevent at the global level the issuance of credits that do not represent actual emission reductions.

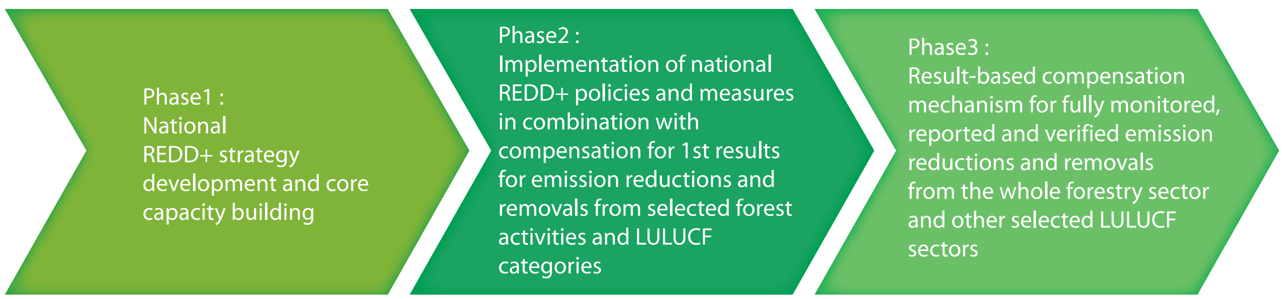
« The setting of national reference levels will be a requirement for participation in the REDD mechanism for Phase 3 (or potentially for Phase 2). Until then, countries must make progress in the implementation of a strategy for fighting deforestation. »

1.3 Framework for the future REDD funding and reference levels

There appears to be broad support for a three-phase REDD+ mechanism (see figure 2) that is flexible and dynamic enough to take into account the differing national circumstances and capacities of developing countries. The exact definition of these phases remains to be negotiated. The progression of each country through the REDD+ phases will demand increased financial incentives commensurate with manifest commitment and the achievement of measurable and lasting emission reductions. A three-phase approach would enable COP-15 to agree on the immediate implementation of the initial phases while postponing a decision on the technical details of the implementation of the later phases. Sufficient flexibility to accommodate national circumstances should apply to the overall design of the initial phases and the transitions between them. The timing of transitions from one phase to the next may vary.

The setting of reference levels is a condition for Phase 3, which provides financial incentives on the basis of the achievement of emission reductions and removals calculated against a reference level. To the extent that Phase 2 measures success in performance against proxies for REDD – such as a reduction in the rate of deforestation – the setting of reference levels would already be required for Phase 2 implementation.

Figure 2: A three-phase REDD mechanism



[5] In this figure, for simplicity's sake, the reference level equals the level used for granting financing.

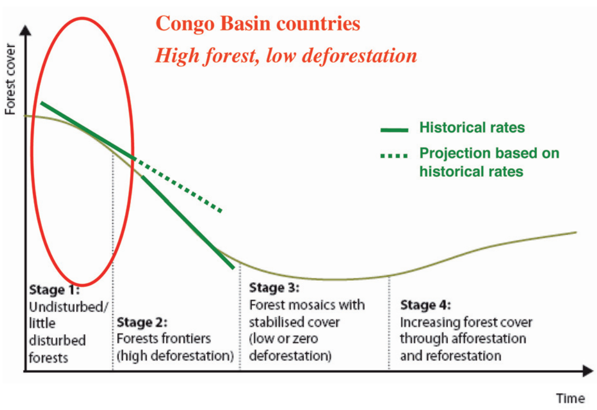
2 Deforestation trends in the Congo Basin

2.1 Historical deforestation trends

The Congo Basin's ecosystems have not yet suffered the same damage as many other regions (Amazonia, South East Asia) and are relatively well-preserved. Indeed, the Congo Basin accounts for only 5.4% (Hansen et al, 2008[6]) of the estimated loss of humid tropical forest cover over the 2000-2005 period. According to the most recent available data (State of the World's Forests, 2008), the net rate of deforestation in dense forests in the Sub-region between 1990 and 2000 was between 0.02% in the Republic of Congo and 0.2% in the Democratic Republic of Congo (DRC), or less than the global average deforestation rate over the same period, which reached 0.22%. This specific situation, sometimes referred to as "passive protection," (Rudel, 2005[7]) partly results from the combination of a history of political instability, low-quality infrastructure, and/or low population densities. But it can also be explained by the early commitment to policies of sustainable forest management and conservation by the Congo Basin countries.

« According to Forest Transition theory, the Congo Basin countries remain at the first stage of the transitional process as these countries have a large forest cover and a low deforestation rate. »

Figure 3 : Stages in forest transition (adapted from Murdiyarso and al., 2008).



The Congo Basin countries strongly argue that the transition to Phase 2 (i.e., to the status of a country with a large forest cover but a high rate of deforestation) has already begun or is about to begin. In the Congo Basin, there are indeed signs that can be interpreted as precursors of forest transition, such as an increase in mining exploration, the implementation of development plans for road infrastructure, and discussions on initiating large agro-industrial projects (especially oil palm plantations). The rate of deforestation in the Democratic Republic of the Congo and Cameroon (two countries accounting for about 70% of the region's humid tropical forest) appears to confirm that these countries have started a process of deforestation.

These new indicators come in addition to historical deforestation factors such as the expansion of subsistence agriculture and the collection of firewood. These historical factors will continue to exert considerable pressure, along with increased demographic density, even if their spatial footprint remains limited to peri-urban areas because of a lack of infrastructure development.

2.2 What pressures affect the forests of the Congo Basin?

Beyond historical threats that were primarily domestic, new external drivers threaten the the forests of the Congo Basin. These drivers result directly or indirectly from the following international factors: global population growth, which increases demand for agricultural and forest products, dietary changes[8] in emerging economies (especially in Brazil, China, India, and Russia), particularly under the influence of GDP growth in these countries, and the development of alternative energy policies (an increased share for biofuels). Free trade policies may also have an impact on deforestation by increasing the share of international trade represented by developing countries. The GLOBIOM model integrates these international factors into its BAU scenario (see Box 2).

[6] Hansen and al., 2008. Loss in humid tropical forest cover over the 2000-2005 period by region.
[7] Rudel, 2005. Tropical Forest: Regional Paths of Destruction and Regeneration in the late 20th century.
[8] Diet modifications affect both the number of calories per person and the increase in the proportion of animal calories in the diet.

2.2.1 Forested areas in the Congo Basin have strong potential for agricultural development

For these drivers to have an effect on the Congo Basin, the land must first be suitable for land uses that compete with preserving the forest, especially agricultural activities, whether for food or energy production.

The Congo Basin holds considerable assets in agricultural land. Many forested areas have characteristics that are well adapted for developing agro-industrial production (cacao, coffee, sugar cane, palm oil, corn, etc.) (see Figure 4, adapted from work by Hansen et al., 2001).

An analysis carried out by the *Terrestrial Carbon Group*[9] found similar results, estimating that the proportion of Congo Basin forests at risk of deforestation is between 64% in the Central African Republic and 92% in the Republic of Congo. These percentages represent the share of land potentially capable of supporting cultivation, both in biophysical terms and in terms of economic profitability[10], excluding protected areas.

Similarly, preliminary results from the IIASA model show that fertile land exists within forested areas and it can be assumed that this land is not yet being exploited due to the lack or poorly maintained infrastructures.

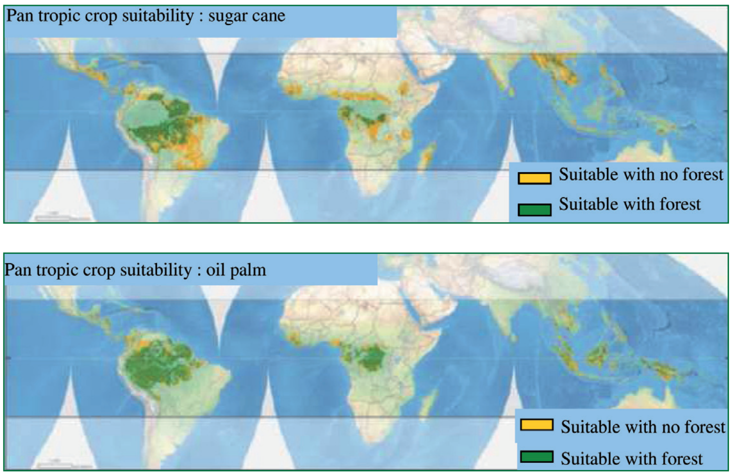
2.2.2 Increasing demand for agricultural and energy products

Several factors indicate potential growth in demand for agricultural products for food or energy use (as fossil fuel alternatives). Population growth is undoubtedly one of the factors with the heaviest impact on this trend, with a projected 38% global population increase over 2000 figures by 2030 compared to a 110% increase in the Congo Basin in the same period (GLOBIOM model data). But other factors also contribute to this trend.

With respect to food products, the last years saw a "land grabbing" by foreign investors[11], in particular from China and the United Arab Emirates. This land grab can be explained by the desire of countries with limited arable land (relative to their demographic density) and/or limited water resources to secure their food supplies (made even more fragile in 2008 as a result of the increase in prices for agricultural staples). However, it seems that the Congo Basin countries have not yet been affected by these types of "contracts", contrary to what is happening in other African countries such as Tanzania, Zimbabwe, and Sudan.

« In the face of a possible increase in global demand for agricultural products, the forests of the Congo Basin are a reserve of fertile land, available for conversion. »

Figure 4: Tropical aeras suitable for sugar can and palm.
Source : Hansen 2001 in A Preliminary Global Assessment of Tropical Forested Land Suitability for Agriculture



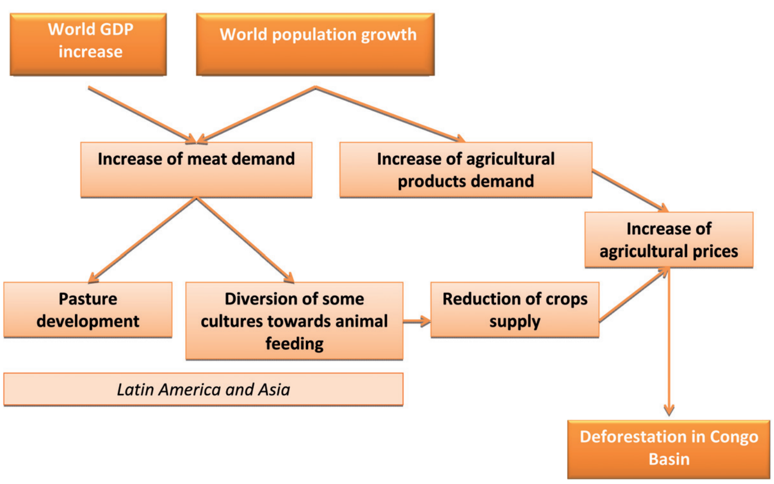
[9] The document is available at:
http://www.terrestrialcarbon.org/site/DefaultSite/filesystem/documents/TCG%20Policy%20Brief%203%20TCG%20REL%20Tool%20090608.pdf

[10] In this respect, economic profitability depends upon existing infrastructure, available technologies, and local capacities.

[11] IFPRI, 2009: *Land Grabbing by Foreign Investors in Developing Countries: Risks and Opportunities*

Additionally, there is significant trend to an increase in international demand for meat. In emerging economies such as China, Russia, and India, the daily diet is likely to be increasingly based on animal protein, which implies heavy pressure to increase meat production at the global level. The Congo Basin has no comparative advantage in meeting this need for meat, not showing the appropriate biophysical and climactic conditions for large-scale cattle farming. However, preliminary results from the GLOBIOM model indicate that the countries of the Sub-region will suffer an indirect impact through the substitution of crops from one geographic area to another and the changing price signals. Therefore it becomes clear from the model that the development of cattle farming in Latin America and Asia may reduce crop production in these countries and that this reduction in supply may lead to an increase in crop prices. The Congo Basin countries may react to this development by increasing the area under production for traditionally imported crops (corn in particular). Depending on the size of the shock accounted for by the GLOBIOM model, the Congo Basin countries could potentially become crop exporters. These indirect impacts, which constitute a risk for the forests of the Congo Basin, are shown in Figure 5.

Figure 5: Indirect impact of meat demand on Congo Basin countries



Box 2:
The GLOBIOM model (developed by IIASA)

The GLOBIOM model is a global partial equilibrium model. Unlike a general equilibrium model, it does not consider all economic sectors but only the primary production sectors that compete for land usage, such as the agriculture, forestry, and biofuel sectors. The land use predicted by the model is the result of an optimization process designed to maximize revenue from a given area (here, from a simulated unit with a size between 10*10km and 50*50km depending on the zone).

Supply will be adjusted to demand for agricultural and wood products, while being restricted at the international level by population growth and GDP. This BAU scenario can be modified to integrate international or regional, political or economic signals. Thus, the model is able to test international or regional policies that impact the three sectors listed above.

As another effect of the growing global demand for food and the increase of extreme weather events (capable of causing a drop in food supply during some years), the Congo Basin countries aim at developing their agricultural sector so as to modify the trade balance for agricultural products in their favor and to secure stable food supplies. Up to now, agriculture has remained comparatively weak, and Congo Basin countries remain net importers of agricultural food products. This can be explained by low profitability due to high transport costs caused by the absence or poor condition of infrastructure, which affects the commercialization of products and access to inputs (fertilizers, seed), land tenure insecurity (which does not promote investment), low yields related to unsustainable agricultural practices (such as slash and burn agriculture), weakly structured sub-sectors, etc. However, a potential increase in the competitiveness of national agricultural sectors could have two effects on deforestation:

- it could reduce the total area devoted to current slash and burn agricultural practices and thus reduce the deforestation associated with these practices; however,

- by increasing the profitability of agricultural land, it could also narrow the difference in opportunity cost existing between agricultural and forest uses and thus promote greater deforestation.

With respect to energy products, an increased development of biofuels at the international level is related to:

- The depletion of fossil fuels and the simultaneous increase in their price;
- increased energy consumption in emerging countries due to an increase in GDP, especially expressed in increased demand for transport; and
- a post-2012 international agreement on climate change establishing stricter target restrictions on GHG emissions (especially for Appendix 1 countries).

As space is limited in densely populated developed countries, the additional production of biofuels may shift to developing countries and emerging economies of the southern hemisphere. Several of the Congo Basin countries have indicated that they have already been in discussion with private investors about the establishment of large scale oil palm plantations (involving hundreds of thousands or even millions of hectares). While no oil palm plantations for energy production have yet been established in the Congo Basin, these signals may be the precursors of future development.

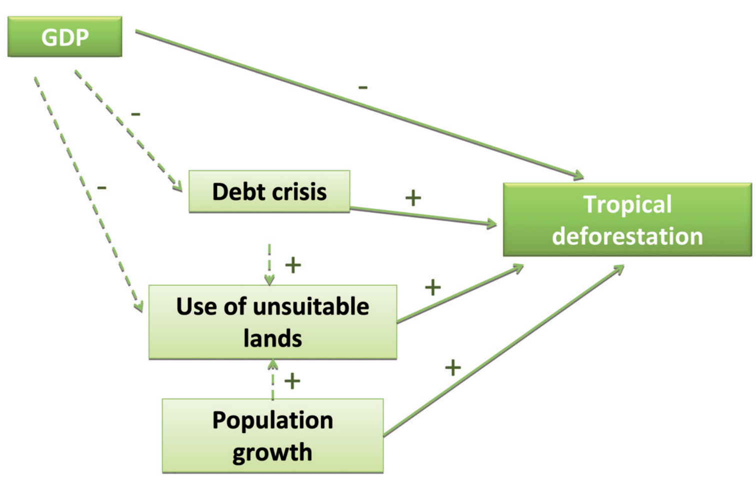
However, preliminary GLOBIOM results indicate that despite having clear attributes in terms of soil quality, especially for developing biofuels, the Congo Basin countries will not be the first to be affected by such developments. Some Latin American and Asian countries seem more competitive in terms of the profitability of such production (in particular due to lower transport costs). However, even if the Congo Basin countries do not see the direct development of oil palm plantations, they may suffer indirect influences via price increases for some crops that compete with biofuels on land available in Latin America and Asia (as with increased demand for meat).

2.2.3. The relevance of domestic drivers

The deforestation and forest degradation stemming from peasant farming and the collection of firewood, which have affected the Congo Basin countries for decades, follow primarily from the "immiserization" model (Rudel and Roper, 1997[12]), as described in Figure 6. It is primarily caused by population pressure and can be accelerated by a lack of economic alternatives to agriculture and the use of natural resources. Deforestation may become even more significant if the expansion of agricultural activities takes place outside of the land most easily cultivated and already saturated, and if the areas to be opened to farming must therefore be larger to maintain production levels.

« The forests of the Congo Basin form part of the globalized world, and decisions or policies that are entirely exogenous to Congo Basin countries could indirectly affect the integrity of these forests. Thus as part of the combat against climate change and to ensure the maximum environmental effectiveness of each decision made, it is important to carefully analyze the chain of causes and effects. For example, a biofuel development policy by developed countries could have significant indirect impacts on forests, which countries are otherwise trying to protect. »

Figure 6: Deforestation path - Immiserization model (Rudel and Roper, 1997).

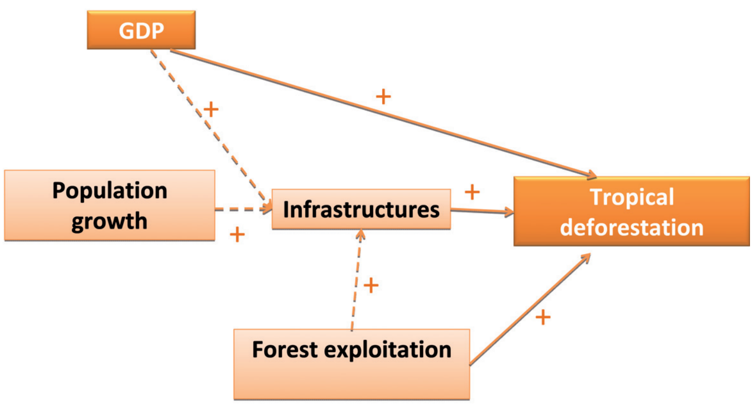


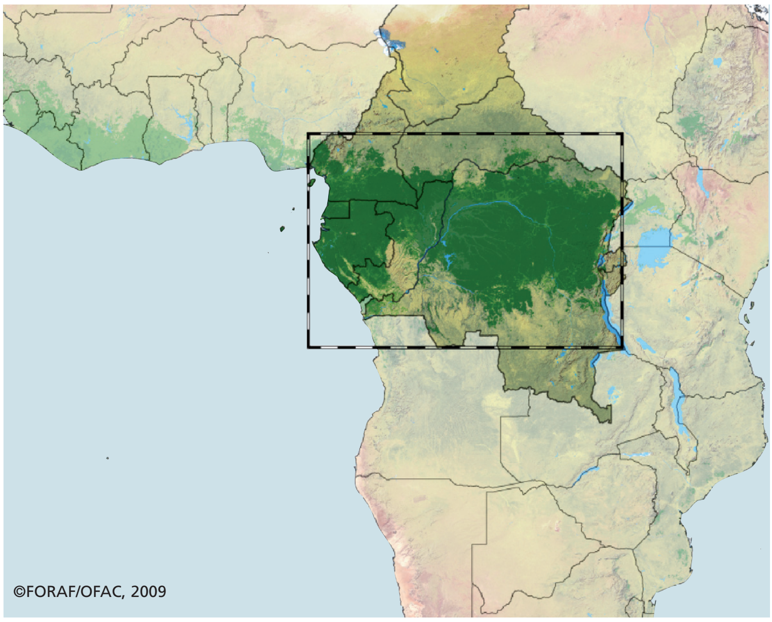
The magnitude of this process is typically proportional to population growth and is of first concern to areas with high population density (on the edges of large urban areas) as well as to areas hosting refugees following conflict related migration.

[12] Rudel et Roper, 1997. *The paths to rain forest destruction: Crossnational patterns of tropical deforestation, 1975-1990.*

« Until now, the lack of infrastructure and the investment climate have protected the Congo Basin from international drivers on tropical forests. However, this situation is likely to change, and the REDD mechanism should help economic development by limiting their impact on deforestation. »

Figure 7: Deforestation path - Frontier model (Rudel and Roper, 1997).





2.3 Why have the deforestation scenarios not materialized yet?

The agro-industrial potential of the Congo Basin countries is significant. However, despite increasing international pressure, the massive agro-industrial development that has been taking place in some regions of the world (South Asia, the Amazon Basin) has not yet occurred in the Congo Basin. Similarly, the Congo Basin countries have significant mineral and petroleum resources, demand for which is increasing due to growth in GDP and to global population growth. However, while exploration is increasing, there has still been relatively little exploitation in the region.

This raises questions about the factors that have restricted the economic development until now and about a possible improvement in competitiveness of the Congo Basin countries in relation to other regions of the world.

Several factors seem to have inhibited the development of large-scale agro-industrial activities, in particular:

Weak infrastructure: According to Rudel and Roper's work (1997) on the concept of forest transition, the existence of infrastructure (in number and in quality) is an important trigger for deforestation (see Figure 7). Deficient infrastructures, especially for transportation (roads, railroads, inland waterways, ports) but also for access to energy have a severe negative impact on the establishment of new industries. Thus, a lack of infrastructure and/or its poor quality undoubtedly represents the best protection for forests.

As is the case for the African continent overall (World Bank, 2009[13]), infrastructure development represents the top priority for the Congo Basin countries to achieve sustainable economic growth and reduction in poverty. Although the number of infrastructure development plans is increasing, they are unlikely to be implemented in an investment climate that does not encourage private international investment and where lack of political will limits the investment of public resources in infrastructures.

Investment climate: The investment climate in the region is high. According to Transparency International, the development potential of the Congo Basin countries remains untapped. The costs imposed on investor (the "costs of doing business") are very high and the risks associated with poor governance represent a significant financial burden. Moreover, the civil wars that have prevailed in several countries in past years have left countries in need of rebuilding, still shaken by sporadic instability, and not yet confident that peace will be lasting.

[13] World Bank, 2009. Africa's Infrastructure: A Time for Transformation. Available at: http://www.infrastructureafrica.org/aicd/library/doc/552/africa%E2%80%99s-infrastructure-time-transformation

Additionally, with respect to agro-industrial companies, land tenure over the time periods needed for such investments often remains unclear and legislation and regulations in place rarely provide the required guarantees for such investments. The availability of public or private capital and investment in support of activities in the agricultural sector, good governance, and better quality infrastructures are essential elements for the development of the sector locally.

All these factors constitute a structural constraint on the development of economic activity (agro-industrial, mineral, etc.) in the region. The situation may however change as a result of, among others, increased population density, infrastructure development plans, adherence to the rules of the Organization for the Harmonization of Business Law in Africa (OHADA), and new investment from emerging economies. However, such change has still to kick in and should not be considered evident. In fact, the recent financial and economic crisis severely reduced the available capital and ability of private companies as well as governments to invest.

2.4 Conclusions for establishing reference levels

The analysis above shows that future deforestation levels in the Congo Basin depend on numerous parameters, in particular:

- External pressures, such as: increased global demand for food, changes in meat consumption in emerging countries, energy policies;
- Regional pressures, such as: agricultural development for food security, increased regional population density;
- and the removal of some regional barriers: investment climate, infrastructure (in both availability and quality).

The various drivers for deforestation in the Congo Basin take place on different spatial scales (global or local) as well as on different temporal scales (in the form of brutal shocks such as an economic crisis or a conflict) or as slow evolutions (such as population trends). Some drivers define also part of the solution. For example, while the lack of infrastructure has so far protected the forests of the Congo Basin, infrastructure development is also a condition for the diversification of economies and, in turn, for a reduction in pressure on forests. Agricultural intensification can also be a means of reducing pressure on forests (ONFI, UCL, in press).

« The analysis of the pressures weighing on the forests of the Congo Basin shows that the setting of reference levels faces a range of challenges. The future macroeconomic pressures to which the countries of the region may be exposed make it unlikely that historical deforestation trends will continue in the future. »

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It is desirable that the reference levels will be able of reflecting the reality of the deforestation process in the region. In fact, even if the negotiation process leads to a potential gap between reference levels and BAU levels, reference levels should be set in a way that represents future deforestation trends at country level. Therefore, faced with the complexity of the deforestation process, which depends on numerous parameters, the use of historical reference levels does not seem appropriate.

3 Consequences of the selection of historical reference levels for the Congo Basin countries

« If historical reference levels were valid during an increased deforestation phase, the incentives received would only cover part (or none) of the emission reductions achieved by the Congo Basin countries. »

The projection of historical scenarios into the future is not representing the reality of potential future deforestation in the Congo Basin. The use of historical reference levels for the Congo Basin would also have an impact on the global environmental effectiveness and efficiency of a REDD mechanism[14] .

We understand "historical reference levels" in the context of the Brazilian proposal submitted to the United Nations Framework Convention on Climate Change, which aims to set reference levels based on historical emission levels over the ten prior years and to continually readjust them on this basis (see figure 8).

Figure 8: Brazilian proposal regarding reference levels (FCPF, presentation on reference scenarios)

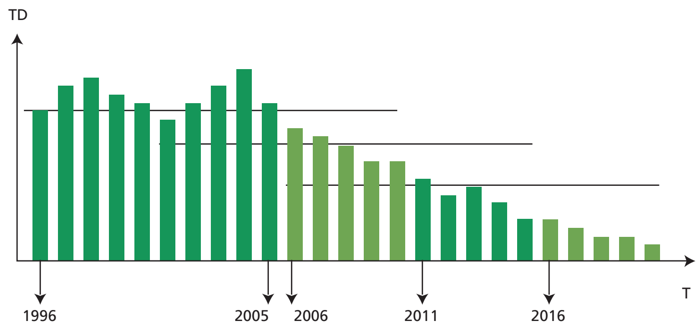
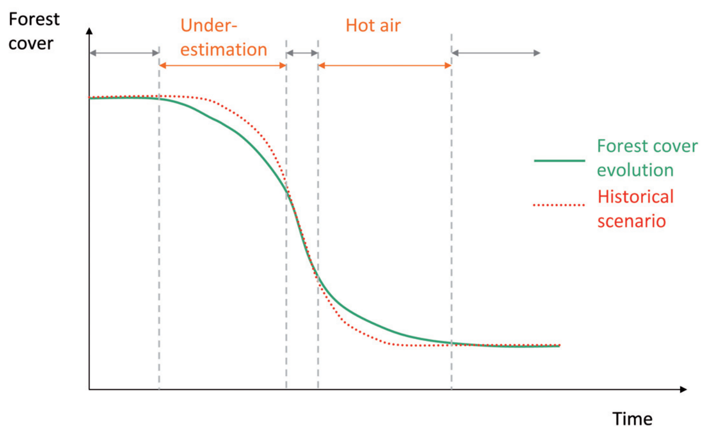


Figure 9: Historical scenario and forest cover evolution.



3.1 Insufficient incentives for the Congo Basin countries

When the deforestation rate is constant (that is, forest cover loss occurs at a uniform speed), a historical scenario will give a reference level equal to BAU emissions (though with a ten-year delay). However, when the deforestation rate rises or falls, a historical scenario will not lead to any real change in emissions. Where deforestation becomes increasingly significant, a historical level would therefore under-estimate BAU emissions. However, once the deforestation rate stabilizes, any such under-estimation disappears (see Figure 9[15]).

[14] By "effectiveness of the mechanism," we mean the total emission reductions that can be attained globally.
By "efficiency," we mean the cost of each ton of carbon saved or sequestered (the lower the cost, the more efficient the mechanism).

[15] Although this is a repeat of the forest transition curve, as a country may go through several phases of increased or reduced deforestation, this curve is used for purposes of illustration only.

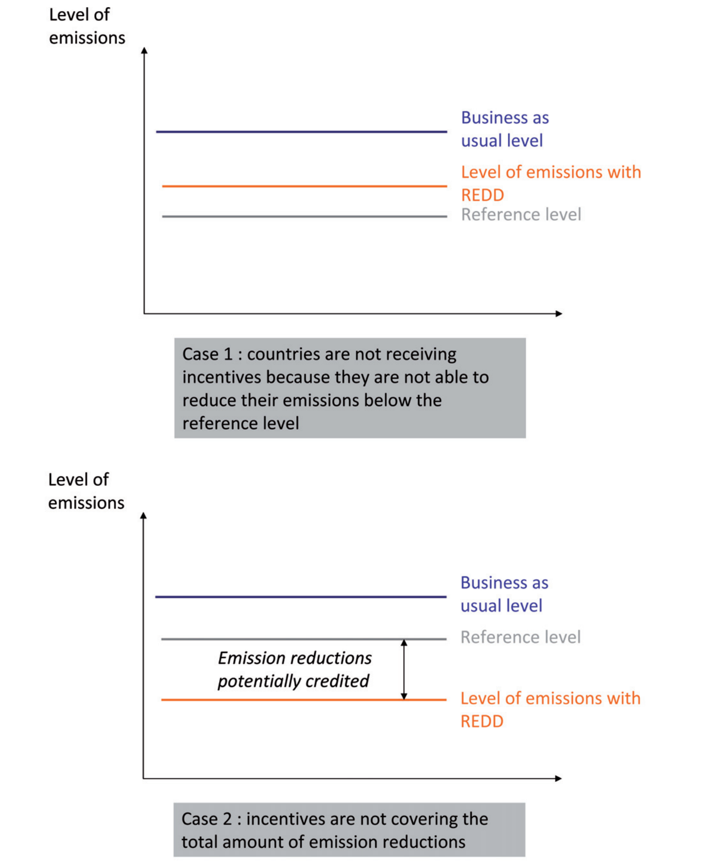
Such under-estimation of the BAU level in the historical scenario may have several impacts on the countries concerned (see Figure 10):

- **Case 1:** Countries make efforts and reduce deforestation to a level lower than the BAU level but not below their historical reference level. These countries receive no recognition or financial incentives for efforts made. In this case, they have little incentive to participate in a REDD mechanism. There are thus risks of international leakage toward these countries (see next section).

- **Case 2:** Countries make efforts and reduce their emissions below the BAU level and the historical reference level. Emission reductions are taken into account and the countries may receive financial incentives in recognition of these efforts even if these incentives do not cover all the efforts made. However, some countries could decide to contribute to REDD and bear some of the costs, either to show their commitment to climate change mitigation or to reflect the value of other environmental services provided by forests that may be beneficial to the countries at the national level.

It should, however, be noted that setting reference levels equal to BAU levels does not guarantee that REDD funding will cover the entire cost of emissions reductions, as this will depend on the approach selected for REDD funding (an approach based on costs or one based on the market).

Figure 10: Implications of an under-estimation of BAU emissions in a historical scenario



> « *Establishing a purely historical reference level would decrease incentives to participate and favor increased deforestation in the region as a result of market leakage.* »

3.2 Increased pressure on the forest caused by market leakage

In the first case, where the Congo Basin countries are unable to reduce emissions below the historical level, they receive no incentives to fight deforestation. This may discourage them

Box 3: OSIRIS Approach

OSIRIS is an open source tool jointly developed by Conservation International, the Centre for Social and Economic Research on the Global Environment, the Environmental Defense Fund, the Woods Hole Research Centre, and the Terrestrial Carbon Group. It can be downloaded at www.conservation.org/osiris

OSIRIS is a partial equilibrium model covering the agricultural and forestry sectors by modeling a range of agricultural and forestry products. The model's equilibrium is calculated at the global level at the intersection between demand and supply for this unique commodity. Each country's supply is calculated based on the potential agricultural and forestry revenues that can be generated per hectare of forest, and this depends largely on the agro-ecological area to which the given pixel belongs. The country's rational response consists in maximizing the income generated from agricultural expansion and from logging timber tracts as well as potential REDD revenues. REDD incentives influence the national supply of agricultural products since by increasing the value of forest they reduce the area a country may want to use for agriculture. The process is static because it does not take into account changes in supply (for example, through the construction of infrastructure) or in demand (for example, through population growth).The results are therefore valid only on a short-term basis (5-10 years). Work is underway to make the model dynamic, and the 3.0 version available online already includes some new features.

from implementing REDD policies and measures. They would thus not participate in a REDD mechanism.
If the Congo Basin countries do not participate in the REDD mechanism, deforestation is likely to increase in the region as a result of international market leakage. In fact, faced with increasing international demand for agricultural products and in a context where other countries are developing anti-deforestation strategies and are trying to curb agricultural expansion, demand could be met by shifting production to areas hitherto less profitable but that may become profitable following scarcity in usually productive areas. Results from the GLOBIOM model highlight this phenomenon. If global deforestation were to be reduced by 50% by 2030, then deforestation in the Congo Basin would likely double relative to the so-called BAU in the model.

Results of the OSIRIS initiative (Box 3) confirm this trend. Thus, figure 11 shows that in countries that have had low historical deforestation rates, the implementation of historical reference levels would lead to increased deforestation, which may double due to international leakages.

« Reference levels must also provide incentives to countries that have so far protected their forests, not only for the sake of equity but also (and above all) to ensure the environmental effectiveness and efficiency of the REDD mechanism. »

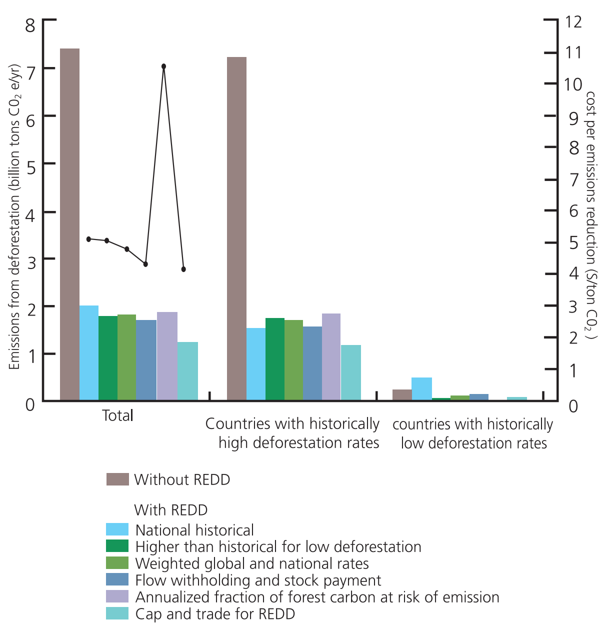
3.3 Reduced environmental efficiency and reduced cost effectiveness at the global level

In terms of environmental efficiency at the global level, Figure 11 indicates that the least effective reference scenario (in terms of reducing deforestation-related emissions) is a purely historical one. This is explained by the fact that deforestation has doubled in countries with low historical deforestation rates as a result of international leakage.
It should, however, be noted that an environmental integrity argument based on market leakage is only valid under the hypothesis that countries do not participate in a REDD mechanism or that they would not make self-funded efforts to curb deforestation. Thus if countries that suffer from the effects of international leakage develop aggressive national policies to counter the leakage effects, a historical reference level may also prove effective.

Regarding cost effectiveness, Figure 11 also shows that apart from the *Terrestrial Carbon Group*'s "stock at risk" approach, a historical reference level would be the most costly option for the international community[17].

The most effective and most efficient reference scenario thus combines incentives to reduce historically high emissions and to keep historically low emissions at the same level.

Figure 11: Impacts of the use of different reference levels on emission reductions and on the cost of such reductions (from Busch et al., 2009[16]).



[16] Busch et al, 2009. *Comparing climate and cost impacts of reference levels for reducing emissions from deforestation.*
[17] Simulations were run on the basis of a cost of US$5 per ton of CO2. Any costs below US$5 (as this applies in all scenario options except the "at-risk stock" approach) suggest that reference levels were set to an extremely low level in all the options and that not all of the emissions reductions that took place were recorded (without the countries necessarily withdrawing from the REDD mechanism (Busch et al., 2009).

4 Methodological approaches to setting reference levels

International negotiations are attempting to define common criteria for setting reference levels. Factors affecting deforestation programs such as national contexts, macroeconomic forces, and government policies are not universal. Consequently, setting a country-specific optimal reference level based on common criteria is a challenge. The reference level must be sufficiently low to guarantee the tracking of real and measurable emissions reductions (future deforestation rates should not be over-estimated) but high enough to encourage broad participation and thus reduce international leakage (encouraging early reductions through crediting of GHG reductions). In fact, although emissions reductions in countries with a significant history of deforestation can be a short-term priority, the most effective way to reduce the risk of international leakage is a broad participation in an international REDD mechanism. It has thus been widely recognized that participation in a REDD mechanism should not only be voluntary but also reflect country-specific circumstances and ensure broad participation.

To take into account these country-specific circumstances and future developments, two main methodologies were proposed during negotiations (see Box 4):

- The adjustment of historical deforestation trends based on a set of standardized factors, which implies using a general standard method for all countries;

- The development of country-specific reference levels, with each country estimating its BAU emissions (e.g., through an economic model or a standard formula, the choice of valuation being left to individual countries).

In both cases, global additionality and attempts to ensure broadest participation may lead to further modifications during the negotiation process.

Several proposals for standard formulas were made by technical and research institutions in their submissions to SBSTA. An example involves the formulas studied in the ORISIS model (see Box 5). These formulas propose various ways through which countries with low historical deforestation rates can also benefit from financial incentives.

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« Thanks to their transparency, standard formulas may be most likely inform the setting reference levels. However, country-specific BAU models may be a good starting point for reference level negotiations as they provide support for choosing the best standard formula and are useful at the national level as a decision supporting tool for defining REDD strategies. »

Box 4: Submissions of Parties on reference levels

Sixteen proposals on reference levels (RLs) were submitted or endorsed by national governments between 2007 and 2009. While disagreement among the Parties remains, there are points of general consensus. Proposals encompass three main approaches to setting RLs:

- historical rates of land cover change, supported by Brazil (and Indonesia for unplanned deforestation);

- projected baselines using economic models of planned deforestation, supported by Indonesia;

- combination of historical and projected baselines adjusted for factors representing national social-economic and developmental circumstances such as demographic trends, agriculture, food self-sufficiency, infrastructure development and renewable energies, supported by AOSIS, Canada, CfRN, COMIFAC, EU, Latin American countries, Japan, Norway but opposed, inter alia, by Brazil.

A general consensus exists among countries to ultimately set national RLs to reduce the risk of leakage with sub-national reference levels (endorsed by Malaysia, AOSIS, Australia, Indonesia, and Latin American countries except Brazil) leading to national reference levels, although subdivision into sub-national reference levels is still possible. Finally, there is broad agreement on using flexible approaches to set reference levels during UNFCCC negotiations. Advocates of this approach, including Indonesia and ASEAN members, favor using suitable national circumstances and capacities, with some common parameters, to determine reference levels, while others prefer standardization of a common reference levels formulation informed by a body such as SBSTA (e.g. Canada).

In addition to serving as a basis for calculating reductions and for eventually crediting these reductions, the reference setting process should supporting country-level decisions, exploring national deforestation processes, making these more understandable, and determining the most effective policies[18]. We therefore compare the various standard formulas and models with regard to two aspects: their use as a basis for credit granting and as support for country-level decisions (see Figure 12).

While standard formulas offer the advantage of transparency, models form the basis for choosing the most appropriate standard formula and may serve as national assessment tools. However, for a model to effectively support decisions, it is necessary to ensure that it is supported at the national level. Moreover, it should be noted that a single model may only be a partial reflection of local realities. To generate a more realistic picture of the process, it is thus advisable to obtain results from several models and to complement them with quantitative analyses (ONFI, UCL, soon to be published).

Box 5: Standard formulas compared in ORISIS

The options considered are:

- **Tracking the national historical deforestation rate** for the 1990-2000 period (Santili et al., 2005);
- Reference level equal to the **average global historical deforestation** rate for countries with low historical deforestation rates **and to national historical deforestation rate** for countries with high deforestation rates (Mollicone et al., 2007, Santilli et al., 2005);
- **Combined incentives** (Strassburg et al., 2009), i.e., basing reference levels on national historical deforestation rates but also on global deforestation rate in tropical countries, with weightings linked to global and national rates;
- **Stock-flow approach** (Cattaneo, 2008), although the reference level is based on the national historical deforestation rate, a portion of REDD carbon credits is set aside in the form of a fund that would reward countries based on carbon stocks;
- **Terrestrial Carbon Group proposal** (Ashton et al., 2008), which defines a risk area and proposes payment based on the stock threatened in this risk area over a given time horizon.

More standard formulas are presented in Griscom et al., 2009[19].

Figure 12: Models and standard formulas for creating REDD reference levels

	Basis for credit granting	Country-level decision support
Development of a model by each country	(+) Negotiation of reference levels closer to BAU (–) Lack of transparency and (possibly) credibility (–) Need for external controls to avoid overestimating future emissions; for verifying coherence with world-wide demand; and for using of similar assumptions across countries	(+) Assessment tool at the national level: deforestation process analysis, simulations of national policies (provided the models are accompanied by a transfer of capacities to the country level) (–) Are projections based on interpretative data reliable?
Use of the same standard formula for all countries	(+) Transparency (+) Less political determination and greater speed (+) Prevents inflation of future emissions	(–) Makes it difficult to simulate national policies

[18] This effectiveness must subsequently be compared to policy costs in order to choose the most cost effective country-specific policies.
[19] Griscom and al, 2009. *Implications of REDD baseline methods for different country circumstances during an initial performance period.*

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Conclusion

Deforestation is not a continuous process. As the drivers of deforestation change over time, historical reference levels inappropriately reflect complex and evolving deforestation patterns. For the Congo Basin countries to enter a large-scale deforestation process depends on three factors: (i) the existence of national and international deforestation drivers, (ii) the availability of land potentially suitable for farming, forestry, and mining, and (iii) the removal of barriers to investment and infrastructure development. Whereas the first two factors seem to be in place, the occurrence of the third remains uncertain.

In addition to being unsuitable for conveying the reality of deforestation in the Congo Basin, historical reference levels also imply that the Congo Basin countries would bear all or part of the costs to control deforestation while at the same time facing even more pressure on their forests due to international leakage. Moreover, while resources to reduce deforestation are limited and given the urgency to tackle climate change, we cannot afford to dilute the limited resources by supporting ineffective action. Thus historical reference levels pose problems relating to the effectiveness and efficiency of an international REDD mechanism.

It is, therefore, necessary to find alternatives to historical reference levels by developing methods based on standardized adjustments or country-specific models, whereby both methods may complement each other. Developed by IIASA and applied in the Congo Basin, the GLOBIOM model is a first step in a long-term process of enabling countries to establish reference levels for Phase 3 of the REDD mechanism and, above all, to identify cost-effective policies that will effectively reduce deforestation in the Sub-region. It would be unfortunate if the REDD would stumble over the technical issue of establishing reference levels when the real problem of a REDD mechanism depends capacity to implement measures for effectively controlling deforestation. Modeling future development in the context of elaborating reference level proposal is an effective tool to inform national REDD policies.