Michael Dutschke

Forestry, Risk and Climate Policy

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Dedicated to Ingrid, my wife
and to our children Dunja and Valentin,
who with all their love have given me faith.

Contents

Statements

Statements pertaining to the doctoral thesis “Forestry, Risk and Climate Policy”, submitted at the University of Groningen.

1. The goal of stabilizing the average global temperature increase at 2° C above pre-industrial levels until 2050 is an ambitions policy goal, which is now widely accepted internationally.
2. The 2-degrees goal can only be reached when including the net emission reduction from land use, land use change, and forestry.
3. Conversely, the survival of forest carbon stocks depends on coordinated climate-change mitigation measures in all sectors to reach the 2-degrees goal.
4. Methodological challenges of mitigation activities in forestry differ from the ones in most other sectors.
5. Climate change mitigation needs to manage the integrity of all available land. Any exclusion will lead to perverse incentives.
6. Policy failure is a necessary, but not sufficient precondition for deforestation and forest degradation.
7. Economic incentives will only work in the context of good forest governance.
8. Climate policy can be considered effective if it acts on a time horizon of 50 – 100 years.
9. This timeframe poses high challenges to multilateral institutions and mechanisms.
10. Success in climate policy depends on massive, long-term, and reliable transfers from developed to developing nations, but also on full responsibility assumed by the latter.

Summary

Forests and forestry in developing countries are major sources of greenhouse gases that cause global warming, but they are carbon dioxide sinks at the same time. They will suffer from increasing temperatures, but they can also help humanity to adapt to climate change. Land use decisions play a pivotal role in national development. The book resumes over a decade of policy advice. It starts by focusing the global frameset of forest-related mitigation activities under the Climate Convention. The subsequent chapters shed light on the diverse underlying methodological and economic issues. The final chapter proposes how to collect funds for tasks of global common interest like the reduction of emissions from forests or supporting adaptation to climate change, while at the same time strengthening the commitment of the beneficiaries towards the international climate regime.

The book concludes that forestry as a means of mitigating climate change is special compared to other sectors, and that environmental risks in striking the balance between environmental effectiveness, cost-efficiency and equity are posing important challenges. Besides identifying the key issues in climate forestry, the book offers pragmatic solutions for the integration of forests into international climate policy.

Introduction

Forestry, Risk and Climate Policy in Developing Countries

1 Introduction

Around one third of the human-induced climate change is attributed to agriculture, forestry, and other land use (Nabuurs, Masera et al. 2007; Smith, Martino et al. 2007). Terrestrial and maritime vegetations serve as buffers against an increase in atmospheric CO_2 concentration. The capacity of the terrestrial reservoir is influenced by a diversity of land management decisions. An increasing share of the land mass is claimed by infrastructure, urbanization, agriculture and forestry. Big cities often spread on fertile arable soils along rivers or the shoreline, and weak infrastructure in the remainder of the country often makes this process costly to avoid. Because of population growth and the resulting demand for space, food, bioenergy and infrastructure, there is no chance to return to the "state of innocence". What can be done is to manage existing terrestrial carbon resources in a responsible way. For aboveground carbon, the most obvious way is to maintain and increase the forest area. The U.N. Framework Convention on Climate Change (UNFCCC) pays tribute to land use on two occasions in its Article 4 on *Commitments,* however no clear and concise forestry mandate can be derived from the Convention.

This book is dedicated to the overlapping fields of climate policy, forestry, and rural development. It summarizes the experience of more than a decade of international climate policy design with respect to land use, land use change and forestry (LULUCF) in developing countries. The chapters are based on articles published over the years on the subject of the Clean Development Mechanism (CDM) and contributions to the debate around a future mechanism on Reducing Emissions from Deforestation and forest Degradation in developing countries (REDD). Under climate policy aspects, the term "risk" is mainly related to atmospheric effects of the implementation of forest-related activities. What are the conditions for mitigation activities not to result in increased greenhouse gas levels? It is acknowledged that there are other risks related to forestry in developing countries, like rural livelihoods and biodiversity. Also, forestry is not specifically risk-prone as mitigation activity. Nevertheless, climate risks for forestry are highly specific to this sector, which is why they merit special consideration. As differently from risk, *uncertainties* in the sense of measurement imprecision are not an issue treated in this book, because they are beyond the horizon of social science.

In order for the reader to understand the process so far, we will recapitulate the history of land use in the climate regime. After that, we will introduce to the main political and methodological questions regarding forestry mitigation. Finally, the chapters will be introduced in their political and historical context.

2 A short history of "sinks"

Already in 1977, a US physicist proposed a global afforestation program to sequester CO_2 from the atmosphere (Dyson 1977). The 1989 Norwijk Conference called upon a global forestation program to cover an annual 12 million hectares per year during the early 21st century (Jung, Michaelowa et al. 2004). A study by the University of Sao Paulo (Ab'Saber, Goldemberg et al. 1995) identified a potential of 34 million hectares in Brazil alone to be afforested over 30 years in a global deal for saving the climate with an overall mitigation effect of 18.3 Gt of CO_2. In 1992, the intent to negotiate a forest convention failed, and since then, the UN Forum on Forests has been a languishing process. Big hopes centred on the emerging climate regime. The UN Framework Convention on Climate Change makes reference to the "enhancement of sinks" as climate change mitigation in its Article 4 (b) and (d), but any specific mandate cannot be derived from it. At the first Conference of the Parties in Berlin 1995, the issue came up again in the context of the pilot phase of "Activities Implemented Jointly" (AIJ). Among the first offset projects implemented under AIJ, a high percentage was dedicated to forest conservation, forest management and forestation (Dutschke and Michaelowa 1997). Costa Rica, in this context, developed a strong forest policy, which within one decade achieved to reverse the trend of forest losses. For the negotiations of the Kyoto Protocol, there was hardly any preparation on the issue of "land use, land-use change and forestry" (LULUCF), except for the position of New Zealand (Depledge 2000). The average 5.5 percent of quantitative emission limitations on a basket of six different greenhouse gases (GHGs) over the 1990 reference year agreed under the Kyoto Protocol were at the lower limit of what the EU was prepared to accept. The negotiation group of Japan, US, Canada, Australia and New Zealand (JUSCANZ), on the other hand, promoted the use of carbon credits from forestry mitigation activities to be used in compliance against these lenient targets. The Kyoto Protocol in its Article 3.3 already included accounting for afforestation, reforestation and deforestation within industrialized countries. The UNFCCC Subsidiary Bodies in summer 1998 asked the Intergovernmental Panel on Climate Change (IPCC) to produce a special report on LULUCF (IPCC 2000). This report cautiously supported the promoters of forestry mitigation activities. Later in the same year, the Hague Conference of the Parties ran into failure over the treatment of forest management under Kyoto Article 3.4 and forestry under the CDM, because the EU, represented by Germany, blamed LULUCF to be the loophole for the US to escape from their domestic emission reduction obligations in the energy sector.

Eventually half a year later, and after the newly-elected president George W. Bush had declared his withdrawal from the Kyoto Protocol, COP 6 bis in Bonn resolved the issue. It allowed voluntarily accounting for the sink enhancement through forest management already during the first commitment period, wherever this was favorable for the respective national inventory. In order to account for business-as-usual sink increase due to age-class structure and to measurement uncertainties, a discount of 85 percent applies. Russia negotiated for a generous exception in the appendix to this decision. Additionally, the Bonn decision allowed the use of credits from CDM forestry projects, restricted to afforestation and reforestation and up to a limit of 1 percent of the respective Annex I country's base year emissions. The choice was made by the COP chairman Jan Pronk after a consultation tour with European Parties and based upon a quantitative study committed by the Dutch government (Waterloo, P.H. Spiertz et al. 2001), which predicted a potential uptake of 7.33 Mt CO_2e during the first commitment period for an afforestation and reforestation CDM with qualitative restrictions.

The Marrakech Conference (COP 7) in 2001 decided on rules and modalities for the CDM and clarified issues around LULUCF for Annex I accounting under Article 3.3 and 3.4. It was in this context in decision 11/CP.7 that forest was first defined for UNFCCC purposes:

> *"Forest" is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30 per cent with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30 per cent or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest;*

The same decision defines afforestation (forestation on land non-forested for 50+ years), reforestation (forestation on land non-forested on 31 December 1989), deforestation, revegetation, forest management, cropland management and grazing land management. These definitions served for differentiated reporting of the different compartments under Article 3.

COP 9 in 2003 decided upon rules and modalities for A/R CDM and adopted the same definitions for forests, afforestation and reforestation that were valid for developed countries. The A/R CDM rules were derived from Marrakech decision 17/CP.7 for energy-related CDM, but complexities were much higher this time.

During the negotiations, the EU had supported temporary crediting and insisted on strict wording on environmental and socioeconomic impacts in Appendix B of the decision. However, at that time, the EU Emissions Trading directive came out (EU 2003). It bluntly excluded any forest-related activities, arguing that temporary credits were not compatible with permanent EU emissions allowances.

As a consequence of picking afforestation and reforestation, the forest definition received an undue weight. Before validating an A/R project, one needs to determine whether the area was non-forested in 1990, considering that it could have been a “potential forest” with young stands that could eventually comply with the forest criterion. In most cases, the project area is fragmented, because there are single patches still forested or deforested after 1990 that need to be excluded from the activity area. Except for providing an alternative source of timber, there are no benefits from A/R CDM for standing forests, because the eligible areas are far away from the deforestation frontier, while forest management on areas recently deforested or degraded is a non-eligible activity.

In order to minimize the sequestration reversal risk (offsetting “permanent” GHG emissions with “non-permanent” terrestrial carbon sinks), two main methodologies were proposed. One was a *pro-rata tempore* crediting, according to which fixing 100 tons of carbon for five years is equivalent to five tons over 100 years. This solution challenged debates over the timeframe of climate policy and of global warming in general. A competing methodology was “temporary crediting” first proposed by Colombia at COP 6 (Blanco and Forner 2000). This latter idea was adopted and further developed by the EU. It resulted in CERs from forestry being merely a borrowing mechanism from future commitment periods, thereby avoiding the debate over the temporal effect of mitigation policies.

2.1 First experience with A/R CDM

The CDM was the intent to “have the cake and eat it too”. Developing country Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have not committed so far to reduce their greenhouse gas (GHG) emissions. Under the legally binding instrument of the Convention, the Kyoto Protocol, industrialized countries listed in its Annex B agreed to differentiated GHG emission control targets. The same Protocol, allows the use of “flexible instruments” for compliance with these obligations. Between Annex B countries, these instruments are project-based joint implementation (JI, Kyoto Protocol Article 6) and emissions trading (Art. 17). To the atmosphere, the effect of flexibility is nil, as long as overall compliance to the climate targets is granted. The CDM, on the other hand, is a mechanism to import additional emission allowances from developing countries. It does so under the restriction that climatic benefits from the respective mitigation activities are “real, measurable and long-term", and that emission reductions are "additional to any that would occur in the absence of the certified project activity" (Art. 12). The host counties needs to individually approve these projects, but does not assume any responsibility. There is the CDM Executive Board, an international body, to watch over project methodologies and their implementation.

Compared to "normal" CDM, most distinctively the following rules were modified for A/R CDM:

1. The activity baseline is for CO_2 uptake only, and does not include any non-CO_2 gases, while project *emissions* that shall be accounted against uptakes include all GHGs.
2. Boundaries are strictly area-based, not activity-based.
3. By definition, there is no positive leakage (often referred to as "spillover effect); only negative effects outside the project boundary are accounted for.

Two different types of temporary credits are available: "temporary" and "long-term" CERs (tCER and lCER). Accounting for them is complex, and the resulting carbon credits are uncertain assets in the portfolio, because their replacement costs are unknown at the time of investment, at least before a long-term climate target is agreed upon by the Parties to the Climate Convention.

2.2 Reducing Emissions from Deforestation and Degradation

Shortly after the Milan decision on rules and modalities for the A/R CDM, the idea of "compensated reductions" in deforestation emissions was brought forward by Papua New Guinea and Costa Rica at the UNFCCC Policy Maker Seminar in early summer 2005, based upon a proposal by research NGOs (Santilli, Moutinho et al. 2003). The Montreal Conference of the Parties in 2005 launched a two-year process for the consideration of the proposal by tropical countries to be compensated by the international community for their forest emission reduction efforts, under the title "Reducing Emissions from Deforestation in developing countries (RED)". In late 2006 and early 2007, much attention was drawn to the issue, when the Stern Report featured avoiding deforestation as "a highly cost-effective way to reduce emissions". In the same vein, the Fourth IPCC Assessment Report concludes that "[f]orestry can make a very significant contribution to a low-cost global mitigation portfolio that provides synergies with adaptation and sustainable development".

Over the course of several expert seminars organized by the UNFCCC Secretariat, it became evident that a reduction of deforestation could eventually result in increased degradation of the forests, if not properly monitored. Also, India and China wanted to see their huge afforestation programs rewarded. The group of Congo Basin countries cautioned that if only avoided deforestation was envisaged, their forests, which today experience little deforestation yet, could see themselves invaded by the logging companies bought out of their traditional grounds. Thus, the scope of the to-be mechanism increased over time, which is why it is today referred to as REDD, with the second D for degradation (Skutsch 2008), or even *REDD plus*, in order to reflect the inclusion of conservation and forest management. Finally, the Bali Conference of the Parties in 2007 decided that a future mechanism be composed of national *and* subnational forestry activities, including preservation and enhancement of forest carbon stocks. It also encouraged the implementation of subnational "demonstration activities". A decision on the future of REDD was due at the Copenhagen Conference in December 2009, together with the determination of GHG emission targets for the second commitment period, starting in 2013. The long-awaited Copenhagen Conference however lost itself in the debate over details and did not achieve to come to any substantive agreement over emission limitations. The so-called "Copenhagen Agreement" is a mere declaration of intentions of the undersigned countries, not a decision taken by the Conference of the Parties. Thus, the world will have to wait at least one more year, before coming to a decision on REDD plus.

3 Methodological issues in climate forestry

The proverb says: "We learn more from failure than from success". Thus, we should be able to learn a lot from forestry CDM. The inclusion of afforestation and reforestation as mitigation activities under the CDM was decided in December 2003 after heated debates, yet only two project have come off the ground (as of March 2009). Many more projects have been planned, but became stuck in the process, due to the lacking demand for credits from CDM forestry. Some of those planned activities were implemented under voluntary schemes that usually produce lower-value credits ("Voluntary Emission Reductions", VER), yet without any validity restrictions.

Today, many hopes are tied to stopping deforestation and forest degradation, for its multiple socio-economic benefits and the conservation of the high biodiversity embodied in the world's natural forests. Nevertheless, in many aspects the debate resembles the one around forestry under the CDM. The benefits from forestry are beyond doubt, even more than in the case of forest plantations under the CDM. And again, the debate focuses on forestry and risks. What exactly are these risks?

Additionality: Any activity is considered additional as climate change mitigation if in the absence of the incentive, the activity would not have taken place. The CDM has developed an intricate methodological tool to prove additionality. For single activities, this proof is easier, because these occur in a "hostile" environment, where the activity is not encouraged in principle. As a drawback, these single activities invite evasion to areas outside the project boundary. Programs of activities, which are accepted under the CDM as well, create a para-regulatory environment of incentives. What is additional is the program itself, but no longer the single activity that benefits from the incentives provided. Attribution in this case diverts from the logics of project-based activities that directly lead to an emission reduction or a carbon uptake at the source. When it comes to policies and measures, the argument of additionality is least certain. An involvement of the state in a program of activity can be additional. State policies and measures however are far off the actual effect, and they do not follow logics of profitability, which is why their additionality is questionable. Additionality is a necessary, but not sufficient condition for climate change mitigation activities.

The **Baseline** is closely linked to the additionality criterion**:** Climate change mitigation is an immaterial service provided to the global community. Therefore, its participants need to prove that the activity is really making a difference, by telling a credible story of what would have happened in the absence of the activity. The GHG emissions and carbon uptake profile of this counter-factual reference scenario is called the baseline. In many land use situations, carbon uptake has good chances to occur without any activity taking place. In the tropics and subtropics, once an area is taken out of production, spontaneous regrowth of forest vegetation is likely to occur. Traditional slash-and-burn systems used to rely on the fact that areas recover their bio-productivity after some years. Even in high-deforestation countries, many forested areas may be out of reach of the loggers, in which case the baseline would be equal to the activity level. Forest mitigation activities consist in changing the previous production patterns completely. While industrial mitigation usually continues producing the same products or services with lower emissions, for forestry, this can only be said about forest management, which usually reduces per-hectare timber production. Thus, the without-project scenario is more complex to determine. What makes a good storyline, how can it be validated?

Leakage: Any mitigation activity in one place can unintentionally cause emissions to increase in another place. This effect is by definition not controlled by the project participants. It can theoretically be positive (for the atmosphere) or negative, which is the main methodological concern. In the REDD debate leakage is being discussed under the term “emissions displacement”. It is difficult to estimate the magnitude of this effect; in some cases however it can be avoided by a careful design of activity boundaries. Leakage is not specific to land use projects. Distinctively from most other climate change mitigation activities, where the previous production of goods or services usually continues on a higher level of carbon efficiency, when converting from one land use to the other the pre-project land use is disrupted. It is therefore a good idea to design projects in a way that the land users find alternative carbon-neutral income sources that do not exclusively depend on carbon payments.

Permanence and liability: GHG emissions in CO_2 equivalents are calculated for a CO_2 residence time of 100 years, which scientifically is a simplification (Solomona, Plattnerb et al. 2009). The damage of other trace gases with longer or shorter residence times is weighed in relation to CO_2. Carbon stocks built up to compensate for these emissions however will not in every case have the same lifetime. This issue became relevant, because Annex B countries that have a quantitative emission limitation target remain accountable for their emissions. In change, under the CDM, developing (non-Annex) countries do not have any quantitative GHG emission targets, and thus no liability. Permanence describes the concern that losing forest carbon in the future after the activity's ending will not be accounted for and could be considered temporal leakage. Theoretically, the carbon profile of a commercially planted forest has a saw-tooth shape: Increasingly over time, the tree takes up CO_2. When the tree is felled at maturity, the carbon embodied in the tree is accounted as being re-emitted to the atmosphere. When a new tree is planted, carbon accumulation starts over. On the landscape level, plantations are usually multiple-aged. Every year, a share of the plantation is renewed and a share is being harvested. Until a plantation is fully established, additional carbon is being sequestered annually. A global incentive program for reforestation would for a long time sequester new and additional carbon. The higher the aggregation level, the lower the calamity risks. The main problem however resulted from the fact that under the CDM, the ultimate liability for carbon sequestered in vegetation could not be allocated to the host country. Under this political premise, the permanence concern became a rather academic discussion.

We need to be clear: Forestry is a necessary but not sufficient contribution to climate change mitigation. If all goes wrong, also forestry is likely to fail. The contribution of the world forests to mitigation will be insufficient to reach the stabilization goal, even under optimal circumstances. Should everything else fail, many of the existing forests will not survive the temperature stress expected from business-as-usual emission increases.

4 Structure of this book

This book covers the different design and methodology issues discussed for land use, land use change and forestry in developing countries over the last decade.

The **first chapter** discusses how forests are related to the ultimate objective of the Climate Convention. Some years ago, it was not commonly agreed that forests are indispensable for this global temperature stabilization. Some years after the chapter was written, the Group of Eight (G8) agreed in 2008 that 2-degree Celsius was the maximum tolerable temperature level above pre-industrial levels and that for this purpose global emissions had to be cut by half until the year 2050. The chapter argues that the policy goal of stabilization spans over this century, and that in forestry mitigation it is most efficient to start by avoiding deforestation (and forest degradation) today. Besides, natural forests contribute to the adaptive capacity of terrestrial ecosystems by preserving the biggest share of their biodiversity. Conversely, should humankind continue to degrade these carbon pools, which contain up to twice as much carbon as today's atmosphere, the negative feedback effect caused by forest die-off would be virtually uncontainable.

Chapter II was written in 2000 and tried to reconcile the two different approaches on permanence of CDM forest carbon sequestration proposed by that time. These were the so-called *ton-year approach* and the solution of *temporary crediting*, two variants of which where finally chosen for the first commitment period of the Kyoto Protocol at COP9. The ton-year approach argues for a temporal limitation of liability, scientifically arguing with the limited lifetime of CO_2 in the atmosphere. Accounting for forest carbon would increase over the years, with the *equivalence period* being between 40 and 100 years. As chapter one points out, the time horizon of climate policy is in fact much shorter. The article proposes a temporary carbon model that makes the ton-year approach financially viable. Temporary credits need to be replaced after the project's lifetime, or whenever the underlying carbon asset is lost. The chapter proposes a premium for every year carbon stocks once built up are maintained on the area. After the end of the liability period, no replacement is needed at all. There may even be a life-insurance type payoff after this period, in order to provide an additional incentive for further maintenance of the area under forest cover.

With the Milan decision on forest CDM, the issue was settled in an unsatisfactory way, because the system of temporary credits assumes unlimited buyer liability and is a major hindrance against the implementation of CDM forestry projects. For the next commitment period, and given a clearer concept of scope and timeframe of climate policy, the debate is open again. This debate is later resumed in chapter VIII.

Chapter III unfolded from policy consultancy during the making of Milan Decision 19/CP.9 and was first published briefly after this decision had been taken. It was the first detailed analysis of the decision, including its methodological inconsistencies. On top of the obstacles identified, the EU decided not to accept afforestation and reforestation credits into the EU Emissions Trading System, the world's largest greenhouse gas market, which was the final verdict against A/R CDM.

Chapter IV was written in the context of the EU-financed PROBASE research project before the Marrakech Accords limited eligible forestry activities under the CDM to afforestation and reforestation. It proposes a PARAPIA approach of two concentric control areas around the project area (PA). The so-called "Reference Area (RA)" is a circle around the project area that is included in monitoring, so as to capture activity leakage around the area controlled by the project participants. The “Project Influence Area (PIA)” is described as the political and administrative environment. Should the land use emission and uptake trends between the reference and the influence areas diverge this is an indication of project leakage. At the same time, the project baseline could be calibrated against the effectiveness of national policies. Similar project designs are currently under discussion for REDD projects.

Chapter V tackles an issue common to all CDM activities, but with specific relevance to forestry. Official development assistance (ODA) has been focussing on forestry due to its socio-economic benefits. When fully integrated in local production cycles, forestry can contribute to job creation, the exploration of non-timber forest products, avoiding depopulation of rural areas and promoting the use of firewood from managed forests, among many other benefits. Yet, the Marrakech Accords that regulate the CDM appear at first glance to rule out the use of ODA for projects subsidized by CER receipts. At the time the study was commissioned by the German Ministry of Cooperation in 2003, this so-called “financial additionality” clause had not been discussed in depth, neither in literature (to one exception), nor in politics. The results helped in preparing the decision by the Development Assistance Committee of the OECD. The article concludes that it is impractical to determine ODA additionality. In case there were carbon credit reflows into the donor state’s budget – or say free CERs for the donor – along OECD rules, these would automatically be discounted from the ODA streams of the year in which they occur. In case in any phase or component ODA was involved, a joint declaration by investor and host country governments that this ODA was not diverted would be required.

Chapter VI leads over the post-2012 debate. Reducing emissions from deforestation and devegetation (REDD) is well-suited for (voluntary) emission reduction commitments by tropical countries themselves. The CDM has so far bypassed countries with a low energy emissions profile, most of all in Africa, but also in parts of Latin America. REDD policy commitments may help them play a more active role in mitigating climate change and at the same time benefit from the expanding carbon market. This chapter, result of a study commissioned by the German Ministry of Cooperation resumes the state of the debate in 2007. It draws upon experience from activities implemented jointly and from ODA forest conservation and management experience.

Chapter VII is dedicated to the ambiguous distinction between national and subnational activities. The CDM model of subnational or project-based REDD activities is generally not believed to solve the problems of leakage control and carbon liability. The conundrum is that on the other hand monitoring capacities are usually better developed on the project level, and that most private and institutional foreign investors prefer identifiable area-based approaches. The solution proposed under the name of the “Nested Approach” is the implementation of national and subnational activities in parallel, with the aim of integrating the host country into a binding system of country emission targets. Until this point, subnational activities would be validated and certified in the same manner as CDM activities, and carbon credits would be originated independently from the achievement of national targets. This will at the same time create a demand for regulatory capacity of the host country that has to approve and oversee the subnational activities. Unlike with the CDM, emission reductions by the project would not create additional allowance, but they would instead lead to a transfer of GHG emission allowances from the host to the investor country.

In the light of the REDD discussion, **Chapter VIII** takes up the debate on permanence and liability issue. It is assumed that on the long run, under a future climate regime today’s developing country parties take over liability for mitigation activities taken. However, as the previous chapter shows, it may take a while until a binding national target for the land use sector will be adopted by countries hosting forest activities. Waiving the liability completely for the single-activity level would most certainly lead to cherry picking. After first identifying risks for forests, the chapter revises the toolbox for reducing carbon risks and securitising emission reduction units. As a result, a staggered system of liability management is proposed, which is able to adapt to the specific circumstances and the necessities of the mitigation activity. The chapter weighs these instruments under the criteria of the three ‘e’, effectiveness, efficiency and equity. It recommends allowing for a menu of choices best adapted to the specific country circumstances.

Chapter IX draws on the tedious experience of defining eligible activities and areas under the A/R CDM. It favors an integrated approach on land use with respect to its climatic consequences. No year-long debate on how to define forest degradation (Penman, Gytarsky et al. 2003) shall encumber the REDD debate. There is further a risk of diverging policy processes between Annex I countries and non-Annex I countries. These categories were defined under the specific historic situation of the Rio Conference in 1992, in order to differentiate the treatment of developing and developed economies (including economies in transition). Today, Korea and Mexico, two of the then developing countries, are already members of the OECD, which was the inclusion criterion for Annex I. Several others are OECD candidates or “enhanced engagement countries”, like Brazil, Chile, China, India, Indonesia, and South Africa. In such a dynamic setting, transitions shall not lead to disruptions in carbon monitoring and accounting. The chapter proposes a harmonized treatment of all land-use based activities with relevance to climate change. In a stepwise approach, countries would include more land use activities into greenhouse gas reporting and accounting, as capacities for monitoring become available, in parallel to the current treatment of LULUCF in Annex I countries under the Kyoto Protocol. The approach taken is to de-complicate the current debate around REDD by keeping it as flexible as possible, while preserving environmental integrity.

Chapter X takes one step back and considers the linkage between future emission reduction targets and the carbon flows to and from human-induced land use. Politically, it seems as if there was interdependence between future emission targets and the availability of emission reduction and carbon uptake credits from the land use sector. The real challenge however is to reach stabilization over the long term until the middle of this century at a level that is likely to preserve human livelihoods and terrestrial carbon stocks. At the same time, a huge incentive is needed for the paradigmatic change in behaviour of developing countries towards their natural resources, commonly referred to as “REDD readiness”. The chapter argues that there will always be finance needs that are not directly related to mitigation, but which create the necessary preconditions. The same occurs with the increasing needs for adaptation, for which a pure market metrics is hardly conceivable. The Climate Stabilization Fund proposed would result from the auction returns of emission allowances for developed countries and provide finance in the order of 100 billion US$ annually. REDD readiness and activities could be pre-financed with these resources in an interim phase, before the institutional and legal infrastructure of the host countries would allow the compliance market to take over, presumably in the third commitment period. For developing countries, payments out of this fund would be conditioned by their acceptance of a global emission limitation target, which would bind them as well. The model presented is open to a variety of modifications, in pursue of political practicability. In this context, national funds in developed countries that are reportable to the Climate Secretariat may be the preferable option, because these can draw on experience from ODA cooperation and may be in the position to better pursue development co-benefits for communities and biodiversity than one centralized fund with a complex administrative structure.

The **Conclusions** wrap up the lessons learned. In spite of its meagre results, the process has helped to understand a lot about the nature of land use and the management of forest resources for climate change mitigation. Today, the Climate Convention is in a critical phase of turning the declarations into concrete action. Cynics state that more trees were felled for the production of the paper on land use, land use change and forestry than will ever be grown due to climate policy instruments. The author still hopes to prove them wrong and sustains that this has been a learning process that will eventually result in climate change mitigation, increased resilience of terrestrial systems, and better rural livelihoods in developing countries.

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Chapter I

CDM forestry and the ultimate objective of the climate convention[1]

Michael Dutschke

Abstract

In its Article 2, the U.N. Framework Convention on Climate Change policymakers gave themselves a long-term dynamic mandate under uncertainty. Taking the example of forestry activities in developing countries, the present chapter discusses whether land-based climate change mitigation measures in the context of compensation mechanisms for human-induced greenhouse gas emissions are covered under the UNFCCC's ultimate objective. Both the problem of climate change and human intervention act over long, yet finite timeframes. The chapter argues for taking a dynamic 100-year timeframe as reference for present-day activities. It concludes that increasing biotic carbon storage is legitimate for measures that contribute to biodiversity conservation, as long as it does not serve as a pretext for neglecting technological change. Among all forestry options, the list of priorities should be avoiding deforestation and devegetation, sustainable forest management, and afforestation. The problem of saturation can be encountered by the combination of forestry with the increased use of wood products and bioenergy. Concluding, the chapter gathers criteria for forest climate activities in the post-2012 regime.

1 Introduction

Forestry as a means of climate change mitigation activities has often been criticized on the grounds that, compared to all other carbon reservoirs, biotic terrestrial carbon stocks are very dynamic, and they are directly influenced by climate change itself. Much criticism against land-use activities under the Clean Development Mechanism (CDM) has been based on the argument that the use of biotic carbon "sinks" for compliance was not covered by the long-term objective expressed in Article 2 of the UN Framework Convention on Climate Change, arguing that developing country parties were unable to guarantee the permanence of land use mitigation projects (Meinshausen and Hare 2000), and that any duration shorter than permanence ("'not permanent' or 'permanent, but not additional over all time"') would not comply with the ultimate objective of the Climate Convention.

Anthropogenic climate change has a time horizon of decades to centuries. Land use is an important source of the greenhouse gases CO_2, CH_4 and N_2O. On the positive side, land use activities have the potential to remove important amounts of CO_2 from the atmosphere to the vegetation cover and to avoid future net emissions from this reservoir. While the role of forests as a source is uncontested, forest carbon source reduction and CO_2 removal by sinks as a means to mitigate climate change are con-

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tentious. The UN Framework Convention on Climate Change (UNFCCC) mentions the enhancement of sinks as a commitment in its Article 4 (b) and (d). The Kyoto Protocol to the UNFCCC recognises the role of sinks in Art. 3.3 and 3.4, related to the industrialized country Parties enumerated in its Annex B that have taken oven emission limitation and reduction targets. For the first Kyoto commitment period, under the CDM only afforestation and reforestation activities are eligible for generating certificates that can be accounted against Annex B targets. Currently, the CDM is the only Kyoto mechanism that allows accounting for climate change mitigation in developing nations. Its intention is "[. . .] to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention [. . .]". What this means for project activities is that these shall neither be in conflict with the elements included in the objective, nor with its timeframe. In this article, project permanence will not be understood in the sense of *infinity*, but related to the timeframe indirectly defined in the Convention. The current article takes a step back from the actual climate regime. It takes into account the CDM modalities and procedures, but aims at the long-term perspective with views to a post-Kyoto world.

This article will concentrate on the following issues:

– Forests in developing countries
– The role of time in carbon storage, and
– The criteria land-use based climate change mitigation activities need to fulfill in order to serve the ultimate objective of the Climate Convention.

2 The ultimate objective and its elements

UNFCCC Article 2 is complex, because it touches on a number of interrelated issues that the following paragraphs attempt to disentangle.

> "The ultimate objective of this Convention and any related legal instruments (. . .) is to achieve (. . .) stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

The following elements can be distinguished:

I. The overall objective is to prevent dangerous anthropogenic interference with the climate system.
II. This is to be done by stabilizing the level of GHGs in the atmosphere. III. The timeframe of stabilization should,
   (a) Allow ecosystems to adapt naturally to climate change;
   (b) Ensure food production;

(c) Enable sustainable economic development.

There is no common understanding about what level of interference can be considered “dangerous”. A timeframe is defined by natural adaptation, food production and sustainable development, every single of which underlie a variety of factors and interpretations. The 2002 World Summit on Sustainable Development defined an umbrella concept of essentials called WEHAB – Water, Health, Agriculture and Biodiversity, adding coastal areas. WEHAB comprises the three areas identified in UNFCCC Article 2 and is intended to help operationalize the concept of dangerous interference (Patwardhan et al. 2003). We will examine Article 2 sub-objective by sub-objective, and assess which role forestry could assume in developing countries, with a focus on timing and duration issues.

2.1 Preventing dangerous interference with the climate system

The majority of scientists agree that dangerous anthropogenic interference with the climate system is mainly related to GHG emissions. No definition has yet been agreed, at what point anthropogenic interference with the climate system shall be considered *dangerous*. Climate change will affect different countries, regions, and sectors in different ways. Some sectors in specific countries (like food production in parts of Russia) may even benefit from higher temperatures or increased rainfalls, while an increased sea level will threaten the existence of whole island states. Both types of countries will support different concepts of “dangerous human interference”. Ultimately, any risk definition on a global level will be a political one (Ott et al. 2004). Unless there are certain absolute temperature values that trigger major catastrophic events, the rate of temperature change seems to be more important than the ultimate temperature level after stabilization is reached. The German Advisory Council on Global Change suggests that the global mean temperature should not stabilize at a level higher than 2 degrees above pre-industrial levels, given that it has already increased in 1.4 degrees since the beginning of industrialization. The rate of change acceptable is estimated at 0.2 degrees per decade (Graßl et al. 1995). Latest findings indicate that, in order to achieve this goal, GHG concentration levels should remain below 400 ppm CO_2 equivalents in order to achieve the 2-degree goal (Meinshausen and Hare 2004). This result contradicts the current EU negotiation position that aims for stabilization at 450 ppm.

2.2 Stabilizing GHG concentrations in the atmosphere

A stabilization target limits absolute total atmospheric loads to the rate of natural CO_2 absorption by biosphere and oceans, plus the uptake by persistent geological sinks. It has been questioned, whether a concentration target can be the ultimate objective, rather than a tolerable human-induced temperature limit above the pre-industrial level

(Graßl et al. 2003). On the other hand, trace gas concentrations can be measured and attributed to a higher degree of confidentiality than global temperature variations. This pragmatic approach however limits the imposition of possible refinements. Several more gases than mentioned in Annex A of the Kyoto Protocol can be subject to future regulation, most prominently water vapor, which shows different levels of radiative forcing, depending on which level of the atmosphere it occurs. Several anthropogenic precursor gases in the atmospheric chemistry can be identified and limited. What is not considered under Article 2 is the radiative forcing effect of land use, even though it may potentially reach orders of magnitude comparable to the effects of afforestation on a specific area (Pielke Sr et al. 2002; Marland et al. 2003). It is interesting to observe that concerns about albedo effect (Hadley-Centre 2000), surface roughness and surface heat fluxes (Marland et al. 2003) are only uttered in relation to forestry land use, while any large-scale land use intervention may cause similar effects, like road infrastructure, airfields, water reservoirs, or large urbanizations, as well as agriculture. Today's knowledge does not seem sufficient to reliably quantify and attribute these effects to determined activities. Once science advances on the issue, an amendment to the Climate Convention may be needed, thereby changing the metrics for the achievement of the ultimate objective.

2.3 Impact of forestry on GHG concentrations

Presently, around 23 percent of all CO_2 emissions emanate from worldwide deforestation and devegetation. Most prominently, Brazil and Indonesia contribute to the destruction of natural forests. There are even opinions that data on the global warming effect of deforestation understate, on the grounds that the IPCC calculation of relative global warming potentials (GWP) underestimates CH_4 and Kyoto does not account for CO_2 emissions, acting indirectly towards global warming, by hindering the decay of CH_4 in the atmosphere (Fearnside 2002a). On the other hand, there are doubts whether industrial emissions can really be compared to land-use related ones, considering that forests are living ecosystems. Much destruction is followed by spontaneous regeneration, leading to increased carbon uptake. This effect depends on the cause of destruction and its mid-term effects (Chazdon 2003). Natural succession in the tropics has the potential to recover carbon stocks on deforested areas within 15–30 years, while from biodiversity and soil indicators human intervention can be traced back over several centuries (Chazdon 2003).

If the area deforested is used for reforestation with fast-growing commercial species, it is likely that the eventual level of carbon stocks does not reach the biological potential of the area. The long-term effect depends on the size of the plantation and the proximity of natural biodiversity reservoirs. Examples for this type of deforestation with the purpose of establishing plantations can be found in Indonesia, where the remaining natural forests are seriously threatened in many regions.

Long-term destruction occurs, if after deforestation the land is used for cattle grazing, or, even worse, for mining activities that drain water resources and contaminate soils and water with heavy metal residues. These activities may lead to irreversible damage on large areas. A direct comparison between the emissions due to burning of fossil fuels and the ones related to forest destruction is inconsistent, because there are chances for recovery in the destruction of forests as depicted above, It would be interesting to quantify anthropogenic deforestation and degradation damages compared to the actual recovery induced by them.

The overall dynamic effect of deforestation on carbon fluxes F_{total} is thus

$$F_{total} = C - V - D + R_{nat} + R_{anth}$$

whereby *C* is inorganic "black carbon" deposited after a fire, *V* is the carbon embodied in the part of the aboveground vegetation destroyed, *D* is the soil carbon deposition deferred by human disturbance. R_{nat} is the increased natural re-growth induced by removal, and R_{anth} the carbon embodied in the anthropogenic use of the area, if any.

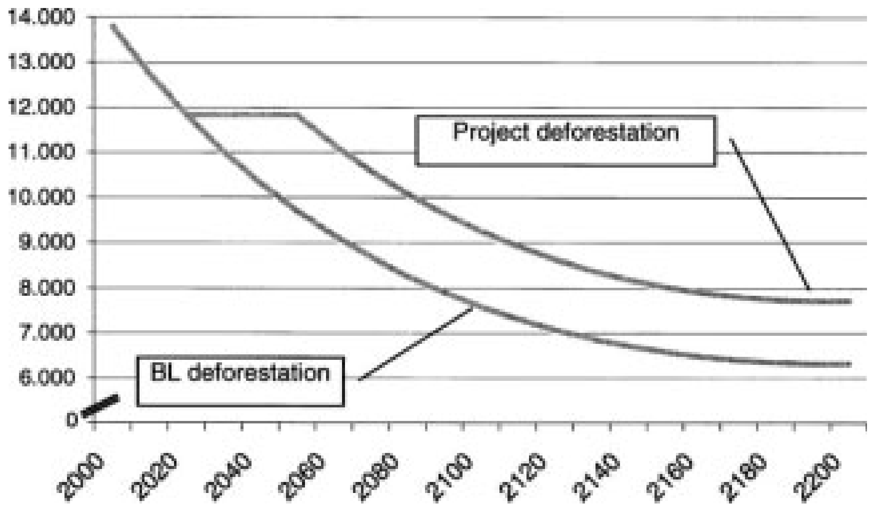
2.3.1 Deforestation and devegetation avoidance baselines and permanence

Deforestation can be explained by the low value of unused land. In developing countries, there is a high social discount rate. Thus, incentives for forest protection need to be more profitable for the landowner on the short term than alternative uses for cash crops or pastures.

Deforestation avoidance has its highest immediate and long-term benefits if started at the earliest point in time possible. Its permanence can however only be granted, if ecosystems' adaptation is achieved. In case combined efforts of energy, transport, and land use mitigation fail to achieve this target, the effect will be aggravated by GHG emissions from a part of the earth's natural forests and other fragile ecosystems. On the other hand, failing to protect natural forests will result in an emissions increase at an earlier point in time. Some observers argue that deforestation does not matter, because today's sinks will turn to sources anyway during this century (Hadley-Centre 2000; Cramer et al. 2001). This statement is imprecise, as it does not attach any value to time. Climate change is only *one* driver of deforestation. Besides, areas that are today most threatened by deforestation will not necessarily be the ones most threatened by future climate change, and vice-versa.

Deforestation avoidance bears more similarities with avoided fuel emissions. One ton of fossil fuel avoided for energy production may be used in the future and thereby delay the end of oil drilling. Emission avoidance in this case could create temporal leakage. The same could happen with the hectare of forest protected and chopped down in the future.

Figure 1: Permanent gain of a 30 years forest conservation



If we assume however the world economy to de-carbonize, then the resource will not be used up, and future energy demand will be covered by less fossil inputs. The same is true for deforestation: The erosion of the terms of trade for goods from agriculture and forestry and the diminishing GDP contribution of the primary sector in developing economies are expected to lead to decreasing deforestation rates over time (Sathaye et al. 2003).[2] The benefit from deforestation avoidance will thus be permanent, because one hectare of forest saved from deforestation for one or two decades will be exposed to a lower deforestation rate in the future. In the example in Figure 1, an area of 15,000 ha was forested in 1990, with a 10-year deforestation of eight percent detected in the year 2000, a rate assumed to decline to zero until the end of this century. A conservation project protects the area against deforestation between the years 2020 and 2050. In our example, 7,710 ha will remain in 2100, as compared to the baseline case of 6,322. Temporary protection has led to a permanent carbon gain. In real life however, it may be difficult to clearly attribute this gain to the protection activity, if it went on for a short period only.

[2] Sathaye et al. use 1990s deforestation trends as a basis for estimating those until 2100. E.g., before 2020 they expect the South American deforestation trend to decrease, for which there are no indications in the actuality. Anyway, the assumption that economic development and deforestation trends are negatively related is a valid thesis.

There are two manners to determine a baseline for deforestation and degradation; top-down or bottom-up. The top-down case is the easier way: a whole country commits to reduce deforestation below a threshold value. This threshold is best determined as an average over a base period. The baseline may be static, if deforestation values have been constant in absolute or relative numbers, or it is dynamic to mirror changes occurred in the past or factors independent from the project partners that will influence future compliance. If a country commits to reduce its deforestation rate, an inventory of the whole forest area and its variations is needed. This is different in the project-based bottom-up case, as for every single activity area involved a scenario analysis is needed that it is indeed threatened by deforestation. This has been done by The Nature Conservancy for the Brazilian Guaraquecaba project using the GEOMOD model (Brown et al. 2000). It reacts to parameters like the proximity of roads, cities and other infrastructure and has been verified by identifying areas based on historical data that were effectively deforested. The problem of leakage has been tackled by contracts with logging companies to refrain from replacement deforestation outside the area. As long as these activities are legal or legally not prosecuted however, there is no long-term security of real project-related emission reductions.

The difference between would-be and actual logging is being accounted for as the actual net anthropogenic GHG emission reduction. However, when reviewing the deforestation baseline, the new deforestation rate will become the activity's baseline. Consequently further deforestation reduction will become more costly per ton of carbon CO_2 equivalent reduced, the more area was conserved in the first term. If deforestation returns to previous levels, permanence of credits is threatened. In the bottom-up case, baseline deforestation will be monitored outside the protected area. If there is negative leakage (i.e. deforestation increase outside the project area) not recognized as such, the future baseline will be higher as if there were none. Thus there is a double incentive for project participants to neglect leakage. On the other hand, if the area was preserved in the first crediting period, deforestation pressure will act on an area that would have been deforested already in the non-project case. By preserving areas that were preserved in earlier crediting periods, there seems to be no additional carbon benefit. Hadn't the project started, areas would be threatened that are out of reach after the first project phase. It is methodologically challenging to account for these effects. While early conservation activities are less costly in the beginning, on stabilization of the forest area, deforestation avoidance is accounted for only once, even though areas are out of reach for intended deforestation due to the existence of the project activity.

While for a first baseline validity term deforestation and degradation avoidance seems feasible in principle, it may become methodologically cumbersome after some time of successful conservation. This is so, because either the baseline builds up on a double hypothetical state (had the project not existed before), or protection starts over with the risk of accounting twice for the same piece of land. In no case however, all of the carbon stored in natural vegetation in a given region can be accounted for, unless a business-as-usual degradation of the complete project area is expected to occur within the first baseline validity period.

2.4 Allowing ecosystems to adapt naturally to climate change

The adaptive capacity of the biosphere is most related to the rate of temperature change. This sub-objective is better described with biodiversity conservation (Ott et al. 2004). Biodiversity is actually being massively threatened by human intervention, not only in climate. Besides a reduction of anthropogenic GHG emissions that helps reducing the rate of change, avoiding deforestation and degradation directly contributes to the conservation of biodiversity. Between 50 and 90 percent of the approximately 10 million species on earth are believed to be hosted by tropical forests (Saphores and Bakshi 2001), thereby constituting a huge genetic pool for species that may be able in the future to cope with changing climatic conditions, ensure food production, and provide pharmaceutical inputs. Commercial logging tends to concentrate on biodiversity-rich forests, as these host the most valuable trees (ibid.). Afforestation may under certain conditions contribute to biodiversity as well, but pure "carbon forestry" will most certainly not achieve this goal. Biodiversity conservation in managed systems requires an inventory of the ecosystem as a precondition for adapted site management. Natural adaptation to climate change implies a high migratory capacity of species within their habitat. Pollination plays an prominent role in this respect (Nasi et al. 2002). Species migration can be enabled or hindered by landscape management. Actually, the increasing habitat fragmentation by human activities reduces natural adaptive capacities for species migration.

Under biodiversity aspects, there is a benefit in terms of the ultimate objective of the Climate Convention even in temporarily reducing GHG emissions from deforestation.

The more biodiversity is protected, the higher the chances for ecosystems to adapt to climate change, the lower the carbon losses that can be expected as a result of climate change.

The flipside of biodiversity is that it holds bad surprises for humankind as well, once natural systems are intervened. Along the lines of deforestation, there is an increased breakout of diseases like Malaria, Dengue, or Typhus (Saphores and Bakshi 2001). The jump-over of HIV from primates to humans has been related to deforestation of areas untouched by men before (McMichael 2003). The spread of diseases is a complex process; it is closely linked to water pollution. Trees contribute to the supply of clean water by stabilizing water levels and filtering water (Nasi et al. 2002).

Forests thus have the ability to increase human health and resilience against the consequences of climate change.

2.5 Ensuring food production

In the actuality, famines occur in spite of food production being more than sufficient worldwide. What the world sees today are mostly problems of distribution and of resilience of the social systems, being aggravated by regional climate variations (Ravallion 1996). The generic sense of the sub-objective relates to the carrying capacity of the earth. Intuitively, the problem is rather population growth than climate change. Under perfect market conditions, short-rotational species like most food crops will be planted where the climate is most suitable for them. New species will be reared that are best adapted to climatic conditions in each zone. Farmers have high flexibility in adapting species and management techniques to climatic variations when they cultivate annual crops (Adams et al. 1999). The limiting factors however are water and soils. When vegetation zones migrate (e.g. by permafrost soils becoming arable or dry soils that desertify under decreasing rainfalls), the newly arable soils may lack humus and quickly lose their water storage ability. The process of desertification leads to CO_2 emissions from soil erosion. The function of bushes and trees for soil and watershed management can thus not be overestimated.

The use of biotic sinks has been criticized from a moral point of view. Considerations over strong vs. weak sustainability lead Ott et al. to the conclusion that under strong sustainability criteria, a “structured heritage package” should be carried over to future generations. This implied that the sink capacity of natural systems should not be over-used (Ott et al. 2004). How could this over-use be defined?

It could be considered such an over-use of the biosphere for its sink capacity, if areas occupied by forests were needed for food production. The underlying assumption is that forests and food production are in opposition, which is vividly contested by the Director General of the Food and Agriculture Organization, Jacques Diouf: “First, trees and forests produce food directly. In some areas, they are a primary source of food; almost everywhere, they provide a regular supplement to the diet. Foods from the forest are consumed when cultivated supplies are in short supply, such as between harvest seasons, or during emergencies, such as famines and wars” (FAO 1996). Additionally, firewood plays a role in food preparation and conservation; mangroves even provide fishing grounds. There are thus strong indications that the existence of forestry activities is positively correlated to food production.

Food production is seriously threatened in the People’s Republic of China, which has been opposing the inclusion of land use activities under the CDM since the beginning. Over 40 percent of China’s total land area is affected by wind and water erosion, loss of grazing, deforestation and salinization (Berry 2003), so that the country is now renting agrarian lands abroad (in Mexico, Cuba, Laos and Kazakhstan) for food production (Gärtner 2004).

Food production however is not a mere function of heads of population. Annex I nutritional habits require so much energy, land and water resources that an adoption of them by the majority of world population would already lead to serious scarcity without climate change. Much of the deforestation in developing countries is related to meat production. Agricultural subsidies in industrialized countries are externalizing the environmental cost incurred for food production. The higher this subsidy level, the less world economy will be able to adapt to global change.

2.6 Enabling sustainable economic development

The sub-objective of sustainable economic development includes all other economic activities, besides food production. The wording “to enable economic development to *proceed* in a sustainable manner” tends to suggest the global economy was already sustainable, which at best expresses wishful thinking. Economic considerations limit the speed of transition to low-carbon production, and its repercussions are short-term. There is a trade-off between mitigation and adaptation costs that determines an optimal time path under economic aspects (Graßl et al. 2003). What could be a potential over-use of biotic sinks with respect to economic development? The dilemma is already being faced on a regional scale, when considering environmental costs and economic benefits of road building, e.g. in the context of the national program *Avança Brasil*, which aims at improving infrastructure. Environmentalists fear for important parts of the Amazon forest to be deforested alongside newly paved roads, like the BR-163 between Cuiaba´ and Santarem (Carvalho et al. 2004). Brazil is facing this dilemma mostly because there is practically no economic benefit attached to the mere existence of its natural forests. In case today’s generations decided to afforest vast areas of the world, this dilemma might under this line of argumentation, become more common. This is however only true for unproductive protected areas. As managed forests usually bring economic benefits to local populations, a CO_2 sink orientated policy will create income sources and resources for future use. As every single investor will have to weigh opportunity costs of alternative investment, under market conditions there will be a point where afforestation is no longer a profitable activity, compared to agricultural production or sale of the real estate for industrial or housing purposes. Today, the problem in developing countries is the opposite: As interest rates are burdened with a high risk premium, long-term investment is not undertaken in most developing countries. In the case of Brazil, this leads to the situation that the country may become a net importer of wood in the near future, as the (planted) resource is over-exploited. Under these conditions, short-term crops are more profitable, even though they in many cases deplete the soils, leading to a direct loss of carbon and, indirectly, further slash-and-burn deforestation.

Under climatic and biodiversity aspects, the first choice is to protect all standing natural forests. This would be conditioned by important North-South transfers to allow economy to proceed in a sustainable manner. The amount of transfers needed depends on the opportunity costs of the lands otherwise deforested over time (Saphores and Bakshi 2001). On the other hand, the subsistence of between 1 and 1.5 billion poor directly depends on forest and its products (Scherr et al. 2003).

On the remaining today non-forested areas, the most carbon-effective way of afforestation are fast-growing fuel wood plantations combined with energy production and geological sequestration (Read 1999; Obersteiner et al. 2002), which would be the first choice, if a critical threshold was to be avoided within few years. This would however not necessarily benefit biodiversity and might conflict with soil and water protection.

The second choice for climate would be to build up carbon-rich forests and leave them as protected areas forever. This solution is likely to be economically unsustainable. The alternative is to develop a forestry sector, which keeps large areas under forest use. Depending on the situation of the area, this can be profitable in the future, once a financial mechanism provides seed capital. Harvesting will lead to a dynamic system in which carbon stocks stay below the biological maximum. In many cases, it will as well remain below the macro-economic maximum, as the landowner's discount rate is so high that the marginal ton of wood would lower economic benefits. There is a role to play for forest management measures.

Figure 2: Present value of a plantation's income streams of timber and combined timer and C plantation at 6% interest rate

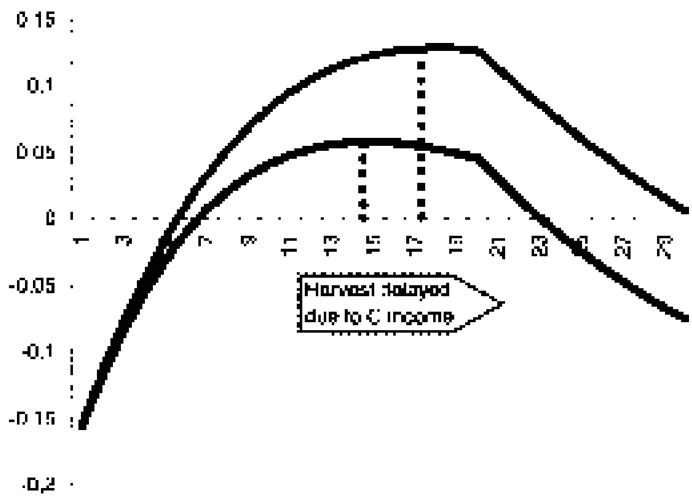


Figure 2 shows how an instrument that values carbon benefits can work. It presents a case for a hypothetical single-stand plantation with constant growth leveling out at year 20, where C content is set at 100 percent, of which the price is one. Assuming a zero interest rate, it would be rational for the landowner to wait until year 20 before harvesting (lower dotted line). Adding C benefits valued according to their lifetime to the salvage value would make it profitable to defer harvesting. Under a 6-percent interest rate, the landowner would not wait until maturity for, but would be forced to harvest at year 15. Combined timber and C benefits would continue to increase until year 18.[3]

The annually granted carbon incentive is calculated based on the pro-rata carbon stock. There is a relationship between growth rate, interest rate, and the carbon incentive needed. A subsidy granted annually based on C stocks and their lifetimes could thus lead to an optimal carbon content of a given area. The amount of additional funding needed for sustaining a forest until the point of saturation is determined by the moment when the marginal stock value increase minus harvesting costs falls below the interest rate. In our example, this occurs in year 16. Carbon returns need to be higher than the opportunity costs of delaying the harvest.

Let us assume, due to an international subsidy, an over-use of mitigation options really took place. Would it have to be considered a mitigation measures that led to an increase in future emissions, as the amounts of forests planted today would lead to land scarcities in the future? Under market conditions, land scarcity provoked by massive afforestation would lead to clearance of the remaining natural forests. In this case, the subsidy would have perverse effects related to biodiversity, but would compensate the "over-use of sinks" from an atmospheric point of view.

Forestry includes adaptation elements related to sustainable development, as for instance:

- The proximity of natural forests increases the pest resistance of agriculture and plantation forests (Nasi et al. 2002).
- Natural forests provide a genetic pool, which represents an option value for drug development and other commercial uses (Saphores and Bakshi 2001).
- Shade trees in many cases increase agricultural harvests, or protect cattle.
- Forests have the potential to protect watersheds and increase soil carbon in the long term.

[3] For this example, the market risk was neglected, and the following assumptions were met: Constant carbon increase of 5% annually until year 20. Annual value per tC at 3 percent of the timber salvage value, plantation costs of 20 percent of the *C* stocks at year 20, harvesting costs at 10 percent of each tC harvested.

- Windbreak plantations reduce soil erosion.
- Urban forests and trees in residential areas decrease people's exposure to direct sunlight, heat and dust and improve the micro-climate through their evapo-transpiration, thereby contributing to public health.
- Forests act as a filter and improve water quality (Nasi et al. 2002).
- "Living fences" are able to protect productive lands or natural forests against intruders.
- Firewood plantations improve livelihoods, where unsustainable biomass use leads to deforestation and degradation.
- Timber as a raw material can in many cases replace energy-intensive materials such as plastic, aluminum, steel and concrete. .
- Forestry creates local income, thereby avoiding migration.
- Mangroves shield low-lying areas against the worst consequences of sea-level rise, while at the same time providing a shelter for marine biodiversity and creating income from fishery.

Most of these features are externalities to the forest owner. Under business as usual, cases exist where forestry operations worldwide that do not contribute to sustainable development, be it for biodiversity, food production or economic aspects. The choice of non-adapted species may lead to an over-use of water supplies. Indigenous peoples are being displaced from their lands, and customary rights not respected (Andersson 1997). Some of these cases may even aspire to be registered as CDM projects (Lohmann 1999; Kill 2001). Due to a lack of control, logging companies in many tropical countries over-use their concessions, or harvest in a way that brings about important collateral damage. Much of the potential harm from large-scale forestry comes from the vast areas covered and the fact that the scarcity of fertile soils is in many cases not reflected in land prices. Land use activities under the Climate Convention thus require higher social and environmental standards than regular forestry operations.

2.7 Timing issues

The "timeframe" issue merits special considerations, as it delimits the upper and lower temporal boundaries of any mitigation activities.[4] Sub-objective II (a) is derived from the adaptive capacity of the biosphere, and it is thus related to the rate of temperature change. This condition is better described with biodiversity conservation (Ott et al. 2004). II (b) relates to the primary land use, namely food production, but impli-

[4] See section 2.7 below

citly also to population growth. II (c) includes all other economic activities. This last sub-objective is the limiting factor to the speed of mitigation, as its repercussions are short-term. There is a trade-off between mitigation and adaptation costs that determines an optimal time path under economic aspects (Graßl et al. 2003). Article 2 does not explicitly define the timeframe within which “safe” concentration level should be reached. However, the word *stabilization* implies a steady state in the future. Under the worst-case scenario of completely burning up fossil resources, CO_2 concentrations are currently expected to peak between the years 2100 and 2300 (Hasselmann et al. 2003) and then slowly decline. This gives us an indication over what to understand by permanence. CO_2 removed by forests today should theoretically be kept out of the atmosphere until the CO_2 concentration increase comes to an end, which is 100 to 200 years from now. Therefore, we will discuss permanence of carbon stocks within this temporal range.

The timeframe derived from this worst-case scenario can only be a first proxy for our analysis. Under the assumption of CO_2 concentrations ranging between 1,200 and 4,000 ppm, it seems unlikely that much of the carbon sequestered in biotic systems will be present by that time, due to extreme climate change. Furthermore, the assumption that fossil resources are burned up completely, leads to a permanence problem for energy-related mitigation. Fuel saved today under this hypothesis would be used up in the future, resulting in temporal leakage, i.e. the same type of problem we are discussing for biotic carbon storage. On the other hand, in this case, either the energy system would crash (long before the end of the resource) or an emission-free energy system would be in place by sheer necessity.

Land use options can thus only fulfill a complementary function within a strategy to halt GHG emissions from the use of fossil fuels. Biotic reservoirs are an indicator of nature’s adaptive capacity. By increasing them, a global mitigation strategy can be supported. If this strategy fails however, they will lead to a feedback effect, as they turn (back) to important sources of CO_2 and CH_4 (Cramer et al. 2001). There is a difference in this respect between managed and unmanaged forests. Managed forests are replanted, be it in clear-cut cycles, be it in cohorts, leading to complete stock renewal within periods of 20–100 years. Economic interest will lead landowners to adapt to gradually changing climatic conditions, as long as no abrupt changes occur. Natural forests benefit from their degree of biodiversity when adapting to climate change, but this process does not include an element of planning. Thus, a temporal differentiation is likely to take place: Anthropogenic forest sinks will slowly be implemented, but may be more stable over a medium timeframe. Deforestation avoidance for existing natural forests on the other hand, will lead to large-scale emission reductions in the beginning, but these gains could be temporary, as stocks may decrease over time due to climate-related impacts. There is a role to play for active resource management, like enrichment planting or other forest management measures to avoid the expected die-back of forests in tropical zones (Cramer et al. 2001).

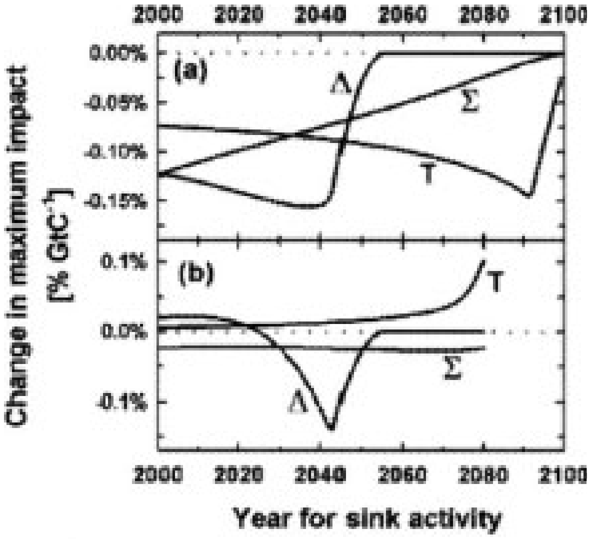
We need to differentiate between the establishment of new plantations on the one hand, and the avoidance of deforestation and degradation on the other, bearing in mind that "[.. .] permanence issues are not the same for all types of sequestration projects. Protecting existing old growth does not increase the risks to future generations in the same way as suppressing forest fires or planting monocultures of fast-growing species. Other sink enhancement projects, such as changes in tillage practices, are also less susceptible to natural disturbances, albeit more susceptible to changes in management practices."(Anderson et al. 2001)

For new plantations, Kirschbaum (2003) identifies three effects of carbon storage in vegetation, which could be expressed by a delay of the related effects in days.

1. *the direct and instantaneous effect of* CO_2 *and its associated temperature;*
2. *the rate of change in* CO_2 *and its associated temperature;*
3. *the cumulative effect of* CO_2 *and its associated temperature.*

He runs his model based on the optimistic 1996 IPCC emissions scenario IS92, which departs from an effective GHG control until the end of this century. The rate of change under this scenario will have its turning point in 2040, while the absolute temperature increase is not completely halted within the century. As the potential for carbon sinks is limited, he distinguishes the three effects of afforestation. Within the 21st century, the instantaneous temperature increase could be diminished more, the later sinks are established. Instantaneous consequences of temperature change ("T" in Figure 3) will be delayed by 25 days, if 1 Gt carbon is removed from the atmosphere at the time of highest concentrations, i.e. late in this century. The maximum effect of 1 Gt carbon reduced will be to delay the rate of change ("*A*") by 70 days close to the year 2100, while the delay would be 45 days, in case the same option were implemented in 2000. Conversely, cumulative impacts (symbolized by "*Z*") would be mitigated most (a 20-day delay) if action were taken in 2000 already. *Temporary* sequestration in turn, may increase overall damages, in case releases occur during the phase of major rate of change. The same would be true for the situation of forest dieback due to climate change. The overall potential of biotic sinks is estimated at 87 Gt carbon until the year 2050 if aggressively pursued (Kirschbaum 2003). Under this assumption, 20 days per Gt carbon sequestered would translate into an overall delay of 5 years. In his model however, Kirschbaum disregards the lead-time for planning, land preparation, implementation and growth of a sink of this magnitude.

Figure 3: Effectiveness for the timing of permanent (a) and temporary sinks over 20 years (b). *Source*: Kirschbaum 2003



Resuming, Kirschbaum advocates for establishing new forests later this century on areas where other equally sustainable land uses exist. He explicitly excludes from this appeal opportunities for carbon sequestration that are not deferrable, like on areas under threat of salinization.

There is scientific uncertainty over the time horizon around the following issues:

1. Threshold values for total atmospheric CO_2 load or mean temperature that lead to abrupt and irreversible changes. In the presence of scientific uncertainty, the precautionary principle of environmental policy should prevail.
2. What is the limit of oceans and the terrestrial biosphere to take up CO_2 ? Most authors assume an unlimited increase in oceanic uptake capacity (Fearnside et al. 2000; Moura-Costa and Wilson 2000; Fearnside 2002a; Kirschbaum 2003), while this is contested by others (Meinshausen and Hare 2000). A MIT Report expects the ocean uptake to peak by the middle of this century at 4.2 Gt of C and decline to 1.6 Gt C in 2300 (Sarofim et al. 2004).
3. The precautionary principle consists in avoiding risks that may occur in the future. Were the oceanic uptake unlimited over the next centuries, it would rather be the rate of change that should concern us. Assuming limited oceanic uptake capacities would lead to a higher degree of urgency, including the immediate expansion of the biosphere's uptake capacity.

An economic equilibrium model serves to answer the question, whether deferring deforestation is economically attractive in order to "buy time" until the global economy has de-carbonized (Lecocq and Chomitz 2001). The authors assume permanence to be achieved in the moment when CO_2 concentrations return to today's levels, which may be in the 24th century. Until this time, payments are due to maintain natural forests protected. They agree that permanent sequestration is equivalent to fossil fuel abatement. Although single projects cannot be guaranteed to live up to this period, the overall portfolio of forestry projects will have a quantifiable survival chance. The expected damage function was found to be key for sequestration dynamics, and not expectations about technological change. Temporary sequestration will, according to Lecoq and Chomitz only make sense if GHG concentrations are to be kept below critical thresholds. Hence, the use of LULUCF should start immediately, if these thresholds were near, and high damages expected at relatively low concentration levels. The shadow prices of carbon would rise at a faster rate than the economic discount rate. The optimum is reached, when the costs for temporary sequestering one ton CO_2 e for a determined period plus abating the same amount, after this ton is released is equal to the actual abatement costs. Similarly, Herzog et al. find that "[t]here is little value to temporary storage if carbon prices rise at or near the discount rate" (Herzog et al. 2002). This finding points into the direction of expiring credits. These have the highest value, if mitigation prices are expected to decline, due to e.g. expectations over technological change, while an expected price increase above the investor's discount rate will invalidate them (McCarl et al. 2001; Dutschke et al. 2005[5]). As investors lack certainty, McCarl and Murray recommend a mixed mitigation strategy between emission reduction and carbon removal.

A somber picture on deforestation avoidance is drawn by a model calculation by Janssen and Mohr. Assuming a 5-year agricultural use of an area deforested, they calculate top-down opportunity costs per hectare for 13 tropical countries, based on real GNP for agriculture divided by the agriculturally used land area as given by FAO in 1999. Assuming that the willingness to pay by Annex-I countries solely depends on carbon content per hectare and is rising at an annual 10 percent, they calculate for which countries there is a window of opportunity for negotiating conservation transfers, which are the minimum strike prices per ton of carbon for each country. Until the moment of an agreement, deforestation is assumed to proceed at the same level. Thus the carbon value per hectare would decrease, thereby determining the moment the window closes. The authors find that by the time the article was written, the cost of a ton of carbon preserved was between 9 US$ (2.50 US$ per ton of CO_2e) in Bolivia and 874 US$ (238 US$ per ton of CO_2e) in India. Even under the assumption of a carbon value of 100 US$ (27 US$ per ton of CO_2e), there would be no chance to survive for the natural forests of India, Indonesia and Malaysia (Janssen and Mohr 1998).

[5] See chapter III

Like other top-down models, the Janssen and Mohr model can be criticized for its high degree of aggregation and the resulting low resolution. The main reason for its pessimistic undertone can be found in the high opportunity costs for foregone land use: First, the assumption that the main driver is agriculture is not legitimate in all cases. Second, the main contribution to the sectoral GNP does not usually come from areas under shifting cultivation, but rather from cash crops like banana, cotton, coffee or sugar that are intensively cultivated on areas cleared long before. Slash-and-burn practices contribute little to the creation of agricultural value added, and they are often realized by marginal farmers, whose products remain in the informal sector. Furthermore, exchange rates are varying (usually the value of the local currencies decreases over time). A functioning market for forest protection services would detect the least-cost options within the countries. Overall, the cited study shows that forest protection is not a low-cost option and it may come too late for important carbon reservoirs and biodiversity pools.

Fearnside, in defense of the ton-year approach for accounting of biotic sinks, argues for a non-linear discount to apply to damage occurring in the future. He ethically justifies his point of view relating to the cascading effect of lives lost or saved today for future generations (Fearnside 2002a). Which discount rate to apply, is an issue widely discussed in ecological economics (Tietenberg 2000), and Fearnside's approach is inspired by Generation Adjusted Discounting (Bayer 2000; Bayer 2003). Risks associated to climate change cannot be framed in present value considerations only, because they are uncertain, potential damages are high, and they will be borne by future generations (Pearson 2000).

The "over-use" argument (Ott et al. 2004) related to timing of land use measures is found in NGO criticism (Kill 2001): If in the future, developing countries were to agree to emissions targets, sinks opportunities would have already been tapped by the industrialized world. This could be the case if these opportunities were static, which however the same authors deny. Furthermore, as discount rates are high in developing countries, there is an undeniable advantage of receiving compensation for climate change mitigation activities today.

3 Discussion

Critiques of land use activities in the CDM have on many occasions pointed to other multilateral environmental agreements like the UN Convention on Biological Diversity, the UN Convention for Combating Desertification, or the UN Forum on Forests to provide the finance needed for sustainable forestry and insisted that the UNFCCC was all about carbon (Fearnside 2001). Like shown in the above paragraphs, natural or sustainably managed forests have their place in achieving the ultimate objective of the Climate Change convention. Their overall carbon removal or storage potential is limited however. The afforestation potential is estimated to remove 87 Gt carbon if aggressively pursued, and its use within this century could theoretically defer effects of climate change effects for a maximum of 12 years, applying the Kirschbaum model (Kirschbaum 2003). Carbon benefits from deforestation avoidance will be in the same range (Sathaye et al. 2003), depending on the baseline in each individual case. Permanent sink enhancement is directly comparable to abatement options e.g. from energy conservation (Greenpeace 2002). The validity of this statement depends on how "permanence" is defined. If defined as an infinite period, conservation or enhancement of biotic pools will not at all contribute to climate change mitigation. Under this perspective however, climate change itself will be a temporary phenomenon, finding its solution in the end of fossil resources and the subsequent global temperature decline. On the long run, ecosystems will adapt naturally. It is thus not *per se* an ecological point of view to consider long timeframes. Considering a timeframe of e.g. 10,000 years, one may come to the result that today's global warming problems are either insignificant, or, with a view to all the potential future damage, decision makers could end up paralyzed (Fearnside 2002b). We might include in our considerations a new ice age in 50,000 years, of which the effects could be delayed by some long-lasting trace gases left over in the atmosphere from the 20th and 21st centuries (Michaelowa 2003). A short timeframe should be expected to be similar in its effects to a high discount rate. The consequence on the choice of climate mitigation measures however depends on the underlying assumptions, rather than on timeframes. Michaelowa, concentrating on mitigating the rate of temperature *decrease* after GHG concentrations have peaked around the year 2200, advocates a bonus for mitigating short-lived gases like CH_4 and N_2O.[6] The same result could be borne if a short timeframe was applied, like e.g. 20 years. The IPCC in its Second Assessment Report has opted for a 100-year timeframe for comparing different GHGs' warming potential with a zero discount rate. This choice is not necessarily the ultimate truth, but rather an indicator for the willingness to pay of today's societies, and it may be subject to change for future commitment periods. Article 5.3 foresees a regular revision by the Conference of the Parties. The need for adopting the timeframe emerged when defining the "basket" of six GHGs not controlled by the Montreal Protocol in Annex A of the Kyoto Protocol. By capping the emission of each single gas separately in the national inventories, the discussion around timeframes would have been avoided. In the context of biotic carbon sinks however, this issue is unavoidable. Every single sink is under constant threat of releasing the sequestered carbon again at any time. An incentive mechanism for the creation and conservation of sinks should assure that not

[6] It could be discussed whether Article 2 includes adaptation to global cooling. In the author's view, this issue is beyond the actual scope of the UNFCCC

all stocks of sequestered carbon are released at the same time. Anyway, climate change is likely to lead to a conversion of some actual sinks to sources in the future (Schulze et al. 2000; Read et al. 2001). Fearnside et al. have referenced to the CWP timeframe: “Whether intended or not, the choice of a time horizon has created a value for time under the Protocol.” (Fearnside et al. 2000). Fearnside bases his argument on the perception of the individual within time, rather than on an economic cost-benefit analysis. His “unified index for time preference” is composed by the forward-looking valuation of the 40-year old decision maker, who may be inclined to attach decreasing values to his or her own life (40%), the children (35%), the one of grandchildren (15%), and finally the great-grandchildren (10%). These values were to be discussed in a societal discourse (Fearnside 2002a). This approach leads to a stepwise decreasing valuation function until year 110. This approach has been criticized as static. Applying it year after year, the discount factor would linearly fall, to reach zero after 150 years (Tol 2002).

After all, we may reduce our perspective to one of the following options:

1. A running hundred-year timeframe: 100 years is the horizon a single human is able to envisage. A mid-aged decision maker knows the persons who will live (and decide) in 100 years from now and is able to take the stewardship for them (Fearnside 2002b). The IPCC Relative Global Warming Potentials (GWPs) on the basis of 100-year damage seem to confirm the view that carbon sequestered needs to be kept out of the atmosphere for at least 100 years (Anderson et al. 2001). A dynamic element is needed, as most of our knowledge is recycled every 20–30 years. The precautionary principle should lead us to err on the conservative side, so that necessarily some of our apprehensions will turn out to be wrong.
2. The time necessary until GHG concentrations start to decline, which – according to the worst-case scenario of full fossil fuel use – will be between the years 2100 and 2200. The closer we get to this point, the higher our certainty. Once stabilization is reached, adaptation will still be necessary, because of the time lag of temperature and sea level changes, but the UNFCCC policy will come to an end. The ultimate objective will at best gradually be reached, and a future desirable temperature path will then need to be determined.
3. As an alternative, the return to today’s GHG concentration levels is envisaged, which will be between the 23rd and the 24th century (Lecocq and Chomitz 2001). This point in time seems arbitrarily chosen. Circumstances will be different, when the atmospheric system crosses this line again.

Alternatives 1 and 2 do not necessarily exclude each other. Climate mitigation and adaptation activities can only be reached within our actual institutional framework.

Institutions have limited lifetimes. The UN system has not accomplished 60 years of age. Taken together with its precursor, the League of Nations, it could be considered to exist for 86 years. The Geneva Convention, the first multilateral treaty in history (Madigan 2004), was signed by 12 nations in 1864. We should thus be cautious with respect to long-term activities, if we do not simultaneously build up the institutional support. The Kyoto Protocol as the first agreement on concrete action against climate change, signed in 1997, took until February 2005 to enter into force. International law is developing slowly, and its institutions are weak. States act under a prisoner's dilemma when complying with international treaties. Public law knows contracts of a maximum length of 99 years. In consequence, individual climate mitigation and/or adaptation activities should be projected in a way that they to the best of today's knowledge do not conflict with the ultimate objective of the Climate Convention (as proposed in option 2), but it is arguable that their scope should be limited to a timeframe of 100 years, counted from their respective starting dates.

The value of forests for achieving the goals of biodiversity (ecosystems' adaptation), ensuring food production, and sustainable economic development cannot be overestimated. Implemented in the right manner, they will contribute as much to climate change mitigation *and* adaptation. How can carbon and non-carbon effects of forests compare? If carbon-intensive land use can delay the incidence of global warming effects, its adaptation effect will gain time by allowing human and ecological systems to adapt to higher levels of GHG concentrations. Forestry projects that do not contribute to adaptation are hardly conceivable as mitigation activities. If they do not contribute to biodiversity, neither to sustainable economic development, their chances to serve as permanent carbon stocks are limited, to say the least. Nevertheless, there are climate adaptive land-use activities with a low carbon value. Adaptation is most cost-effective where it attends the needs of today's populations (Michaelowa 2001). As it tends to increase wealth, it will provide cascading benefits for future generations as well. It is therefore justifiable to apply a discount on benefits from adaptation. The adaptative value will even be achieved within a timeframe shorter than permanent.

For carbon benefits, discounting is being questioned because future generations will suffer from the release of CO_2 and other GHGs if an area is deforested again. It is arguable however, that the carbon sequestration time path is non-linear. Deforestation and degradation avoidance are activities that cannot be delayed, as the resource is currently being overexploited and will most likely not recover within our 200-year timeframe. Another non-linearity is derived from the actual atmospheric GHG and temperature levels. The fertilization effect from higher CO_2 and N_2O levels in the atmosphere contributes to higher growth. There is an individual saturation level to this effect, depending on soil composition and solar exposition. It is rational to take advantage of the fertilization effect as long as it lasts. The opposite effect is the vegetation dieback under increased temperature levels, but it is yet impossible to tell, at which point in time this will occur on a worldwide level (Cox 2005). Both effects may act in parallel, differentiated along regions, and counteract on a global scale. Using the fertilization effect may contribute to delay the dieback. Under the aspect of the trade-off between the positive fertilization effect and the negative climate-change induced dieback, no discount should be applied to the earlier (Jackson 2002). In the meantime, forest research may be able to develop species adapted to a wider range of change in climatic conditions. As deforestation and degradation avoidance will not be CDM eligible in the first Kyoto commitment period, its acceptance after 2012 will already come too late for many of the Indonesian natural forests (Wietling 2004). It can be argued that a for the sake natural forests' adaptation services high time preference should be given to conservation, while afforestation can be delayed, as long as there are alternative sustainable uses of the area, eventually bringing about additional benefit in the future (Kirschbaum 2003).

There is a fundamental confusion in the argument that the potential non-permanence of biotic carbon storage should not allow present generations to use it as a climate change mitigation option. Damages from future deforestation or devegetation are not bound to occur automatically, but they depend on the respective care of each generation. By inheriting forest resources to future generations, we entrust these to care for this heritage in a sustainable manner. Only the damage attributable to present GHG emissions can be considered our responsibility. Assuming we expect 30 percent of the Amazon carbon content to be emitted over the next century only due to human-induced climatic changes, there is a share of 70 percent remaining to be protected by future generations. Forest resources built up today offer future generations opportunities rather than risks. As for the risks attached, these are no different than the ones related to fossil resources: By refraining from using fossil fuels today, we give future generations the option to use them, which could end up in temporal leakage of emissions (Herzog et al. 2002). The criterion of intergenerational equity implies that we must not be prescriptive in what we deem appropriate today.

The responsibility question needs to be answered differently for the question of nuclear waste or geologic CO_2 deposits from technical carbon sequestration and storage that bear only risks and no opportunities for future generations. Another example for long-term decisions with intergenerational effects is the one of urban structures built up today. Suburbia will always imply a carbon-intensive transport infrastructure, and consequences of today's decisions will leap into the 22nd century (Spence 2004).

As we saw above, carbon is an imperfect measure for the combined benefits of land use. While adaptation measures can stand for themselves, pure carbon forestry without a contribution to climate change adaptation is not compatible with the ultimate objective of the Climate Convention. From a pure carbon point of view, the overall contribution by biotic sinks to long-term climate stabilization is rather insignificant on the secular timescale. Its adaptation effects can however increase the resilience of biotic and human systems against expected rates of temperature change. As we lack measures for the combined value of global ecosystem services (Andersson 1997; Saphores and Bakshi 2001), there is no quantitative manner to treat the issue. There are however priorities among the activities related to land use, land-use change and forestry:

1. Avoiding deforestation and degradation is in many cases a cost-effective way to preserve big amounts of carbon from being emitted, while protecting soils, biodiversity and livelihoods needed for adaptation to climate change.
2. Forest management activities have the potential to increase carbon density in managed forests and avoid lasting damages from unsustainable harvesting practices. In most cases, forest management can only be profitable on the long run, as it increases site productivity and resource renewal (Ruzicka and Moura-Costa 1997). Therefore, the higher the country risks, the higher the carbon potential for forest management, given the right incentives.
3. Afforestation and reforestation according to the Marrakech definitions[7] can have a supplementary role in conservation and forest management. Contrarily to forest conservation, plantations will take up carbon slowly. There is a principal difference between restoration forestry destined to create secondary forests and production forests. The latter are harvested regularly and will thus never achieve their biological growth equilibrium. As a minimum criterion, AR activities should not decrease carbon stocks in soils, even if properly accounted for. This can best be achieved, if only afforestation projects of a certain minimum length are eligible for credit.
4. Bioenergy is an important aspect of managed forestlands. Using wood from afforestation and forest management for energy production increases economic returns from forward linkages of the resource, adds another element of technology transfer, while at the same time addressing methodological problems like market leakage, permanence, and scale (Schlamadinger et al. 2001).

[7] 5. For foresters, reforestation is the re-plantation of trees after harvesting. In Marrakech terms, it is the installation of forests on areas that were non-forested on 31st December 1989. Afforestation is understood to be the land-use change to forestry on areas that were non-forested at least for 50 years. Under the CDM, both categories are treated in the same way, which is why we will refrain from further differentiation of the two categories in this article.

Independently from their type, preference should be given to (combined) activities that achieve highest sustainability co-benefits at the lowest costs. This can be achieved by preserving or increasing biodiversity in carbon forestry and by creating community benefits. In the next paragraph, we ask, considering the above, which criteria a forestry incentive mechanism should fulfill in order to achieve long-term carbon and adaptation benefits.

Subject of the CDM are activities within states that do not belong to Annex I and have not (yet) agreed to a quantitative emission limitation obligation. For Annex I, there is unlimited liability for carbon removal once reported (Kyoto Protocol, Articles 3.3 and 3.4). It is likely that in the second or third Kyoto commitment period (or any other post-Kyoto climate regimes) more countries accept quantitative GHG emissions targets, be they voluntary or in the form of a full accession to Annex I. The CDM in their case is a temporary fix for a problem that will find a long-term solution. Permanence problems will vanish, as more countries get involved in target setting. The risk of gaming between the acceptance of liability for carbon stocks built up under the CDM and future targets needs to be minimized by transparent target allocation rules for future commitment periods. However, these are required anyway, in order to avoid free-riding effects like under the current commitment period.

There are two logical failures in the argument that potentials for developing country engagement were being taken by the CDM (besides the fact that it does not relate to the land-use mitigation option specifically). One is that mitigation opportunities are time-dependant and may not be present in the future, which is especially true for areas under deforestation and degradation pressure. The other is that no country will take on future commitments, if CDM mitigation success is debited from its account.

Whereas the aim of any mitigation activity should be permanence (i.e. over 200 years), even temporary measures may be beneficial under the following conditions:

1. A slower pace in temperature increase would allow biotic systems to adapt, which would be impossible under very rapid global warming. The time needed for adaptation however depends on geological and biological conditions. Given the high uncertainty over the speeds of climate transition and adaptability of natural systems, thresholds will act on a regional rather than a global level.
2. Future damage resulting from a potential release of the carbon removed may be discounted. Assuming a positive discount rate depends on one or more of the following assumptions that are closely related to each other:
    a. Delaying global warming will increase the welfare of present generations and lead to a higher accumulation of wealth for future generations.

   b. Increased wealth will help future generations coping with global warming problems.

3. Under the assumption of increasing greenhouse gas levels, the future emission of one ton of CO_2 sequestered today will cause a lower marginal damage than it does today (Chomitz 2000). This argument however is misleading, if the rate of change by the time these emissions occur is higher than the actual one.

The permanence risk is further mitigated by two considerations. Overall, a higher percentage of land-use mitigation measures will remain permanent than without the carbon subsidy (Marland et al. 2001). In developing countries, a future increase in wages and intensified agricultural technologies will lead to a reduction of marginal farming over time. In 30 years time, there will thus be less incentives for deforesting the areas protected or afforested today (Chomitz and Thomas 2001). It is expected that in consequence of the declining dependence on primary resources, deforestation rates will fall over this century.

4 Conclusion: criteria for forestry incentive mechanisms

Sink conservation and enhancement is not at odds with the Climate Convention, but an integral part of it, as evidenced in Articles 3.3, 4.1 (d) and 7.1 (d). Nevertheless, it is no catch-all solution. Forest climate activities are marked by two types of trade-off. The mitigation trade-off is characterized by the risk that forestry mitigation measures may help deferring GHG emission reduction in industry, transport and household. Therefore, for future commitment periods, emission targets should only be agreed *after* the activities eligible for compliance with these targets have been stipulated. An alternative could be to fix separate targets for credits from land use activities within the Parties' country budgets (Graßl et al. 2003). The aim should be to keep incentives for technological development high without disregarding the high mitigation, adaptation and sustainable development contribution of land use to the ultimate objective of the Climate Convention. There is an adaptation trade-off in the sense that a failure to reduce GHG by sources will result in high mortality of any biotic systems, including forests. On the other hand, increased forestation is likely to increase the resilience of human systems against global change, thereby increasing the tolerable temperature increase. In this respect, they acquire a double time value: Besides delaying climate change, they delay effects of vulnerability.

Preference should be given to measures that avoid deforestation, degradation, and loss of soil fertility. Minimum project duration for afforestation should ensure that initial losses of soil carbon if they occur are over-compensated in a later project stage. Beyond this minimum duration, there should be ways to account for temporary carbon storage. Any regulation needs to make accounting systems compatible to Annex B and to foresee a transition from CDM to domestic host country accounting, respectively Joint Implementation between Annex B Parties.

Contrarily to the critiques, there is no conceivable over-use of sink potentials. Assuming growth conditions and soil quality to be constant over time, there may be benefits of eventually delaying afforestation and reforestation until late this century. Afforestation is most efficient as a complementary measure to conservation, and in situations where no alternative land use is able to protect soils or water resources. Competition with other land uses will lead to opportunity cost increases of sinks at the margin, so that market forces will limit unsustainable afforestation. Under an inter-generational equity point of view, forested lands constitute an exploitable renewable resource, as distinct from geological or marine CO_2 storage.

Compared to environmental services that act on a regional scale, such like watershed conservation, GHG removal or emission avoidance compensation is a relatively simple mechanism. The global benefit is uniform (CO_2 equivalent), verifiable and tradable, there is one central institution (the CDM Executive Board), a host country reference institution (the Designated National Entity), and there are internationally renown certification agencies (Designated Operational Entities). There is a need for a good storyline in the absence of the planned activity (the Baseline), and a reliable monitoring plan. For other positive project externalities, it is in many cases difficult to find appropriate beneficiaries (willing or able to pay) or to quantitatively define the service. In many cases, the consumers of these values are not even born today (Andersson 1997). There exist market mechanism on regional or national scales (Nasi et al. 2002), but it is hard to imagine that rules for an international market based compensation scheme could be found, nonetheless because developing countries insist in defining sustainability for themselves. It seems thus rational to co-finance land use activities with high adaptation value from separate funding schemes, for which there should be an explicit exemption from the Marrakech rule over non-diversion of Official Development Assistance (Dutschke and Michaelowa 2004[8]). Combined mitigation and adaptation activities should be exempt from the adaptation levy, as they contribute to adaptation themselves. Carbon accounting should be differentiated according to the activity’s contribution to adaptation, as expressed in the above ranking. Time preference can be expressed in a discount rate. As a practical example, a replacement for losses occurred on the area could be discounted for the time emissions were avoided.

For conservation, a supportive political environment is key, as there is a high leakage risk in the absence of administrative control. Logging companies bought out of one

[8] See pp. 115ff

area will take up concessions in other places. Conservation should thus be carried out at least in a regional (Fearnside 2001), or better, a national framework. Costa Rica offers a living example how conservation can be integrated into a national regulatory structure (Dutschke and Michaelowa 2000; Vöhringer, 2004). Government support is indispensable for conservation measures; in many cases, it seems sensible for governments to seek for CDM funding to implement planned national parks. As the establishment of national parks by law increases chances for permanence, policies and measures for conservation should thus be eligible under the CDM. Conservation promises high carbon rewards in the beginning and longterm climatic benefits. The flipside of the coin is that conservation once achieved will become part of the baseline when the project baseline is reviewed, and not even temporary crediting will allow the trick to be repeated. This calls for the seller to take over long-term liability or an international financial mechanism that helps in securing protected forests.

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Chapter II

Fractions of Permanence – Squaring the Cycle of Sink Carbon Accounting[1]

Abstract

As vegetation is an unstable, dynamic system, emission credits generated by carbon (C) sink projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol suffer from an inherent permanence risk. There are basically two approaches on how to balance greenhouse gas (GHG) emissions against C uptake in vegetation. The merit of the so-called 'ton-year approach' is to destroy the fiction of infinity when talking about permanent sequestration. The merit of the temporary credits is to destroy the fiction of comparability between technological emission reduction and sequestration in natural systems. This chapter discusses the pros and cons of both approaches, which have been brought forward as more or less unrelated alternatives. By making use of both methodologies and providing a link between both proposals on permanence in CDM forestry, the chapter puts forward the proposal of leasing reduction certificates.

1 Introduction

The inclusion of forests as carbon (C) sink in the Clean Development Mechanism (CDM) is one of the most contentious issues in the ongoing negotiations around the Kyoto Protocol (Fearnside 2002). Although some of the conclusions of this chapter may hold true for Annex B countries (the developed country parties) as well, it will focus on the most specific problem for CDM forestry – the issue of permanence. For many environmentalists, conserving or increasing C stocks in biomass are very uncertain measures to combat climate change. They claim that forest conservation and afforestation or reforestation (A&R) can only offset GHG emissions from fossil fuel burning if the near infinite existence of forests can be assured (Cullet and Kameri-Mbote 1998). Many developing countries, on the other hand, fear that these lands could become a permanent liability unduly putting use restrictions on large portions of their territory – the so-called 'Kyoto lands', once used to offset industrialized countries' GHG emissions. Thus, the permanence of C sequestered in forests is a concept that is difficult to achieve and may result in inequity. On the other hand, neither environmentalists nor development specialists deny the potential contribution of forests to sustainable development, as these can create income to local populations, preserve watersheds, prevent erosion, smoothen local temperature patterns, and – last not least – contribute to mitigation of and adaptation to global warming.

Several proposals have been made to solve the permanence dilemma (Fearnside 2002; Marland and Sedjo 2001). The chapter covers two basic proposals, one that

[1] First published in Mitigation and Adaptation Strategies for Global Change 7: 381–402, 2002.

tries to operationalize the timeframe of permanence (*ton-years* accounting), another one that limits the timeframe of GHG credit validity (*temporary CERs*) and a third option – the *leasing approach* – that intents to combine the advantages of both. The respective consequences on C accounting will be discussed regarding the CDM's dual aim defined in Article 12 of the UNFCCC Kyoto Protocol; environmental integrity and sustainable development of the host country. The use of wood as a renewable energy resource or as charcoal for steel production is not a contentious issue as related to permanence and is therefore not considered in this chapter.

2 The long-term requirement for CDM forestry

In the wording of the Kyoto Protocol's Article 12, emission reductions from CDM projects 'shall be certified on the basis of real, measurable and long-term benefits to the mitigation of climate change'. From a scientific point of view and under the long-term requirement of the CDM, a C sink should ideally exist over the same period that the emission offset by a particular project needs to decay in the atmosphere. However, due to the bundling of six different types of greenhouse gases (GHG) in the Kyoto Protocol, there is an extremely high variation of decay times, between twelve years for methane, up to several thousands of years in the case of perfluorocarbons. Thus, the long-term requirement of the CDM could imply near eternity of CDM forests.

Less than eternity could be sufficient, if we approach the long-term issue from a political point of view. Forestry activities will have an effect on climate change if GHG emissions are reduced or C is sequestered over a period of time, while alternative emission abatement strategies are developed and become widespread. Structural change in the host countries could mean that the last natural forests have only to be protected over a specific time span, until the country has adopted sustainable forestry practices by itself. In this sense, the long-term requirement is defined by the expectation that structural changes in the world economy and technology will be achieved through climate related or other policies at some point in the future. Given enough political pressure, de-carbonizing the leading world economies could take as little as 50 years.

The rationale behind thinking about temporary emission reduction is the assumption that there is a value in postponing emissions (Chomitz 1998). This value has five main aspects:

1. A slower pace in temperature increase would allow biotic systems to adapt which would be impossible under very rapid global warming. Successful adaptation is consistent with Article 2 of the Climate

Convention. The time needed for adaptation however depends on geological and biological assumptions. Given the high uncertainty over the speeds of climate change and adaptation of natural systems, it is difficult to estimate universally valid thresholds.

2. The decay in the global warming contribution of every single unit of CO_2 is quantifiable in principle. Temporary compensation will at a certain point in time have offset the initial warming pulse.
3. A slower increase of the damage level lowers the present value of costs. This depends on the assumption of a positive discount rate for future damages. This discount rate is based on one or more of the following assumptions that are closely related to each other:
   a. Future generations will be able to cope more easily with global warming problems due to higher wealth.
   b. As in other economic issues, there is a simple economic time preference for the delay of costs and the near-term realization of incomes that results from expected future interest rates.
4. Under the assumption of increasing GHG levels, the future emission of one unit of CO_2 sequestered today will cause a lower marginal damage than it does today (Chomitz 2000).
5. Costs of abatement technologies will be lower in the future, meaning that abatement now is more expensive. However, to initiate the development of new technologies, state action is necessary – the cost savings do not fall from the sky. Moreover, the time lag between the development of low-emitting technologies and their widespread application has to be bridged.

For any single project, it is virtually impossible to guarantee permanence. This is so, because infinity cannot economically be dealt with and, in a strict sense, any sink can turn out to be no longer 'additional over all times' (Meinshausen and Hare 2000) and retroactively lose credits. This latter risk is external to the project.

On the other side, the permanence risk is mitigated by two considerations. Overall, a higher percentage of UNFCCC Kyoto Protocol A&R measures will remain permanent and additional over time than without the C subsidies (Marland et al. 2001). In developing countries, a future increase in wages and intensified agricultural technologies will lead to a reduction of marginal farming over time. In 30 years time, there will thus be less incentives for deforesting the areas protected or afforested today (Chomitz and Thomas 2001). How big they will ultimately be, depends on the design of the mechanism and of the time scope. Therefore they are difficult to factor in any model, but it would be unfair to completely neglect them.

3 The concerns of developing countries

At Kyoto, developing countries did not commit to specific emissions reductions. However, they offered to participate in joint mitigation activities if these served their development needs, and if the funding of these activities was new and additional, over and above the normal development aid package.

Some developing countries have expressed fears that the CDM was a form of carbon colonialism (Cullet and Kameri-Mbote 1998) that was destined to hinder their economic development. This point of view is partly based on the perception that deforestation equals economic development, which, in fact, was a successful development pattern in the case of most of today's industrialized European countries. However, it would be worth studying the impoverishment subsequent to periods of deforestation in cases like Spain, where deforestation led to serious droughts and rural famine. Norway, on the other hand, offers an example how to make self-sustaining forestry the basis of successful industrialization. The other part of the idea of carbon colonialism is a systemic problem: The existence of areas permanently protected against any future land use change will conflict with territorial sovereignty, a fact that is hard to deny, even if there is no near-term intention to actually change the use of these lands.

There is the problem of differing timeframes and changing development needs. While the planning period of governments usually does not exceed ten years, CDM forestry projects operate on a significantly longer time scale. If the long-term requirement is taken seriously, the project liability extends over 50 to 100 years after the project itself has ended. Compared to the liability arising from nuclear energy (e.g. nuclear waste disposal), this is a short span of time. Still, 50 years or any other reasonable minimum period to achieve structural change is seen by many developing countries as an impediment to their national sovereignty. It overrides by far any political and economic planning horizon in most countries, be they industrialized or developing. Moreover, what seems good business today may turn out to be a rip-off in the future, depending on the speed of structural change and the subsequent demand for emission reduction credits in Annex B countries, or future land use alternatives. For example, opportunity costs of forests can rise substantially if beef prices – actually the dominant alternative use on cleared tropical lands – rise, or mineral resources are discovered on the area. Political preferences in developing countries may rapidly change, and long-term commitments might be felt to be unfair. Admittedly, the sovereignty concern is often uttered as a rhetoric formula in pursue of vested interests. Foreign direct investment always entails a limitation to future governmental decision-making. It should be noted at this point, that there is interest in limiting the liability resulting from climate projects.

Other arguments indicate that the current refusal of developing countries to accept binding commitments might vanish in the long run. The fear is that, once a host country accepts its first emissions target, the low-cost opportunities will have been used to offset industrialized countries' emissions in the past and, what is worse, in the case of land use projects, still visibly remain as a permanent liability within the country. On the other hand, a move of developing countries into the system of emissions control would solve the problem of permanence immediately, as CDM forests would turn to joint implementation (JI), and after the end of their crediting period would be accounted against national emission targets. The problem would then become of purely contractual nature between the investor and the host country on how to allocate the long-term responsibility.

As a safeguard against host country fears, the CDM is strictly based on voluntary participation (Wiener 1999). No country is obliged to host any CDM projects if it feels these are against its national benefit. Up to the present, there is no limit to any government's freedom to withdraw its agreement to climate projects, thereby putting at risk any CDM investment. In order to solve this dilemma, individual CDM contracts might include a governmental warranty, or a periodical revision of the credit sharing clauses (Dutschke and Michaelowa 1998a).

In the run-up to the Marrakech Conference, land use, land use change and forestry (LULUCF) have often been perceived as a 'loophole' for cheap fulfillment of emission reduction obligations. Many environmental NGOs, the Group of 77 and China, and the European Union condemned LULUCF projects for not contributing to the North-South transfer of know-how, occupying large areas and contributing to deforestation. It is undeniable that large G77 countries like China and India with their high-emitting energy production patterns saw good chances to profit from the CDM if it was restricted to energy-related projects, while if land use was allowed they would have more competitors. The EU, as an industry and energy technology provider, has also little material interest in the development of land-based mitigation options. The non-Annex B countries interested in LULUCF can be grouped in two main fractions; countries with a low-emitting energy production, like most of the Latin American countries, and countries whose energy consumption is so low they offer virtually no potential for energy-related emission reduction projects. Most of the African nations belong to the latter category. Permanence in the sense of infinity of C sequestration impossible to achieve in practice, and it will conflict with the sovereignty of the host country, as long as it does not yet belong to Annex B.

4 Approaches for permanence of CDM forests

In theory, C reduction or sequestration projects used for mitigation of climate change will only temporarily outweigh GHG emissions from fossil fuels. Fire, pests, harvesting, or even the effects of climate change itself can remove C fixed in vegetation at any given time in the future. According to a recent study (Hadley Centre 2000), the current sinks in forests could turn to sources of GHGs at the end of this century in response to an increased global mean surface temperature. This would lead to accelerated climate change with an overall temperature increase of between 6 to 8 ◦C. Anyway, CDM projects need to be designed in a way they can in future be sustained with or without C credits.

Disregarding permanence leads to unfair competition against permanent technical GHG reduction and conflicts with the environmental integrity of Annex B targets. Taking permanence as ‘near eternity’ means that no value is attached to time (Fearnside 2002), which is unfair as well. It would lead to near infinite monitoring and enforcement costs and therefore turn out to be completely impossible. Solutions to the permanence dilemma were brought forward in two directions: one is an exact definition of the time-span; the other extreme is a limitation of responsibility (Watson et al. 2000). The third one is a combination of both. The following will elaborate on these different approaches on permanence.

4.1 Ton-year accounting

The so-called ton-year approach (Moura-Costa and Wilson 2000) offers a simple accounting solution to the problem of permanence. It is essentially a scheme for the sale of fractions of a long-term project. The authors define an ‘equivalence time’, after which the global warming impact triggered by the emission of one ton of CO_2 over 100 years is leveled out by sequestration, independently from the future release of the C stocks sequestered. This equivalence time is calculated to be 55 years, while other authors propose 100 years (Watson et al. 2000). The choice of the timeframe cannot be purely based on scientific evidence, but is rather a political choice, comparable to the choice of the time horizon for the global warming potentials used to compare the different greenhouse gases under the Kyoto Protocol (Fearnside 2002). What is important however is that the equivalence time is a finite number of years.

This equivalence time can be used for several purposes. It could either help determine the project end for *ex-post* crediting, or the average storage timeframe, for calculating annual fractions of C permanently removed, or, consequently calculating the remaining sequestration liabilities after an eventual project failure before the end of the equivalence time. Acknowledging that the decay time of the contribution to global warming of a CO_2 pulse in the atmosphere is a non-linear process, which is rapid in the beginning and slows down asymptotically towards the end, Moura and Wilson propose dividing these 55 years in linear fractions. This procedure does not conflict with environmental integrity, because it understates the effect in the beginning. After half of the equivalence time, half of the first year's credits are accounted as permanent. This scheme provides greatest flexibility for forestry project developers and host countries. It allows contracts of practically any duration with equivalence being achieved through increasing the average amount of C fixed or, alternatively, the area of protected or afforested land.

Basically there is no difference between ton-year accounting and any other type of 'guaranteed duration of storage (GDOS)' approach (Schlamadinger et al. 2002). In both cases, a common timeframe needs to be agreed upon after which the overall effects of temporary C storage are either considered to be equivalent to the permanent removal of the removal, or after which the host countries will be integrated in a climate regime with common inventory and reporting obligations.

4.2 Temporary CERs

Many developing countries have urged to limit the liability duration of land use projects and to share the liability for CDM contracts between Annex B and Non Annex B-countries. They insist, alongside many project developers, that long-term projects do not necessarily require long-term contracts. Lasting efforts can also be achieved through a series of renewed short-term contracts.

The proposal brought forward by the Colombian delegation to the Sixth Conference of the Parties to the Climate Convention (Blanco and Forner 2000, UNFCCC 2000) is based on the worst-case scenario of any forest project, which is the reversal of all the mitigation achieved after a certain period. Taking this case as a rule, the *expiring CERs* model consists in limiting the lifetime of the credits to the rental contract period, after which the liability to offset its own emissions falls back to the buyer. Expiring or *temporary* CERs (T-CERs) will be a yet another type of emission permits. Differently to permanent CERs resulting from energy related projects, expiring credits have only a limited validity from the outset. Virtually each ton of C stored in organic matter has a different lifetime, depending on monitoring and certification intervals. The length of the credit validity is determined by the distance between the time of certification and the project's end, e.g. the credits certified for the last year of the project cycle are only valid for one year and will consequently suffer high depreciation. These credits could, for instance, help the investing company to reduce its emissions over one particular budget period. After the end of the credit validity, the investor has the choice either to renew the contract or to offset emissions by reductions achieved elsewhere. If after the contract's start the C pool is lost, T-CERs remain valid until credit expiration. After credit expiration, the land is free of any liability, meaning that the C stocks could be removed, the project extended, while producing new T-CERs, or a new CDM project could take place on the same area (UNFCCC 2000). The latter option however seems extremely unlikely, given the discussions about eligible project types, additionality and baselines. As in the case of ton-year accounting, this proposal results in an increased flexibility for project developer and the host country government. Blanco and Forner (2000) go one step further by allowing the transferal of T-CERs from the date of certification to the future. While the authors do not explain the usefulness of T-CER banking, it would turn bookkeeping extremely complicated.

In a discussion paper by Marland et al. (2001), the Colombian Proposal has been reformulated as ‘renting carbon’. The authors compare the temporary transfer of CERs to the simple rental of a garage, and thus leave contract and project duration up to the market. This might solve the legal problem of creating a new type of credits, because rental is but a contractual variation of CER sale and does not require approval by the UNFCCC Conference of the Parties. The liability during the rental period would rest with the host country, though it could eventually be transferred to an insurance company. The authors are however not explicit over the legal consequences of their model. One is that renting would start as soon as the respective sequestration level is reached for the first time and be continued as long as it is maintained. The other is that ownership remains with the host country.

An EU submission to SBSTA 17 (UNFCCC 2002a) has picked up on the Colombian Proposal. It supports the Colombian Proposal, adding a standard validity of five years for T-CERs, in order not to complicate accounting within a budget period and to limit the risk of project reversal during credit validity. This in turn means that short-term stock variations cannot be accounted for, which cuts off the upper peaks of the growth curve and makes the curve more similar to average accounting. On expiration of the T-CERs, the investor can choose to replace them either with permanent emission allowances or with new temporary credits. Afterwards, they can be re-issued, if the project is still in place. For the purpose of distinction, we shall in the following denominate the EU proposal ‘T-CER5’. Nevertheless, the EU proposal lacks clarity in some vital points. It states that ”credits will be valid for use in helping to meet commitments for the current commitment period only, because they will have expired by the time the following five year commitment period comes to an end”. It is hard to follow the semantics of this sentence, as it only applies to Parties as a whole. They do not need to care about credits that expire before the end of the commitment period, while investors certainly do. Projects that start before the first commitment period will only create T-CERs in 2008 or later, because otherwise they would expire prematurely. If a new verification shows that there was no reversal, T-CERs can be re-issued. This can be done annually for each T-CER age class.

The initial Colombian Proposal was modified in Colombia's submission to SBSTA 17 (UNFCCC 2002a). Under the modified Colombian proposal, by the time sequestration is first achieved and verified, a certificate is issued over the amount of carbon stored, but with a zero lifetime. Its usefulness depends on the time between issuance and first use. Meanwhile monitoring and verification needs to continue at least until the credit is *retired,* i.e. used for temporary compliance. The modified Colombian T-CER model relies strictly on *ex-post* verification. Supposing the T-CER was first issued in 2005 and used for compliance in the period 2010 to 1015, the area is liberated from any liability from 2010 onwards. It might then be deforested or even be used again for C sequestration purposes, depending on the rules and modalities to be decided by the Conference of the Parties. As the risks occur *before* the credits are granted, an insurance against the loss of stocks during the time of the credits' use is not required. Probably, there will be hybrid forms of futures trading combined with risk sharing between project developer and investor. Anyway, there is a trade-off between increasing the crediting period and realizing the benefits earlier. Under developing country conditions, the tendency will be to go for short validity periods, in order to cover the front-loaded costs of forestry. The new Colombian submission further contains the formula 'Each Annex B Party can retire CERs resulting from A&R project activities whose capture duration or sequestration period is at least 5 years'. It remains unclear, if this clause reduces the creditable sequestration to the one that remains constant over at least five years, as a tribute to the EU model, or if it relates to the overall project lifetime, in response to the criticism that the T-CER approach may set incentives for unsustainably managed short-term projects (Dutschke 2001). The first interpretation would, likewise T-CER5, drastically reduce the attractiveness of plantation projects under the CDM.

4.3 Leasing carbon

The merit of the ton-year approach is to destroy the fiction of eternity when talking about permanent sequestration, while its pure application offers little economic return, because the bulk of the credits will accrue at the end of the equivalence period. The merit of T-CER proposals is to destroy the fiction of comparability between technological emission reduction and sequestration in natural systems, while disregarding the environmental value of time. Yet, both approaches appear as more or less unrelated alternatives. While the ton-year approach does not reward the project's existence after the end of the equivalence period, the T-CER approach does not attach any value to time. The *leasing* approach proposed here is to draw a link between both accounting methods.

If market based instruments shall play a role in fulfilling the ultimate goal of the Climate Convention, and if there is a measurable value in deferring CO_2 emissions, the useful economic lifecycle of C sinks needs to be defined. This does not in any way say they cannot exist for several decades or even centuries.

The leasing approach is based on temporary CERs, but acknowledges the value of time. As any other asset, the leased C sequestration suffers from (linear) depreciation over the equivalence period. Taking the 55 years equivalence period as a reference, the first year's C vintage will be linearly devaluated until 55 years are reached. Assuming a leasing period of five years, this amount can be leased for eleven subsequent periods, only that its value needs to be corrected year after year. After the end of the first five-year contract, for example, one ton of C sequestered in the first year will be worth 909 kilos.

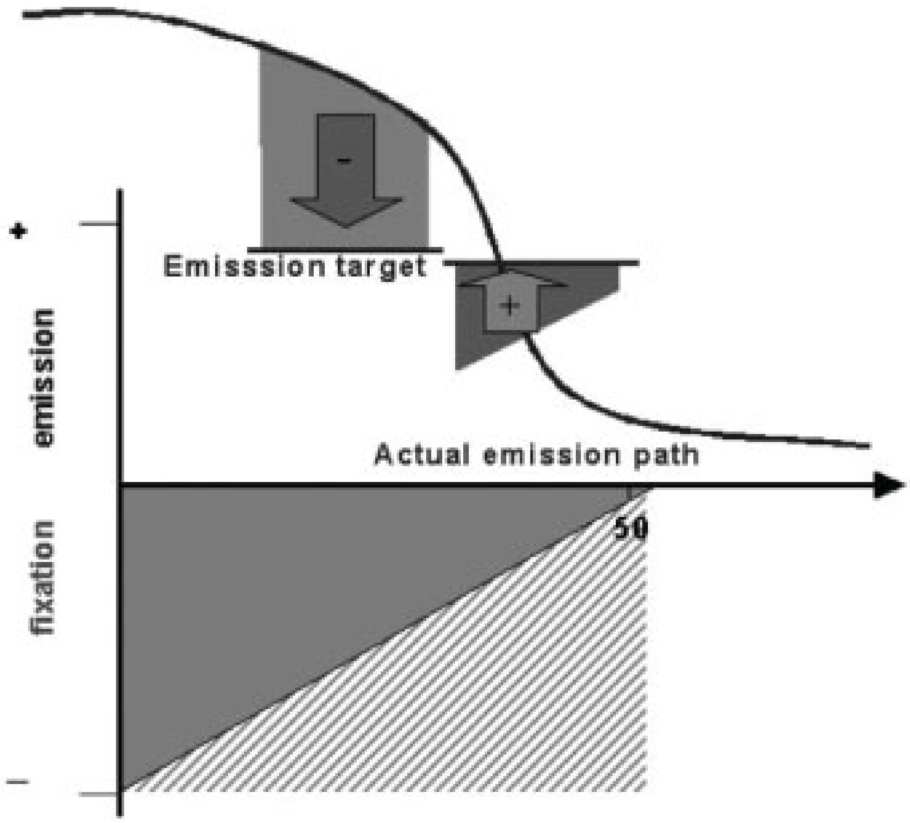
Leasing is different to both T-CER approaches in that the ownership of the credits is not transferred, but like in the 'renting C' approach, only temporarily granted to the investor. Ownership remains in the project host country, which over the leasing contract's duration is held responsible. Crediting starts as soon as stocks first reach the defined level. Therefore, compulsory insurance plays a prominent role under the leasing approach, in order to safeguard environmental integrity. This insurance could be part of and cover the duration of the leasing contract, provided under brokerage of an international institution like World Bank, Global Environmental Facility (GEF) or the CDM Executive Board. It covers three separate risks:

1. Standard forest insurance.
2. The risk of project discontinuation and subsequent release of the C sequestered during the respective contract period.
3. The risk of CO_2 release after the end of the equivalence period (optional).

Premia of standard forest and C insurance depend on regional factors and on the peculiarities of the project involved. Forest insurance premia usually do not surpass one percent per annum and can even be lower if precautionary measures are good or species are planted that are less susceptible to fire damages. As the C value is decreasing, the value relative to every ton leased is constant.

The third insurance is an option proposed to compensate an eventual global warming push caused beyond the 100-year timeframe, upon which the equivalence period is based. Fearnside (2002) proposes a value of 10 percent of the initial emission to be carried over as a compensation for uncertainty in intergenerational allocation. The equivalence of this sum in C could be set aside on the first lease or divided over the whole credit lifetime. It could constitute a kind of life insurance for the C after the end of liability. A similar approach has been made by Goldberg (2000), however with temporally undetermined liability. As the author himself points out, such an insurance is commercially not viable and would thus need to be an additional financial instrument under the UNFCCC. As in life insurance, a prime could be paid at the end of the project cycle to an escrow account that can only be accessed for financing re-plantation or the acquisition of new areas for the project's purpose. This prime honors the difference between releasing and holding back the sequestered in the future.

Figure 1: Working principle of the carbon leasing approach



Like in the case of renting C, leasing C will turn CDM host countries to legal subjects in emissions trading. For unilateral projects, this question will arise anyway. If the Kyoto Protocol Article 17 remained restricted to Annex B Parties, a gray area of Annex B based marketing agencies and funds would profit from non-Annex countries prohibition to sell emission credits by themselves. In the author's view, opening the market to non-Annex country Parties would be more efficient and could even motivate those Parties to take major stakes in the future. Obviously, only those Parties should be allowed to participate in emissions trading that have ratified the Kyoto Protocol.

4.4 Costing and pricing of CERs in the three approaches

Early land use projects in Costa Rica, Honduras and Bolivia indicated that their C price could be extremely low, thus crowding out many energy and technology related emission reduction options. It is however obvious that the referred accounting options have an influence on the price of CERs from sinks, which will definitively reduce this effect. According to Ellis (Ellis 2001), the credits' value would vary by more than a factor of 30. Which exactly is the discount as compared to 'permanent' credits, depends on the frequency of measurement and certification and on the accounting method chosen (Moura-Costa 2001).

Table I summarizes the potential of a hypothetical afforestation project over 25 years, under the assumption of crediting running over the whole lifetime. For simplicity, the stocks are assumed to grow by 100 t CO_2 annually. The first year's vintage will therefore last for another 24 years, the second for 23 years, etc. This potential can be expressed by multiplying the amount with the number of remaining years. The project's total potential is thus 30,000 t CO_2 for one year. Ton-year accounting would convert this amount to permanent credits by dividing it by the equivalence period of 55 years, resulting in 545,45 t CO_2. T-CER accounting would rent 6,000 t CO_2 in fractions of 5-year contracts. Due to its equivalence period driven depreciation factor, out of the theoretical potential of 30,000 t CO_2 leasing would market 25,818 t CO_2.

Table 1: Annual carbon sequestration and total potential over lifetime of a hypothetical CDM project

Year	Amount of CERs [t CO_2]	Validity period	Potential [t CO_2 p.a.]
1	100	24	2,400
2	100	23	2,300
3	100	22	2,200
...			
22	100	3	300
23	100	2	200
24	100	1	100
Total	**2,400**		**30,000**

While credits from ton-year accounting are free of any liability, their production costs are extremely high. In the case of a 55-years equivalence period, 55 tons of C need to be fixed annually to produce only one ton of 'permanent' C. T-CERs are more guided by short-term price expectations, e.g. from one commitment period to another. As long as the timeframe of re-rental remains undetermined, their total lifetime value is unforeseeable. The total value of C leased is identical to the one of ton-year accounting, only that it accrues earlier. Under this aspect, C leasing is just a modification of ton-year accounting, while its organization is more similar to the one of T-CERs, so that the proceeds come closer to the project start. Assuming a constant discount rate however, the length of the equivalence period makes little difference in the leasing case. This is so, because the slower depreciation is going on, the longer the CERs can be re-leased.

On the transaction cost side, renting or leasing credits over various periods instead of permanently buying them may lead to a slight increase in contracting costs. Moreover, monitoring and verification, as well as baseline revisions, will need to occur over all the contract duration, which adds to the contract costs. In order to minimize those costs, leasing and insurance contracts could be standardized by the host country's focal point or the CDM's Executive Board.

The valuation of any type of T-CERs depends critically on the length of the credit rental or leasing period. Assuming a contract period between 50 and 100 years, willingness to pay for a long-term contract will be nearly as high as for permanent CERs. The crediting period valid stipulated for non-sink CERs of 10 or three times seven years (2001b) is not suitable as a determination for the contract period. Besides contradicting the long-term intention of UNFCCC Kyoto Protocol Article 12, it would drive T-CER prices so low that little or no additional A&R projects would be feasible. As a practical solution to this dilemma, the generation of credits could be limited, e.g. to 21 years or more, while project participants could choose the most appropriate contract period.

4.5 Carbon verification options

After comparing the three main accounting methodologies, we shall define as C verification options, how those credits are being produced. Basically, there are two ways of regarding C pools, which do not directly depend on the accounting method, so that a matrix of six different cases of verifying and accounting for CERs is available.

The first verification option is the average storage (AS) approach (Phillips et al. 2001). Credits will be given up to the average C storage. This long-time average however depends on the timeframe (Moura-Costa 2001). Any timeframe shorter than the first rotation cycle may be fraudulent, because it does not take into consideration the C loss at the moment of harvesting. A very long timeframe will lead to the existence of 'untouchable' UNFCCC Kyoto Protocol forests, bringing with it problems of enforcement and sovereignty. In any case, the timeframe would need to be standardized by UNFCCC regulations. If, for instance, this timeframe was 100 years, meaning that the line is drawn on the basis of the average C stocks over one century, after 20 years one fifth of this average can be taken as granted, independently from the potential future land use. Economical viability depends on the existence of risk sharing clauses between seller and buyer and on the duration of the timeframe. What then is the age of each ton of C? The author would propose, age counts from the moment the C stock reaches the average level for the first time. Nevertheless, if T-CERs are to be produced, it could make sense to adapt the timeframe to the length of one rotation period or to the one of the overall project lifetime. If the average value turns out to be equal or higher the measured average, the whole amount of credits will remain stable over time. This option has been proposed in a submission by EcoSecurities (2002), but not explored in literature.

The other verification option is the stock-change (SC) method (Moura-Costa 2001). Credits are allocated according to the annual growth progress of the trees. Theoretically, SC is a zero-sum game, and the average growth line is flatter the longer it lasts. Thus, credits help finance plantations closer to the high-cost implementation phase and CERs are repaid when the timber is going to the market. Let alone the growth in soil C stocks, the C credit rotates, as does the plantation. The first advantage of the SC option is obvious: It produces much more credits during the life of a forest operation. As no time horizon is determined, this option is most suited to the T-CER and the leasing approaches. Nevertheless, if C stock peaks are discounted according to their existence in time, also the ton-year approach could take advantage of them. In all cases, there is a trade-off between monitoring and certification frequency on the one hand, and the profitability of C stock peaks. The longer renting or leasing contracts last, the higher they aggregate past uptake, the more SC resembles AS. The second advantage of SC is that crediting is verified when the respective sequestration level is reached, while the average amount used in the AS option is a hypothetical value that might need to be corrected downwards at a later stage. On the other hand, the more a plantation achieves a sustainable yield cycle, the more concrete is the value of the hypothetical AS, in the way that removals and additions are balanced over time. SC is most appropriate for restoration projects without harvesting. Observing a certain security margin to provide for the later loss of pioneer species, the carbon balance will stabilize over time. Therefore, AS and SC could be allowed optionally, according to the properties of the particular project modality (Schlamadinger et al. 2002).

5 Discussion

After UNFCCC SBSTA 17, twelve Parties submitted views on rules and modalities for sinks under the CDM (UNFCCC 2002a, UNFCCC 2002b). On permanence, the vast majority preferred a TCER model, some combined with insurance and risk mitigation, while according to the European Union (EU) position insurance is not of need, as failure will be detected after five years at the utmost. The ton-year approach is not reflected in the submissions.

The three accounting methods, each of which, as we saw, embraces a variety of subcategories, will be discussed in respect to the specific risk scenarios of CDM forestry projects. In a first step, we explore these different scenarios.

5.1 Risks

Permanence of A&R projects is threatened under the following conditions:

(a) Drought, fire or pest destroys the afforestation during the project phase.

(b) Calamities destroy the afforestation after the project ended.

(c) The plantation does not live up to the expectations, and average yields are lower than calculated.

(d) After the first harvest, the project owner discontinues the operation.

(e) The plantation is sustained beyond the project phase, however afforestation has become a widespread land use option in the area.

It is noteworthy that these risks for the Kyoto Protocol's environmental integrity only apply for host countries *without* an emission target. Considering the timeframe of most forestry projects, it is highly probable that some of the host countries in question may have accessed Annex B by the end of the project period and from that particular point in time onwards need to provide compensation for emissions caused by human induced vegetation losses. Different accounting methodologies will be examined to see, how they react towards the different risks.

Table 2: Opinions of UNFCCC Parties on permanence (SBSTA 17)

	TCER	TCER5	Insurance	Crediting period	Average Storage or Stock Change	Other proposals
Bolivia	Yes			4 × 7 years		Permanence < 100 years
Canada			Yes			
Chile	Yes			50 years or longer	AS	
China		Yes		10 years		
Colombia	Yes					Cancellation not with TCERs
Costa	Yes					
EU		Yes	No			
Japan				Longer		No delayed crediting
Malaysia	Yes		Yes			
Mexico						

	TCER	TCER5	Insurance	Crediting period	Average Storage or Stock Change	Other proposals
Norway			Longer	AS		
Uruguay	Yes		Yes	Up to 50 years or longer		

5.2 Problems with the ton-year approach

It has been argued the ton-year approach was illegitimate as compared to technical emission avoidance. As the latter would lead to emission reductions, which did not decay over time, it would reap a net climate benefit over carbon sinks (Kerr and Leining 2000). This is however illogical, because the ton avoided would decay in the atmosphere as well in case it had been emitted, while forests are part of the system responsible for the decay of CO_2. As long as a forest exists, it permanently keeps C out of the atmosphere. C fixed in vegetation or soils does not decay as long as the vegetation cover is preserved. For a forest that still exists after the equivalence period, ton-year accounting therefore effectively understates the reduction effect. The difference still lies in the point of definitive emission when the forest that created emission rights is removed. In that case, the reduction was superior, provided it did not lead to a prolongation of fossil fuel use. The hope attached to technical emission reductions is that the fossil fuels that were saved will not be used in the future, i.e., structural change will come before the last coal mines and petrol wells are exhausted. The expectation attached to forest projects is that over time structural change leads to a valorization of the existing forests, be they natural or planted, thus avoiding their future loss. There is uncertainty in both approaches.

The ton-year approach's advantage is that it operationalizes a period of time too long to be framed in public and private contracts. As it arbitrarily cuts off the CO_2 decay after 100 years, a real compensation for e.g. 150 or 200 years might take some years longer. The Conference of the Parties to the Climate Convention will need to define a conservative equivalence factor and the resulting equivalence period, in order to facilitate ton-year accounting. The objection that any such definition would be arbitrary is not a valid argument against this definition, because under the conditions of scientific uncertainty and diverging political interests, international diplomacy always needs to find pragmatic solutions that imply a certain level of arbitrariness. The author proposes however, to limit the use of sinks to compensation of emissions with a decay period equal or shorter to CO_2, rather than allowing the compensation of long-lived trace gases on the basis of the decay curve for CO_2.

Following the Costa-Wilson approach and assuming 55 years as equivalent period, there is no difference between sequestering 100 tons of C over 55 years and 1,000 tons of C over 5.5 years. And conserving 5,500 tons of organic C over one year?

Conservation is not eligible for the first commitment period, but may become available in the future. The short-term attitude towards protection obviously conflicts with the additionality criterion, because it is hard to prove that deforestation is really being delayed for this short span of time. Allowing for such a simplistic project design would pave the way for free riders. Minimum project duration of e.g. 15 years in forest protection and restoration could assure the project developers are serious about permanently protecting the area. This is not as much the problem for A&R projects, as these need a lot of seed capital and have longer economic payoff periods, and here even accounting for short-term sinks can make sense, as it would facilitate credit rotation. The problem in tree plantations might be unsustainable land use over the first turnover periods, thus fixing high quantities of C, but depleting the soils and over-using water resources. The subsequent loss in land cover might occur only after the end of the CDM contract and thus not be monitored any more. The certification process will therefore need to take special care for sustainable land use practices. Ideally, the lifetime of A&R projects should cover at least the start of the second plantation cycle.

Cases (a) and (c) and (d) are problematic for AS, as C yields will have to be corrected downwards. Case (b) is considered neutralized by the accounting method. In case (e) above (retroactive denial of project additionality), ton-year accounting is the perfect match, because the value of the forestation's anticipation to the reference case can be measured. The uncertainty that remains with the tonyear approach is the adverse effect of a potential release of the C stored after the equivalence period (Meinshausen and Hare 2000). If the underlying assumptions of the ton-year approach are right, it should be compensated by then. However, there still is high uncertainty over atmospheric chemistry and the real decay factor of CO_2.

In comparison to JI sinks, ton-year accounting could be regarded as a privilege for CDM sinks (Greenpeace 2002). Why do the first need to be fully compensated by the host country when they are lost, while the latter are forgiven after a certain period? A pragmatic answer has to do with incentive structures. The CDM is destined to help committed countries in their compliance while subsidizing sustainable investment in developing countries. Over time, this subsidy can increase the global share of forestry activities, thus preserve C stocks and create a basis for successful adaptation to climate change. This overall effect will occur independently from the eventual failure of single A&R projects. Two features are however important, first that this subsidy is disbursed close to the point of highest negative cash-flow; and secondly that it does not burden the host country with future debits, in order to maintain the incentive for them to fully join the climate regime at a later stage. On the other hand, accounting procedures must not encourage shorthanded sink projects. A minimum project and monitoring lifetime needs to push the generation of the related benefits far into the 21^{st} century.

5.3 Problems with temporary CERs

Some problems may arise from T-CERs on the international level. Expiring credits require a more complex bookkeeping at the international registry, because they need to be notified at the moments of transfer, first use, and replacement. The demand, sustained by the European Union and other negotiation partners, to limit the use of flexible mechanisms, will be even more difficult to operationalize than it already is (Dutschke and Michaelowa 1998b). If a part of one party's emission reduction obligations is postponed due to the use of T-CERs, it is impossible to tell *ex ante* if they later on are replaced by domestic action.

Another unexpected problem in the T-CERs practice will be earmarking, at least if the SC verification is applied. Not only need the CERs a precise definition of precedence, but they depend as well on the existence of other parts of the stocks. Let's assume an annual growth of 100 t of C over a given area. After year 1, the first 100 t C were certified. They will be retired in year 6, with a validity of 5 years, until year 11. In year 2, another 100 t C are certified, being retired 5 years later, with a validity of 5 years, until year 12. The trouble starts in year 6, when the area whose first-year growth was certified in year one is theoretically free of liabilities, and the respective part of the C could theoretically be removed. So the second year's vintage of 100 t C depends on the fact that on the area there are at least 200 t C present. The third year's vintage will need to be defined to be the 100 t C over and above the 200 t C already present on the area, and so on.

In the negotiation language, the fulfillment of foregone obligations in a future budget period for countries was referred to as *borrowing*, which was explicitly excluded. Applying the Colombian approach could lead to *de facto* borrowing on the country level. This may conflict with paragraph 1(f) of draft decision -/CMP.1, para 1 (f) of decision 11/CP.7 (UNFCCC 2001a, p. 56) that stipulates, *'... that accounting for land use, land use change and forestry does not imply a transfer of commitments to a future commitment period'*. Depending on how this decision is interpreted, any kind of temporary crediting would be questionable.

There are serious drawbacks of T-CERs for ecological sustainability: Non-permanence of the related CERs could instigate project owners to use unsustainable forest management practices. Monitoring and verification then takes an important stake regarding watersheds and practice soil conservation in order not to leave desertified land behind after two or three harvests. The case is even worse for forest restoration and conservation, in case the latter was made eligible in future commitment periods, where the initial investment may be much lower than in the case of plantations. Temporary CERs could lead to temporary ‘protection’ of ‘parked’ land that is to be cleared in the future. If, for instance, an investment company buys land for the construction of an airfield, it might come up with renting C credits for its protection during the planning phase. In both cases, the T-CER protects the validity of the rented credits until expiration even though the underlying project has ceased to exist in the meantime (Kerr and Leining 2000).

An important flaw of T-CER5 is its inflexibility caused by the fixed crediting period. Not only does it not take account of the full C fixation potential of a given project, it may even lead to cheating. In rotations of fast-growing species, the last year’s sequestration could be verified, even knowing that it will be felled on the next day. To some extent, and given the intention to cheat, the same sequestration level could be verified at the end of credit validity, because the trees were felled and replanted in the meantime (EcoSecurities 2002). It may be wiser to set an upper validity limit, but leave the determination of an appropriate crediting period to the monitoring and verification plan to be validated by the certifier (DOE). The modified Colombian Proposal, where credits are certified *ex-post,* will not lead to very long validity periods, because there will be an equilibrium between credit validity and net present value for its future use.

Both T-CER approaches are not explicit over baseline renewal, which would be necessary in case (e)[2] above. Baseline revision is foreseen in the Marrakech Accords after 10 years, respectively 7 years, in which case the project can be revalidated twice (UNFCCC 2001b). If this rule was to be maintained for A&R projects as well, the baseline revision would not coincide with the stocks verification. Both periods need to be adapted one to the other.

It seems as if any type of T-CER was a minimal consensus even environmental NGOs could adhere to. This may be so, because it regards biological sinks as temporary by definition. Assuming general non-permanence for dynamic C stocks in vegetation is committing the same error to the other extreme as assuming them to be stable. T-CER approaches have no specific incentive structure that avoids short-term projects (Goldberg 2000).

There is the question of how to transfer temporary credits into a national inventory, in case the host country Party decides to join the Annex B at any point in the future. Theoretically, from this moment onward, the permanence problem ceases to exist, because any future removals needed to be accounted against the host country’s assigned amounts. Consequently, the lucky Annex B investor can keep his or her

[2] The plantation is sustained beyond the project phase, however afforestation has become a widespread land use option in the area

share, because the project has turned from CDM to JI. Conceivably the host country partner will want to renegotiate the deal in this case.

The Colombian Proposal only implicitly addresses the subject of ownership. While credit ownership presumably lies with the investor (as different to the classical understanding of renting), the liability for case (a)[3] is with the project owner. The initial Colombian and the EU proposal allows even a liability break during the total contract duration of five years. In the author's view, insurance should be compulsory during this period. In case of the premature loss of C fixation, the insurance would need to provide temporary credits whose value expressed in 'tons times remaining validity period' equals the losses.

Given its supplementarity concerns, the EU approximation to T-CERs is astonishing. If T-CERs can be replaced by (re-issued) T-CERs, renting C credits will over time create high debits for past emissions on the national level. It is unclear how the share of domestic abatement can be calculated in any future commitment period, if there are considerable 'sink hangovers' from earlier periods. Compliance risks from bankruptcy can become quite important.

If C sequestration projects are allowed to create a near-infinite stream of income, their long-term market value is a direct function of their lifetime. As the IPCC Special Report on LULUCF states, a common definition on project timeframe and liability is needed (Watson et al. 2000).

5.4 Problems with sink carbon leasing

The creation of a new type of CERs, as criticized in the T-CER case, can be avoided, if the leasing conditions are integrated in the certification process. It would thus be more practicable to only certify an average credit value between start and end of the leasing period every time the contract is renewed and the project verified. The international registry would thus not be burdened with the annual credit discounting.

The leasing approach takes the economic advantage of *ex-ante* crediting, i.e. the emission right depends on the continuity of the C stocks. It could be argued that T-CER is a simpler proposal as it does not need any insurance during the contract duration. This is only true on the first glance. In reality, the same continuity risks apply under the Colombian Proposal *before* the T-CER is retired and is thus left to the project owner.

The earmarking problem, which exists as well in the leasing model can be addressed by adapting the contract length of each fraction to the actual sequestration profile of the project. Monitoring and verification needs to take account of the project area in its

[3] Drought, fire or pest destroys the afforestation during the project phase.

integrity over all its lifetime. In this sense, the overall liability can only end with the end of the last contract.

6 Conclusions

The two main proposals on how to make CERs from sink projects comparable to those from emission reduction have been under discussion for nearly three years now. Related, but not necessarily tied to those approaches is the question over how C sequestration is verified, as a stock average or a variation of stocks.

This chapter has examined the so-called Colombian Proposal for the creation of expiring CERs and combined it with the ton-year approach, creating the leasing proposal. The advantages of this proposal are the following:

- The leasing approach makes C sequestration and reduction by conservation an asset with a defined value and lifetime.
- CERs from emission reduction and temporary CERs resulting from C sequestration in organic systems are made comparable.
- Monitoring, control, compliance and liability costs for long-term projects become calculable.
- Host countries do not see themselves confronted with large portions of their territory whose use is permanently blocked by international contracts (‘Kyoto Lands’).
- The contract renewal will lead to an income stream for the host country over the whole project lifetime and will allow for revaluation of the certificate. A chain of contracts may even lead to the project’s ‘real’ permanence, subsidized by the conditioned liberation of the life insurance lump sum after the end of the equivalence period.
- The certificate remains in the ownership of the host country. After the contract’s end, the country may decide on retaining the certificate, in order to fulfill own GHG control targets it may eventually accept in the future.

Still, several problems will have to be solved. There is an incentive for over-using soils in the first one or two contract periods. Only if land use projects will have to undergo a strict environmental audit as part of the sustainability test, this risk can be mitigated. In order to maintain ownership of CERs within the host countries, their participation in emissions trading (Article 17 of the Kyoto Protocol) needs to be clarified.

Depending on the approach chosen, decisions on some definitions concerning permanence need to be taken by the COP. These are:

- The minimum required lifetime of a ton of C fixed and standard project lifetimes.
- If any ton-year element is adopted, the decay time of CO_2 or the equivalence factor that allows comparing emission reductions to temporary C storage.
- Under the same precondition, the emissions available for compensation by C sinks need to be defined.
- In any case, guidance is needed over the meaning of draft decision -/CP.1, para 1(f) of decision 11/CP.7 (UNFCCC 2001), according to which *'... accounting for land use, land use change and forestry does not imply a transfer of commitments to a future commitment period'*.

The current discussion suggests wide backing for any kind of T-CER. The value of T-CERs critically depends on the contract duration. Under the crediting period of up to 21 years, which is actually foreseen for CDM emission reduction projects, the value of temporary credits would be so low that no substantive additional A&R investment can be expected. If the spirit of Bonn (COP-6b) and Marrakech (COP-7) is to prevail, it should be possible to re-issue T-CER over longer periods. This would result in long-term sequestration, which is in line with the UNFCCC Kyoto Protocol and the ultimate goal of the Climate Convention.

Further studies should look into the question if the model of leasing CERs eventually makes sense for energy related CDM projects as well, as a means to integrating non-Annex countries into the Kyoto regime. Leasing CERs give any non-Annex B country the chance to 'warm start' as soon as it wants to join Annex B. After the ending of their respective leasing periods, the country's CERs could be used as 'early credits' for the fulfillment of own obligations.

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Chapter III

Value and risks of expiring carbon credits from afforestation and reforestation projects under the CDM[1]

Abstract

The Milan Conference of the Parties to the UN Framework Convention on Climate Change has established two types of emission offsets under the Clean Development Mechanism (CDM), valid for afforestation and reforestation activities. In order to account for the non-permanent nature of carbon storage in forests, these credits expire after predefined periods, after which the buyer needs to replace them. The chapter assesses their market value in relation to 'permanent' credits, identifies their specific risks, and proposes how to mitigate and manage them. It analyzes strengths and weaknesses of expiring credits for sellers and buyers. Taking the example of the EU emissions trading system, the authors discuss how expiring credits could reach fungibility with permanent emission allowances on domestic markets.

1 Introduction

The rules governing afforestation and reforestation (AR) activities under the CDM have been among the most controversial issues arising under the Kyoto Protocol. One major issue was the potential 'non-permanence' of carbon stored in AR projects. In 2000, the delegation of Colombia proposed a scheme under which CERs were only granted temporarily and would need to be fully compensated upon the date of their expiration. This proposal rapidly won support among the participating Parties. Although modified and revised by several Parties, the basic approach of temporary CERs has imposed itself onto the international discussion and was f inally enacted in Decision 19 on 'Afforestation and Reforestation Modalities and Procedures under the CDM' of the 9th Conference of the Parties to the UNFCCC in Milan.

First reactions to Decision 19/CP.9 revealed some confusion among the market participants. To date, no in-depth analysis has been carried out on the consequences of the modalities and procedures on issuance of, and accounting for, expiring credits. The authors try to answer pertinent questions on the value and risks attached to the two new types of expiring certified emission reductions (CERs) that emerged, namely 'temporary CERs' (tCERs) and 'long-term CERs' (lCERs). In this chapter, we subsume both types of CERs issued for afforestation and reforestation (AR) activities under the CDM – tCERs and lCERs – under the term 'expiring CERs'. We will assess

[1] First published under Dutschke, Michael; Bernhard Schlamadinger; Jenny L.P. Wong; Michael Rumberg (2005), Climate Policy 5 (2005): 109–125

chances ofachieving fungibility between different permanent and expiring CER types and domestic trading units, as exemplified by the European Emission Allowances.

2 What is an expiring CER?

For both types of expiring CER, there is the choice between one single crediting period,[2] with a non- renewable baseline of a maximum of 30 years, on the one hand, and a baseline of a maximum of 20 years, which then can be revised and renewed up to two times, on the other. Thus, up to three consecutive crediting periods, summing up to a maximum of 60 years, are achievable for AR projects. The operational lifetime of the forestry activity can be no shorter than the chosen crediting period. Another common feature is the verification period of 5 years. The first verification is at any point in time during the crediting period, but afterwards the carbon stocks will need to be re-verified every 5 years. Proper project design needs to make sure that rotation length and verification cycles do not coincide in such a way that verification is taking place systematically at the point of time when carbon stocks are peaking (see Decision 19/CP.9, Article 12 (d)). Upon re-verification, the liability for non-permanence moves to the credit owner, who can replace CERs upon expiration with any type of emission permits: AAUs, ERUs, RMUs, CERs, or with newly certified expiring CERs of the same type. Once a project has decided to use either lCERs or tCERs, it needs to stick to this decision until the end of the (last, in the case of baseline renewal) crediting period. On expiration, tCERs and lCERs can in no circumstance replace each other.

There are two limitations imposed on expiring credits. One results from paragraph 14 of Marrakech Decision 11/CP.7, which stipulates that CERs from AR may not exceed 1% of each Annex-I Party's base-year emissions annually. Due to the fact that forestry projects have long operational periods before the first expiring CERs are certified, this limitation is not seen to be critical for the first commitment period. The rule on how to impose this limitation domestically is left to the individual Annex-I Parties.

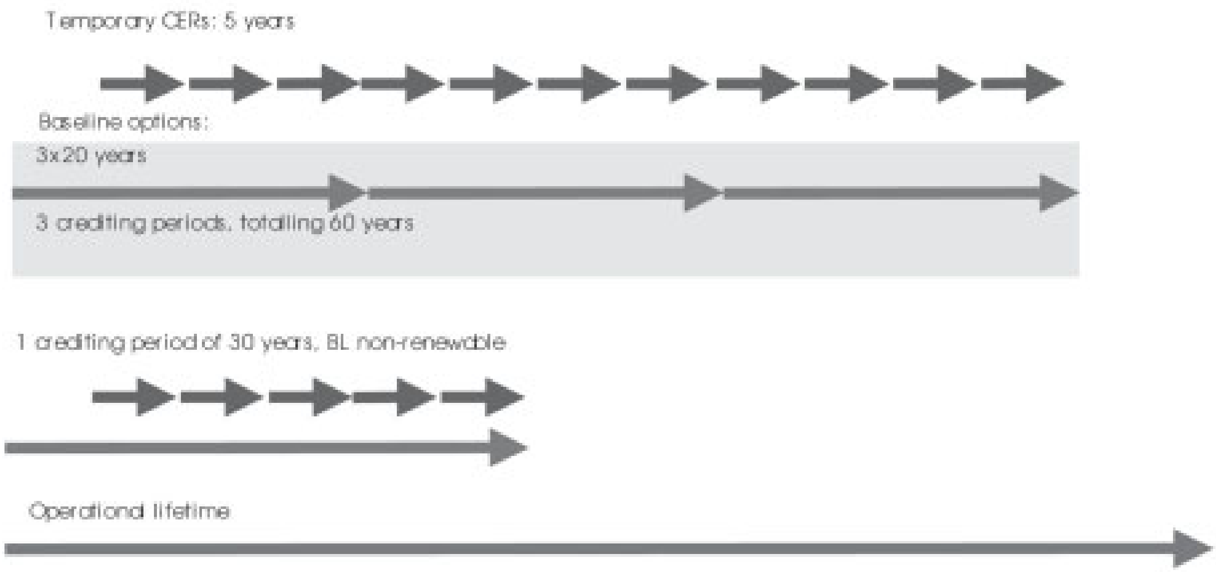
Another limitation of AR CERs is that they cannot be carried over ('banked') to a subsequent commitment period (Decision 19/CP.9, paragraphs 41, 45). Consequently, the accepting Annex-I Party will first submit expiring CERs and bank AAUs instead. Given the limited amount of AR credits within the CDM, this rule is of no practical relevance to the value of expiring CERs.

[2] Crediting period is the term used under the AR modalities for the period during which tCERs or lCERs can be certified.

3 Temporary CERs

tCERs help Annex-I Parties meet their GHG emission target for one commitment period only. These certificates expire before the end of the subsequent commitment period, during which the respective Party needs to over-comply with its target by the corresponding amount. With every successful re-verification, new tCERs are issued for the whole net anthropogenic greenhouse gas removals by sinks since the project start. As expired tCERs can be replaced by newly certified tCERs, it is most likely that a project developer will try to sell a succession of tCERs over the crediting period. Credit sales covering only one commitment period will increase transaction costs for both sides. The project risk is exclusively on the seller's side. After the termination of the (last) crediting period, tCERs can be replaced by tCERs from any other AR project. In our examples in Figure 1, the first tCERs are only produced 5 years after the start of the crediting period. It is unlikely that any AR project will yield relevant growth before this time, and will therefore start verification earlier.

Figure 1: Terms and timeframes used in the context of temporary CERs



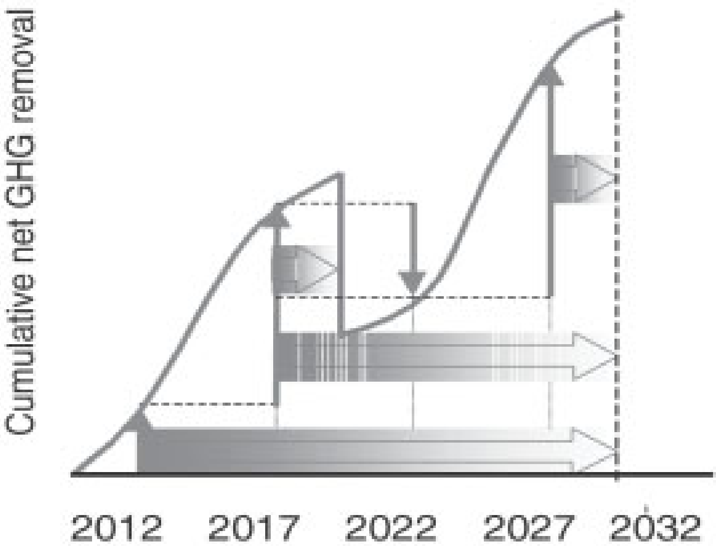
4 Long-term CERs

In contrast to tCERs, lCERs by default only expire at the end of the project's (last) crediting period, provided that the carbon stocks are still in place. If they are not, the respective lCERs expire upon the reception of the certification report detailing their non-permanence, and need to be replaced immediately. The validity of the different vintages differs. Assuming a non-renewable crediting period and the first verification in year 5, the first lCERs may thus have a validity of 25 years. Upon the second verification, the increase in carbon stocks produces lCERs with 20 years' validity, and so on.

In cases where a due verification report is not provided after a notification period of 120 days, all the lCERs ever produced will expire. Even though up to three crediting periods can be achieved with one activity, it would be misleading to believe that any lCER could have a validity of 60 years. The start of activity determines the start of the crediting period, not the time of the first verification. As stated above, project developers will probably not seek verification during the first 5 years. As carbon stocks increase, there will be additions in 5-year increments of lCERs with a shorter lifetime. Figure 2 shows how the regular validity of lCER can even be limited to one verification period, if there is a net decrease in the sequestration level due to harvesting. Either these 'short-term lCERs' are not sold, or they are sold for a price that compares to that for single tCERs.

An lCER may be used for compliance only during the commitment period in which it was issued. Environmental NGOs could choose to buy lCERs without using them, in order to achieve the climate benefit while avoiding additional emissions within the Annex I countries. In that case, no replacement on expiration is necessary. Only if the owner submits lCERs for compliance, replacement is due at the end of the (last) crediting period of the project.

Figure 2: Different lifetimes of 1CERs from one activity.



There is a clause in the rules for lCERs, that in the case of losses or failure to provide the verification report, one lCER shall be replaced by 'one AAU, CER, ERU, RMU or lCER from the same project activity' (Decision 19/CP.9, paragraphs 49 (d) and 50 (c)). This rule might not be applied to actual projects, as under-achievement of net carbon removal will not result in a need for replacement during the growth phase and as long as the overall carbon stocks remain at least constant. If growth is negative, however, there will be no newly certified ICERs from the same activity to replace losses. The same is true if no certification report (Decision 19/CP.9, paragraph 50) is submitted, because in that case, no replacement by 'ICERs from the same project activity' is possible, and all ICERs ever certified for this project will expire.

5 What is the value of expiring certificates?

For an investor, the effect of buying expiring credits is equivalent to deferring his or her compliance towards a future commitment period. The decision to buy expiring CERs depends on the expected price of replacement credits. In cases where the buyer does not expect a second commitment period to occur (i.e., no replacement is due), the value of expiring credits from AR would be identical to that of non-expiring CERs from GHG reduction projects, and it would be very low for both, because there would be no effective compliance mechanism. However, if the future price of credit replacement is expected to increase, the discount rate could be lower than the price increase of credits. In this case, the present value of ICERs would be negative, and it would be a better option to buy non-expiring CERs. Nevertheless, it is rather difficult to expect either investor preferences or the discount rate to remain constant over crediting periods of between 20 and 60 years (see Figure 3). The investor's horizon is much shorter than this; the institutions themselves seldom reach this age (consider that the UN system itself has not yet celebrated its 60th birthday). Costs that occur beyond the investor's horizon are usually assigned a much lower net present value.

Additionally, most of today's host countries may have taken on some kind of reduction commitment by the middle of this century. All these expectations lead to the consequence that the individual buyer's discount rate does not remain constant over time.

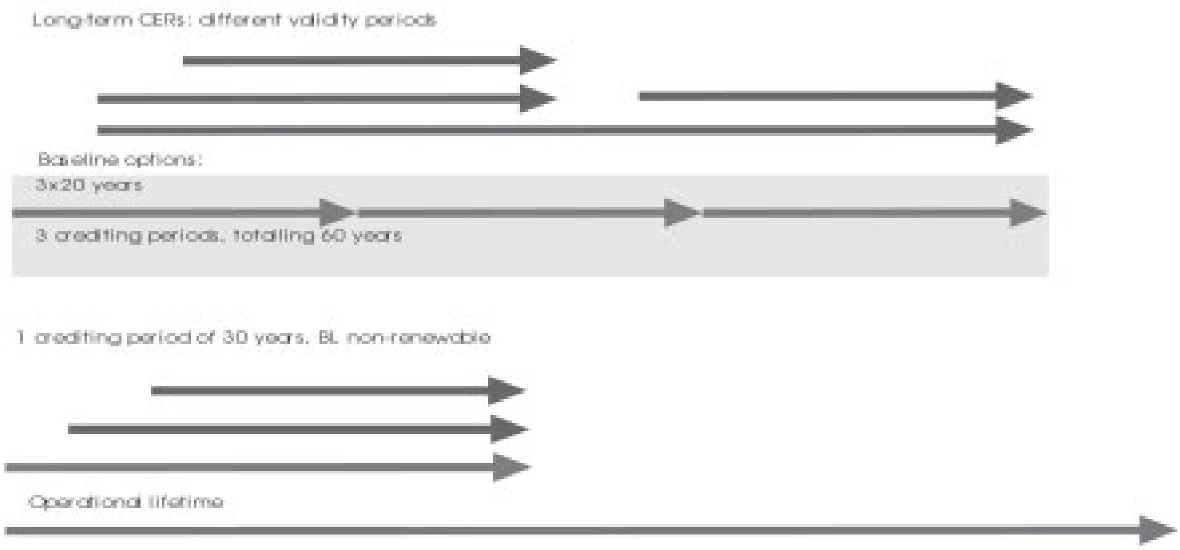
Yet assuming a constant discount rate, the actual net value of deferring compliance is calculated as follows:

$$V_{\exp.CER} = 1 - \frac{1}{(1+i)^n}$$

where i is the discount rate, and n being the number of years that compliance is deferred. Table 1 gives an overview over expected values of ICERs or a succession of tCERs, assuming costs and risks were equivalent to permanent

CERs (Dutschke and Schlamadinger, 2003; Subak, 2003). We will further differentiate risk assessment below.

Figure 3: Terms and timeframes used in the context of long-term CERs



A tCER with a fixed validity period of 5 years will be worth between 14 and 35% of a permanent CER. An ICER with a validity period of 60 years, on the other hand, would almost reach the value of a CER.[3]

6 Specific risks for AR projects

In this section, we refer to risks that are generic to CDM. However, due to the non-permanent nature of AR CERs, these risks not only affect credits to be produced after their incidence, but also those that have been generated before.

As the issue of liability only arises on verification, expiring CERs are risk-free during the commitment period in which they are issued. Subsequently, for each additional verification period, a certain percentage of the values referred to in Table 1 needs to be discounted in order to cover the costs of re-verification and risk management.

We distinguish three types of risk for AR projects: baseline, commercial, and institutional risks. In the following paragraphs, we will describe them in detail, and propose ways of mitigating and managing them.

[3] As stated above, this is a hypothetical case. In practice, maximum ICER validity periods will be no longer than 55 years.

Table 1: Net value of expiring CERs and economic equivalence period under different discount rates

Discount rate	Value after… 5 years	20 years	30 years	60 years
3%	14%	45%	59%	83%
4%	18%	54%	69%	90%
5%	22%	62%	77%	95%
6%	25%	69%	83%	97%
7%	29%	74%	87%	98%
8%	32%	79%	90%	99%
9%	35%	82%	92%	99%

6.1 Baseline risks

The baseline is the sum of carbon stock changes on the project area in the project's absence and subject to external influences. These may be price variations of timber or alternative land use products, such as meat, corn, or soybeans, the subsidy level for different activities, and long-term financing conditions. In addition, migration patterns can play a role, if increasing population pressure acts on the area, or if depopulation leads to the formation of natural succession forest in the project's absence. The project's additionality is at risk, in the event that the baseline carbon stocks at any point in time are higher than the verified actual net removals. The project design document should explore the likelihood of the occurrence of baseline-related risks, but the longer the baseline validity, the harder these are to assess.

Decision 19/CP.9 offers the option to use control plots for a dynamic baseline determination, as described by the Good Practice Guidance (IPCC, 2003, p. 4.96). There are, however, practical difficulties in installing these control plots. They should be inside the project area but not subject to the influence of the AR activity, or located outside the project boundaries. In the first case, it will be uncertain whether they represent 'business as usual'. In the latter case, direct measurement may be difficult, and it will be difficult to establish whether they really represent the project area. Furthermore, there is little incentive for the project developer to incur high costs for control plots and losses due to baseline dynamics if static 30-year baselines are also acceptable to the Executive Board. Additionally, a static baseline secures first-mover advantages.

In spite of a theoretical chance of achieving a maximum crediting period of 60 years, there is a risk in choosing a renewable baseline. We therefore expect most project developers to select a non-renewable crediting period of 30 years.

6.2 Commercial risks

Commercial risks are the ones that are under control of the project developer. Before thinking of managing risks, it is imperative for a project developer to mitigate them. Besides the choice of a low-risk host country, risk mitigation should be guided by standards and criteria for good practice in the forestry sector. The higher initial costs may be recovered by increased project permanence and credibility, both of which will result in lower commercial risks. Additionally, project design should be aware of the creation of long-term benefits, in order to foster self-interest of local populations in ensuring the permanence of the afforested areas.

6.2.1 Failure of the operating company in the host country

Failure of the local project operator need not have repercussions on the verifiable sequestration level. The project will go on if the new owners continue the management of the project. Continued management implies the implementation of the measures outlined in the monitoring plans if, during the takeover negotiations, monitoring does not fall behind, thus affecting the next verification by the DOE (see section on 'Interruption of monitoring and verification'). Community schemes may be less likely to fail, as single dropouts will not necessarily endanger the whole project. The risk of failure of the operating company can be mitigated by conservatively checking the project's financial and economic feasibility.

6.2.2 Partial loss

Fires, strong winds, earthquakes, pests, animals, or theft of timber may lead to a decreasing sequestration level (Cottle and Crosthwaite-Eyre, 2002). This risk is lower during the afforestation phase of the first 10–20 years, when stocks are building up by regular increases of the planted area. A slower-than-expected increase will only become a risk for the project's expiring CERs that were already issued, if it leads to economic project failure. The sequestration level may also decrease due to the selection of unsuitable sites, species, and management practices. The same may happen if changing climate leads to deteriorating growth conditions. Fire risks depend on the climate zone and the species selected, and fire damages vary depending on the age of the stand; often they are higher if they occur in young stands. A management plan needs to include the delimitation of fire breaks, installing watch towers, and building competency among the employees in fire prevention and extinguishment. Risks of over-exploitation can be adequately mitigated if sustainable management criteria are followed.

6.2.3 Interruption of monitoring and verification cycle

There is a risk that the project operator may lose interest in monitoring and verification. The cessation of project monitoring and verification (M&V) will lead to the project becoming a defunct CDM project. This risk is differentiated between tCERs and lCERs. As tCERs are paid on delivery, there is always an incentive to go on with M&V, as long as the returns at least cover both activities. Where the lCERs are paid on delivery after selling all potential credits, there would no longer be an incentive for M&V continuation. It is clear that monitoring will only go on if this activity is adequately funded by a compliance fund. Therefore, after the initial phase of stock build-up, a proportion of the carbon proceeds needs to be withheld in an escrow and partially disbursed on every successful re-verification. Part of this amount could be contracted with the designated operational entity (DOE), the certifier, while another part needs to be transferred to the company that does regular project monitoring – in most cases the very project operator.

6.2.4 Credit replacement risk

There is no simple or direct way to estimate the costs for replacement of the expired CERs. At the moment that replacement is due, prices may be higher or lower than at the time of initial project investment. As a mitigation strategy, expiring CERs can be replaced at any time during their validity. The buyer then has the opportunity to choose a favorable moment, when certificate prices are low. If tCERs are replaced by the buyer before the end of delivery contract, the remaining stream of tCERs can be sold again. In contrast, lCERs once used for compliance cannot be used again, even though they were replaced by permanent credits before expiration.

For verification, DOEs may come up with package offers over the whole baseline validity period.[4] The credit replacement risk may be reduced by financial instruments like options and forwards on allowances once certain market liquidity is reached. These options may cover periods of up to 10 years, provided that international climate policy becomes more entrenched in the future.

There are various options to secure carbon investment, which we subsume under 'insurance', but which can be granted by any actor within the finance sector. Carbon insurance against commercial project failure will only be achieved if the project operator is backed by a credible investor country company or bank. It is more realistic that the investor keeps various types of carbon projects in the portfolio, in order to spread the failure risk across several projects. Eyre and Mundy (1999) name the following interests that are commercially insurable:

[4] The authors do not expect prices to be fixed upfront for a time longer than one commitment period.

- carbon offsets *per se*
- (agreed) value of the carbon offsets per tonne
- start-up capital (investment costs)
- annual management budget
- forest timber itself
- amenity value of the forest for ecotourism
- replacement value of amenities and equipment destroyed by an insured peril
- costs of restoration of the project following a destructive event
- amortized cost of the project carbon credits per tonne over the life of the project
- net present value of the sales of carbon credits over the next 30 years
- direct fire fighting costs (over and above the annual protection budget).

Where fire insurance for the timber value of the plantation is being offered, it will be relatively easy to piggyback an insurance against losses of carbon stocks within one 5-year period. Fire insurance usually costs around 1–2% of the timber value annually (Subak, 2003), and it takes into account the fire risks of every particular project. Five years, however, is at the upper margin of insurance coverage, and usually it is issued over 1- or 2-year terms (Wong and Dutschke, 2003).

Insurance for expiring CERs will look very much like a capitalized life insurance. If the insured risks do not occur, an end-of-contract payment will enable the insurance taker to replace expired CERs. In the actual pre-market phase, insurance will not be able to cover the price risk at credit replacement, not even over 5 years (Cottle and Crosthwaite-Eyre, 2002). The insurance policy will thus stipulate a maximum restitution, and most likely a deductible. Additionally, a contract clause could make sure that the insurance may at any moment partially or totally replace the expiring CERs, without interrupting the contract. In this case, regular M&V payment could be left to the finance institution in order for it to weigh between project M&V and CER replacement costs.

If the losses cannot be replaced from new growth within the same project, the insurance would replace tCERs with tCERs from another project until the end of the insured project's crediting period. Alternatively, the insurance company has the option to replace expiring CERs with permanent allowances, thereby putting an end to liability. This would be the only choice in the case of lCERs lost, as no replacement with other expiring CERs would be admitted. Depending on the insurance conditions, replacement of prematurely expired CERs would be done in one of the following ways:

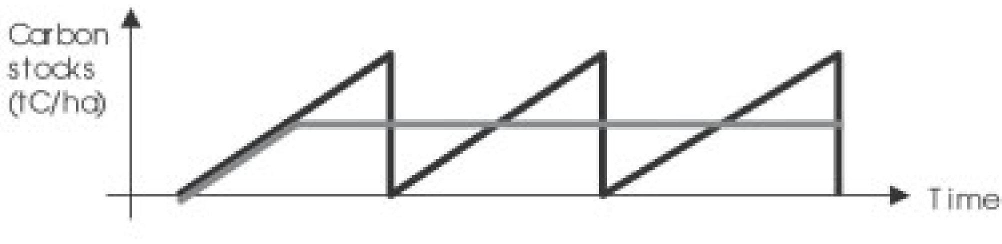
- *For contracts that include end-of-term replacement*, the lCER owner needs to compensate the insurance for the difference in value between the planned and the actual lCER lifetime. This amount would be calculated as in Table 1.
- *For contracts that do not include end-of-term replacement*, the insurance mechanism would only disburse the value of the above temporal difference and leave the acquisition of replacement units to the owner of the expired 1CER.

Unlike in the early AR projects of the 'activities implemented jointly' pilot phase, the current AR rules make self-insurance on the project level obsolete. This is because, from the moment of verification onwards and until the next verification, there is no risk to be covered. Neither buyer nor seller has an interest to refrain from using the credit stream over the expiring CERs complete lifetime. The buyer will only pay on delivery in the case of tCERs and on prolongation, in the case of 1CERs.

As a simplification for small-sale projects, it has been suggested that while monitoring should determine the actual time-path of carbon stocks, the issuance of 1CERs should be based on the time-average carbon stock, shown the with the grey line in Figure 4. This line follows the actual growth of the project until the average carbon stock has been reached; subsequently it stays constant at the level of the average carbon stock. For further details see Schlamadinger et al.(2004a).

Given the current market size for AR projects, the design of specialized insurance contracts will certainly take a while. In the meantime, funds such as the World Bank's BioCarbon Fund are already developing their own insurance schemes, in order to make expiring CERs marketable.

Figure 4: Average carbon accounting



Source: Schlamadinger et al. (2004a).

6.3 Institutional risks

6.3.1 Annex-I company default

The Annex-I company using the expiring CER for compliance within a national emissions trading system fails. If the risk of expiring CERs was internalized within this company, lCER to tCER replacement at the end of the crediting period will not be given. In any event, at the national level, the Annex I country holding the expiring CER in its registry must take over liability. Therefore, it is usual to ask the company for some sort of external insurance or other coverage.

6.3.2 Unplanned events in the host country

The host country may retroactively disapprove the project: Radical changes in government may lead to a risk for all types of foreign direct investment. The only possible risk mitigation is an appropriate choice of the host country. Social unrest leading to invasion and sequestration losses can be partially prevented through a social impact assessment.

The risk of host countries being subject to secession or annexation can be mitigated if the investor country draws up a blacklist of countries whose institutional risks will not be covered by the investor country. There will be consensus between the investor and its government in most cases because CDM projects in high-risk countries are unlikely to be financed. Commercial host country risk insurance is in the range of 5% annually (Eyre and Mundy, 1999), which may become prohibitive for long-term projects.

6.3.3 Host country takes over commitment in the land-use sector

The host country may undergo a change in status within the climate regime. In subsequent commitment periods, the host country may take over climate change mitigation responsibilities for all or parts of the land-use sector. Either the effect on AR projects is a conversion of the expiring CERs issued to permanent emission reduction units with the subsequent risk of the release of sequestered carbon residing with the host country, or the appropriation of present or future removal units by the government. While a memorandum of understanding (MoU) between investor and host country is not a precondition under Kyoto Protocol regulations, it is highly recommended for AR projects. It elevates the approval from a matter of international private law to public law. The MoU should stipulate the fate of credits certified under the CDM in case the host country takes over its own commitments. In this case, two options will apply. Either the afforested area becomes a part of AR under Kyoto Protocol Articles 3.3 or 3.4 or comparable future regulations, in which case the expiring CERs would be counted as removal units (RMUs), or alternatively the CDM AR project turns into a JI project, in which case the expiring CERs would be canceled, and the holder would receive ERUs. In this latter case, a MoU may stipulate a compensation payment by the holders of expiring CERs, whose credits become upgraded as consequence of a future host-country transition regime.

Due project diligence will consist of selecting an appropriate project type with high social benefits within a stable political environment. However, as the Kyoto Protocol is a contract under international jurisdiction, the ultimate country risk lies with the investor country (i.e., the country that takes expiring CERs into its registry).

As it stands, commercial finance institutions will not be willing to cover these institutional risks. Before taking over institutional risks, the investor country needs to ensure whether the project's commercial risks are covered by the investor. Risk management will form an important share of the expiring CER's emission compliance value, but once in place, it will create conditions for making them fungible with any other GHG allowance.

6.3.4 Project quality and permanence

As pointed out above, the long-term liability of ICERs will lead investors to look for projects with a high chance of surviving their crediting period. Unsustainable projects will hardly be insurable (Eyre and Mundy, 1999; Subak, 2003), as their risk of failure is to be borne by the buyer. This would be all the more true if there were financial mechanisms to insure project failure and end-of-contract repayment. Obviously, guidance on criteria and indicators is needed in order to determine how permanence can be enhanced inherently within project design and implementation.

The Forestry Stewardship Council (FSC) or the Pan European Forest Certification System (PEFC) offer internationally recognized certification for sustainable forest management.

The Intergovernmental Panel on Climate Change has published its 'Good Practice Guidance for Land Use, Land-Use Change and Forestry' (IPCC, 2004), with instructions on good practice in project monitoring in Chapter 4.

A 'Triple Standard' for the design of forestry projects related to climate change mitigation, drafted by an international endeavor called 'Climate, Community and Biodiversity Alliance' will become applicable by mid-2005. An implementation standard is in planning stage (CCBA, 2005).

While the use of the IPCC guidance is 'recommended' in Decision 19/CP.9, compliance with FSC forest certification and CCBA standards is purely voluntary. Transaction costs linked to certification result less from the certification process itself, but rather from the additional considerations necessary in the design phase. Therefore, it is sensible for project developers to seek good practice certification early in the project design phase, rather than to retrospectively adapt the design during implementation. If investors additionally wish to convert ICERs into EUAs or other permits, insurance against commercial risk will become compulsory. In cases where commercial insurers enter this still very limited market segment, it is likely that they will go for an agreed standard to make sure that a project is inherently permanent. It took 10 years to impose the FSC, yet the supporting environmental NGOs have refrained from adding a climate component. As exemplified in the case of the CDM GoldStandard,[5] developed by the Worldwide Fund for Nature (WWF), it is easier to develop new standards than to promote them (Michaelowa, 2004).

High-standard AR projects compete with low-standard projects on the international market.

Where trading systems as the EU ETS avoid a direct import of AR carbon credits by companies, they may still enter the system. As governments become competitors with companies in CER acquisition (Buen, 2004a), Member States could buy up expiring CERs and trade AAUs. Yet, in most cases, there will be a discount for low-quality projects.

If a government wants to provide additional incentives for specific project types, e.g., small-scale or combined afforestation and energy projects (Schnurr et al., 2004), or in specific regions (such as LDCs), the following measures can be applied:

1. *Financially*: A state guarantee can help finance and insure the project. There is a role to play for export credit insurance. The monetary value of this guarantee may possibly be accounted as financial development assistance. Another example is the IBRD partial risk guarantees (PRGs), which can help manage risks (Eyre and Mundy, 1999).
2. *Mitigate replacement risk*: As pointed out above, the price risk at the moment of replacement at the normal end of the project's crediting period will be a major disincentive against AR projects. Replacement could thus be granted by the investor country. In this case, for the ICER owner no end-of-term payment would be due, and commercial insurance would be less costly.
3. *Institutionally*: Providing or subsidizing supra-national insurance schemes for expiring CERs.

Similar to the experience of the Prototype Carbon Fund, these schemes could be located at the World Bank before the private sector moves in. For its own purposes, the World Bank carbon finance unit is already developing instruments for risk management.[6]

[5] GoldStandard is a quality standard for certain types of non-sinks CDM projects (see www.goldcdm.net).
[6] Personal communication, Benoit Bosquet, 25 March 2004.

Considerations on the use of expiring CERs by governments can be found in the next section on fungibility.

7 Making expiring CERs fungible with other credits

In order to discuss fungibility issues, we take the example of the EU emissions trading system (EU ETS) (Schlamadinger and Dutschke, 2004). The results of this section are, however, valid for any domestic emissions trading system, whose allowances do not expire.

One of the main reasons for excluding sinks credits in the first EU trading period from 2005 to 2007 was the perceived incompatibility of expiring CERs with other CERs and EU allowances, due to the fact of their limited lifetime. While the Kyoto Protocol is an international agreement between governments, individual companies only enter the picture under the provisions of domestic policies. For example, the EU has established an emissions trading system that will start operating on 1 January 2005. It puts a ceiling on the emissions of a few thousand companies belonging to the sectors of energy activities, production and processing of ferrous metals, minerals, and pulp and paper. Companies can either reduce emissions themselves, or can purchase emission credits from other companies. They can also invest in CDM or JI projects (the latter only from 2008) to obtain credits. Credits from CDM AR projects will most likely be included in the system from 2008 onward. The European Commission, on the occasion of its review scheduled in 2006, will then establish modalities for the 'linking' of AR credits in the second EU trading period (which is identical to the first Kyoto commitment period).

There is no need to regulate the import of tCERs into the system if Member State governments will accept them. For the company using tCERs for domestic compliance, the Member State government will decrease its target in the subsequent trading period. However, this does not result in the conversion of tCERs into EU emission allowances.

In order to achieve full fungibility between non-expiring and expiring CERs, however, insurance, credit replacement after expiration, and investor state acceptance are needed. An Annex-I government will hardly accept a chain of successive tCERs in exchange for a permanent emission allowance. The tCER supply contract between project owner and credit buyer does not have the legal quality required for long-term fungibility with state-backed emission allowances. In this section on fungibility, we will thus concentrate on lCERs.

There are two main situations of lCER use:

1. Governments buying lCERs for their compliance with Kyoto Protocol targets

2. Companies that are subject to domestic emission limits (e.g., as part of a national emissions trading system) buying ICERs.

When a government purchases ICERs for compliance with Kyoto Protocol targets, it retains the liability due to the risks of unplanned release and is liable for replacing the credits at the end of the project's crediting period, even if the carbon stocks stored in the project remain intact (see Case 1 in Table 2). The purchasing government can in turn hedge against the risk of project failure through insurance (Case 2). It may, however, turn out to be costly to internalize ICER replacement costs at the end of the project-crediting period, depending on market expectations.

If a national government were to allow companies to use ICERs towards their compliance, the government would then simultaneously use the ICERs in its national Kyoto accounts. In other words, the government would accept a liability at the international level. At domestic level, there are now several possibilities of assigning the risk and liability of credit expiry. In all these cases, ICERs will be fungible with domestic allowances, like European emission allowances in the case of the EU emissions trading system.

Case 1: The government assumes the liability upon project failure as well as project termination.

This option would, however, be a subsidy that fails to provide incentives for good project design and implementation.

Case 2: The government assumes the liability upon project termination, but leaves the liability upon project failure to the company which submitted the ICER for compensation. In that case, risk management will look for ways to increase project-inherent permanence. Engaging the local community in project design and implementation and creating local benef its minimizes the risks of project failure. Only once such safeguards are taken, will financial risk management come into effect. The governmental guarantee for credit replacement upon successful termination of the crediting period could be perceived as a premium for sustainable management of the project.

Case 3: The government assumes no liability at all, while the submitting company assumes liability for project failure and termination. However, because the acquiring Annex-I company may not exist at the end of the crediting period, the government would most likely ask the company to provide a life-insurance type contract or an allowance purchase option due at the end of the ICER validity. Essentially, the risk of project failure and the cost of future replacement will be internalized in the present value of the credit, in turn adding to its cost. With this, the cost of the credit that the company uses to comply with the domestic emissions trading system will consist of (a) the price of the ICER, (b) the price of insuring against non-permanence, and (c) the cost of the future replacement by permanent credits.

Table 2: Options for addressing non-permanence and credit expiration at the project end. Two main cases are distinguished (governments or companies purchasing ICERs)

		Who carries liability of non-permanence	Who takes debits for expiration
Government purchase of ICERs	Case 1: no additional measures	Government	Government
	Case 2: Insurance against non-permanence	Insurance	Government
Company purchase of ICERs for compliance in regional emissions trading system	Case 1: ICERs can be converted into local currency, e.g., EUAs, without additional measures.	Government	Government
	Case 2: ICERs can be converted into local currency if company insures against non-permanence.	Insurance	Government
	Case 3: ICERs can be converted into local currency if company insures against non permanence and has futures credits for the time of project termination.	Insurance	Company (has to buy future credits)
	Case 4: The government exchanges each ICER against a discounted amount of x (e.g., 0.6) "local currency (e.g., EUAs). For each ICER the government uses for Kyoto compliance, it banks (1 – x) AAUs into future commitment periods in order to protect against future risks of the project. This approach works better if applied to a whole portfolio of projects funded by companies within a country.	Risk is internalized into the price of EUAs by means of discounting.	Government, but only up to the "risk free" share of every ICER.

Source: Schlamadinger et al. (2004b).

Case 4: The government discounts the ICERs according to their estimated risks, which will depend on host country, project type, hazards to permanence of projects, etc. It is helpful here to think of a project portfolio, because individual projects might be subject to complete failure, while the failure of the entire portfolio is not likely. A European Member State would thus convert one ICER into, for example, 0.6 EUAs, assuming that 60% of the projects' certificates are considered 'risk-free'. Nevertheless, the government can still use the full amount of ICERs from the CDM afforestation and reforestation projects for compliance with the Kyoto targets, so that a surplus arises to the government in that commitment period. This surplus can be banked into the next and subsequent commitment periods in the form of AAUs. As more carbon is stored, this banked amount would increase from commitment period to commitment period and would serve as an 'insurance buffer' in the case of an unplanned release of carbon from the project. At the end of the crediting period, all the remaining ICERs are due to be replaced. If the project has gone according to plan, there will be an amount of banked AAUs available so that the ultimate debit to the government would only be as high as the amount of risk-free carbon sequestered by the project. If the project has produced only the risk-free portion of carbon sequestration, then part of the ICERs will already have been retired, and only the remainder is retired at the end of the crediting period, inasmuch as no AAUs are left. The net result is the same.

By converting ICERs into, for example, EU emission allowances (EUA), it falls upon the converting Member State to decide upon its risk management strategy (see Table 2).

8 Expiring CERs and interests of market participants

Long-term liability and complex modalities will be the main impediments against buying expiring CERs. On the other hand, they have a short-term price advantage over permanent CERs. In Table 3, a SWOT analysis for the buyer's side of expiring CERs is carried out.

In most cases, certain amounts of expiring CERs have their place in larger carbon credit portfolios, whereby their use for compliance will free permanent CERs for sale or banking. Institutional buyers will capture secondary benefits, including a positive public image for biodiversity conservation and social benefits for the host country. Accounting rules for emission allowances, and especially expiring CERs, may turn out to be a challenge to Annex-I domestic legislation, with implications for flexible mechanisms in general, and long-term CERs in particular. Where expiring CERs in the company balance were to be accounted for as liabilities under their present value, companies would have little incentive for their acquisition. National fiscal legislation could thus threaten a complete activity type under the CDM.

A SWOT analysis for the seller's side (Table 4), including the host-country government, shows that the limited host liability will be reflected in lower demand as well as in contractual agreements imposed by the potential buyers that try to partially rule out Annex-I liability for project risks. It is thus likely that projects seeking for certification would proceed anyway, due to domestic incentives and internal profitability. Truly additional projects will need to go for co-financing, albeit with voluntary compliance schemes, offering environmental services like watershed protection or biodiversity conservation on parallel markets. Another source of co-funding would be official development assistance (ODA), the eligibility of which under the CDM remains contested (Dutschke and Michaelowa, 2005[7]).

Table 3: SWOT analysis for buyers of expiring CERs

	Strengths	Weaknesses	Opportunities	Threats
Prices	Low-cost	Liability management as a cost factor	Use as a compliance reserve. If not used for	CER futures as a competing instrument
Project liability	Demonstrates high commitment, if the lCER user is project participant (not necessarily true for tCERs)	Project quality control and search for insurance mechanism increases transaction costs	Specialized agencies will offer package deals for quality control, monitoring and verification in the future	Small market niche, if CER prices remain low. Development of markets will take time
Replaceme nt costs	If beyond planning horizon, costs when they occur may not be due any longer	Present costs may be higher than today's CERs	Investor state may guarantee replace- ment at fixed costs	Depending on domestic accounting rules may result in long-term liability to be accounted at current CER prices
Flexibility	Little actual capital fixation	Only limited amount can be used for compliance cap of 1% of investor country 1990 emissions)	Individual company not responsible for compliance with 1% cap	National allocation rules for acceptance of expiring CER

In an article for Carbon Finance, Carbosur consultants calculated the revenue of expiring CERs for two single cohorts of exemplary plantations (Martino and Reali, 2004). In their example, only 20–25% of the total carbon would be fixed in the first commitment period. They compare numbers of tCERs to those of lCERs credited and find that the projects receive more tCERs, which is a tautology, given the difference in validity between tCERs and lCERs. Given the current uncertainty over future commitment periods, they see a tendency for buyers to favor tCERs, while project developers for the same reasons might prefer lCERs. Another reason why this conflict of interests may arise is that, in the tCER case, after tCER expiry project risks fall back to the project owner (Buen, 2004b).

[7] See chapter V

Table 4: SWOT analysis for the seller side of expiring CERs

	Strengths	Weaknesses	Opportunities	Threats
Prices	Will be attractive on demand peaks, shortly before end of commit- ment period	Small market segment	There is willingness to pay for projects that offer additional environmental services, like biodi- versity conservation	Low prices may not sustain truly additional projects
Project liability	Increases chances for high-quality projects	May increase project development and contracting costs	Procedures related to insurance mechanism are left over to the buyer	Investors may try to channel back liability to the host country
Flexibility	Host government is free of sovereignty concerns; no inf inite foreign control	Limited fungibility of credits lowers demand	Use of lCERs as early domestic action under future compliance regime	Future treatment of expiring CERs is uncertain

Many brokers see expiring CERs as being too complex to become operational. If the market establishes anyway, its actors will be a specialized minority. As sellers will try to combine project benefits, tCER/lCER prices will reflect the willingness to pay for side-benefits specific to AR projects.

9 Conclusions

This chapter has attempted to assess the value and market opportunities of expiring CERs. It has noted high uncertainties, not only due to the ongoing buyers' liability for AR projects, but also to the uncertain future of international climate policy. This latter uncertainty has greater repercussions on expiring CERs than on CERs from other GHG mitigation activities under the CDM. This is because the integrity of an AR project's CERs remains at risk until the end of the crediting period. We show that there are indeed ways to mitigate most project risks. As the option for one-off baselines for up to 30 years has been agreed upon by the Parties, most projects will refrain from using baselines that are renewed after a maximum of 20 years, even while promising a 60-year total crediting period. They are also likely to refrain from the option to use control plots for a dynamic baseline, as this will increase baseline risks without bringing added benefits for the project. Commercial risks strongly relate to project quality. It will be in the interest of finance institutions providing insurance to ask for a certification of high-quality project implementation. We have shown that insurance is more likely to cover risks related to lCERs than those of a succession of tCERs. Mitigating the price risk for credit replacement is an interesting leverage that governments can use for encouraging high-quality project development and implementation. Finally, part of the failure risk for the Annex-I company and diverse host-country risks need to be covered by the investor country that accepts expiring CERs for compliance. Prudent selection of host country Parties will help mitigate these risks, which on the other hand means that least-developed countries will tend to be systematically disfavored. Having AR projects in LDCs will require additional investor country risk-taking, which could possibly be reported as ODA. A SWOT analysis for the market of expiring CERs has shown that the complex AR modalities and procedures will lead to a specialist market niche, where credit valuation will be subject to one of the projects' added sustainability benefits. Ultimately, opportunities for AR projects under the CDM depend on factors external to the sector. As the climate regime will consolidate, so will the opportunities for long-term project investment.

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Chapter IV

A spatial approach to baseline and leakage in CDM forest carbon sinks projects[1]

Purpose

Only in 2003, the international climate negotiations decided on rules for afforestation and reforestation (A/R) activities under the Clean Development Mechanism (CDM). Both the identification of a realistic, appropriate reference scenario and leakage determination are relatively complex for A/R projects due to the numerous factors influencing the final land use type and patterns in a given area. Those factors include political structures, social habits, land-use prices, geological, climatic and other natural factors, etc. For A/R activities, the area is the basic variable. In literature, only a few suggestions have been made for area-based A/R baseline methodologies (e.g. Tipper et al. 2002; IPCC 2000), providing an overview but abstaining from giving clear recommendations. Decision 19/CP.9 (UNFCCC 2003) defined rules and approaches for baseline setting under A/R CDM. Until mid-2005, 11 methodologies were submitted to the A/R Working Group with the CDM Executive Board, but so far no A/R baseline methodology has been approved.

If A/R projects are to be implemented on a significant scale, the most important challenge besides accounting for non-permanence (Dutschke, Schlamadinger et al. 2005[2]) will be to reduce the complexity of baseline determination, quantification of leakage and the development of solid monitoring methodologies for both, in order to render them manageable for project developers/operators and clear for potential investors. This chapter proposes a practical tool for A/R CDM baseline development and monitoring - a spatial framework of system boundaries, which will be called "PaRaPia-concept". It offers a straight-forward geographical reference for baseline determination and leakage detection.

1.1 Definitions

The Marrakech Accords, the final document of the 7th Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC), reflects high cautiousness with regard to any land use related activities. This is the result of the failure of the previous COP in The Hague, where conflicting views on the role of

[1] First published Dutschke, Michael; Sonja Butzengeiger and Axel Michaelowa (2005), Climate Policy 5 (5): 517-530
[2] See chapter III

land use options for compliance led to a negotiation deadlock3. The term reforestation under Marrakech was redefined to cover activities that occur on an area which was non-forested on December 31st, 1989, while the term afforestation was reserved for areas that have been non-forested for at least 50 years previous to the start of the activity. In this context, we will treat A/R as one activity type. Under developing country conditions, afforestation in Marrakech terms will be the major exception, because available data on land use in most countries do not allow determining the exact land use of each particular area fifty years ago. Decision 19/CP.9 at Milan (UNFCCC 2003) specified the details of development of A/R projects in the CDM context. It defines what used to be called “net sequestration” in literature as “net anthropogenic greenhouse gas removals by sinks”. In order to avoid confusion, this and all other terms defined in Annex A of the Milan Decision will be used. Another important source to take into account is chapter 4.1 of the IPCC’s Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003), in the following referred to as GPG.

1.2 Methodology

Basically, A/R under the CDM is based on the principle that a non-forested area is converted into forest. A/R thus can cover the following modalities, always depending on thresholds in the definition of forest:

- Plantation forestry for timber production;
- Rehabilitation activities, including plantation;
- Combination of silviculture and agriculture or pasture farming; often referred to as agro-forestry or silvo-pastoral systems.

In an attempt to reduce the complexity of baseline and leakage determination while including all major influencing factors, we propose a spatial framework on system boundaries relevant for the project activity. The concept constitutes the basis for the initial inventory of the project area, for the determination of the land use reference scenario and for a distinction of leakage effects. It was developed in the course of a two-year research project funded by the EU’s Fifth Framework Programme, PROBASE (Procedures for Accounting and Baselines for JI and CDM Projects). Other major aspects of forestry projects, especially the issue of permanence of carbon storage, are not dealt with in this place.

[3] The issue of sinks in the CDM has been extremely contentious from the beginning. For some views on this see Noble and Scholes (2001) and Bernoux et al. (2002).

2 The PARAPIA concept

Project boundaries in land use are exclusively defined in a spatial manner. The geographical boundary of the project activity is the core parameter for baseline determination and the calculation of carbon sequestration. However, the business-as-usual case for different areas in a country can be extremely inhomogeneous and variable over time. This is due to factors like population pressure, social structures, alternative agricultural uses, infrastructure, legal issues around land tenure and ownership, and non-forestry policies. Therefore, it becomes important to develop an easily understandable but environmentally credible method that selects areas for definition of the baseline. We suggest a method based on three different levels of spatial aggregation: the PARAPIA-concept. Its three concentric areas can be applied to determine an appropriate reference land use without the need to evaluate all the factors and underlying forces mentioned above. It can also be applied to evaluate leakage in a systematic manner (see chapter 4). We differentiate between:

- the project area (PA),
- the reference area (RA), and
- the political influence area (PIA).

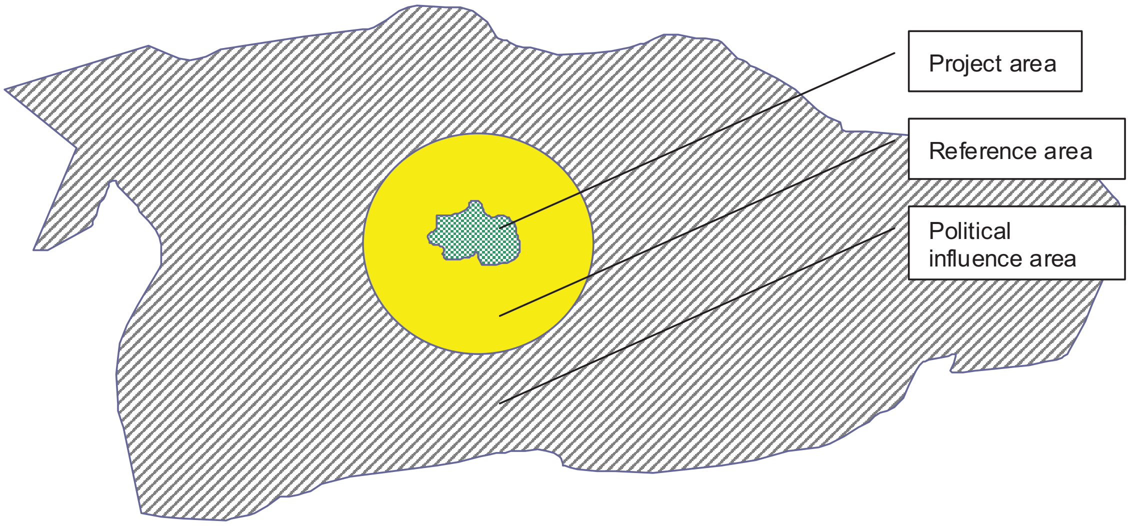
Direct effects of the project activity will appear in the PA itself, whereas most of the project's indirect effects (leakage) will appear in the RA. The RA is also relevant for the baseline determination, as to be described below. The PIA allows the incorporation of political and national circumstances and may help calibrating effects identified within the RA.

Requirements for data collection and monitoring differ between the three areas. Whereas in the PA several types of direct measurements are necessary to determine pre-project carbon stocks and changes during the project, one can often use cadastral or statistical data in the outer circles.

Project area

The project area (PA) is congruent with the area geographically delineated by the project boundaries as defined by Milan Decision 19/CP.9 (UNFCCC 2003). The PA may contain several discrete areas of land (Decision 19/CP.9, paragraph 1 (b)). Firebreaks, on-site roads, airfields and administration buildings may be included as far as the project operator directly controls them. In case they are not, GHG emission increases by sources are to be accounted as leakage if measurable and attributable to the A/R project activity. The GPG (IPCC 2003) gives further orientation referring to boundaries and which greenhouse gas stocks / flows to monitor.

Figure 1: Area levels in the PARAPIA concept



Reference area

The reference area (RA) is a land unit used to reflect the baseline land use without the planned activity. It is applied to determine the likely future land use for the project area in a standardized way[4]. The RA shall be a circular area of 5 to 10 times the size of the PA around the geographic centre of a contiguous PA, which allows assessing local trends in land use. However, there may be good reasons to deviate from a circular design of the RA. The RA should embrace landscape where the particular A/R project type is a valid option. This can be agricultural land, pasture, fallow land, and unprotected forest of any kind.

Neighbouring cities and protected areas need to be excluded from the RA, as their land use is to be considered invariable. In arid environments, the vegetation zone often stretches alongside rivers, so that an inclusion of the hinterlands would invalidate the RA. The same applies where the vegetation zone is located within a steep valley. Other CDM A/R projects need to be deducted from the RA expanding it accordingly to adjacent areas. In doing so, “me-too” A/R projects in a given area will not be disadvantaged. If sub-areas are excluded, the boarders of the RA should be expanded respectively to keep the RA size constant (also see figure 2). The same procedure is to be applied if the area reaches national borders.

Once the PA is determined, it needs to be stratified (subdivided in land use compartments) according to soil conditions and water availability, social factors like ac-

[4] A determination of the reference land use type could also be conducted in a “project specific” approach, i.e. reasonably arguing which land use form is the one to be expected by looking at the determining drivers behind actual land use. This approach, however, might require a significant amount of research while leaving a lot of space for subjectiveness.

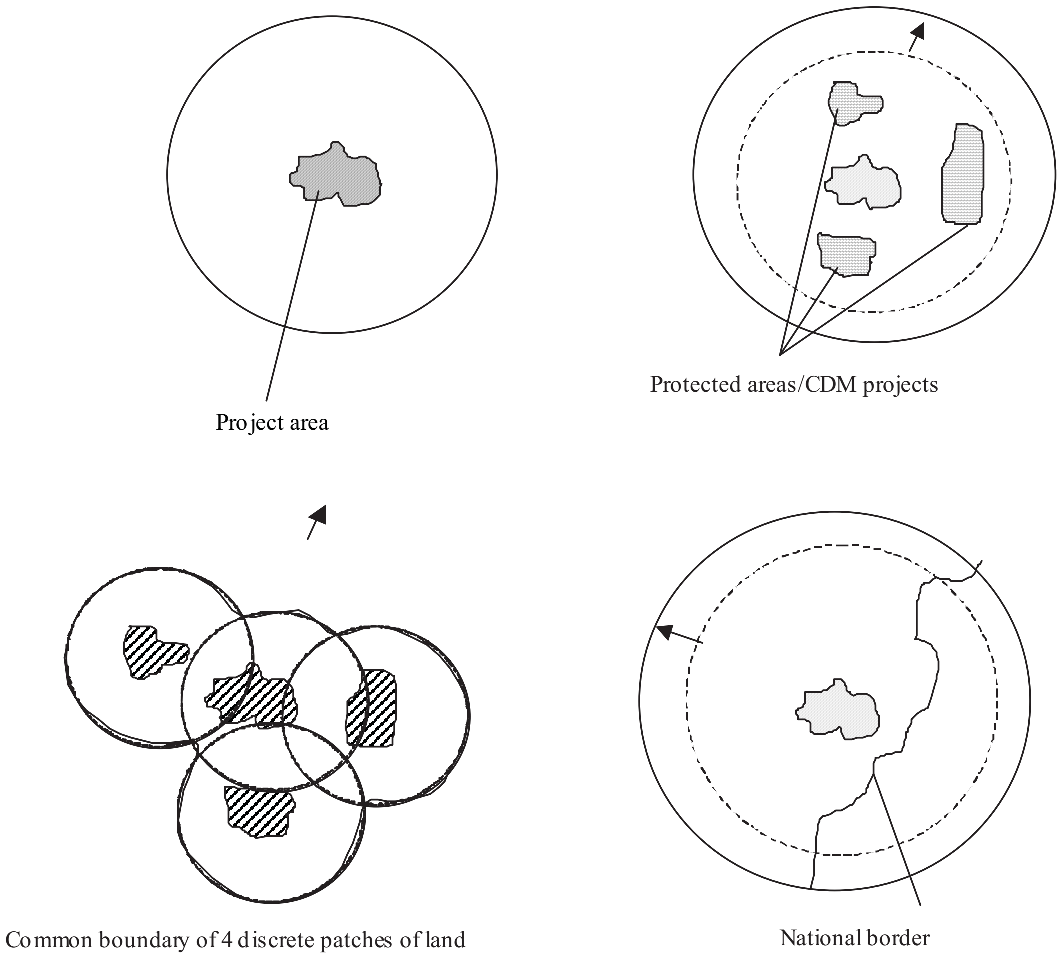
cess to infrastructure and ownership structure, and composite indicators like land prices. Overlaying the different criteria, a map of clusters classifiable as strata will emerge. The same needs to be done for the RA. It is likely that the RA will show a different quantitative composition of the strata identified in the PA. The RA will only be monitored for land-use change, specifically whether deforestation or A/R is taking place. This is consistent with the GPG (IPCC 2003), which proposes either peer-reviewed model simulations (e.g. CO2fix) or measurements in control areas, or alternatively a combination of modelling and measurement. Our proposal lies between modelling and the combined approach, as it refrains from any direct measurement or other interventions in the RA. Notwithstanding, if project participants choose to do so, permanent sample plots for direct measurement may be installed within the RA in order to increase the precision level. For sinks and sources in the RA, either regional default values can be adopted, in case these exist, or, if relevant, carbon measurements in strata similar to the natural conditions within the PA will be used as an estimate. The data required from the RA can be derived either from cadastral data or observed from aerial maps every five years.

If the project consists of several discrete areas, each area has to develop its own RA. Where various RAs of one project overlap, a contiguous RA for all the PAs can be chosen. As a maximum, we propose that the RA covers one fifth of the PIA[5].

On one hand, the RA reflects local conditions and circumstances prevailing on the PA. On the other hand, the chance to register any indirect influence of the project in a statistically significant way is highest in the proximity of the project, while e.g. a national influence will be covered up by statistical noise. Unlike the PA, the 1990 time-line for a land-use change between non-forest and forestland is not relevant. The RA land use is a snapshot to be taken at project start and on each verification.

[5] If this limit is exceeded, an indirect project influence on the whole country or state needs to be assumed, and the PARAPIA approach is not longer a viable option.

Figure 2: Determination of the Reference Area



Political influence area

The widest circle is the political influence area (PIA). Data from the PIA areused to calibrate data obtained for the PA and RA, thus eliminating statistical noise. It is generally an administrative or politically determined entity, such as a province, state, or the entire country, if it is small or national regulations are homogeneous. Land-use changes observed in the RA can result from national trends, or they can be induced by the project. In case the change in any specific activity in the RA does not exceed the one in the PIA, it is unlikely that the project activity is the underlying cause – which would then be of relevance for baseline determination. If e.g. deforestation is increasing at national level, enhanced deforestation in the RA does not automatically constitute an indication for project leakage.

Alternatively, the PIA could stretch beyond the national level. The advantage of choosing a cross-national PIA would be that “good” or “bad” national climate policies might result in less distortion. Cross-national PIAs could optionally be set for project activities that are carried out in more than one neighbouring countries.

3 Baselines for forestry projects

A/R activities by definition change the previous land use and disrupt any activity on-going on the project area. The products or services formerly provided by the area will, as a rule, not be provided by the A/R activity. Thus, there is no emission intensity factor per unit output as a reference for the emission baseline. Furthermore, an emission reduction project will not be allowed to account for the cessation of an emission-intensive production, if there is an obvious risk of it being displaced outside of the project boundary. The potential for such effects is relatively high for A/R projects and thus has to be carefully considered.

Other difficulties in baseline determination for A/R result from the specificities on every project site: biome types, climatic and ecological variability (Lanchbery 2003), and socio-economic issues are specific to the area. Consequently, many of the commonly discussed approaches of standardisation of emission reduction projects, as e.g. benchmarking, can hardly be applied to A/R projects. Here, a benchmark – e.g. a national reforestation or land conversion rate – would not allow for an appropriate consideration of site-specific circumstances. This is the strength of the PARAPIA approach, which honours region-specific features in a standardised procedure.

3.1 Applying the PaRaPia-concept to baseline determination

Decision 19/CP.9 determines three baseline approaches among which project developers have to choose:

(a) *Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary,*

(b) *Changes in carbon stocks in the carbon pools within the project boundary from a land use that represents an economically attractive course of action, taking into account barriers to investment;*

(c) *Changes in carbon stocks in the pools within the project boundary from the most likely land use at the time the project starts.*

"Existing or historical" C stock changes relate to pre-project situations, likewise approach (c), which refers to the situation at the project start. In these cases, no generic instrument is needed for baseline monitoring. Then, the PARAPIA concept could still be used for leakage monitoring..

In case of baseline approach (b), the PARAPIA concept helps determining the economically attractive course of action in an empirical and standardized way. The situation in the RA serves as the reference unit. Several options exist to define the reference land use at a given time:

- Shares of current land-use types in the RA
- Land use options whose weighted average of the current share in the RA and the share in land use changes of the last five years is the highest of all land use options
- Weighted average of current shares in the RA and shares in land use changes of the last five years

After determining the reference land use according to one of the options listed above, its "reference carbon stock" needs to be defined. Regularly, this should be done by direct measurements. In a last step, one must agree on a transition period after which the project area's current land use would be fully transformed into the reference land use. Those three factors then constitute the basic structure and scale of the project's baseline.

The reference area is most suitable for an observable or at least an adjustable baseline. The proposed standardised procedure constitutes a hybrid between a project-specific and standardised baseline (Sussman and Leining 2002, p. 16).

3.2 A practical example

To illustrate the PARAPIA concept described above, we apply it to a fictitious example. Let us assume a planned A/R activity on an area of 5,000 ha (PA), currently characterised by multiple uses (agriculture, pasture, human infrastructure, forest lands). According to the PARAPIA-concept, the RA should be 25,000 – 50,000 ha of size. In this example, we assume a RA of 30,000 ha with the following characteristics:

Table 1: Characteristics of the Reference Area (example)

Land use	Carbon content [t C/ha]	Area in 2005 [ha]	Shares in 2005	Area in 2010 [ha]	Shares in 2010
Farming	20	7500	25%	8100	26%
Pasture	45	9900	33%	9200	28%
Forest	280	10900	36%	10500	40%
Sealed area	0	1700	6%	2200	6%

Table 2: C stock changes resulting from land-use change

Land use change gains & losses [tC/ha]	Farming	Pasture	Forest	Sealed
Farming	n/a	25	260	-20
Pasture	-25	n/a	260	-45
Forest	-260	-235	n/a	-280
Sealed area	20	45	280	n/a

At project start, pasture accounts for 33% of the land use types in the RA with an average carbon stock of 45 t C/ha; forest area accounts for 36% with a carbon stock of 280 t C/ha; agricultural land accounts for 25% with an assumed carbon content of 20 t C/ha. Consequently, the average reference carbon stock of the RA is determined to be **121 t C/ha**.

In the PA however, by definition there is no forest. If there were, the forest patches unaffected by the activity would need to be included in the monitoring plan. At project start, the land use shares are 70% pasture, 28% farmland, and 2% roads and other infrastructure. The average pre-project carbon stock for the PA is (0.7*45+0.28*20+0.02*0=) **37.1 t C/ha**

The land use composition in the RA is re-checked for every stratum at the next verification date. For simplicity, we assume in this case that pasture and farmland belong to one stratum respectively. At the next verification, 5% of the pasture in the RA have been converted to other land uses, of which 1% to farmland and 4% to non-CDM forestry (0.01*-25+0.04*260), thus we assume an overall increase of **10.15 t C/ha** for the RA. As the real carbon content is not measured in the RA, conversion is accepted to be immediate, both for higher or lower carbon content. For the PA, the carbon uptake needs to be measured anyway. For the project owner, this situation leads to a discount on its net anthropogenic GHG removal. This is fair in case the project benefits from the same incentives as any non-CDM afforestation. The methodology however needs to provide for the case, in which for the CDM A/R activity no incentive is granted besides the CDM. In case a subsidy program is phased in after the start of the A/R activity and excludes early CDM projects, this is a normal CDM risk.

Depending on the project methodology applied, on the PIA level the following data may need to be determined: Incentives for specific land uses, land-city migration, and commercial interest rate. If economic factors or regulatory barriers prevail for the assessment of additionality, PIA will play an important role for baseline determination. If local and regional factors prevail, the need of installing a PIA will mainly reside in the calibration of leakage data.

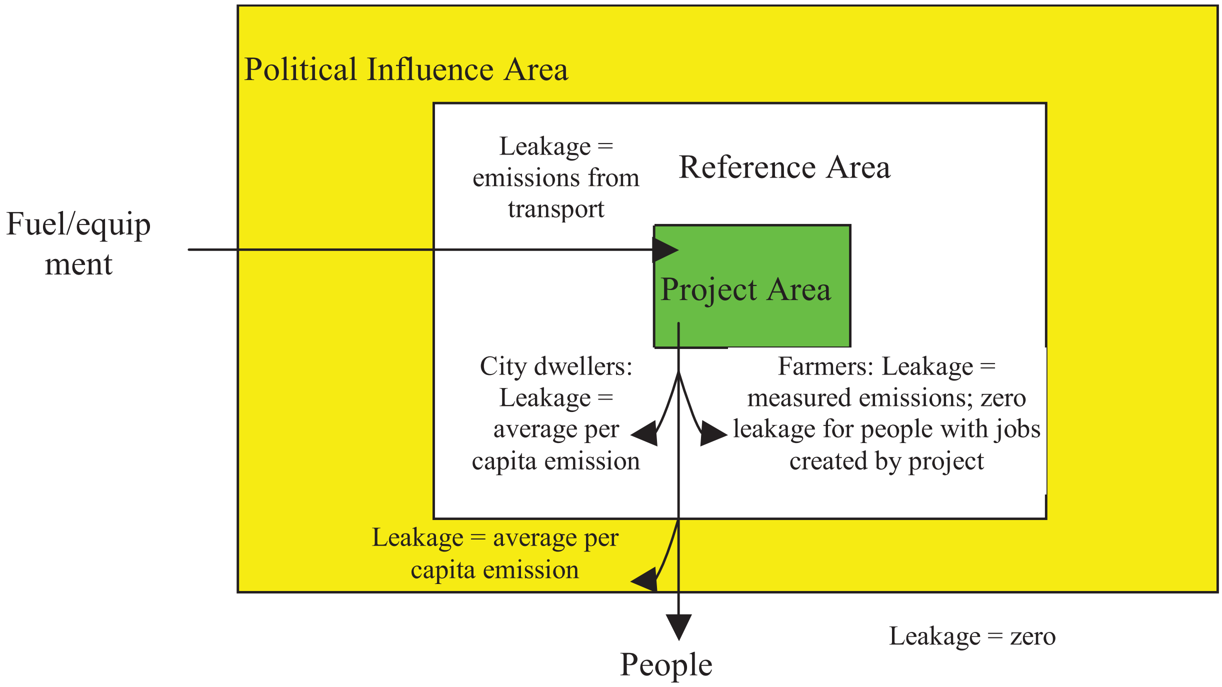
4 Leakage estimation

Under A/R CDM, leakage is defined as "the increase in greenhouse gas emissions by sources which occurs outside the boundary of an afforestation or reforestation project activity under the CDM which is measurable and attributable to the afforestation or reforestation project activity" (UNFCCC 2003). Positive leakage, as admitted under Marrakech Decision 17/CP.7 is not eligible. Only an emission increase by sources is seen as leakage, while a decrease of sink activities outside the area (i.e. via market effects of increased wood supply) is not considered.

There are perceptions that the magnitude of this risk may be higher in forestry than in other sectors, which, however, is debatable (Schwarze *et al.* 2003). One reason why the leakage risk may be inherently higher is that land-use change projects require a disruption of the previous land use activity (see section 3 above), which then may shift to areas that were forested when the project started. Agro-forestry projects may be an exception to this rule, as the main activity remains unchanged, and the additional forestry activity may even increase productivity in the agricultural activities.

Some forms of leakage can easily be detected and avoided, like temporal leakage. For example, defining the project start and thus the crediting period *after* site preparation is finished (Ellis 2003 p. 34) is normally being rejected by expert reviewers and certifiers. Furthermore, there are GHG sources directly related to the A/R activity, like transport of inputs and timber between the project area and the next port, or workforce-related transport emissions. People's behaviour may change as a result of the project, too. We propose to differentiate between on-site effects of increased wealth (suppressed demand), dislocation of dwellers into the RA, where average emission patterns can still be observed, and moving outside the RA into the big cities. Setting a kind of regional boundary (Sussman and Leining 2002 p. 24), the PARAPIA concept can help simplifying calculations. Figure 3 visualises the process schematically.

Figure 3: Leakage determination using the PARAPIA scheme



In doing so, two clusters of leakage would be distinguished: leakage caused by people that are not linked to the project, and leakage due to use of fossil fuels, equipment and others by project participants.

Leakage caused by movement of people: People currently living in the project area might leave due to the project activity and start up elsewhere. Such a displacement can primarily be assumed in two cases: either, if the project restricts free access to natural resources, or if the project reduces the number of local job opportunities (e.g. afforestation project in an area formerly used for agriculture). Concerning the future activities of those people, the following options have to be considered: They could either move to rural areas within the reference area, or move to cities inside or outside the reference area. Emissions resulting from deforestation or degradation of forested area caused by people from the first category can directly be detected by monitoring land use changes in the reference area. People moving to cities inside the observation area as well as people moving outside the area but staying in the country would be assumed to cause leakage at the level of average per capita emissions.

Leakage due to use of fossil fuels, equipment and other by project participants: The relevance of this leakage type strongly depends on the definition of the project (activity) boundaries. If, for example, transport emissions were only to be registered within the PA, not taking into account the distances of products from the project boundaries to the destination, leakage would likely be negligible. Consequently, one should at least consider the following potential emission sources: use of fossil fuels, use of fertilisers, and road building. Relevant data can be obtained from regional and/or national statistical offices. In case no sufficient data are available, reasonable default factors should be applied. Those factors should be agreed upon at international level in order to standardize procedures[6]. Additionally, project developers should be obliged to identify other relevant sources and take them into consideration.

5 Monitoring and data requirements in PARAPIA

Project Area:

The characteristics of the PA can be described and monitored in detail – covering the selected carbon pools, ecological, social and economical structures. In the PA, the project's impacts are directly measurable and attributable to the project activity itself. Direct measurements should be the rule, i.e. by taking soil and vegetation samples (Hamburg 2000; IPCC 2003). The same holds for the control of fuel and energy consumption, etc. Population that stays in the area can be registered, staff and its families' emissions behaviour is observable.

There needs to be a carbon inventory for each land-use type occurring in the PA. For the purpose of monitoring, the area has to be stratified and representative samples are to be determined. On these samples, a full initial inventory is performed on all relevant pools within the PA. Carbon pools can only be omitted, if it is proven that this choice does not increase the expected net anthropogenic GHG removals by sinks (UNFCCC 2003).

The initial carbon inventory of the PA (including natural succession) can be used as the baseline in case the land use in the RA has not been changed since the project start.

Reference Area:

Whereas changes in carbon stock of the PA – including sample plots for natural succession – are directly measured and monitored in the project area itself, data for baseline monitoring from the RA will be used to determine the *reference land use type* and to reasonably quantify carbon stock changes for those reference land uses. Project operators thus need to collect and monitor data of land use categories in the RA and to measure carbon stocks and stock changes. Concerning forest land use in the RA, it is not important that the shares of strata present in the PA are equal to their

[6] A relatively easy way to standardise emissions factors for those activities would, for instance, be to use software programmes like the Global Emission Model for Integrated Systems (GEMIS), developed by the German Oeko-Institute. This model calculates emission factors for all kinds of activities. The number of forward and backward links to be considered by the model can be chosen freely (also see www.gemis.de). However, GEMIS requires a national database in order to achieve reasonable results. Development of such databases could be realised through coordinated donor activity. In case of lack of national data, the IPCC emissions factor database should be used.

occurrence within the RA, as long as they emerge within the RA. In order to obtain comparability, the respective shares can be statistically normalised, as shown in the example above.

Political Influence Area:

Relevant data to be monitored can relate to migration, deforestation and afforestation rates, soil erosion, per-capita emission factors, timber imports and exports. These data are usually readily available with national statistics offices. They are needed for calibrating data obtained in the RA. For example, as population concentration in big cities is characteristic for most developing countries, migration from the RA is only a significant leakage indicator if its increase lies above the one observed in the PIA for rural areas. Aggregated data from the PIA might be used as a control group.

Table 3: Data availability on the three area levels

	Land use type	**Emissions from energy & fertilizer use**	**Social data**
Project area	shares of different land uses	current energy-related emissions	employment situation
	changes in land use over time	N_2O emissions from fertiliser use before project start	migration patterns
	degree of human intervention	energy emissions for the project case	land tenure
		transport emissions between related project areas	timber and fuel wood use
Reference area	as compared to the one found in the Project Area	emissions from energy use and fertilisation on cultivated forest and agriculture lands	employment situation
	changes in land use over time		migration patterns
	degree of human intervention		land tenure
			timber and fuel wood use
Political influence area	as compared to the ones found in the Reference Area		employment situation
	changes in land use over time		migration patterns
	degree of human intervention		land tenure
			timber and fuel wood use

6 Application and critical discussion of the ParaPia-concept

Selection of the project area:

Apart from the CDM eligibility criteria, there is a wide array of technical criteria for project area selection. Those criteria include for example water availability, steepness, soil quality, etc. Thus, the PA once identified may actually differ in its conditions from the RA. As long as conditions comparable to the PA exist in the RA, the PARAPIA approach can be used. If a complete biome is afforested under the CDM, PARAPIA cannot be applied.

Size of the reference area:

Land use occurs in a regulatory framework, but local conditions are critical. Under the same incentive structure, A/R will be profitable in one area and unfeasible in the other. While the regulatory and economic framework is derived from the PIA, the ultimate determination of additionality and the baseline net GHG removals by sinks can only be carried out at local level. In most cases, spatial leakage is very limited, too. If it occurs far from the PA, it will no longer be “measurable and attributable”. Furthermore, data for any larger area beyond administrative boundaries are difficult to obtain, while the RA can in most cases be inventoried with the help of local agencies. At local level, this effort can be limited, and data precision will be higher. The ultimate size of the RA needs to be validated by the designated operational entity. Table 4 summarises the potential errors that can occur when determining the RA size. Project developers will have a tendency to choose too small a RA in order to limit costs for data collection and processing.

However, the RA concept has not yet been tested in practice on a large scale. The size range indicated above may turn out to be unrealistic. If the areas are highly inhomogeneous, a higher number of sample plots will require a larger universe. However, apart from the cost argument, data precision will suffer, if the area chosen is too large, because statistical noise will increase with the size of the RA, thus hiding the indirect project effects.

Table 4: Potential errors when determining the RA size

		Effects on	
Error type	**Error**	**Baseline setting**	**Leakage determination**
RA too small	Full plantation forest not included if project is part of a larger afforestation area	Underestimation of carbon uptake in baseline case; additionality wrongly assumed	None
	Unprotected natural forest not included	Underestimation of non-anthropogenic carbon uptake by natural succession, as proximity of natural seed source is not considered	Underestimation, because forest invasion is not attributed to the project

Error type	Error	Effects on Baseline setting	Leakage determination
	Portions of lands not included that show the same characteristics as the plantation site	Unclear effect for initial baseline When reassessing the baseline, changes in the incentive structure that lead to increased afforestation may not be detected, thereby underestimating the baseline sequestration	Negative effects on local land prices overestimated
RA too large	Areas included that are unlikely to be indirectly influenced by the project	Unclear effect for initial baseline Not accounting for negative leakage means underestimating the reassessed baseline	While the total effect can still be quantified, a variation compared to the one observed in the PIA may not be detected any longer, thus leading to an underestimation

<u>Baseline revision</u>

The PARAPIA concept is especially suitable for mid-scale and large-scale projects where a baseline renewal is intended by the project developers. According to paragraph 23(a) of Decision 19/CP.9 (UNFCCC 2003), A/R projects can choose either a one-off crediting period of up to 30 years or a renewable crediting period of a maximum of three times 20 years. As baseline monitoring will be the standard procedure under PARAPIA, a revision will not induce conceptual changes. If over time the baseline net GHG removals by sinks will be found to increase significantly, the project-induced net anthropogenic GHG removals by sinks will already phase out during the actual crediting period. In this case, it will be obvious that a planned baseline renewal will deny project additionality. Again, baseline renewal is linked to baseline approach 22 (b), because in the options given in Decision 19/CP.9 paragraph 22 (a) and (c), the baseline is determined by “existing or historical changes in carbon stocks within the project boundaries”, respectively those most likely “at the time the project starts” (UNFCCC 2003). By the time the baseline has first been determined, data from the RA and PA are not yet skewed by the project. If however a revised baseline is chosen along the lines of the baseline renewal procedures, the PA is no longer available for baseline determination, and the project is likely to have had some influence on the RA.

The question is thus, whether for approach 22 (b) the RA is valid for baseline determination in subsequent periods. As no positive leakage has been admitted, emissions may be lower in the RA due to the first phase of the project, so that there is a risk when setting a baseline for the second crediting lifetime of the project, to underestimate the baseline emissions. Negative leakage having been conservatively quantified, these factors can be discounted from the observed values at the time of baseline reassessment, which will again lead to the tendency to underestimate the baseline emissions or overestimate the baseline uptake. Thus, the error in correcting the baseline by the time of its reassessment will not jeopardise environmental integrity.

7 Conclusions

The PARAPIA approach here presented contributes an element of standardisation in CDM A/R project development, namely the definition of the Reference Area for baseline and leakage determination. Baseline monitoring is not mandatory under modalities and procedures for A/R CDM; yet it has been proposed in several A/R methodologies so far. The trade-off is usually between the risk of project participants' influence on the sample plots on the one hand and the high aggregation of national data on the other.

PARAPIA is an intermediate solution between project-related bottom-up and national-level top-down approaches. It is a a hybrid between a project-based and standardized approach for baseline and leakage determination. There are a number of conditions for application of this approach:

1. Baseline approach 22 (b) is chosen, that relates to a "land use that represents an economically attractive course of action, taking into account barriers to investment" (UNFCCC 2003).
2. The project developer wishes to monitor the baseline.
3. The RA provides areas in circumstances comparable to the ones found in the PA. For a whole biome or regulatory unit being subject to an A/R activity, PARAPIA is not a viable approach.
4. Leakage in the sense of its restricted Milan definition is considered significant.

Summing up, the PARAPIA approach of "partial standardisation" of baseline determination for A/R activities looks promising. Different projects may become more comparable to each other, while leaving enough space to incorporate the numerous individual aspects that characterise each single forestry project. As a starting point for further research, PARAPIA should be applied to different planned A/R project activities, in order to gain experience and to fine-tune the approach.

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Chapter V

Development assistance and the CDM – how to interpret 'financial additionality'[1]

Michael Dutschke and Axel Michaelowa

Abstract

International climate negotiations have specified that projects under the Clean Development Mechanism (CDM) should not lead to a 'diversion' of official development assistance (ODA). It is however unchallenged that ODA can be used in capacity building for the CDM. Diversion can be interpreted in purpose, sectoral, and regional terms. There are possibilities to use ODA benchmarks to define diversion such as the UN 0.7 per cent target, but they are unlikely to be politically acceptable. At the project level, three main options exist but none of them is perfect. The Development Assistance Committee of OECD endorses deduction of the value of emissions credits (CERs) from ODA. This however leads to a long-term pressure on the ODA level. Differentiating an ODA-financed baseline project and a 'piggyback' CDM option is likely to be arbitrary in many circumstances. Even if CERs do not accrue for the ODA share of the investment, still private CDM projects are crowded out due to the subsidizing of CDM projects.

1 Introduction

The Clean Development Mechanism (CDM) as stipulated in Article 12 of the Kyoto Protocol has the double aim of fostering sustainable development in developing countries and assisting developed country parties in reducing greenhouse gas (GHG) emissions. Under the CDM, industrialized countries (the group mentioned in Annex B of the Kyoto Protocol) receive emission credits ('Certified Emission Reductions', CERs) for emission reductions achieved through projects in developing countries. As the CDM enhances the emission allowances of Annex B countries, it is important that the corresponding reductions would not have occurred in the absence of the respective emission mitigation projects. This issue is commonly termed 'additionality' and has its base in Art. 12 (5c), that states that 'emission reduction [shall be] additional to those that would have happened in the absence of the certified project activity'. Financial additionality is one element of the additionality concern; it originally meant that no public money that would have been spent anyway on climate-related action in developing countries could be relabeled as CDM. This originates in the fear of LDCs that the continuation of ODA flows could be linked to their acceptance of CDM projects. Ever since Kyoto, Japan had shown its intent to use official development assistance (ODA) for CDM projects and also the EU Commission (1999: 11) accepted use of ODA by stating that "official development finance and GEF should only be supplementary to private funding. ... ODA within the framework of [the] CDM ...

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would have to be targeted to areas where the public sector has a comparative advantage over private investment and where additional social benefits are to be expected". But the Commission also clarified that ODA should not be used to finance the acquisition of CERs (ibid. 12). In the negotiation of the CDM text in 2000, the G77 and India asked for CDM funds to be additional to ODA, while the Umbrella Group and the EU in a rare accord developed the new term 'diversion' of ODA, which should be avoided (UNFCCC, 2000: 39). When the Parties to the UN Climate Convention met in Marrakech in late 2001 to define the detailed CDM rules, the very broad Umbrella—EU definition for financial additionality prevailed. It states that "public funding for clean development mechanism projects from Parties in Annex I is not to result in the diversion of official development assistance and is to be separate from and not counted towards the financial obligations of Parties included in Annex I" (Preamble of Decision 17/CP.7, UNFCCC, 2001: 20). Besides official development assistance (ODA), the cited paragraph relates to the Parties' contributions to the Global Environmental Facility (GEF).

Despite the flurry around CDM project development, up to the present little attention has been paid to the practicalities of the relation between ODA and CDM. The Development Assistance Committee (DAC) of the OECD negotiated this issue over the last two years, and at its high-level meeting on 15—16 April, 2004 took the following decision:

> 'We agree that the value of any Certified Emission Reductions (CERs) received in connection with an ODA-financed CDM project should lead to a deduction of the equivalent value from ODA, irrespective of whether the CERs are sold or retained by the donor. We also rule out the possibility of counting as ODA funds used to purchase CERs. We request the DAC's expert groups on environment and statistics to continue work to clarify remaining unresolved issues and formulate a practical approach in time for the next reporting cycle. This approach would be subject to review within three years. (OECD 2004)'

Whether this decision will be accepted by the CDM Executive Board remains to be seen. In this chapter, ODA is understood to consist of technical cooperation and financial cooperation. Compared with financial cooperation, the monetary volumes (and carbon revenues) from technical cooperation are usually rather small. Financial cooperation is typically channeled through the host country's central bank, which then distributes loans to local banks for financing concretely identified projects. Financial cooperation agencies like the German KfW stress that the terms of these loans shall reflect market conditions.[2] These conditions are in many cases hypothetical, as long or medium-term loans would otherwise not be available.[3]

[2] Personal communication Joseph Gamperl, 9 April 2003.
[3] In the case of the World Bank's Prototype Carbon Fund, the Brazilian Plantar project under market conditions would have received a loan with a duration of one year and an interest rate of 20 per cent. When presenting the PCF's carbon purchase contract, the bank increased duration to six years, and brought down the interest rate to 6 per cent.

We start by defining the term ‘diversion’ for the purpose of the subject. Then we study proposals for a benchmark approach, followed by options to interpret diversion at the project level. Even in this latter case, our focus is on the aggregate consequence on the amount of CERs generated and on the regional allocation of CDM projects. In conclusion, we give concrete policy recommendations on how to find suitable international regulations that could guide the DAC in its implementation and review of the April 2004 decision. Moreover, we give recommendations for development assistance agencies on how to deal with this issue.

2 What is diversion?

In order to understand the concerns expressed in the discussion around financial additionality, we shall first define types of potential diversion. These are (1) diversion of purpose, (2) sectoral diversion, and (3) regional diversion. These are not clear-cut distinctions; they rather look at the problem of diversion from different angles. Any regulation concerning financial additionality can result in one or more diversion risks.

2.1 Diversion of purpose

If ODA is used for direct acquisition of certified emission reductions (CERs), while still being reported as ODA, its original purpose may not be pursued any longer. For any single case, this argument may be difficult to sustain, because both CDM and ODA have the objective to further sustainable development of the target country (Kete *et al.*, 2001: 5). If a host country does not endorse a project, it will not produce CERs. The risk however is that ODA might directly or indirectly be tied to the execution of CDM projects (ibid.: 8). Furthermore, climate change is not a top priority for many developing countries, given more pertinent concerns about food and water security and poverty alleviation. Mitigation projects may have combined goals, but climate projects will not necessarily be the most efficient use for the solution for the above-mentioned problems. The ‘Copenhagen Consensus’, a theoretical exercise led by climate skeptic Bjørn Lomborg (2004), has ranked the cost efficiency of different ODA projects. Highest ranks are given to HIV and malaria control, provision of micronutrients, and trade liberalization. Climate mitigation and adaptation measures are lowest on the list.

2.2 Sectoral diversion

Similarly to the diversion of purpose, ODA investment could preferably be led into sectors that are most likely to produce CERs, such as waste disposal or large-scale energy production, while the most pressing necessities may lie in other areas, such as social infrastructure and education.

2.3 Regional diversion

The incentive of gaining carbon credits could also divert ODA investment to countries where those projects are most likely to be successfully implemented. This could relate as well to mitigation potentials as to administrative capacities. One part of this concern is certainly participation in the climate regime. Currently, most of the African nations have not ratified the Kyoto Protocol, which makes them ineligible for the CDM. Actually, much ODA investment is directed into national and regional capacity building. Nevertheless, should ODA flows depend on the recipient's active participation in the Climate Convention?

3 Why should ODA come into the CDM?

If the risk of diversion is there, why then should ODA be used under the CDM? It is not controversial today that ODA operates in the field of CDM institution and capacity building, such as in the case of the World Bank initiated National Strategy Studies (NSS). These activities are financed on a bilateral basis and create the framework for successful project implementation. One result of these studies is a CDM project pipeline. The development of complete project documents is only one step further, which is actually undertaken by the cooperation agencies of several countries (e.g. Canada and Germany), but this effectively moves into a grey zone where ODA might subsidize implementation.

The rationale for looking into direct ODA involvement in CDM projects is that it may increase the chance to attract private sector investment in neglected regions and in specific project types and modalities with a high contribution to sustainable development, but which would not be profitable enough for private investment alone. This may be due to the high CDM transaction costs, to a lack of institutional capacity, to the small project size, to the large number of stakeholders, or to the fact that in terms of CO_2 reduction the options favored by the host country are not the most profitable ones. If ODA agencies were not allowed to participate in this process, decades of valuable project experience would be lost. In certain cases during the AIJ phase,[4] ODA grants to projects were even withdrawn in order to allow turning them into carbon projects (Dutschke and Michaelowa, 1997: 36). As with foreign direct investment, the bulk of private sector investment in the CDM will probably go to three countries, China, India, and Brazil (Halsnaes, 2002: 26). This concentration will be extremely high in the first commitment period, because of the low expected CER demand. ODA could help balance this unfair division of resources and mitigate perceived country

[4] AIJ (Activities Implemented Jointly) was a test phase for emission reduction projects in developing countries and countries in transition between 1995 and 2001. The projects did not generate any emissions credits.

risks. In least developed countries, ODA may leverage private CDM investment. Furthermore, ODA has the chance to promote project types the private sector would rather not invest in, especially small community-based projects and advanced technology developments (Kete *et al*., 2001: 6).There are thus good arguments in favor of combining public and private funding for the CDM. In the next section, we shall see how regulations could be designed to address ODA involvement.

4 Options for avoiding ODA diversion

The discussion on how to avoid ODA diversion through the CDM moves between two extreme cases. One is to simply ignore the diversion rule, arguing that it is only expressing a political intention, without any practical consequences. This case will not be considered, as we think it runs counter to the intention of the Marrakech Accords. The other is to disallow any involvement of ODA funding into the CDM. This would probably lead to circumvention strategies, like granting ODA funds to NGOs or defining the focus of ODA programs in a way that single CDM projects can indirectly obtain ODA finance made available to host country institutions in a broader context.

There are principally two ways to look at diversion, the macro and the micro level. The macro approach consists in observing the country level and needs to define a baseline for ODA 'without CDM', be it for the donor, be it for the host country. The micro-level approach observes likely changes in ODA flows based on project opportunities.

4.1 An ODA baseline

Jusen Asuka proposes an ODA baseline, beyond which ODA could participate in the CDM. His methodology is guided by two criteria: '(1) There will be no reduction in the overall ODA flow from developed countries to developing countries. (2) In the overall aid projects portfolio of an industrialized country there should be no crowding out of regular ODA projects by global warming mitigation projects' (Asuka, 2000). A third criterion (3) should be environmental additionality: climate change mitigation projects might already be the business-as-usual case for ODA. In this respect, what has been common practice in the last years will under the CDM eventually generate extra credits and thereby inflate Annex B emission budgets.

Criterion (1) is acting on a very large scale. As public expenditures are more determined by business cycles and the resulting state income, they are quite erratic over time. It could be a valid option to allow proceeds from ODA to be realized only under the condition that ODA budgets are at least maintained at the level of previous periods (e.g. over five years). A less stringent approach would be to observe ODA receipts of the individual host country by the implementing donor. It could require ODA directed to the host country from the individual donor to increase by the same amount publicly invested under the CDM. This approach could still lead to regional diversion.

If, in contrast, the compliance with the Millennium Goal for industrialized countries to give 0.7 per cent of their GNP as ODA were a prerequisite for investing ODA funds into the CDM, this would limit CDM investment eligibility to just four donor countries (Denmark, the Netherlands, Norway, and Sweden) and multilateral donors like the World Bank. Under the actual demand, ODA expenditures will certainly not be increased only for being able to sponsor CDM projects. This option would thus be nearly as restrictive as the option of total ODA prohibition under the CDM.

Criterion (2) ‘no crowding out’ is near impossible to monitor. Even in the absence of CER incentives, donor countries could increasingly ask for ODA contributions to climate change mitigation and adaptation, in which case no diversion of purpose would take place. Overall, there are no ‘regular ODA projects’.

Monitoring criterion (3) would require a quantification of GHG effects of business-as-usual ODA projects. This has been done for the World Bank, whose investment in emission-intensive technology between 1992 and 1997 was found to be 100 times higher than the GEF budget during the same period (Sustainable Energy and Economy Network *et al*., 1997: 5). Thus, the World Bank involvement in climate change mitigation is hardly suspect of being non-additional. A graduation approach could also be applied. Assuming 20 per cent of ODA in the previous period were spent on activities that have a high impact in climate mitigation, any CDM investment could be regarded as 20 per cent non-additional. Over time, and as climate mitigation measures under ODA increased, CDM investment would slowly be phased out.

4.2 CER value deducted from ODA

As suggested by the DAC, in order to decrease the incentive for diversion, CER revenues could be deducted from the net aid disbursement in the period they accrue. The investor country can then either sell them immediately, or put them in the national registry. In order to avoid the perverse incentive for the investor country to sell its CERs below their value, they need in every case to be valued based on actual market prices by the time they are certified. A particular price index needs to be chosen in advance on an international level.

The higher the CER revenue, the lower the total amount of ODA spent over the lifetime of the project. If the CER revenues are higher than the initial investment, ODA becomes negative.

As for the market effects of this regulation, let us assume that under a business-as-usual case, there is a stable amount of ODA funds for renewable energy and energy efficiency projects. In fact, since the UN Summit on Environment and Development in 1992, the share of ODA going into such projects has strongly increased. This in itself could be seen as sectoral diversion of ODA as recipients may have preferred other uses.

In this case, ODA funds can be used for CDM projects and all renewable energy, energy efficiency, or afforestation projects are now labeled CDM.

We have to distinguish two extreme cases:

1 All CERs accrue to the donor country. ODA will increase during investment and later decrease as shown in Figure 1. Only if politicians decide to channel the CER receipts back to the ODA budget, is there no net ODA decrease over time.
2 All CERs accrue to the host country. ODA remains constant, ceteris paribus.

Figure 1: Overall ODA changes over time if CER revenues are deducted

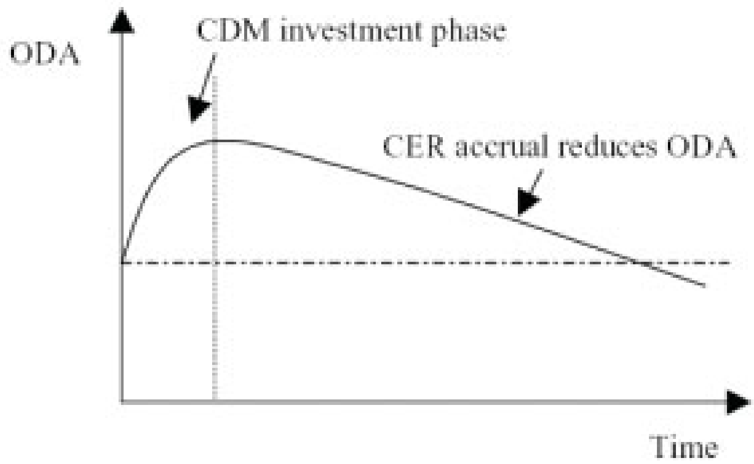
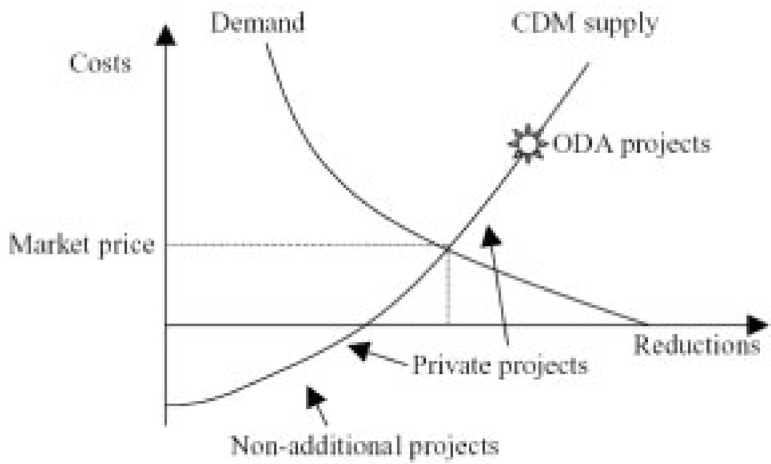


Figure 2: Private and ODA-financed CDM projects



The impact on emissions budgets depends on the characteristics of ODA- financed CDM projects. We base the subsequent analysis on the following assumption: CDM projects financed by ODA will typically have higher implementation costs than privately organized projects, as they want to provide development benefits (Figure 2). This does not necessarily mean that only high-cost mitigation measures are financed by ODA, but ODA finance covers country risks private investors would not be disposed to shoulder on their own. Otherwise no ODA would be needed as the private sector would take up these projects anyway, and ODA engagement would only lead to crowding-out private sector investment. In case of private-public partnerships (PPP), ODA commitment works as a subsidy.

The effect on the market depends on who gets the CERs, the investor (Figure 3) or the host country (Figure 4).

As ODA projects are more expensive than the market price, there will be no change in the market. For the investor country, spending ODA is bad business, as it could get the CERs cheaper on the market.

Figure 3: Investor country gets CERs

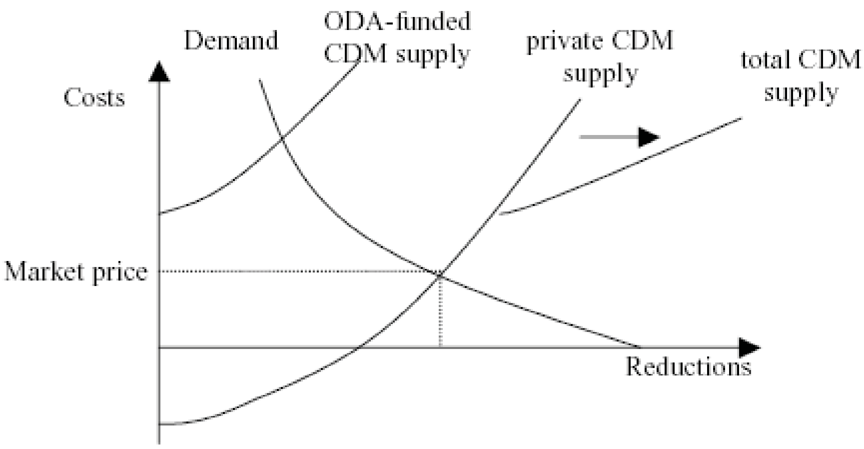
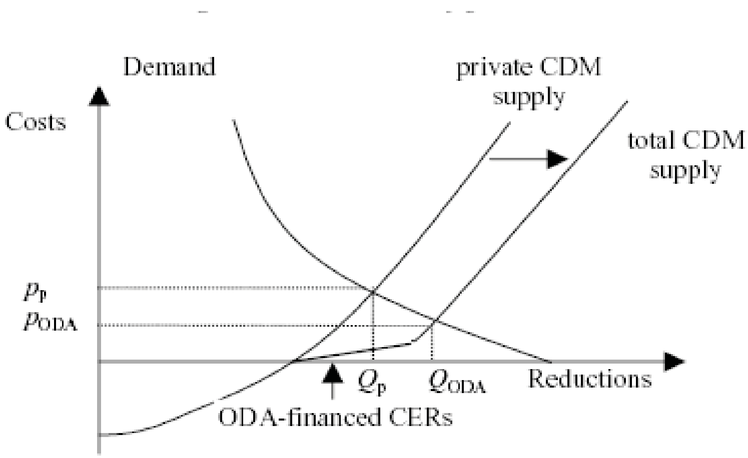


Figure 4: Host country gets CERs



If the host country gets the CERs, the picture changes completely. It receives the CERs at zero cost, if the project is fully grant-financed and at low costs for concessional financing, and thus the supply curve shifts to the right. Price falls from p_p to p_{ODA} and CERs rise from Q_p to Q_{ODA} . Private projects are crowded out, and the revenue of the remaining ones falls. The CDM gains market share compared with Annex-I domestic compliance, which is however of no concern under the perspective of the non-diversion clause.

4.3 No credits for the ODA share of investment

If in the previous option, the CERs’ value was deducted from ODA, CERs could as well be deducted according to the ODA share of investment. This could be done by the certifier (designated operational entity — DOE), provided the CDM Executive Board should wish to add a rule in this sense. As an alternative, the investor country could definitively retire the relating CERs from the market. In this case, ODA may leverage private investment, but the donor country’s incentive for ODA to be invested in CDM projects will not be as high as in option 2 above.

Project proponents will ask for a high grant element, as ODA with a low grant element will lead to the same reduction in CER as ODA with a high grant element. For illustration, consider the following case.

> A small-scale wind power project of 1 MW costs €1 million and gets an ODA loan with an interest rate of 10 per cent over ten years, equivalent to €100,000 annually. Assuming an increase in the CER value to €5, and an annual CER generation of 6,000 t of CO_2 reduction, the return from CDM will amount to €30,000. For the project owner, taking an ODA loan will thus imply opportunity costs of €30,000 per year. The fact that the grant element of the loan is at least 25 per cent when going to the central bank does not necessarily mean that the CDM investor receives the same conditions. On the contrary, financial cooperation agencies pretend to mirror market conditions for the borrower, in order not to introduce market distortions. If the investor has a realistic choice to obtain a commercial loan, he will negotiate conditions for the ODA loan to compensate his opportunity costs due to the loss of CERs. He will now only take up the ODA loan if its net costs compared with a loan at market rates are at least €30,000 lower than the ones of a market loan. Here, he will ask, as compensation, to receive a grant element of at least 15 per cent if the grant element threshold of 25 per cent is calculated at the level of the central bank.

The question arising from this example is whether the loan is in this case to be considered ODA or not. The central bank receives a higher grant element in order to guarantee for the general country and special currency risks. The German KfW Development Bank asks recipient central banks to re-invest benefits, if they accrue from the differential between the conditions offered by KfW to the central bank and those offered by the central bank to the investor into development projects. Thus, this amount cannot be considered diverted from ODA. Therefore, we propose to measure the ODA share at the project and not at the central bank level. In our example, this means that the investor will get the CERs as long as the grant element stays below 25 per cent. As he loses the CERs at a higher value of the grant element, he will decline any loan with a grant element between 25 and 40 per cent.[5]

4.4 Distinction between baseline project and CDM 'add-on'

Here it is assumed that a baseline project (e.g. a coal power plant) would have been funded through ODA anyway and a CDM portion (e.g. the improvement of efficiency due to use of a more advanced technology) can be defined. ODA may not be used for the CDM portion. Diversion of ODA on a macro level (towards projects that are suitable baseline projects to 'piggyback' CDM projects) would be likely.

Problems arise in defining the baseline project. The following options are possible:

1 The baseline project is the *macro-economically* most attractive solution. This is the incremental cost principle applied by the GEF. It has encountered numerous implementation problems.

2 The baseline project is the *commercially* most attractive solution. This would require the determination of the most attractive investment which may be difficult (compare the debate on investment additionality, Greiner and Michaelowa, 2003)

3 The baseline project is the project planned on the site before the CDM idea came in. However in the future, planning will consider the CDM option from the outset

The West Nile hydropower project of the World Bank's Prototype Carbon Fund has a US$3.7 million ODA component; it was argued that this component was necessary to overcome the barrier that commercial financing is not available for projects in that region (PCF, 2000: 6f).

5 Discussion

The ODA baseline approach is not adequate to identify diversion. Sectoral and regional diversion of ODA can happen due to intervening factors other than CDM involvement. As host countries take increasing stakes in the allocation of ODA funds,

[5] As the total volume of loan and interest amounts to €2 million,€30,000 loss per annum equals 15 per cent of loan value.

there is no sense in fixing the quota over an indefinite time in the future. ODA baseline approaches can thus be a starting point to avoid Annex B budget inflation, but they cannot prevent diversion. We should therefore study the consequences at a macro level of additional sets of criteria that are related to individual projects.

Deducting the CER reflow from ODA will lower investor country’s interest in diverting ODA. As it is common sense that ODA should not directly acquire CERs, the rule decided upon by the OECD Development Assistance Committee constitutes the minimal consensus. In order to avoid reflow, there are two alternatives. One is that the CERs remain in the host country. As the host country is free to reinvest the returns from their sale into national priority areas, theoretically diversion is ruled out. Practically, there may be under-the-counter deals that allow the investor to acquire these credits at a price below market value. The other alternative is to grant the ODA share of carbon returns to the private investor directly, which is to be considered a subsidy and may in future lead to conflict with WTO rules. Another way to deduct ODA from the CERs produced is that the investor country temporarily retains or definitively retires the ODA share of the credits from the market as a voluntary action. Alternatively, the Executive Board could decide to reduce the number of credits certified accordingly. As in the case of deducting the ODA share from ODA reporting, in the case of financial assistance it is hard to tell the grant element within the financing package. In technical cooperation, activities in institution and capacity building will result in increased CER production, without a direct link to it. Under this aspect, the OECD decision leaves much room for debate.

The last option, a hypothetical ODA baseline project will lead to a second baseline for CDM projects. The ODA baseline would be the ODA project in the absence of the CDM incentive, while the commercial CDM baseline would be no financing whatsoever for the project. The ODA baseline assumes the ODA project would have occurred within the same sector, in which case diversion had not happened anyway, and no diversion needed to be prevented. Additionally, as ODA is not necessarily linked to economic rationality, the ODA baseline would open all gates for subjectivity.

6 Conclusions and recommendations

In this chapter, we have discussed how to operationalize the term ‘diversion of ODA’. We distinguish overlapping categories of diversion of purpose, sectoral and regional diversions. Means of addressing the different types of diversion can be grouped in benchmark approaches and project-level regulations, both of which might be combined. Among the benchmark options, only the orientation towards the 0.7 per cent of GNP UN target can be determined easily by the end of each year. Even though an increased pressure to fulfill this target is desirable, the political feasibility of this proposal is negligible, given that only four investor countries plus multilateral agencies would be eligible to use the CDM. The other practical option is to compare annual national donors' ODA expenditures with previous periods to be determined. This option requires a high amount of data availability and aggregation, but it does not prevent regional diversion either.

There is thus no perfect option for regulating ODA use for CER acquisition. Most options only address one or two types of diversion and disregard others.

Deduction of CER value leads to long-term pressure on ODA flows to the extent that the CERs are not given to the host country.

Distinguishing between an ODA-financed baseline project and a CDM 'add-on' opens a Pandora's Box of baseline determination.

While the non-accrual of CERs to ODA-financed project activities avoids diversion of ODA, it still leads to a crowding out of private-sector CDM projects, a problem that even more characterizes the other options.

The highest number of CERs would have undoubtedly been produced under the unrestricted use of ODA within CDM projects, which in our view lead to ODA diversion, is not consistent with the Marrakech Accords, and thus was ruled out correctly by DAC. On the other hand, we think that the DA was right in not totally prohibiting ODA use in the context of CDM projects, as both have complementary aims. We think a rule according to which the ODA share of financing is not allowed to generate CERs would limit interest to use ODA in the CDM, while not necessarily leading to a total retreat of the ODA from CDM. On the one hand, it is sufficiently conservative to not predetermine practices that may lead to future conflict. On the other hand, it allows for a reasonable involvement of development agencies into the CDM, to the benefit of projects that contribute to the host countries' sustainable development.

Ultimately, and in the absence of an impartial criterion for diversion, a practical approach would be to require a joint declaration for every ODA co-financed project by donor and host country that ODA diversion is not taking place. One might think that the host country could see itself forced to accept ODA involvement in CDM projects. On the other hand, at least the larger CDM host countries have an incentive to care for their credibility within the developing countries' Group of 77 and China. Several prospective host countries have already declared they would not give host country approval to ODA-financed projects (Buen, 2004). If consistently the big CDM host countries refrain from ODA financing in order to maintain their public image within the negotiations, at least the risk of regional diversion could be mitigated. As with the host countries, also investor countries are not representing homogeneous interests.

Development assistance ministries competing for funding with other ministries, they may also not be willing to certify non-diversion at all costs.

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Chapter VI

Reducing emissions from deforestation and forest degradation in developing countries – the way forward[1]

Michael Dutschke and Reinhard Wolf

Abstract

Deforestation is considered the second most important human-induced source of greenhouse gases, being responsible for approximately 20% of total emissions. In recent years, much knowledge has been gathered on drivers and causes of deforestation and forest degradation. Also methodological tools are available to monitor large areas and proxies for the quantification of carbon benefits from reduced deforestation and forest degradation (REDD). There is common understanding that these emission sources need to be tackled in the near future. Several proposals have been brought forward within the international climate regime that could support reducing emissions from deforestation in developing countries. This chapter finds that they are complementary in many aspects.

As distinct from most industrial mitigation activities, REDD requires a coordination between different levels of governance of the implementing country. Much experience has been gathered in official development assistance (ODA), notably in the context of the Brazilian PP-G7 program, with strong support by Germany.

Once there is a long-term greenhouse gas emissions target, emission reduction credits from REDD could be traded freely during commitment periods, without risking environmental integrity. This will furthermore allow taking full advantage of today's ample reduction opportunities without distorting the market.

Estimates for the total potential and costs of REDD vary widely in literature. With the aim of protecting substantial quantities of the world's tropical forests, a minimum of annual transfers in the order of 10 billion USD is needed. This would equal double the amount of all Kyoto markets until present. Finally, we put up some design and framework criteria for REDD projects.

1 Introduction

Deforestation is the second single greenhouse gas source, behind energy production, being responsible for about 20 % of human GHG emissions. The carbon reservoir in the world's forests is presently higher than the one in the atmosphere (Stern 2006).

This chapter will resume the state of the discussion around reducing emissions from deforestation and forest degradation (REDD). It departs from the proposals that have been submitted by developing countries and the research community during the last years.

[1] This study was commissioned and first published by GTZ Climate Protection Programme, Eschborn 2007. The chapter reflects the authors' personal opinion.

At the 11th Meeting of the Parties to the UN Framework Convention on Climate Change (COP 11), Papua New Guinea and Costa Rica, supported by several developing countries, tabled a proposal for including emissions from avoided deforestation in some kind of compensation scheme under the UNFCCC (UNFCCC 2005). It leaves open, whether this should happen under a separate forest protocol or as a part of an overall post-2012 protocol under the Convention. It argues that time was pressing for the last natural forests, and that including deforestation avoidance would help to integrate developing countries into the efforts to reduce greenhouse gas emissions. The proposal was welcomed by most Parties. Indirectly it referred to "compensated reductions" (CR), as proposed by a group of Brazilian authors (Santilli, Moutinho et al. 2005). This model foresees emission reduction certificates to help industrialized countries in fulfilling their emission targets. Differently from the project-based CDM, implementation would take place on the country level. As a baseline against which reductions would be verified, the authors proposed average deforestation rates from the 1980s, 1990s, or the phase between 1995 and 2005. The country would commit to reduce these emissions below the baseline. In an earlier version of the paper, countries achieving their deforestation emission reduction targets would receive financial compensation according to the average market value of CO_2 equivalents in 2012 (Santilli, Moutinho et al. 2003). This way, *early action* during the first commitment period would already be compensated for. Conversely, if the country increased its emissions from deforestation, it would be liable to reduce the related emissions accordingly in the subsequent commitment period. In the Papua proposal, a share of the credits would not be sold, but banked, in order to compensate for potential future losses. A later research paper by the European Commission's Joint Research Centre JRC (Achard, Belward et al. 2006) assists the proposal by introducing a methodology based on remote sensing for a simple determination of proxies for carbon gains and losses from deforestation and forest degradation processes. It avoids the difficult political differentiation between forest and non-forest by defining three categories, intact forest, non-intact forest and non-forest. The three possible downward transitions between those three categories would be accounted for with standard carbon losses, according to ecosystem and growth region.

The 11th Conference of the Parties to the UNFCCC (COP 11) called upon Parties to submit their views and invited interested Parties to a workshop on the issue held in Rome in August 2006. COP 13 by the end of 2007 was requested to decide on the treatment of REDD after 2012.

At the UNFCCC Rome Workshop, Brazil proposed a voluntary REDD fund, arguing that participation of developing countries should not create future obligations, and that the system should not offset Annex I commitments for emission reduction. This fund was to compensate countries if they remained below a negotiated deforestation level. If deforestation was above this level, the country would be liable to compensate for these emissions with lower emissions during the subsequent commitment period, similar to the CR proposal. Another similarity is the intent to reward early action on REDD already during the first Kyoto commitment period. Also the countries of the Congo Basin proposed a fund that would be shared along the percentage of forests under sustainable management and certification (UNFCCC 2006).

Table 1: Main features of the different proposals for voluntary approaches to reduced deforestation and degradation

	Compensated Reductions	PNG	JRC	Brazil
Scope	Deforestation + implicitly Degradation	Deforestation	Deforestation & Degradation	Deforestation
Mechanism under Kyoto (KP) or a separate Protocol (sP)	KP	Open	Not considered	sP
Reference level	Historical, "over some agreed period" (e.g. 1980s, 1990s, 1995-2005)	Historical	(Tropical) Global Conversion Rate & historical National Conversion Rate	Historical
"Growth cap" for historically low-emitting countries	Yes	Not considered	Yes	Not considered
Liability	Banking & Borrowing, insurance	Banking & Borrowing	Temporary crediting	Banking & Borrowing
Financing	Credits sold to governments or private investors	RED as part of CDM is one option	Not considered	Voluntary fund by Annex II Parties
Price formation	Nearly unrestricted access to allowance market	Open	Not considered	Contracted fixed price per t CO_2e
Early action	Not considered	Yes	Not considered	Not considered
Monitoring	Remote sensing	Remote sensing	Remote sensing	Not considered

Table 1 summarizes the main features of the REDD approaches under discussion in the run-up to the Bali Conference. Not every proposal considers every aspect. Except for the JRC's, all approaches propose a carry-over of commitments to the subsequent commitment period, in case deforestation has increased, together with some share of obligatory credit banking (termed "Banking & Borrowing" in Table 1). Overall, the different proposals show a high degree of compatibility. What is diverging most is the framework in which the mechanism is embedded. The Brazilian proposal is opposed to any compensation of industrialized countries' commitments, which is why it suggests a separate protocol under the UNFCCC.

An important message from the Rome workshop was that advanced remote sensing technologies are available that – combined with appropriate ground truthing – allow for a monitoring of country commitments. Also, enough data are available to establish a backward-looking multi-year reference level for nearly every part of the world since the year 1990 at last.

We will first review current knowledge on deforestation reasons and drivers and discuss arguments for including REDD in a future climate regime. Such a regime requires some design features granting long-term reliability for the actors involved, in order to accommodate REDD commitments. In REDD project activities supported by ODA some experience has been gathered that a future regime should build upon.

2 Tropical forest loss: causes and consequences

In order to assess the chances of REDD, it is important to understand the background of deforestation and forest degradation. According to the FAO 2005 Forest Assessment Report (FRA), forests cover around four billion ha or 30% of the earth's land area. Compared to the previous 5-year reporting period, net global annual forest losses decreased from 8.9 to 7.3 million ha. From a carbon perspective, it is however not admissible to account deforestation against new forestation due to the asymmetry of carbon sequestration ("slow in, fast out"). Replacing a standing forest by a forest plantation usually implies significant carbon losses. Gross deforestation is 13 million ha, equivalent to 1.5 percent annual loss compared to the 858.842 million ha of the world's tropical forests (ITTO 2006). Forests represent a carbon pool of 1,037 Gt CO2e, most of all decreasing in Africa, Asia,[2] Oceania and South America, increasing in North and Central America. Deforestation is estimated to be responsible for around 20 percent of all human-induced CO_2 emissions, two thirds of this effect being attributable to the loss of tropical forests. This figure is highly uncertain, due to the following reasons: (1) There is a notorious lack in reliable forest inventories. (2) The ascertainment of deforestation depends on the diverging definitions of forests. (3) Greenhouse gas emissions from forest degradation (i.e. vegetation loss inside a standing forest) are difficult to estimate, and there is no single accepted definition of it. (4) Re-growth after deforestation (also the one below the forest definition threshold, i.e. revegetation) is a widely unknown variable and (5) N_2O and CH_4 emissions due to forest fires have not yet been quantified on a global scale, but they contribute in a significant way to the increase in greenhouse gases in the atmosphere.

Historically, most of today's industrialized nations had a period of deforestation. Over-use of forest resources may be due to a variety of malfunctions – policy, institutional and market failures. In most cases, more than one cause act towards deforestation. Frequent causes are deforestation due to agricultural extension combined with wood extraction, or infrastructure expansion. On most occasions, forests com-

[2] The massive reforestation programs in India and China partially outweigh the forest losses in South-East Asia

pete with agriculture, and deforestation occurs at the agricultural frontier. An important driver is infrastructure development. The latter is true for all types of land use change, whether its intention is timber extraction, grazing or cash crops. There is no such strong correlation between other single factors and deforestation (Geist and Lambin 2001; Wunder 2005).

Globally, forest losses increase the greenhouse effect. Regionally, they are expected to lead to micro-climatic changes, biodiversity losses, and changes in the water regime. As an aggravating feedback effect, climatic change itself may lead to a die-off of forests in tropical areas, which could trigger a chain reaction difficult to stop (Hadley-Centre 2000).[3] While for individuals deforestation is usually profitable, it leads to a macroeconomic welfare loss. Deforestation will decrease over time, as the remaining forests become less accessible. Avoiding deforestation therefore acts under time constraints; the window of opportunity is closing. The immediate *and* long-term effects of REDD are highest if it is started as early as possible (Dutschke 2006)[4].

Causes and drivers of deforestation are very case-specific. In most cases, causes are interdependent, and thus allow for diverse interpretations. Nevertheless, researchers coincide that there are spatial patterns of deforestation that can be observed worldwide on the agricultural frontier and alongside roads. Depending on coverage and quantity of remote sensing data, regional deforestation hotspots can be identified globally (Lepers, Lambin et al. 2005).

Literature has distinguished between governed and ungoverned deforestation (Trines, Höhne et al. 2006). Nevertheless, there are hardly any policies deliberately directed to deforestation as such. Planned deforestation occurs with infrastructure development (e.g. road building, canals, airfields and pipelines) or where mineral resources are being explored. *Direct* effects of these activities are usually minimal, compared to indirect consequences. Opportunity costs for refraining from those development projects can be extremely high, besides that it would run counter the Climate Convention to hinder economic development in tropical countries. However, large deforestation often occurs around the affected areas: Road building attract loggers that cut logging roads deep into the forests, because the road makes timber transportation cost-effective. The same occurs with pipelines, because of their service roads. Furthermore, oil spills by accident or due to illegal tapping increase the risk for adjacent forest and wildlife.

[3] For some time yet, fertilization due to higher CO_2 levels will likely outweigh the savannization effect. Depending on rainfall patterns and the availability of sunlight, both negative and positive effects of climate impacts on standing forests will not be evenly distributed.

[4] See chapter I

In many cases, short-sighted land use is related to legal uncertainty. In the Brazilian Amazon, around one third of the forests – the *terras devolutas* – have an uncertain ownership status, leaving them legally unprotected. Traditional land rights are often not codified, which leaves local populations defenseless against a change in the legal status of open access lands. In most of Latin America, deforestation used to be considered a proof of ownership, thus provoking the so-called "land race": land claimers compete for the area by clearing as much forest as they can. Economic rationality is a good explanation for people's behavior (Wunder 2005). In subsistence economies, cattle are often the only way to build up a capital stock, even though they contribute in many cases to forest degradation and devegetation. Due to market imperfections, standing forests are usually under-valuated, and benefits like their life support functions and the value of its scenic beauty do not materialize for the forest owner or tenant (Karousakis 2006).

Additionally we need to take into account socio-cultural factors. For instance, the tradition of "clearing the wilderness" often survives regulation. Cattle ranchers sometimes enjoy a higher social status than foresters. Slash-and-burn practices in agriculture will in some places have been the most rational behavior for subsistence farming in the past. During the idle phases, the land had plenty of time to recover to near-natural vegetation, and nutrients would accumulate in the soils again. As population grows, this type of agriculture is no longer adequate in most places, but consciousness is lagging behind. In many African cases, firewood collection is the domain of women and children, and a change in behavior will entail gender issues.

Unplanned and semi-legal or illegal deforestation and devegetation are symptoms of a lack in governance. Governments can be expected to take an interest in the strengthening of institutions and in streamlining administration, as these can bring about a variety of secondary benefits on all levels of governance.

3 REDD in the future climate regime

The ultimate objective of the UNFCCC, as defined in its Article 2, is to prevent "dangerous human interference with the climate system" and to "ensure food production" by stabilizing GHG concentrations in the atmosphere. Among other things, this is to be done in a timeframe that allows ecosystems to adapt naturally to inevitable climate change already underway. Adaptation of natural systems is a process of species selection and mobility. This is best possible in large, biodiverse areas under a regime of low human intervention and which comprise different climatic zones. While forests and agriculture compete for available areas, the latter depends on the genetic pool represented by natural forests, on ecosystem services like natural pest control, the stabilization of water supply, the forests' function as windshields, and pollination, to name only a few. Besides, in many tropical countries, forests provide a regular supplement of food for local populations.

Worldwide, climate policies are providing massive incentives for the use of biomass energy. If unchecked by forest conservation and management, biomass policies may lead to a negative leakage effect, because the increased demand for arable soils may foster higher GHG emissions from deforestation. At the same time, the above-mentioned feed-back effect in consequence of increasing temperature levels may lead to the die-off of forest stands already debilitated by human intervention. Thus, deforestation and forest degradation make up an important part of human interference with the climate system and, at the same time, increases the forests' vulnerability against climate change. The Climate Convention pays reference to this fact on various occasions, for instance, Article 3 on *Principles* in its paragraph 3 declares: *"[p]olicies and measures should … be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors."* A sink (naturally) absorbs CO_2 from the atmosphere, e.g. a growing forest. Standing forests are the most important terrestrial reservoir of CO_2.

The mandate has not been fulfilled by the Kyoto Protocol, which limits accountable forest management to Annex I Parties (Dutschke 2006). There were several concerns that led negotiators in 2001 not to include REDD under the project-based Clean Development Mechanism (CDM) of the Kyoto Protocol. These were the leakage risk, non-permanence, baselines, monitoring and measurement uncertainties, lack of human control, and the potential scale of the emission reductions(Schlamadinger, Bird et al. 2007). Today, sector-wide approaches are being discussed, whereby a country as a whole commits to a REDD target. They address many of the concerns against project-based REDD.

Leakage is an issue common to all climate change mitigation activities, but there was the notion that it could be especially high in land use. On a project level, leakage can be estimated and deducted from emission reduction credits. On a national level, and with national monitoring in place, leakage is automatically accounted for. Leakage can be avoided by intensifying land use on non-forested areas, e.g. by increasing agricultural production per hectare (Chomitz 2002; 2006).

Non-permanence only becomes a problem, if a country that reduces its emissions from deforestation is not held liable for later re-emissions by increased deforestation. For afforestation and reforestation under the CDM, the solution of temporary crediting has been found, whereby the liability falls back to the Annex I investor in five-year intervals. Temporary credits could in fact be one solution for REDD. The flipside is that the market value of a temporary emission allowance can be very low, as it depends on the price expectations for the subsequent commitment period (Dutschke, Schlamadinger et al. 2005)[5]. In order to increase proceeds from the sale of carbon credits, countries could be willing to take over liability for long – but not infinite – periods. For instance, a country may remain liable for forests preserved under a REDD scheme within the timeframe of a long-term 2050 emissions target. Deforestation has never been a long-lasting phenomenon, but it has been occurring in consequence of specific local historical situations. In case the Climate Convention is still active in 2050, it is very likely that in the meantime all Parties have become accountable for their GHG-related activities (Dutschke 2002)[6]. Finally, REDD may buy time for technological development, thus forming a "wooden bridge to a clean energy future" (Lecocq and Chomitz 2001).

Baselines: The reference level of emissions against which progress is measured is always hypothetical. It was proposed by Santilli et al. (Santilli, Moutinho et al. 2005; Schwartzman 2005) to be the average deforestation in the 1990s. Alternatively, a reference level could be determined by projecting a trend from previous periods into the future, or by identifying secondary indicators (like the prices of meat, cash crops or timber) that have influenced deforestation rates in the past. A third alternative is a normative baseline that benefits countries that are already undertaking action for REDD (Achard, Belward et al. 2006). These techniques offer basis for the reference deforestation level. National REDD targets for tropical countries - like any other country target – are subject to political negation. On the one hand, they bear the risk of creating "hot air" (i.e. rewarding inactivity). On the other hand, they offer a real chance to revert the global deforestation and forest degradation trend.

The uncertainties around monitoring and measurement can be treated in a conservative manner. It is good practice in CDM methodologies to apply a discount on the measured carbon benefits by taking the lower boundary of a 95% confidence interval. There are standard values recommended by the Intergovernmental Panel on Climate Change (IPCC) for above-ground carbon density in the different types of vegetation that can be easily applied. For large-scale monitoring on a region or country level, the use of satellite imagery is steadily becoming less expensive and more accurate.

As compared to other human activities, forest interventions are marked by a lower degree of human control. Natural systems interact with the climate and hydrological systems, which makes them behave unpredictably to a certain degree(Schlamadinger, Bird et al. 2007). This is reflected in the distinction between direct and indirectly human-induced land use changes, the so-called "factoring out". There is little chance in telling the one from the other, or both from natural variability. Therefore, emission reductions from land-use changes should be averaged over

[5] See chapter III
[6] See chapter II

longer periods. In this context, the current discussion around 10-year commitment periods could be specifically interesting for the land use sector. REDD country targets expressed in CO_2 equivalents could be bolstered by conservative standard IPCC values for carbon content per hectare in different forest types, with the aim to avoid unexpected losses due to climate change.

Finally, the magnitude of potential reductions was a concern when REDD was discussed as a compliance tool for the already determined Kyoto commitments of Annex I. In that historic moment, environmental NGOs and European negotiators perceived the risk that these targets would be nullified by the unforeseeable quantities of allowances produced under a REDD scheme. Annual deforestation in Brazil and Indonesia alone is estimated to be equivalent to four fifths of the total Annex I reduction targets under the Kyoto Protocol (Skutsch, Bird et al. 2006). The situation for post-2012 agreements is different, as future commitments have not yet been fixed. The potential magnitude of REDD credits should rather be a hope than a concern (Chomitz 2006). The influx of REDD credits will allow to reach ambitious reductions with less costs. Combining an ambitious long-term target with shorter, Kyoto-type commitment periods can create a robust balance between demand for and offer of emission reduction certificates. Emissions from deforestation are in the same order of magnitude as all GHG emissions from the United States. Nobody concerned about climate stability would prefer the US not to adopt binding commitments, just because this might disrupt the market. Market stability is a weak argument against the inclusion of REDD.

4 Setting targets and linking sectors

The Rome 2006 UNFCCC workshop on reducing emissions from deforestation in developing countries focused on methodological issues, while avoiding political questions. Nevertheless, some criteria were formulated for policies that reduced deforestation: These should

1. not be policy-descriptive at the national level
2. not weaken incentives for emission reductions in other sectors
3. be flexible enough to adapt to national circumstances
4. reward early action[7]

At the same time, these instruments shall reward real, additional and measurable emission reductions in tropical land use and contribute to the achievement of the ultimate objective of the UNFCCC. It is acknowledged by the Parties that REDD im-

[7] Chairman's summary, non-paper distributed after the workshop

plies opportunity costs for the implementing countries, even though these may vary according to national circumstances and actors. Given the magnitude of emissions related to LULUCF, a meaningful reduction will require considerable financial North-South transfers. In order to be politically acceptable in times of widespread budget deficits among industrialized countries, these transfers need to be allocated in a cost-efficient manner.

An international policy solution that takes account of all these criteria and premises and finding an agreement will necessarily require an optimization process.

Before COP 3 at Kyoto, Brazil had proposed a “Clean Development Fund”. This fund was to finance mitigation activities in developing countries. It would have to be filled up by contributions of countries according to their historical contribution to the current levels of atmospheric GHGs. As a side effect, this proposal caused scientific discussions on decay periods of different GHGs to determine the relative responsibility of each nation. Eventually, the proposal gave rise to what became the CDM. The old “Brazilian Proposal” completely fulfilled the criterion of not offsetting Annex I reduction obligations. With the Brazilian REDD fund proposal, the principle of historic responsibility may see a renaissance. Scientific questions arising from such an approach would become even more complex, as it would have to consider re-growth occurred in the meantime and could end up in a backward-looking full carbon accounting.

Proposals currently presented on REDD can be seen as complementary in many ways. The main difference is that the proponents of the REDD fund are not (yet) willing to accept a marketing of credits. From a macro-economic perspective, the difference may not be as important as it seems: Given that a worldwide limited amount of money is available for climate change mitigation and assuming that the efficiency level of both instruments to be comparable, filling up a REDD fund theoretically costs as much money as buying emission credits for compliance. Timing is more important, because the money will have to be spent before the mitigation effect can be verified. The next sections will therefore focus on timing and funding efficiency.

4.1 Target setting

Forest management decisions are long-term, as trees need time to grow and to re-grow. An additional factor is the virtual non-permanence of carbon stocks in vegetation. Long-term continuity is a prerequisite for any functioning market in GHG credits, but liability questions in forestry make a long-term climate target even more pertinent. This is completely in line with the stabilization goal formulated in the UNFCCC’s ultimate objective.

A post-2012 system suited for REDD would combine a long-term emissions target with shorter (e.g. 5-year or 10-year) commitment periods. Not only for the sake of forests; carbon market balance, investment security and ultimately the atmosphere would all benefit from a long-term binding worldwide GHG emissions cap.

4.2 Market-based approaches

At Kyoto, country targets were negotiated based upon historic emissions – the grandfathering principle. Grandfathering is as much opposed to equity as to efficiency. It creates a virtually unlimited number of assets for free and consequently the perverse incentive for each country Party to overstate its own future emission necessities, instead of obeying to the “common but differentiated responsibilities” for the stabilization of greenhouse gas concentrations in the atmosphere. A symptom of imbalanced distribution is the emergence of windfall profits. Additionally, under Kyoto, there is uncertainty for the market participants, what – if at all – will be the supply after 2012.

A market based approach requires scarcity – a finite supply of goods and services, and a temporal reference. Long-term climate policy will require a massive North-South transfer of funds. UNFCCC Executive Secretary Yvo de Boer estimates that the 60 – 80% cut in GHG emissions by 2050 required to stabilize temperature at a level of approximately 2 degree Celsius will have to lead to a necessary North-South transfer of 100 billion USD of green investment per year (UNFCCC 2006). For industrialized country policymakers, this is an “inconvenient truth” (like Al Gore puts it), because it will cost taxpayers’ money without immediate and noticeable benefits. During the next decades however, it will avoid social costs that are orders of magnitudes higher (Stern 2006).

The dual system between Annex I and non-Annex I countries offers no one-size-fits-all solution to the complex necessities of climate change mitigation and adaptation. There will necessarily be different degrees of commitment to GHG emission reduction. We therefore depart from a multi-stage model for a post-2012 regime (Höhne, Phylipsen et al. 2005).

It was proposed that countries taking over an REDD commitment might choose to temporarily limit the liability for the REDD credits produced on their territory, making them comparable to temporary CERs, known for afforestation and reforestation projects under the CDM (Achard, Belward et al. 2006). According to first experiences, temporary CERs seem too complex for the market. Most of all, temporary crediting for REDD will not bring about increased participation in the climate regime for developing country parties.

Poorer countries will lack capacities and institutional strength to implement REDD. Bilateral “bubbles” or forest partnerships between Annex I and developing countries can liberate the necessary upfront North-South financing for REDD. The Annex I Party in question would assist the tropical country partner in the fulfilment of its (voluntary) REDD target. The participating developed country could engage in creating an enabling institutional environment in the tropical partner country. In exchange, it could negotiate favorable conditions for REDD credit futures. Forest partnerships would evolve between countries that have a tradition in bilateral cooperation, and where enough mutual trust has been built up over the years. In compensation for the risk involved, no limitation would apply for the Annex I Party on using credits from forestry for compliance.

For emerging economies, voluntary REDD targets could be a testing ground for an economy-wide GHG (voluntary) reduction commitment. They could grant long-term liability and even withhold credits for risk mitigation for the country's own future compliance.

Any of these options would require transitions between the current and a future climate regime. For example, assuming a land use sectoral cap, CDM forestry project activities shall not be double-counted, just because these are not deforested during their crediting period. They would either be excluded from monitoring or their carbon proceeds "nationalized", so that their owners would be compensated under a domestic environmental service scheme.

4.3 Linking REDD to other sector targets

As the human influence on forests is limited and unforeseeable climate events have the potential to exert considerable influence in terrestrial carbon stocks, the magnitude of reductions is difficult to estimate. Some observers fear that increased credit supply from REDD would lead to higher-cost industrial, transport or household mitigation options to be deferred into the future. Contrarily, were the supply of REDD credits lower then expected, committed country Parties would menace to fall short in meeting their targets, and allowance prices would sour. It has been proposed therefore to set up a separate protocol under the Convention for the protection of carbon pools in vegetation (Graßl, Kokott et al. 2003; Freibauer, Höhne et al. submitted). There are two reasons that justify skepticism against the separate-protocol solution. (1) Considering the destiny of the United Nation Forum on Forests (UNFF) and the negotiation time needed for Kyoto, much deforestation would occur before such an accord became effective, and (2) As industrialized countries have little or no deforestation, and trading would only be allowed inside the forest sector, there would be no demand for REDD credits. We will therefore refrain from further discussing a separate land use protocol in this context.

Besides a full integration in the carbon markets, REDD credits need to be transferable toward future commitment periods (i.e. "banking"). This is for two reasons: (1) A certain amount of banking is needed to insure against unforeseeable forest losses, and (2) Today's deforestation reduction opportunities will not come again, once they are foregone. Therefore, early reductions achieved during the first commitment period should be accountable towards compliance in future commitment periods.

5 Development assistance and avoided deforestation

Mitigating the climatic effects of deforestation has not been in the focus of land-based development cooperation. Nevertheless, in this section, we will review some examples of cooperation projects in tropical countries targeting deforestation. We cite a forest protection project in Bolivia, a large-scale example from Brazil, and a supranational policy initiative in the Congo Basin.

5.1 The Noel Kempff Climate Action Project

The Bolivian Noel Kempff Climate Action Project (NK-CAP) is an ongoing project activity that started in 1997 under the auspices of the so-called "Activities Implemented Jointly", a pilot for the CDM, which did not generate credits to be accounted towards Annex I commitments. NK-CAP's aim is to reduce deforestation. Projects under this regulation were developed to gain experience in baseline determination and monitoring. Deforestation is reduced by a) stopping legal logging by indemnifying logging concessions, and b) increasing the protected area and creating employment opportunities in forest management, thereby reducing slash-and-burn degradation practiced in small-scale agriculture. In spite of not being an eligible activity under the CDM, the project's methodology has over the years been adapted to comply with methodological requirements of the CDM. The emission reductions are being verified by the certification enterprise SGS. For baseline determination, project developers use GEOMOD, a spatial explicit dynamic model that predicts the size and area distribution of deforestation, based on variables for relevant drivers, like proximity of roads, rivers or urbanizations and edges of natural forests. This baseline was calibrated over the period 1986 to 1992 and validated for the period 1992 to 1996,[8] for which deforestation dynamics were known, and it projects the historic trends into the future. Between 1997 and 2005, a total of 1 million tons of CO_2 equivalent reductions were verified. There is a wider, non-contingent observation area around the project that eventually allows a recalibration of the baseline.[9] Over the 30 years of its lifetime, the

[8] The process of calibration consists in finding weighing factors for the different deforestation drivers, so as to maximize the model's explanatory power. During verification, the model's validity for a later period was checked.

[9] Personal communication Jörg Seifert-Granzin, Nov. 3, 2006

project is expected to result in 5.8 megatons of CO_2 equivalents reduced net of baseline re-growth and leakage (activity shift and a decrease in carbon stocks in long-lived harvested wood products). Half of the certified offsets belong to the Bolivian Government. Total costs are expected to arise to 10.85 million USD, equivalent to a price of 1.87 USD per CO_2 equivalent. Considering profit sharing with the Bolivian government, the CO_2 price is below 4 USD per ton. The project costs are shared among the Bolivian Government and the private investors American Electric Power Company (AEP), BP of America and Pacific Corp.

5.2 PP-G7 and ARPA – a framework for action

Planned in the late 1980s, launched at the Rio Conference on Environment and Development in 1992, and started in 1995, the *Pilot Program to Conserve the Brazilian Rain Forest* (PP-G7) has been implemented jointly by Brazil and seven donor countries. Its objectives are described by the World Bank (Millikan, Leitmann et al. 2002) as follows:

- Experimenting with and demonstrating ways of protecting Brazil's rain forests and using them in a sustainable fashion
- Protecting and conserving rain forest natural resources
- Strengthening civil society and public institutions involved in environmental protection of Brazil's rain forests
- Supporting scientific research and disseminating findings to conserve Brazil's rain forests

Since 1995, PP-G7 has spent 428 Million USD, 360 Million USD of which were contributed by Germany, into several sub-programs. Among those, indigenous land has been demarcated and registered. Cooperations between forest communities on the one side and major national cosmetic companies logging companies and soft drink producers on the other have been established. 200 participatory community projects for biodiversity conservation were implemented, institutions were empowered. Under the Amazonian Working Group (GTA), a social network has been created, today linking more than 700 non-governmental organizations. The following enumeration includes the most significant projects that have been implemented within or in the context of PP-G7.

Since its coming into existence in 1994, the ***Indigenous Lands Project (PPTAL)*** has demarcated and registered 45.4 million ha of indigenous land, an area larger than Germany, Switzerland and the Netherlands combined. It has identified 9.5 million ha of new areas. Indigenous reserves are uniquely administered by FUNAI, the National Indian's Foundation. PPTAL is strongly orientated towards a participatory approach, thus strengthening the indigenous communities' autonomy and modernizing FUNAI's activities. There is an indirect effect on deforestation reduction, because forests inside indigenous reserve areas have over long periods proven to be better protected then other Amazon forests. This effect may be due to the cultural context, it can however not be taken as granted.

The ***Extractive Reserves Program (RESEX)*** responded to an older claim of the Brazilian national federation of rubber tappers. It created four prototype reserves for the use of non-wood forest products and appropriate forest management. In doing so, the participative reserve management resorts to traditional local knowledge. One objective is to offer alternative income sources, in order to prevent the local populations from migrating into the large urban areas, in which case the forests would be left unprotected. During the years of implementation, forest population has even increased. Sub-objectives are (1) the legal implementation of the reserve areas, (2) strengthening of organizational structures among the forest users, (3) the improvement of productive activities, and (4) the establishment of environmental management and development plans.

The ***Project for Mobilization and Training for the Prevention of Forest Fires in the Amazon (PROTEGER)*** promotes the sustainable use of fire in small-scale agriculture, while raising public awareness for the risks attached to uncontrolled forest fires. Besides forest destruction, fires spreading to neighboring cultivations have been causing extreme economic losses for small farmers. For both rural and urban populations, respiratory health problems result from wildfires. Training in controlled use of fire directly involved 12,000 community leaders. In an internal review, PROTEGER was evaluated a successful grassroots program initiated by NGOs and jointly managed with government agencies.

The ***Ecological Corridors Project*** with an initial budget of 5 million USD has introduced large-scale land planning by interconnecting fragmented forests. Five corridors were installed within the Amazon, and two along the Central Atlantic Coast forest. The ecological corridors lead to a decentralization of environmental protection, increased stakeholder involvement, and biodiversity benefits. Last, but not least, ecological corridors enable a better adaptation of protected areas to the consequences of unavoidable climate change.

The ***Natural Resources Policy Project (NRPP)*** follows a participatory approach to environmental management, including – among others – environmental monitoring, licensing and enforcement, ecological-economic zoning and educational activities. The largest land owners now need a license to put their land under productive use. They need to determine once and forever legal reserves (under permanent forest use), areas of permanent protection, and degraded areas that need to be recovered.

Most of the measures like licensing and zoning are not new, but they were usually not enforced and implemented. Also the process was streamlined. Enforcement is backed up by remote sensing and has been extremely successful in the federal state of Mato Grosso, where in the years 2000/2001 an annual 319,393 ha were spared from deforestation, compared to the 1998/1999 baseline. In these base years, Mato Grosso alone had accounted for 40% of the whole Amazonian deforestation. Considering the different vegetation types, 156 million tons of CO_2e (36 Mt C) from deforestation were reduced annually, which is about half of Brazil's emissions from fossil fuels. The program costs between 1999 and 2002 were 6 Million USD per year, 5 of which were covered by PP-G7 (Fearnside and Barbosa 2003). From a back-of-the-envelope calculation, we may find that each ton of CO_2 emission reduction cost below 0.20 USD per year. Salaries, buildings and infrastructure provided by the State Environment Foundation FEMA are not included in this budget. Another study using multivariant analysis confirms that the project's success cannot be attributed to a decrease in soy demand only (Chomitz and Wertz-Kanounnikoff 2005). Nevertheless, with the rapid land use changes going on in Mato Grosso in recent years, no reliable reference deforestation level can be determined from a two-year base period. Overall, the success has been very encouraging, as Mato Grosso was historically among the federal states with least public concern about deforestation. Therefore, the federal Ministry of the Environment has decided to scale up the experience to the entire Legal Amazon.

Finally, the ***Science and Technology support program*** has improved conditions for work and dissemination for the National Institute for Amazonian Research (INPA) in Manaus and the Emílio Goeldi Museum of Pará (MPEG) in Belém. Until 2002, 23 dedicated research projects were funded, involving 26 regional institutions, 17 national agencies based in other parts of Brazil, and nine international institutions. Amazon institutions have been in the forefront of the international debate around deforestation and how to reduce it, including the occurrence of fires, which suggests that funding under the program has reaped some effects.

5.2.1 The Amazonian Protected Areas Project ARPA

The ***Amazonian Protected Areas Project (ARPA)*** is executed outside the PP-G7 framework, but it builds upon its experiences. It is a trust fund started in 2000 with the aim to create and consolidate Conservation Areas covering 50 million ha or 10% of the land area of the Legal Amazon until the year 2013. It was initially financed by GEF, WWF Brazil, the German development bank KfW and GTZ with a contribution from the budget of the Federal Government, and is operated jointly by the Ministry of the Environment and the NGO FUNBIO. Due to increased fundraising efforts, several major Brazilian companies with concern for the environment have made individual contributions of up to 500.000 USD. The program receives technical assistance from GTZ. The National System of Conservation Units (SNUC) was created together with the program in 2000. For the first four years, 18 million ha of new Conservation Units (CUs) were to be created, and the existing seven million ha to be consolidated. The recently approved Forest Concession Law from 2006 creates the institute of logging concessions new in the Brazilian context. These require an approved management plan. There are CUs on federal, state, municipal levels, and private CUs. For the areas involved, especially CU for strict protection, ARPA could be a functional and transparent mechanism to collect and administer carbon receipts.

The above examples – maybe to the exception of ARPA - are typical ODA sector programs. They address the underlying drivers of deforestation in a synergetic manner by combining legal and institutional instruments, as well as incentive structures destined for REDD on state *and* private lands. They are clearly orientated towards the grassroots level and social empowerment of the actors. All this makes them complex and sometimes burdensome to manage. It is unfair to criticize the PP-G7 for not achieving its goal of reducing deforestation**.** As the its name states, the program is only implemented in pilot areas, and it is an ongoing effort, with new elements starting up every now and then. Compared to a climate change mitigation project activity, it definitely lacks carbon methodology. As its elements are inter-related, a scaffolding baseline and monitoring concept would be needed for every single activity. Therefore, success cannot be measured, but only argued. There is a high likelihood that the combination of increased institutional capacities, better forest conservation enforcement, higher environmental awareness among the population, increased productivity among smallholders and financial incentives for sustainable forestry among other things, will lead to lower deforestation pressure in the pilot areas. Due to its patchy regional implementation, its effects will hardly be observable over the whole Brazilian Amazon. There was no baseline scenario determined before the program's start that would allow an impartial assessment, whether it has really been effective in reaching its goal on the regional level, and there is no systematic monitoring of appropriate indicators**.** Still a variety of disincentives exists. Subsidies in meat and soy bean production since the coming into existence of PP-G7 are dwarfing the amount invested into sustainable forest use and conservation. PP-G7 demonstrates the high coherence between REDD and "traditional" ODA values, like poverty alleviation, given that the primary aim is the reduction of deforestation and forest degradation. On the other hand, a prioritization of infrastructure, energy supply or productivity in the agrarian sector has the potential to increase deforestation pressure. These issues were not addressed by PP-G7. Hence, program integration cannot be broad enough to cover all relevant policies.

5.3 The Forest Commission of Central Africa

The COMIFAC (Commission Forestière de l'Afrique Central) is an initiative of ten Central African Congo Basin countries, with support by international donors, including WWF, IUCN, FAO, The World Bank, the European Commission, and the German Ministry for Economic Cooperation and Development (BMZ). Its lines of action are (1) Harmonization of forest and fiscal policies, (2) Resource inventory, (3) Ecosystem management and reforestation, (4) Biodiversity conservation, (5) Valorization of forest resources, (6) Employment alternatives and poverty reduction, (7) Capacity building, (8) Research and Development, (9) Development of financing mechanisms, and (10) Regional cooperation and partnerships (COMIFAC 2004). There is a first supported CDM pilot project supported by the France government with five subcomponents: industrial afforestation, community-based afforestation, forest regeneration, use of wood residues for bioenergy production, and improved forest management guidelines. Currently, the program is in its beginnings, and it starts from a very low level. Governance is weak over the whole region. There are indications that today's deforestation rate is very low (0.19% p.a.). Forests are state-owned. Among these, 10.2% are under legal protection, 76% may be managed under restrictions, and 14% are completely unprotected. Due to the lack of reliable data, these numbers need to be interpreted cautiously.[10] The amount of degradation is an unknown factor, but it is assumed to be relevant. The civil wars in the zone have led to a decrease of activities in the land use sector. Under peace conditions, the agricultural frontier will most likely be pushed forth, putting a new threat to the forests. This scenario will have to be considered when determining the deforestation reference level. For potential deforestation avoidance projects, a baseline cannot be determined by past deforestation trends only; it will need to model proximate causes and drivers for the prediction of future trends. The precondition for any sector-based activities is a reliable inventory and a drastic improvement in forest law enforcement and governance. COMIFAC is thus only an appropriate first step towards efficient protection.

5.4 Lessons learned from pilot activities

From the activities presented, some preliminary lessons can be deduced. More than any other mitigation activities, REDD depends on the political and institutional framework conditions. Capacity building on all levels of governance is needed. The Noel Kempff Climate Action Project represents the first generation of REDD. While benefiting from the extension of a national park, there was no fundamental change involved in the legal and political framework. Therefore, a trend-based project base-

[10] Personal communication by Claus-Michael Falkenberg, GTZ, Aug. 14,. 2006 and Nov. 18, 2006

line is feasible. There is an inevitable part of activity shift from the protected to unprotected land that could be deducted from the project's carbon receipts as leakage.

The PP-G7 program is on a much more advanced stage. In the Brazilian Amazon, reliable forest inventories are in place, fire and deforestation monitoring is based on time-near remote sensing. PP-G7 includes diverse policies and measures in selected regions that take an integrated approach to sustainable management of forest resources. A baseline in the classical sense cannot be determined, because the regulatory environment is changing, and leakage from activity shifting is difficult to postulate. The activities in the program's framework are regionally overlapping, even though they do not cover the Amazon as a whole. Still, many drivers of deforestation remain active, even within the target areas, most of all in consequence of policies outside the land-use sector.

The Forest Commission of Central Africa, COMIFAC, on the other hand, is a supranational endeavor to integrate policies and measures to make sure that the forest resource remains intact. First of all, it needs to depart from reliable forest inventories. Independent third-party monitoring will increase the credibility of actions taken. Determining a deforestation reference level is an indicative modeling exercise, based upon factors that potentially increase the pressure on the existing forestlands, but they need to be considered no more than proxies helping to defend a politically negotiated deforestation reference level. National REDD targets create an integrated policy incentive to protect forest resources. Should COMIFAC become effective, it may in future constitute an example for nature resource management that even avoids international leakage.

6 Sources of finance for REDD in developing countries

Tropical forests deliver significant benefits for local and regional development, potentially including adaptation to inevitable climate change for the local population. At the same time, preserving standing carbon and biodiversity pools represents an international public good. Contrarily to afforestation and reforestation, successfully halting deforestation will reduce large amounts of emission in the beginning. As success will only be demonstrable in the true-up period after the end of each commitment period, important upfront investment is needed to create the necessary infrastructure.

There are "traditional" sources of bilateral and multilateral finance, like development assistance and GEF, but these are by far insufficient to tackle the enormous task ahead. As soon as the Kyoto Protocol Adaptation Fund (filled with a share of the proceeds from CDM projects) and the Special Climate Fund become operational, these could contribute a part of the finance needed for poorer countries. Nevertheless, these funds' managers will weigh the efficiency of their use against technical approaches, the result of which will depend on the time preference. Stabilizing forests may in some cases not be considered as efficient on the short run as demonstration projects like dams or water reservoirs. A dedicated forest fund has been proposed, yet the question is where the money could stem from. First experiences with voluntary funds show that no significant amounts can be expected from these.

6.1 How much does REDD cost?

How much carbon in forests can be kept out of the atmosphere depends on the price level. Table 2 summarizes a model run starting in year 2010 for different price scenarios.

Table 2: Deforestation avoided under different price scenarios

2010 C Price + annual increase	Carbon Price ($/t CO_2)		Land area gained (Mha)		Carbon Benefits gained (Mt CO_2)	
	2.050	2.100	2.050	2.100	2.050	2.100
$1.36 + 5%	10	110	122	499	2,191	10,120
$2.73 + 5%	19	220	219	649	4,035	13,319
$5.45 + 3%	9	39	160	478	2,917	9,422
$5.45 + 3%	18	78	288	684	5,363	13,905
$27.27 + 0%	27	27	454	810	9,181	16,834
$20.45 + $5	75	75	501	959	10,261	20,396

(Source: Sathaye, Makundi et al. 2005 originally cited C values converted to CO_2)

Costs are extremely region-specific, most of all because of land opportunity costs, i.e. the income foregone from alternative land use. Many of the estimates in literature are given as a one-off payment, which neither reflects the cost, nor the necessary incentive structure for the landowner. Annual payments have higher chances for success, because deforestation and forest degradation incentives act on a long-term timescale. One study indicates that an annual transfer of 10 billion USD would save as much as 70 to 80 percent of Latin America's forests (López 1996). In a meta-analysis, the recently released Stern Report (Stern 2006) differentiates between opportunity costs, administration and enforcement costs and the costs of managing the transition. International estimates are available for opportunity costs only. Worldwide opportunity costs alone for forest preservation are estimated in the range of 5 to 10 billion USD annually. Similarly, the "$5.45 + 3%" scenario from the above table is equivalent to a total annual payment of 10 billion USD in emissions reduced in 2010 prices. From the literature reviewed we resume that 10 billion USD is the minimum annual amount able to save a substantial part of the world's tropical forests. A transfer of 10 billion USD is 0.02% of 2005 world GDP and 13% of total ODA. Due to the socio-economic benefits for the tropics, the macro-economic cost would likely be lower. Just for illustration: (1) An annual transfer of 10 billion could be refinanced by a tax of 39 cent per barrel of oil. (2) The amount could as well be financed out of a modest cut in the budgets spent on distorting energy subsidies of around 250 billion USD annually worldwide (Stern 2006).

6.2 Who pays, if not the polluter?

The most straightforward, yet unrealistic, solution would be the application of the polluter-pays principle on the problem of deforestation. Obviously, had countries and individuals to pay for deforestation and forest degradation on their territories in the context of an emissions target, they would only buy emission allowance for the share for which opportunity costs of REDD are higher then the GHG allowance prices.[11] The principle of "common but differentiated responsibilities" laid down in the UNFCCC leads us to a more complex solution involving international transfers.

How shall Annex I Parties honor their responsibility towards the forest resources of developing countries by providing the necessary funds? One solution would be to levy a border tax on wood and wood products. This would however be incompatible with the goal of increased carbon storage in wood products and the increased use of bioenergy. It would furthermore be felt as a tariff barrier benefiting northern producers.

A tax on Kyoto Mechanisms would be another option. This is actually being applied on the CDM, thereby putting CDM projects at a disadvantage against the compliance mechanisms exclusive to Annex-I. It would thus be justifiable to levy a share of proceeds from the other two mechanisms, namely Joint Implementation and International Emissions Trading, to forest preservation and management. Yet, the actual volume of the total carbon market since 2000 up to the present is 10 billion USD, half of it from CDM transactions (Capoor and Ambrosi 2006). Even assuming a steep increase in trading over the coming years, any share of proceeds from the Kyoto market would never suffice for the imminent REDD needs.

More income could be expected from a sector for financial participation that has been spared from targets during the first commitment period. International air and maritime transport has shown a steep emissions increase in the last years. An international agreement on "bunker fuels" is pertinent anyway. As transport companies are free to buy their fuels outside the Annex I countries, an inclusion under their targets will not be effective. The overall quantity of bunker fuel emissions for 2002 was estimated between 409 Mt CO_2e (UNFCCC 2005) and 817 Mt CO_2e (Wit, Kampman et al. 2004). Assuming airlines and marine shipping companies had to pay a 15 USD tax

[11]Of course, this purely rational behavior is likely only if we assume perfect foresight and market transparency.

per ton of CO_2 emitted (i.e. no baseline allocation) the total receipt would be between 6 and 12 billion USD per year. In the tax case, we will need to deduct a share of transaction costs for the Parties. This receipt could also be realized through an international auction of emission permits, which may have the advantage that a centralized auction is lower in transaction costs. The flipside is that this would imply overall emission limitation targets for the bunker fuel sector, which may be difficult to agree upon. In any case, it makes sense that a climate-related instrument should feed back to climate change mitigation in another sector that has not been included under a climate treaty until now. There are many interests involved trying to receive a piece of the pie, but at least bunker fuels can contribute a share of the money needed for REDD.

What other option is there for filling up an endowment fund that subsidizes efforts for REDD? For the first commitment period, industrialized countries have received their allocations (emission targets) for free, meaning that they only need to pay for mitigating the exceeding share of their GHG emissions. In order to create an incentive to keep target allocations low, Parties could be obliged to make a contribution to a compliance fund for every ton of CO_2e they are entitled to emit during the commitment period. Committed Parties found to be in compliance after the true-up period would recover their payment afterwards. In the event of non-compliance, the payment would be lost partially or in total for the country Party in question. The fund's receipts would be used for financing additional mitigation activities (Dutschke, Michaelowa et al. 1998). How high could this contribution be? Taking the first commitment period GHG emissions target as a reference, in order to gather the amount of 10 billion USD, countries would have to spend around 0.90 USD per ton CO_2e, respectively 0.60 USD per ton, if the US and Australia were to participate (calculations based on Ziesing 2006). For Germany, this would make up an annual amount of 2.8, respectively 4.4 billion USD over the five-year commitment period.

The upfront compliance payment could be used for a revolving fund. This fund should primarily finance capacity and institution building, as well as forest inventories and monitoring, while the proceeds from REDD could be sold on the international allowance market, as described in section 4.3 above.

In order to honor early action and at the same give time for negotiating an eventual target, the fund could consist of two tranches: The first tranche would be disbursed directly to country Parties willing to take over a voluntary target, and which helps building up capacity and inventories and would be on a grant basis. The second tranche would only be disbursed, once a reference level and a target had been agreed. In order to achieve a firm commitment by the country Party, the fund would be on a loan basis only, to be repaid with receipts from *ex post* allowance trading.

7 Concept for the design of country-based pilot programs

Due to the diverse regional and national circumstances in tropical countries, there is obviously no one-size-fits-all approach to REDD. In order to describe the instruments, some definitions are needed:

Policies and measures: In order to be successful, REDD needs an enabling policy framework. It includes, among others, clearly defined land rights, law enforcement towards deforestation agents, general investment security, transparent subsidy schemes, and administrative capacity to support land use programs.

Programs: The terms “program” and “project” are often used in an overlapping manner. Typically, a program is a policy-near instrument with a joint budget, pursuing a variety of goals. A program for the land use sector may pursue the goals of rural poverty alleviation, stopping rural depopulation, promoting food and energy security. It will include institution building, capacity building, and integration of marginalized groups, including indigenous population. It will aim to improve the access to finance, energy, transport and education.

Projects: Under a program’s auspices, several projects can be carried out. Projects typically group targeted activities. In our example, REDD can be the target to be reached within the context of a program. In order to prove its effectiveness the project’s target should be measurable *ex ante* and *ex post*. In order to allow an efficient allocation of funds, for climate change mitigation, the reference scenario (i.e. the baseline deforestation) needs to be determined before starting concrete activities.

Project activities: Activities are the category most related to the desired effect. They may or may not be financed out of the project budget. Forest management definitively is a field of activities that can result in REDD. The activity in forest protection is in some cases difficult to determine. In the absence of protection, loggers are the direct actors, be their activity legal or illegal. The cessation of logging is no activity *per se.* If e.g. a logging permit is cancelled, the direct actor is the institution, not the logging holder that now profits from an indemnification payment. The protection of a forest may include fencing an area, policing it, setting up visitors’ facilities, mapping and inventorying forest resources. Assuming the most frequent case of frontier deforestation, REDD is no one-time activity. Without REDD, over time, logging would pave its way into the forest. A REDD strategy reduces or stops the encroachment by loggers. Thus, the project area will remain stable, and any avoided loss of vegetation in adjacent or even remote areas will be due to activities within the project area, as long as it remains intact. Reducing deforestation is therefore an activity that takes place on a fraction of the whole forested area. Funds can thus be efficiently concentrated along the deforestation frontier. Ideally, a sectoral project for REDD will combine all forest related activities, deforestation avoidance, forest management, and reforestation.

REDD as an overarching goal can be pursued on all levels, and these can be mutually reinforcing. ODA should concentrate on the policies and program levels. It can further contribute to national baseline setting and finding an appropriate emissions reference level and the development of in-country technical capacities for methodology, project design, and monitoring. Not by coincidence, the discussion on CDM sector-level projects came up after first experience had been gathered with CDM project activities for some years. The CDM has demonstrated that success was greatest where policies, program and project levels were involved in a mutual learning process.

REDD can thus only be successful where there is a bundle of mutually supportive measures and activities. Experience should be gathered in different tropical countries. In some cases, an international eco-regional approach to an ecosystem appears to be sensible, like in the case of the Amazon or the Congo basins, thereby limiting international leakage currently not addressed under the Kyoto Protocol.

REDD pilots should be developed in a stepwise approach:

1. Carry out an inventory of a country's or the region's forest resources and their development since 1990.
2. Identify and map deforestation and biodiversity hot spots
3. Among the above, separate the ones deemed crucial for the country's economic or demographic development, i.e. the land areas with highest opportunity costs.
4. Devise areas that can be protected at low cost. Ideally, an REDD cost curve is established for the country.
5. Determine the carbon density for the different vegetation classes, either by on-the-ground measurements or by referring to relevant IPCC sources.
6. Derive a deforestation baseline for the business-as-usual scenario, and calculate the reductions achievable under different CO_2 allowance price assumptions
7. Create a land use development plan, including agricultural expansion areas and future protected areas.
8. Distinguish between state, communal and private property and tenure. For each case, a different composition of deforestation and devegetation drivers will apply. The better these are identified, the more efficient REDD will be.

9. Identify agents of deforestation and forest degradation and design mechanisms that are capable to involve them in REDD. As an example, the Bolivian solution of an indemnification of logging concession holders has proven effective.
10. Open space for private investment in land use. Allow for sustainable forest management where appropriate. As a precondition, the adoption of forest certification rules and the building up of certification bodies are needed.
11. Identify a pipeline of priority forestry activities to be executed by private actors.
12. Develop suitable compensation schemes. These shall not only include the global services rendered by REDD, but also local environmental services, like enhanced water catchments or pest resilience through biodiversity conservation. It is of utter importance to find suitable and convincing monitoring and verification mechanisms, in order to prove direct utility to the local population.

The described process will necessarily result in a labor division between the different activity areas Different pilot activities should use compatible baseline and monitoring methodologies, so these can be integrated under the sector-wide approach.

8 Conclusions

After shortly summarizing the current understanding of deforestation and forest degradation processes, we have summarized the proposals on how to include REDD into a future climate change mitigation agreement. Fully including REDD credits into the carbon market will be possible once there is a reliable long-term climate policy framework. Based on real-life examples and on experience from the Clean Development Mechanism (CDM), we draw conclusions on how to design programs, projects and concrete REDD policies. According to different estimates from literature, any significant reduction of worldwide emissions from deforestation and degradation will cost a minimum of 10 billion USD annually. A combination of refundable upfront North-South transfers and *ex post* carbon credit sales could ensure the necessary funds.

The failure to conserve existing forests will forego a huge mitigation potential that is relatively low-cost today, but unavailable in the future, independently from the willingness to pay. As most deforestation and forest degradation occur along the forest frontier, there are good chances to concentrate funds efficiently. Further studies will have to develop frameworks for upscaling and integrating forest governance programs on different levels.

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Chapter VII

Creating incentives for avoiding further deforestation: The nested approach[1]

Lucio Pedroni, Michael Dutschke, Charlotte Streck and /Manuel Estrada Porrúa

1 Introduction

Forests are our most important terrestrial storehouses of carbon[2] and play and important role in controlling the climate. Yet, in many parts of the world forests are degraded and destroyed to expand agricultural lands, gain timber, or clear space for infrastructure or mining activities. Tropical deforestation has severe consequences for biodiversity, impacts water quality and storage, exacerbates flooding, landslide and soil erosion hazards, and threatens the livelihoods of the poorest of the poor.[3] It is also a major contributor to global climate change. About 36% of the carbon that has been added to the atmosphere in the period 1850-2000 comes from forests that have been eliminated[4] and about 18%[5] of the carbon added in the 1990s comes from land use change.[6] At a worldwide scale, gross deforestation is about 12.3 million hectares per year.[7] Effectively reducing deforestation is therefore a strategic issue in the climate change and development agendas for the period post 2012.

Despite its relevance as a source of greenhouse gas ("GHG") emissions, tropical deforestation in developing countries has not been adequately addressed in the Kyoto Protocol. During the negotiations of the Kyoto Protocol, negotiators considered addressing emissions stemming from agriculture, forestry, and other land-uses ("AFOLU") as subordinated to any agreement on the reduction of industry and energy related GHG emissions. Nevertheless, the topic came up various times during the negotiations and controversies spanned around the ability to devise a practical

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[1] First published Climate Policy 9 (2009), pp. 207-220

[2] IPCC, 2000, Land Use, Land-Use Change, and Forestry. A Special Report of the IPCC, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[3] According to the World Bank Forestry Strategy 2002 Appendix: 1.2 billion people or 80% of the world's extreme poor depend, to some extent, on forests (including agroforests and tree crops) for their income or livelihood, for maintenance of soil fertility and water value, and for fuelwood (for cooking and heat). Uma L., Hsaui S. A., Kumar N., Zuzueta A., and Kelly L., 2000. The World Bank Forestry Strategy: Striking the Right Balance, 192 p.

[4] Houghton, 2006. Role of forests, in particular tropical forests in the global carbon cycle. Presentation at the 2006 UNFCCC workshop in Rome on reducing emissions from deforestation http://unfccc.int/files/methods_and_science/lulucf/application/pdf/060830_houghton.pdf

[5] Due to the rapid expansion of emissions from fossil fuel consumption in the last decades, the relative contribution of deforestation to global GHG emissions is decraseing but the absolute emission level is not decreasing.

[6] IPCC, 2007. Forth Assessment Report.

[7] FAO, 2005. Gobal Forest Ressources Assessment 2005

means to include the complex accounting of sinks in a manner that adequately maintained the environmental integrity of the overall agreement.[8] The solution found in Kyoto is based on a partial accounting framework which was probably best achievable in 1997, but which remains unsatisfactory in the long run. Despite its inconsistencies, the system devised in Kyoto and elaborated since, rewards carbon emission reductions and removals in industrial countries and creates incentives for forest conservation and afforestation in these countries. On the other hand, the decision not to permit "avoided deforestation" as a project class under the Clean Development Mechanism ("CDM") leaves the largest source of GHG emissions in many developing countries unaddressed.[9]

It is essential that a post-Kyoto agreement addresses this gap and includes policy and economic incentives to reduce further emissions from deforestation. Since 2005, when Papua New Guinea and Costa Rica put forward their proposal to consider whether and how incentives to reduce tropical deforestation could be included in the future climate regime under the UNFCCC or the Kyoto Protocol,[10] international negotiators have discussed ways on how an international mechanism could be shaped that would trigger reductions of emissions from deforestation and forest degradation in developing countries (REDD). The 13th Session of the Conference of the Parties of the UNFCCC, held in Bali in December 2007, adopted a decision that confirms the intention of the Parties to address the issue of deforestation in a post-Kyoto framework and encourages the implementation of demonstration activities.[11] The implementation of such activities is encouraged at both national and subnational levels - which, "where applied, should constitute a step towards the development of national approaches, reference levels and estimates". [12]

In this chapter, recognizing that REDD will imply a continuous international effort to build the required capacities and to sustain adequate levels of funding, we propose an integrated accounting system for emissions and emission reductions resulting from national and subnational REDD efforts as well as the accompanying reward system. The objective of this "nested approach" [13] is to devise a framework aimed at achieving meaningful reductions in GHG emissions from improved forest governance

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[8] Murray Ward, Where to with LULUCF? First, how did we get there? http://homepages.paradise.net.nz/murrayw3/documents/pdf/Where%20to%20with%20LULUCF.pdf (accessed 12 September 2007).
[9] FCCC/CP/2001/L.7 (Decision 5/CP.6 , 2001. http://unfccc.int/resource/docs/cop6secpart/l07.pdf, accessed 20 September 2008)
[10] FCCC/CP/2005/MISC.1
[11] FCCC/SBSTA/2007/L.23/Add.1/Rev.1.
[12] FCCC/SBSTA/2007/MISC.14
[13] The "nested approach" has been presented first by the Tropical Agricultural Research and Higher Education Center (CATIE) and The German Emissions Trading Association (BVEK) in a submission to the UNFCCC Secretariat in February, 2007 and later by a number of Latin American countries in other submissions to the UNFCCC Secretariat on August, 2007 and March, 2008.

and management in developing countries while allowing for an immediate and broad participation by developing countries, civil society, and the private sector.

2 The financing gap

Long-term protection of tropical forests will depend on the mobilization of sufficient human and financial resources as well as on the capacity of public institutions to promote efficient and sustainable forest protection and management. Research carried out for the Stern Review[14] indicates that "*the opportunity cost of forest protection in 8 countries responsible for 70 per cent of emissions from land use could be around USD 5 billion annually, initially, although over time marginal costs would rise*". The required level of funding will have to draw on public and private sources. The global carbon market has emerged over the last years as one of the most promising sources of private capital. The total volume transacted in the regulated carbon markets in 2007 was an estimated 2.9 billion tonnes of CO_2 equivalent (CO_2e), worth a financial value of approximately USD 64 billion.[15] While the lion share of this market has to be attributed to transactions under the EU emission trading scheme, the CDM is, with trades representing a value of more than USD 12.8 billion, the second largest segment of the global carbon market. About three quarters of the CDM market, and more than 90% of the carbon market as a whole, is made of private carbon purchase and trading activity.[16]

Through the CDM, the Kyoto Protocol has established a financial tool of unprecedented success in international environmental law. In 2007 the primary market of CDM transactions alone mobilized more than triple the funds than the forth replenishment of the Global Environment Facility ("GEF"), the single biggest environmental trust fund and the financial mechanism for four international environmental conventions mobilized for its operations between 2006 and 2010.[17] Since the CDM's launch in 2001, traded volumes have been steadily on the rise with stable growth of the CDM market and there are no signs of it slowing down or reaching maturity.[18]

A review of these numbers as well as international experience in mobilizing public vs. private funds shows that the latter are essential to scale funding for REDD at a meaningful scale. It is also clear that such a level of upfront investment in climate

[14] Stern Review (2006), Final Report. Part VI, Chapter 27. Cambridge University Press.
[15] Market data from: K. Capoor and P. Ambrosi, "State and Trends of the Carbon Market 2007", 2008, World Bank Institute & International Emissions Trading Association, Washington, DC.
[16] Ibid.
[17] In August 2006, the GEF received in August 2006 USD 3.13 billion from 32 donor governments for its operations between 2006 and 2010. GEF Forth Replenishment, relevant documents on http://www.gefweb.org/interior.aspx?id=48 (accessed 1 September 2008).
[18] UNEP Risoe CDM/JI Pipeline Analysis and Database, September 1st 2008, http://www.cdm-pipeline.org/ (accessed 1 September 2008).

change mitigation cannot be mobilized by developing countries alone. Compared to more traditional commodity markets, the carbon market remains small; still it dwarfs financing made available via official development assistance and its continuous growth evidences the trust of market participants that credits with vintages beyond 2012 will come into play. It is therefore probable that the carbon markets triggered by the Kyoto Protocol will outlive the protocol itself and will remain a force behind attempts at moving towards a carbon constrained way of doing business. Linking some of the funding for international REDD activities to global carbon markets seems thus a prudent strategy to complement public transfer payments.

Markets depend on a reliable regulatory framework that enables participants to count on certain returns on their investments. The level of investment reflects the level of risk exposure market participants attach to a certain activity, country, and mechanism. Private investors as well as communities, local governments, and other private and public entities wish to control the risks associated to their financing and be rewarded for their efforts. They will only deploy capital if they can manage the risks associated with their investment. Private REDD investors will thus favour sub-national and project investment opportunities over reward schemes set up by national governments. The poorer the country rating of a REDD host country, the lower their appetite to be dependent on government action to secure their returns. Governments may therefore consider a REDD strategy, which consists in institutional strengthening, broader public programmes and reward schemes on one hand, on the other in stimulating public and private investment in designated REDD activities. Whereas it is essential to integrate such sub-national REDD activities into broader public programmes, the rewarding of approved sub-national activities should be de-linked from the risk of broader policy failure.

3 The governance gap

Addressing REDD at a national level implies that countries are able to successfully implement effective policy, legal and institutional reforms nationwide and that they are in the position to formulate and enforce appropriate social and economic safeguards. A review of selected governance indicators of the eight countries that contribute 70% of the total GHG emissions from land-use referred to in the Stern Report provides a sobering view on the ability of some of the governments and public sectors of these countries to provide and enforce robust policies in their territories (Table 1). Poor forest governance, characterized by illegal logging, corruption, and land speculation is a common phenomenon among rainforest-rich countries. Public sector performance is thus often aggravating the problem of deforestation rather than contributing to a country's attempt to protect forest resources. A 2006 World Bank report on forest governance emphasizes that failures of law and of enforcement must be addressed to improve forest sector governance and ensure that the forest-dependent poor are not unfairly punished.[19] Abusive central government intervention that awards lucrative forestry concessions to political allies and foreign corporations contribute to the general problem.[20] Improved forest management, land reform, and fight against corruption and forest crime are essential to enable countries to effectively protect their forests. However, the central insight of the community-based forestry effort is that the law enforced by a centralized state can be only one component of a broader forestry solution.[21]

In the context of a REDD-based system, the above means that significantly reduce the national rate of deforestation and forest degradation in most developing countries will take time and will bear important socioeconomic and political costs.

Table 1: Selected governance indicators

Country/Governance Indicator	Year	Bolivia	Brazil	Cameroon	Congo D. R.	Ghana	Indonesia	Malaysia	PNG	AVG
Government Effectiveness[1]	2005	23.9 ↓	55.0↑	21.5↓	1.0↓	53.6	37.3↑	80.4↓	16.7↓	36.18↓
	2002	35.4	53.6	25.8	1.4	54.5	34.0	80.9	21.5	38.39
Regulatory Quality[2]	2005	32.7↓	55.0↓	23.3↑	4.5↑	49.5	36.6↑	66.8↓	19.8↓	36.03↓
	2002	47.8	61.1	21.7	4.4	44.3	23.6	67.5	35.5	38.24
Rule of Law[3]	2005	27.1↓	43.0↓	15.5↑	1.0 ↔	48.3	20.3↑	66.2↑	18.8↑	30.03↑
	2002	29.8	43.3	10.1	1.0	49.0	18.3	64.4	14.9	28.85
Control of Corruption[4]	2005	23.6↑	48.3↓	8.4↓	3.0↑	45.3	21.2↑	64.5↓	12.8↓	28.39↓
	2002	22.5	54.4	10.8	2.0	44.6	6.9	66.7	25.0	29.11

1 *Government effectiveness* measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies

2 *Regulatory quality* measures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development

3 *Rule of law* measures the extent to which agents have confidence in and abide by the rules of society, in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence

4 *Control of corruption* measures the extent to which public power is exercised for private gain, including petty and grand forms of corruption, as well as "capture" of the state by elites and private interests

Source: WGI: Worldwide Governance Indicators Country Snapshot, World Bank., with special thanks to Manuel Estrada Porrua.

[19] Strengthening Forest Law Enforcement and Governance – Addressing a Systemic Constraint to Sustainable Development, http://siteresources.worldbank.org/INTFORESTS/Resources/ForestLawFINAL_HI_RES_9_27_06_FINAL_web.pdf? (accessed 30 September 2007).

[20] Craig Segall, The forestry crisis as a crisis of the rule of law. The Stanford Law Review, Vol. 58, Issue 5. p. 1539, 1540, 1541. Unfortunately, a recent report of the World Bank's Inspection Panel shows that the Bank itself is not free of blame: "The World Bank encouraged foreign companies to destructively log the world's second largest forest, endangering the lives of thousands of Congolese Pygmies, according to a report on an internal investigation by senior bank staff and outside experts." John Vidal, in The Guardian, 4 October 2007.

[21] Craig Segall, The forestry crisis as a crisis of the rule of law. The Stanford Law Review, Vol. 58, Issue 5. p. 1539, 1540, 1543.

4 Challenges of a REDD mechanism based exclusively on national-level accounting

Recognizing sovereign authority over forest resources, national governments are essential for a long-term effective REDD policy. In order to further allow the full national accounting for emissions and emission reductions from deforestation and forest degradation, scholars and UNFCCC negotiators have proposed a REDD system that is exclusively built on national accounting of emissions.[1] Such a system would reward emission reductions below a pre-established national reference emission level and would go hand in hand with the establishment of a national monitoring system. A REDD mechanism exclusively built on national accounting would require the definition of a national reference emission level and a nation-wide monitoring system. Credits would be issued *ex-post* for emission reductions achieved below the reference emission level, which means that, in principle, the cost of the additional efforts required to change historic deforestation patterns would have to be covered up-front by developing country governments. Moreover, under such a scheme, countries would have to have the capacity to adopt and enforce forest management and protection policies, as well as to accurately account for forest carbon and be accountable for subsequent carbon losses.

Consequently, a national approach to REDD is based on the assumption that countries are able to fund and successfully implement effective policy, legal and institutional reforms nationwide, and that they are able to do this within the next years – something that, as shown in the previous section – has proven a challenge for many developing countries. History shows that deforestation has very rarely been successfully limited at the national level through specific policy interventions. Indeed, as noted in a workshop organized by the UNFCCC in 2006 (Rome) all of the reported policies to reduce deforestation applied so far (except for one) show either variable, moderate, low, or even negative success, with success often dependent on local circumstances.[22] From this it seems that policies are likely to fail if countries do not have adequate resources to identify, develop, and implement appropriate policies.[23] The massive capacity building effort and long-term funding required will be beyond the possibilities of the public resources available in most developing countries and depends on long term cooperation and support from donors.[24] Would a REDD

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[22] The workshop was held in Rome from the 30 August till 1 September 2006. See http://unfccc.int/methods_and_science/lulucf/items/4123.php (accessed 27 November 2007)

[23] Views on the range of topics and other relevant information relating to reducing emissions from deforestation in developing countries. Submission by the Republic of Vanuatu, February 2007 (FCCC/SBSTA/2007/MISC.2).

[24] The World Bank's Forest Partnership Facility supports REDD "readiness" of selected developing countries. While marking a first step, the provided funding is insufficient to guarantee a longer-term institutional strengthening in the selected countries.

scheme require all participating countries to have functioning accounting systems, relevant institutions and policies in place. Initial participation in such mechanism would be extremely limited. Countries with little capacity to implement forest protection measures, and therefore most in need of international support, would not be able to benefit from incentives for REDD. In addition they may be subject to (most likely unaccounted) international leakage from the few successful countries.

Given the level of resources required to reduce emissions from deforestation and forest degradation, the participation of sub-national private and public actors in any REDD mechanism is critical. In a system in which the allocation of funds and potential carbon credits is controlled by host country governments, the political and legal risk of the mechanism is considered too high as to attract private finance. The experience of the Kyoto Protocol's Joint Implementation mechanism shows that the mere fact that credits will be issued by national governments rather than an international body creates a significant market barrier.[25] Establishing a government-controlled REDD system has also led the International Forum of Indigenous Peoples on Climate Change voicing concerns regarding REDD[26] amongst other things because national-based mechanisms could contravene indigenous rights to the land and forest resources.

In sum, in most of the relevant countries a REDD system which is based *exclusively* on a national emission reduction crediting system is likely to take significant time to be established, and the risk of failure will remain high.

5 Cornerstones of an inclusive REDD mechanisms

Decades of international cooperation for the protection and development of forest resources in developing countries, as well as the recent establishment and rapid growth of the international carbon market, provide the foundation for the identification of some basic success factors for any future REDD mechanism:

- Any mechanism has to be embedded in a wider participation and deeper GHG emission reduction commitments by industrialized countries and an enhanced contribution by developing countries to the international GHG mitigation effort.
- Incentives to undertake REDD measures under the UNFCCC framework should accommodate different national circumstances and levels of capacity, so that countries are able to immediately participate and increase their partici-

[25] The slow progress of countries like the Russian Federation in issuing approvals for JI activities creates additional risks. By November 2007, only a handful of JI projects have achieved international registration compared to more than 800_CDM projects.

[26] ENB COP 13 and COP/MOP 3 highlights: Wednesday, 5 December 2007 Vol. 12 No. 346 www.iisd.ca/download/pdf/enb12346e.pdf (accessed 1 September 2008).

pation as they enhance their capacities, thus allowing for a growing involvement in global emission reduction efforts.

- Incentives provided should be complemented by instruments to allow countries to build capacities and enhance the availability and quality of data, as well as to propose and implement effective policy measures.
- REDD should acknowledge indigenous, customary and other land rights.
- In order to mobilize the necessary investment flows into developing countries, a private-sector driven element allowing for the commercialization of carbon credits is essential.
- REDD should reward capacity and good governance on all levels of society.
- Since Kyoto, scientific and methodological uncertainties have decreased, and capacities have increased to make the proposed mechanisms consistent with the principles of the carbon market (environmental integrity). This mechanism shall build upon and at the same time improve the technical and institutional infrastructure already in place.
- Effective mechanisms to address technical issues, such as baseline and leakage, have to be formulated in order for these issues not to become a barrier against initiating REDD activities. Where such mechanisms cannot be established or where sub-national activities cannot be verified as being environmentally robust, they do not qualify as REDD activities.

Based on the assumptions laid out above, we propose a phased, double baseline-and-credit mechanism which rewards governments as well as public and private entities for lowering deforestation rates.

6 Proposal for a nested REDD mechanism

Success of an effective REDD mechanism will depend upon the adoption of a flexible policy approach to address deforestation drivers at both the national and sub-national levels whilst creating an enabling environment for forest carbon conservation and management. Such an enabling framework should put in place the conditions for private and public activities at the national, sub-national, provincial, local, and project levels.

6.1 National Approach

Developing countries should be encouraged to account for and control their emissions from forest lands at the national level as soon as possible. However, due to different national circumstances, some countries will not be able to do this in the short run. We therefore propose a double accounting approach, whereby both sub-national activities (i.e., projects, programs, activities at the municipal or federal state levels) and national ones can be started immediately. Developing countries would be able to decide on their initial level of participation in this mechanism, according to their particular circumstances and interests. Countries could support sub-national activities first, thereby creating learning and capacity to eventually fully account for national deforestation emissions. Sub-national engagement is thus always a step towards full national participation in REDD. The path leading to full accounting ensures that governments are careful when approving sub-national activities knowing that eventually they will be held accountable for an over-allocation of REDD credits to individual activities. The implementation of sub-national activities and the development of projects allow developing countries to access funding without further delays and promotes the creation of capacity and relevant expertise in their territories.

In the case of implementation of activities at the sub-national level, once the total area of a participating country reaches a determined percentage of its forest territory or, alternatively, more than an agreed number of years have elapsed since the start of the first sub-national activity, such country would have to participate in a full national accounting scheme. These threshold values are debatable and one could argue that “5 – 10 years after initiation of the first sub-national activity” or “10 – 20 percent of the national forestland under REDD activities” are practical thresholds for host country national engagement. The proposed “area trigger” would provide an incentive for Annex I Parties to invest in REDD activities in developing countries and/or to buy the ensuing emissions reductions (i.e., accelerating an increased participation by such countries in the climate change regime). Moreover, participating developing countries could, at any time before reaching either one of these limits, decide to voluntarily adopt a national emission reduction target.

National target GHG emission levels may be above or below the empiric deforestation and forest degradation levels of the base-year or base reference period and be re-viewed periodically (i.e., for each engagement period) to account for structural and other relevant changes. As exact deforestation and forest degradation levels and future land use trends are uncertain, developing countries should be given sufficient time (and assistance) to assess these issues. Moreover, in order to be realistic and achievable, the emission reduction target to be pursued by each country should first be discussed and agreed internally by each host country, taking into account institutional barriers, agents and drivers of land-use change, growth projections, conflicting interests of different economic agents, and the multiple views on national sustainable development. The success of reducing emissions from deforestation and forest degradation depends on developing countries being able to conclude this process with sufficient technical and financial assistance. This takes time. We therefore envision a roadmap with clearly defined milestones to reach the goal of establishing a national target level of GHG emissions from deforestation and forest degradation.

REDD credits shall be issued for any emission reduction below the agreed national target emission level. Such credits would be permanent and fungible with other international emission allowances and credits. An established percentage of REDD credits issued from a country would be retained in a mandatory reserve account of the host country to guarantee compliance with the agreed target in future verification periods. Credits in this reserve account would represent net contributions to global emission reductions, as they would not be available to offset emissions in industrialized countries. Issuance of REDD credits would be overseen by a UNFCCC body according to the following principles:

- A target emission level would be defined for each relevant engagement period.
- If emissions from deforestation and forest degradation remain in the initial verification period above the target emission level, no credits would be issued and no emission debits accounted for.
- Emission reductions accounted for on the sub-national level would be reflected in the national REDD inventory; credits issued for sub-national activities would be discounted from any allocated national carbon credits.[27] National REDD credits would thus be calculated as follows[28]:
  - Tradable Credits = Reference Emissions – Observed Emissions – Tradable Project Credits – Reserve Credits
  - Reserve Credits = X% * (Tradable Credits) + Credits Deduced from Sub-National Activities[29]
- In case emissions from deforestation remained below the target emission level within a verification period, and REDD credits were issued for that period, the implementing country would have to compensate any potential future over-emission in subsequent verification periods. Consequently, in case of future emissions above the target emission level, the implementing country could choose to:

[27] The proposed system can be compared with the accounting under the current Joint Implementation mechanism.

[28] FCCC/SBSTA/2008?MISC.4 - Submissions by Paraguay on behalf of Argentina, Honduras, Panama, Paraguay and Peru to the UNFCCC Secretariat on “Views on outstanding methodological issues related to policy approaches and positive incentives to reduce emissions from deforestation and forest degradation in developing countries.

[29] Credits deduced to mitigate the effect of emissions displaced by sub-national activities, as explained below

- Offset the excess emissions by canceling REDD credits from its reserve account, or by acquiring REDD credits from other implementing countries' reserve accounts; and/or
- Over-comply in the subsequent verification period by an amount of emission reductions equivalent to the excess deforestation emissions of the previous verification period; and/or
- Request an adjustment of its target emission level for the subsequent verification period, arguing justifiable reasons of force majeure (such as large-scale forest destruction due to extreme climatic events and their consequences, war, terrorism, etc.) or improvements in the availability of data and methods. Any adjustment of the target emission level would be subject to either review and approval by the Parties, or independent validation and certification following transparent procedures, agreed to by the Parties.

6.2 Sub-National Mechanism

In order to mobilize emission reduction from a broadest possible range, it is necessary to allow sub-national level activities and encourage the participation of the private sector. Sub-national level activities can start without further delay and in all countries, independent from emissions reduction targets at the national level and international support. Successful REDD activities will further encourage governments to take action and will bend the learning curve upwards, since the private sector does not only bring finance but also human resources. Some countries may be able to speed up their national process and announce a voluntary national emission target already for the post-2012 period. Any country may authorize private or public entities to develop and implement REDD activities at sub-national level.

Such REDD activities would either have to adopt already pre-existing regional emission reference levels (baselines) or establish their own emission reference level. REDD activities would have to be authorized by the host countries and implemented in accordance with their sustainable development policies. REDD credits for such project activities would be issued by a dedicated UNFCCC body following processes and rules agreed upon by the Parties in order to guarantee that they represent real, measurable and additional emission reductions. Such credits would be issued directly to the authorized project participants by the competent UNFCCC body, even in the case of excess forest sector emissions at the national level.

In order to account for displacement of emissions (leakage), – one of the main environmental concerns associated with sub-national REDD activities – two options would be available for sub-national REDD activities, depending on each host-country's sovereign choice[30]:

- Accounting and deduction from the project credits (Tradable Credits = Baseline Emissions – Observed Emissions – Measured and Verified Leakage); or
- Transfer of a share of the credits, negotiated between the host country government and the project participants, to the host country's national reserve account (Tradable Credits = Baseline Emissions – Observed Emissions – Project Credits transferred to the National Reserve).

Project-level accounting will thus guarantee the atmospheric integrity of such project activities compared to national accounting schemes. Moreover, it may be argued that since the present proposal aims at a broad participation of developing countries, the risk of international leakage – currently not accounted for by any of the Kyoto Protocol´s market mechanisms – would be minimized.

In addition, good policies and methodological guidance will have to be developed to:

- Promote project designs that address the drivers of deforestation, rather than displacing them elsewhere, e.g. by providing alternative livelihood options to the deforestation agents.
- Attribute leakage to deforestation and forest degradation agents, rather than to agents of conservation and sustainable forest management. For instance, if illegal logging increases in a country after the implementation of a REDD project, but the project has actually provided sustainable livelihood alternatives to the communities that were previously deforesting the project area, leakage should be attributed to poor law enforcement, rather than to the project.
- Design and enforce policies and regulations that minimize the risk of leakage and complement conservation activities, such as displacement of illegal logging.

To further enhance the contribution of developing countries to global emission reductions, credits issued rewarding the emission reductions of specific activities could be either temporary, with no project and no host-country liability (similar to tCERs), or permanent, with a mandatory reserve of credits to be transferred to the national reserve account. In the absence of such a reserve fund, projects could follow the example of the Voluntary Carbon Standard that requires the establishment of buffers of

[30] Ibid.

credits at the project level, or a collective buffer at the global level.[31] Once a country has adopted a national emission target, only permanent credits would be issued.

6.3 Supporting Instruments

We further encourage the establishment of a multilateral fund that would finance activities aimed at creating enabling conditions, including institutional and technical capacities. The fund may include an enabling window (readiness) and an activity window. The enabling window of the fund shall be disbursed on a grant basis. Part of its tasks shall be to develop reliable carbon monitoring systems. An activity window of the fund may enable early action activities implemented prior to 2012 and any posterior pilot activity designed to test the effectiveness of capacities and measures to reduce emissions from deforestation.

A new fund, or the replenishment of an existing one, have also been proposed to finance government cost of REDD. To achieve the scale of emission reductions required to achieve climatically meaningful emission reductions would require identifying sources of sufficient, continued and predictable replenishment from industrial countries, especially if seen by the Parties as an alternative to market instruments. Therefore, in addition to voluntary contributions to kick-start capacity building and early action activities in developing countries, any new fund shall be fed by institutionalized mechanisms such as inter alia:

- A levy on Assigned Amounts first traded in the carbon market, similar to the one imposed on CERs, and/or
- fees on carbon-intensive commodities and services in industrialized, and/or
- a levy on international transport emissions; and/or
- revenues from auctioning of credits;[32] and/or
- where emission trading systems have price caps, revenues from selling credits at the price-cap level.

7 Conclusion

Deforestation and forest degradation are symptoms of a multi-causal disease for which a proven cure does not yet exist. Governments and multilateral agencies have been trying to promote forest conservation and halt illegal logging for almost three

[31] Voluntary Carbon Standard, Guidance for Agriculture, Forestry and Other Land Use Projects. http://www.v-c-s.org/docs/AFOLU%20Guidance%20Document.pdf (accessed 1 September 2008).
[32] E.g. Dutschke, M. 2009. The Climate Stabilization Fund: global auctioning of emission allowances to help forests and people',in: W.L. Filho, F. Mannke (eds), Interdisciplinary Aspects of Climate Change, Peter Lang Scientific Publishers, Frankfurt and New York, pp. 103-120. (see chapter X)

decades. Success has been modest. Taking into account the multiple challenges developing countries face, the risk of governments failing to reduce emissions from deforestation is real and undeniable. The world does not have the time and resources to take this risk. The consequences of global climate change are real and imminent and they will hit developing countries hardest. Many recent scientific papers estimate that global GHG emissions should be cut 60%-80% by 2050, to stabilize the global warming at +2ºC.[33] This means that we do not have any time to lose. Relying exclusively on governments to act would be negligent. To maximize chances to reduce emissions from deforestation, negotiators are called upon to put in place a system of incentives that encourage all layers of society and all sectors to contribute to the enormous effort to decrease tropical deforestation and to move towards a fair and robust land management system.

In our view, the nested REDD crediting system has the following advantages:

- It is able to attract private capital into REDD activities, because successful project-based activities would be credited even in the case of excess forestry emissions at the national level.
- It incentivizes early (pre-2012) activities while countries are still getting ready for the national REDD approach.
- Finally, the nested approach helps build up country capacities and encourages governments to adopt an internationally negotiated and agreed target level of forestry emissions, which rewards effective reductions.

One popular misunderstanding of the nested approach is that it is opposed to national-level activities. The contrary is the case: As a bottom-up approach, it builds up experience and capacities while obliging governments within a predefined timeframe to adopt a (voluntary) forest sector target. It is likely that the nested approach will encourage developing countries to take national action faster than a top-down approach that risks losing time with a yearlong readiness building process.

While we think that such approach would facilitate national as well as sub-national activities to reduce emissions from deforestation and degradation in a timely manner, we are aware that the system in itself remains incomplete. It can only be an element that encourages broader conservation, including of forests that are not under actual threat of deforestation. Once such threat can be measured, in many cases it will be too late to effectively protect the forest and the treasures it harbors.

[33] Nick Hurd MP and Clare Kerr, April 2007. Don't give up on 2°C. Conservative Party's Quality of Life Commission. http://www.qualityoflifechallenge.com/documents/TwoDegreesApril2007.pdf (accessed 22 September 2008)

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Chapter VIII

How do we ensure permanence and assign liability?[1]

Michael Dutschke with Arild Angelsen

1 Introduction

One of the major concerns in the reducing emissions from deforestation and forest degradation (REDD) debate is the permanence of emissions reductions. How can we make sure that a forest area saved today will not be destroyed tomorrow? Who should be held liable if that happened? How can REDD contracts and financial mechanisms be designed to ensure permanence?

Compared with other climate change mitigation options, forestry is often considered special in two ways. First, it is more difficult to control carbon storage. Even under the best management practices, an unexpected carbon release cannot be excluded. Droughts, pest, or fire have the potential to revert yearlong carbon uptake within weeks or months (Schlamadinger, Bird et al. 2007). Second, the climate effect of a forest mitigation activity is linked to the ongoing existence of trees on the area once verified. An effective REDD mechanism must provide continuous incentives for landowners to monitor and maintain their forestlands.

There are at least three counter-arguments against a categorical distinction between reduction of fossil emissions and carbon management in terrestrial systems: First, given the finiteness of fossil fuels, it is likely that they will anyway end up in the atmosphere over the long run. Reduced fossil fuel use today preserves a part of the reservoirs of coal, oil and gas, and carries the risk of higher production and consumption of the share in preserved today in the future. The question of permanence is therefore not limited to REDD.

Second, even in case terrestrial carbon sequestration was in fact temporary, it will still have a positive climate effect (see the 'ton-year approach' discussed below). Related to that, REDD can produce large emissions reduction quickly, buying time for technological development and be a 'wooden bridge to a clean energy future' (Lecocq and Chomitz 2001). Without mitigation from forestry, the world is unlikely to get the quick emissions reductions needed to reach the maximum 2 degree Celsius target (Stern 2006).

Third, in most of today's developed countries, deforestation was a phase of development. Forest transitions tend to occur in phases: from slow to rapid deforestation

[1] Book chapter commissioned by CIFOR and first published in Angelsen, Arild (ed.) 2008. Moving Ahead with REDD: Issues, Options and Implications, CIFOR Bogor pp. 77-85

to a phase of stabilization and a later transition to a slow increase in forest cover (Rudel, Coomes et al. 2005). Successful REDD will preserve forests during this risky development phase, and much of it will turn out to be permanent (Chomitz 2006).

Still and although not uniquely confined to REDD, permanence is a real issue that will have to be taken into account in the REDD negotiations. Once someone assumes liability for terrestrial carbon stocks, non-permanence may still be a threat, but its damaging effects to the atmosphere are being compensated for. This may be the case in the future, if developing countries assume proper emissions targets, for example, within a cap and trade (CAT) system (Eliasch 2008). Before this happens, we need to find intermediate solutions. This chapter looks at different permanence risks and how these can be managed, and provides a toolbox of different liability mechanisms needed for achieving fungibility of carbon credits from land use and other sectors.

2 Permanence risks and how to manage them

There are a number of direct risks that can jeopardize the permanence of the emissions reductions achieved. One layer of risk management is how the risk of re-emission can be managed and mitigated by projects or countries. A second risk management layer is needed, however, if REDD mechanisms are to be credited and used for compliance in voluntary or formal (compliance or offset) greenhouse gas (GHG) markets. In this case, some system of commercial liability must be in place. Both layers are necessarily overlapping. The main distinction is that permanence risks need to be managed anyway, independently from whether emissions reduction credits are being generated, while the second layer is a commercial necessity in case REDD credits are to be traded.

2.1 Risks and risk management

What are the risks that can jeopardize the permanence of carbon stored in forests? We distinguish between the following categories of risk (Wong and Dutschke 2003):

1. **Natural/ecological risk:** Erratic variations in carbon stocks, caused by natural events such as storm, drought, pests, or fire.
2. **Climate change-related risk:** Climate change may lead to systematic carbon losses in certain regions. This is distinct from other types of natural/ ecological risks in that it involves a new class of threats that may be more difficult to insure, as historical experience is lacking.
3. **Demand-side risk:** Where the demand for agricultural crops is the main driver of deforestation, an increase in prices on the national or world market may

drive up opportunity costs to levels above the carbon prices agreed, making forest conversion profitable.

4. **Failure of project partners:** Risk related to non-performance of the project can be due to, for example, ineffective project management, insecure tenure rights to the forest (encroachment), or bankruptcy of project partners.
5. **Political risk:** A change in government may lead to a change in or reversal of any prior approvals or commitments. The same may occur in the event of civil unrest. Depending on how the REDD mechanism will be ultimately designed a change in status from non-Annex I to Annex I country may also impact subnational activities.

In case of natural events (risk type 1), traditional forest insurance covers the difference between the salvage value of timber and the commercial value of the trees at maturity. Contracts are usually renewed on an annual basis, in order to reflect the current risk profile. This coverage can be expanded to the carbon fixed in vegetation. This expansion would require insurance companies to participate in the emissions market.

Long-term climate variations (risk type 2) will not uniformly lead to worldwide damages, but they can negatively impact large areas, while climate change may lead to increased biomass growth in other areas. In case indirect human interference can be factored out, these risks (and benefits) will not be attributed to the individual activities.

The risk for a change in commodity prices (risk type 3) can be shared between funding agency and landowner by including an indexing clause in the contract that foresees additional payments during times when the prices of - say - soy or palm oil move outside a predetermined price corridor.

In case the project owners fail to meet the obligations or disappear (risk type 4) and permanent credits have been created, the ultimate liability will fall back to the government, most likely the one of the selling country. In order to be able to respond to this risk, the national REDD focal point may ask for an in-kind risk premium (e.g. a credit sharing clause), before approving a subnational activity.

Political risks (risk type 5) can be minimized by broad participation in the climate regime and by international cooperation. Nevertheless, under an international agreement like the United Nations Framework Convention on Climate Change (UNFCCC), the basic construct is that states are permanent and comply with treaties. Legal enforcement options against states are necessarily limited.

2.2 Liability management

Permanence risks apply independently from any credit trading under a future REDD regime. Under a national approach, the concern is no longer the permanence of particular forest areas, but whether the country as a whole continues to maintain reductions below the reference level established, regardless of where the particular reductions are coming from. A critical question then arises: What happens if the country exceeds its reference level? One option is the requirement that the nation makes up the reductions or pay some other penalty. Under a 'debit system', for example, any emissions above the reference level will be deducted from a future account (perhaps plus interest or some additional penalty). The extra emissions must then be made up before any later reductions below reference level are credited (Schlamadinger and Johns 2006).

However, before REDD countries accept full liability for reductions achieved or if REDD credits from subnational activities are to be made fungible with other mitigation credits or allowance units, the resulting commercial risks need to be securitized. The following options exist:

1. **Temporary crediting** conditions the validity of carbon credits from land use to the continued existence of the carbon stocks (Blanco and Forner 2000). This approach has been applied under the Afforestation and Reforestation (A/R) Clean Development Mechanism (CDM). Depending on the modality, emissions reductions have to be either recertified or re-verified after five years for the credit to remain valid. In the CDM, when the project lifetime (up to 60 years) ends, or in case of premature losses, credits need to be replaced by other types of emissions allowances. Thus, under the current CDM rules, temporary crediting always creates a future debit, independently of the fate of the carbon stocks built up.
2. The so-called '**ton-year approach**' was discussed in the Intergovernmental Panel on Climate Change (IPCC) Special Report on Land Use, Land-Use Change and Forestry (Watson, Noble et al. 2000). It departed from the ideas that (i) the present value of mitigation is higher today than the same mitigation effect tomorrow, and that (ii) there is a limited residence time of CO_2 in the atmosphere. The combination of human time preference and the natural decay period led various authors to the calculation of an 'equivalence period', after which forestry mitigation could be considered permanent. Authors proposed the length of this equivalence period to be between 42 and 100 years (Fearnside, Lashof et al. 2000; Moura-Costa and Wilson 2000; Fearnside 2002). Consequently, with an equivalence period of 100 years, keeping 100 tons of CO_2 out of the atmosphere over 1 year would be equivalent to 1 ton of

CO_2 permanently removed. This type of accounting has a big drawback in the cash flow: full payment for permanent reduction accrues after the end of the equivalence period, while costs are mainly frontloaded. Nevertheless, the private sector might separately be willing to advance upfront loans based on the credit worthiness of the project and the expected future stream of payments.

3. **Project credit buffers** are another option used in voluntary mitigation projects. Only a certain share (e.g. 80%) of the credits generated are sold, while the remainder is held in an escrow account during the project lifetime (e.g. 30 years). A proportion of these credits are liberated as the guarantee period ends if no losses have occurred.
4. **Risk pooling** is a variation of project credit buffers where several projects maintain a joint credit buffer, thus minimizing the risk of damages occurring simultaneously. The individual project buffers can be smaller than non- pooled project credit buffers. The same would be the case for a national- level REDD program in which risks are spread across activities and regions within the country.
5. **Insurance** is an advanced version of risk pooling. A third-party insurer selects a portfolio of insured projects in a way that several growth regions and ecosystems are covered, thereby limiting the risk of occurrence of massive simultaneous damages. The risk premium is paid in emission reduction units. In case of a damage event, the insurance company replaces credits lost by the ones held in stock. The residual risk is hedged by financial instruments and reinsurers (Subak 2003). This scheme can also lead to an improved cash flow for mitigation activities.
6. **Shared liability or forest compliance partnership (FCP),** is a proposal for managing national-level liability under a 'bubble' approach on land use accounting between two or more Annex I and non-Annex I countries (Dutschke and Wolf 2007). Under this construct, developed countries would bear a negotiated share of the liability for the permanence of REDD credits once they are certified. They could account for the land- use sector under their sectoral target, stipulated under Kyoto Article 3, paragraphs 3 and 4 or any new agreement agreed upon. The FCP suggests that a developed country receives preferential access to REDD credits for compliance if it shares the liability. The proposal assumes that for compliance with Annex I targets, certain restrictions apply with regard to the use of REDD credits. Aid donors would also become motivated to invest in forest governance. Bilateral funding will be directed into the most effective policies and measures to reduce emissions in the forestry sector. The special relationship between REDD countries and their Annex I

stewards will have repercussions on the private sector too, because FCP limits the country risk for subnational activities with foreign participation.

Several combinations of the above options are possible. For example, options 1 and 2 can be combined with a sliding cancellation of debits incurred from temporary crediting over time (Dutschke 2002), thus improving the cashflow for mitigation activities. Temporary forestry credits have to be replaced in the future, but each year until the equivalence period a prorated percentage of this future debit is forgiven, in case no damage occurs.

All except option 1 limit the liability over a predetermined timeframe. The ton/year approach considers forestry mitigation effects permanent after the equivalence period. Credit buffers and insurances release credits from the escrow account, as no damages occur for a certain number of years. For A/R CDM projects in the first commitment period, no temporal horizon of the risks for sequestered carbon could be agreed upon. Therefore temporary crediting was chosen that assumes all mitigation to be lost after project termination. Nevertheless, this assumption has stifled the market's appetite for temporary and long-term certified emission reduction. As the price of temporary credits point to the future value of replacement units, these credits are highly speculative and lose their value if more stringent targets are expected for subsequent commitment periods. With stable market signals in place and banking of credits being allowed, this situation may change in future commitment periods.

With the 2 degree Celsius target to be reached until the middle of this century, the timeframe for mitigation action is much clearer now than it was when rules and modalities were discussed for A/R CDM. Thus, all the options dismissed at that time can come back into consideration for REDD liability management.

3 Evaluation of liability management

Assigning liability is a precondition for credit fungibility. Independently from the mode of financing proposed under a REDD system options, the criterion of environmental effectiveness requires that the overall effect is a lasting reduction of GHG levels in the atmosphere. Table 1 lists options that have been proposed for safeguarding permanence of emissions reductions and carbon uptakes in terrestrial systems, and each of them is assessed in terms of the 3E criteria (effectiveness, efficiency and equity). Options 1 and 2 avoid a clear allocation of liability and consequently are suboptimal in terms of all three criteria. In the start-up phase of a nested approach[2], temporary crediting may be a useful fix, before national REDD targets are set and the ultimate country liability is determined. After that, credits may be converted from tem-

[2] See chapter VII

porary to permanent. Once there is ultimate country liability, like in the case of Annex I parties, any re-emission is captured in the national inventory and is taken into account when assessing compliance with the country's reduction commitments.

The options listed are non-exclusive; they may be seen as a logical succession, once the activities reach a certain volume. In options 4 and 5, there may occur 'cherry-picking' of 'good risks' by pool operators. Annex I countries should consider providing international start-up finance to organize larger pools, make these accessible to countries perceived as 'high risk', or work with these countries to reduce their risk profile. Option 6 is only related to national-level REDD, and it is complementary to all other options. It offers potential investors and insurers higher confidence that the ultimate liability for credits is backed by Annex I support, and thus political risks are minimized. It has the potential to increase the effectiveness of policies and measures in the land- use sector and bolster private investment in REDD. It is equitable in that it can contribute to the attractiveness of countries that would otherwise have difficulty attracting REDD investment because of their political risk.

Table 1: Options for securitising permanence in terrestrial carbon management

		Effectiveness	Efficiency	Equity
1	**Temporary crediting**	**LOW** Start-up option for small overall carbon volumes and isolated activities	**LOW** Complex accounting, high transaction costs and low-value credits result in minimal use	**LOW** High transaction costs benefit large projects
2	**Ton-year accounting**	**LOW** Low upfront pay and low net present value (which depends on discount rate), limited incentives	**LOW** Leads to heavy discounts in credits, which causes cash-flow problems	**LOW** High financing costs exclude poorer participants
3	**Project credit buffers**	**MEDIUM** Effectiveness depends on project credibility and maintenance of buffer	**LOW** High unaccounted share of credits, late cash-flow	**HIGH** Easy and transparent implementation
4	**Risk pooling**	**MEDIUM–HIGH** Effective instrument, depending on pool's size and distribution	**MEDIUM–HIGH** Smaller relative buffer size	**MEDIUM** Organisational capacities required, risk of free-riding, but fairly equitable

		Effectiveness	Efficiency	Equity
5	**Commercial insurance**	**HIGH** Outsourced liability, instrument for mature markets, low hurdles	**HIGH** Low transaction costs through out-sourced risk as-sessment and man-agement	**MEDIUM** May be equitable if socially desirable 'bad risks' are sub-sidized
6	**Shared liability**	**HIGH** Will give additional incentives to readiness and capacity building, thus preparing the ground for effective REDD	**HIGH** Will make REDD insurable, as country risk is minimized	**HIGH** Depending on the motivation of Annex I parties involved, may contribute to fostering investment in high-risk countries

4 Conclusion

Building up, managing and conserving carbon pools, whether in forests or elsewhere, entails the risk of non-permanence. This risk needs to be addressed for any climate change mitigation. Further, in order to make credits resulting from forestry mitigation fungible with other credits and emission allowances, liability mechanisms are needed. The risks for forest carbon stocks can be mitigated in a staggered approach, with different mechanisms covering different risk layers. The most efficient mechanism for risk pooling is national liability of REDD countries in case risk mitigation strategies should fail. As REDD governments do not (yet) have GHG targets for the whole economy, they are not in the position to cross-compensate underachievement in forestry with over-compliance in another sector. A shared sectoral liability ('emissions bubble') between developed and developing countries may thus add to the REDD system's stability. For the respective developed country partner, the benefit could be preferential access to the partner's REDD credits.

The chapter has offered a summary of tools proposed for reducing carbon risks in forestry and for securitizing carbon contracts from forest mitigation activities. This toolbox is the result of pilot project development and a vivid methodological debate at the UNFCCC level over the last decade. Permanence and liability under a REDD mechanism can be realized by combining a variety of complementing approaches. A future REDD decision should offer a menu of choices based on what best serves different country circumstances.

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Chapter IX

Will the future be REDD? Consistent carbon accounting for land use[1]

Michael Dutschke and Till Pistorius

Abstract

This chapter is a contribution to the international debate on the compensation mechanism for reducing emissions from deforestation and forest degradation in developing countries (REDD). Since its inception, the debate has constantly widened its scope to now cover deforestation, degradation and forest management. In order to avoid methodological complexities and inconsistencies in carbon reporting and accounting, the authors promote a unified accounting system that does not distinguish between industrialized and developing countries. Such a system has been created for Annex-I countries with the Kyoto Articles 3.3 and 3.4. It allowed for a stepwise implementation and recognized the need for capacity building and "learning-by-doing" for the first commitment period. If this system serves as a blueprint, the main difference will be that industrialized countries have overall targets, while developing countries would determine a sectoral reference level for land use emissions, against which emission reductions in the land use sector are to be measured. As developing countries take over wider climate commitments in the future, this will not affect reporting for land use uptakes and emissions. In order to develop a comprehensive system, Article 3.3 and 3.4 need revision concerning the accounting modalities, i.e. Annex I countries would have to switch to net-net accounting. The way REDD has been conceived in Bali, it is restricted to developing countries' forest sector only. If this REDD mechanism were to be the future, it would create methodological hurdles and provide ammunition for opponents against enhanced responsibilities by developing countries within the climate regime.

1 Introduction

Reducing Deforestation and forest Degradation in developing countries (REDD) has been high on the agenda since a country group led by Papua New Guinea and Costa Rica presented its proposal for "Compensated Reductions" at the Conference of the Parties (COP 11) of the UN Framework Convention on Climate Change (UNFCCC) in Montreal 2005. The basic idea of REDD is to provide positive incentives for non-Annex-I countries to reduce the second largest single source of greenhouse gas emissions. Thus, a future REDD mechanism takes into account the UNFCCC principle of common, but differentiated responsibilities between industrial and developing countries (Art 3.1 UNFCCC).

Until COP 13 in Bali the future REDD mechanism has slowly taken shape. There are several basic features we can take for granted so far:

1. REDD will entail a North-South transfer mechanism. It is estimated that financial flows need to amount to several billions of Euro per year in order to re-

[1] First published International Forestry Review Vol.10 (3): 476-484

duce a significant share of forest emissions (Karousakis and Corfee-Morlot 2007).

2. Activities will include the avoidance of deforestation, forest carbon management, and the enhancement of forest carbon stocks.
3. The accession to the REDD mechanism is voluntary, while compliance is still an open question.
4. Countries shall decide individually on how to tackle their particular domestic drivers and underlying causes of deforestation. Activities may take place on national and subnational scale, provided the central government agrees.
5. There is a need for capacity and institution building in most countries.

Unsustainable land use is the combined result of policy and market failure. Whatever its particular causes and drivers, their correction will bring about significant costs in the short run. These political and economic opportunity costs will not be incurred by developing countries, unless the proposed mechanism succeeds in providing reliable long-term income.

During the last three years, the focus of the discussion has widened enormously, from deforestation avoidance only to also cover land use conversion from forests to non-forest and forest management (UNFCCC 2007). The negotiation Parties have realized that choosing the narrow scope of deforestation only will bring about the risk of perverse incentives for carbon storage and biodiversity. But, is the scope now adequate? Does it cover all potential sources and sinks in a way that is consistent across countries and accounting periods? Will the future be restricted to REDD?

We propose a reporting and accounting system that complies with the following criteria:

- become quickly operable,
- be consistent, be compatible with Annex-I country reporting,
- take into consideration the objectives of other multilateral environmental agreements,
- account for leakage and permanence risks,
- facilitate learning by doing.

2 Scope of the future compensation mechanism

When it was initially proposed, the mechanism (then denominated “RED”) was to include deforestation avoidance only. This was challenged by developing country Parties, whose carbon losses actually occur within closed forests rather than from forest conversion. There was also apprehension that the logging industry would move into countries where deforestation is not an issue yet, e.g. in the Congo Basin (Greenpeace 2007). A third group of countries, represented by India, China, Viet-Nam and Costa Rica, has successfully halted deforestation and is engaged in massive reforestation (Table 1). The negotiation positions appear to be correlated with the respective position of the individual countries on the forest transition curve (as introduced by Rudel, Coomes et al. 2005).

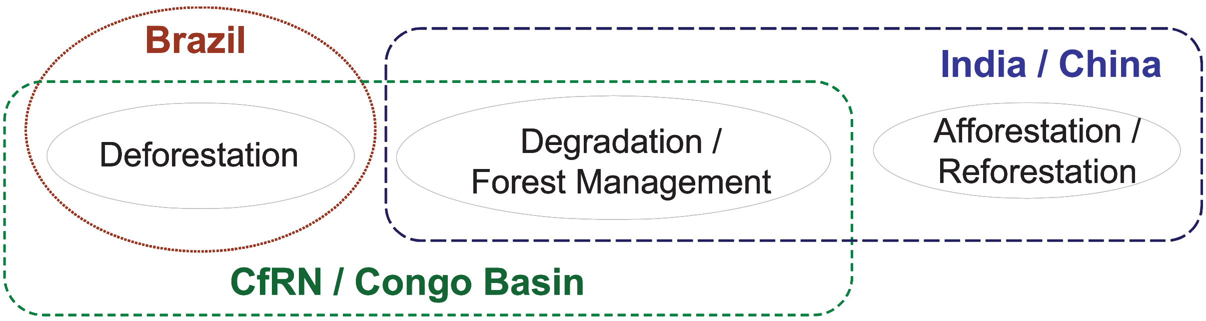
Table 1: Net changes of forest area in selected countries (Karousakis 2007)

	Country	forest area change in ha / yr. (average 1990 - 2000)	forest area change in ha / yr. (average 2000 - 2005)	LULUCF as % of total domestic GHG emissions
w/ a net loss of forest area	Brazil	- 2,681,000	- 3,103,000	62%
	Indonesia	- 1,872,000	- 1,871,000	84%
	Sudan	- 589,000	- 589,000	20%
	Myanmar	- 467,000	- 466,000	84%
	DR Congo	- 532,000	- 319,000	86%
	Zambia	- 445,000	- 445,000	40%
	Tanzania	- 412,000	- 412,000	18%
	Nigeria	- 410,000	- 410,000	50%
	Zimbabwe	- 313,000	- 313,000	58%
	Venezuela	- 288,000	- 288,000	38%
w/ a net increase of forest area	China	1,986,000	4,058,000	
	Vietnam	236,000	241,000	
	India	362,000	29,000	

Data: http://cait.wri.org/, http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php, FAO (2006)

Consequently several countries proposed different scopes for the mechanism (see Figure 1). There were partial overlaps between the CfRN and the Congo Basin approaches and the ones of Brazil and India, but no common ground between the Indian and the Brazilian approach. The way these approaches were presented risked driving the negotiations to a deadlock.

Figure 1: Scope of the most prominent proposals



As the figure shows, none of these proposals covered the full spectrum of activities concerning forest land use. They focussed on specific forest land use aspects, often with the argument to ensure the technical feasibility. This created a large potential for loosing out of sight significant carbon fluxes. A universal approach should be both, technically feasible and comprehensive in the sense that all relevant pools and fluxes are included.

Much of the debate around methodological issues takes place on the background of distributional conflicts. Bali decision 2/CP.13 found a Solomonic solution by covering all forest-related activities:

“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” (UNFCCC 2007)

Afforestation and reforestation are the only forest categories not subsumed under REDD and are thus exclusive to forestry CDM. After days of discussions, when the whole decision text was finally de-bracketed[2] and ready for approval, the US submitted a change in paragraphs 11 and 12 introducing the phrase “in the context of land use in general”. The proposal was historically consistent with earlier expressions of US interest in cropland management, but in this debate it had never been brought up and came out of time. It would have required longer deliberations on the consequences for rice-growing countries and the treatment of greenhouse gas (GHG) emissions from non-forested lands. It was consequently dropped, in order to facilitate a consensus.

For most observers, the Bali compromise went further than expected. However, is it a workable solution? We sustain that this is not the case. Our thesis is that REDD in its present scope is short-sighted. It is mainly a transfer mechanism between industrialized and developing countries. However, on the one hand neither will the willingness to pay of industrialized nations last forever, nor is the status of today’s developing countries carved in stone, e.g., the OECD members Mexico and South Korea cannot be considered developing countries any longer. Malaysia’s self-proclaimed target is to be an industrialized nation in 2020. On the other hand, deforestation and forest degradation is occurring in Russia and Canada as well. In order to attain the ultimate objective of the UNFCCC, the emission of GHG needs to be controlled in an integral manner. It makes no sense to build up an intricate monitoring system, if it is not compatible with data needed once the country changes its status to Annex I. It is counterproductive to insist in having REDD *outside Kyoto*, when the same sectoral emissions are controlled under the Kyoto Protocol for Annex I countries.

[2] Term from UN slang referring to the practice to put in square brackets text alternatives that have not been agreed upon by all Parties.

3 Lessons learned from A/R CDM

A large potential for perverse incentives lies in the use of definitions. Under the Kyoto Protocol, land-use definitions used for industrialized country Parties merely distinguished the different compartments of carbon accounting for land use related GHG emissions and carbon uptakes within a system heading towards full-carbon accounting.[3] Decision 11/CP.7 contains the agreed forest definition for use under the Kyoto Protocol during its first commitment period (Box 1). For example, the forest definition is the smallest common denominator of what might be considered a forest. European Parties feared that forest activities in developing countries covered through the Clean Development Mechanism (CDM) would become so popular that domestic mitigation activities in Annex I were neglected. Thus they insisted in limiting it to afforestation and reforestation, excluding forest management and deforestation avoidance from the CDM (Jung, Michaelowa et al. 2004). Resulting from this cherry-picking, forest definitions received an unmerited weight.

For the afforestation and reforestation CDM (A/R CDM), the forest definitions added a host of complexities in determining that the project areas was not even a potential forest in 1990, neither at the time of project start. To complicate things even more, under A/R CDM, with temporary crediting recurrent investor liability was introduced. Investors only “borrow” credits during the commitment period in which these were certified, having to replace them with other types of allowances in case these cannot be re-verified after five years, or at the project ending. Permanence of carbon fixation is a concern, because under the CDM, the host country does not take over liability for its land-based carbon pools. All these problems led to the near complete failure of A/R CDM. To-date, worldwide there are 11 approved methodologies and only one project approved by the CDM Executive Board.

[3] For the first commitment period, certain limitations apply.

Box 1: Definitions of forest under the Koto Protocol (FCCC/CP/2001/13/Add.1, p.58)

a) “Forest” is a minimum area of land of 0.05-1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height of 2-5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10-30% or tree height of 2-5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest;

b) “Afforestation (A)” is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources;

c) “Reforestation (R)” is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31.12.1989.

d) “Deforestation (D)” is the direct human-induced conversion of forested land to non-forested land.

e) “Revegetation (RV)” is a direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here.

f) “Forest management (FM)” is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

It has been part of the REDD mandate to seek national approaches and thereby reducing the risk of leakage immanent to project-based activities. National-level activities are also expected to better adapt to the regionally varying drivers and underlying causes for deforestation (Geist and Lambin 2001; Chomitz, Buys et al. 2007). In contrast to the Clean Development Mechanism (CDM), many methodological problems are simply deferred to the national level. This tends to reduce conflict on the Convention level, but requires high institutional capacities on the side of the tropical countries in question.

We learn from forestry CDM that cherry-picking approaches lead to methodological and definitional problems. Under REDD, an upcoming contentious issue will be the definition of “degradation” (Penman, Gytarski et al. 2003) and how to distinguish it from (sustainable) forest management. Another aspect worth consideration is the cross-cutting character of the issue and the threshold to non-forest land uses. In order to avoid perverse incentives and the methodological pitfalls exemplified above, we propose an integral approach to land-use accounting and reporting.

4 LULUCF in Annex-I countries – blueprint for consistent land-use reporting?

The inclusion of land use under the Kyoto Protocol has been highly disputed due to methodological issues, such as permanence, leakage and accounting problems (Schlamadinger and Marland 1998; Schlamadinger, Bird et al. 2007). The rather imprecise character of the Kyoto regulations reflects the negotiations on this crunch issue: This debate could not be resolved in the subsequent elaboration of rules and modalities, and led to the failure of COP6I-negotiations in The Hague in 2000. While the opponents argued that the inclusion and accountability of “sinks” would dilute the originally agreed reduction targets and thus impair the environmental integrity of the protocol, those in favour realized that leaving out carbon in terrestrial ecosystems would create an imperfect system and leave an important part of the global carbon cycle unaddressed (Dessai 2001). Given the political dimension of the complex land use issue, the understanding of global carbon fluxes at that time and the necessity to save the achievements of 10 years of negotiations, a compromise with iterative procedures and a certain degree of flexibility was found which is reflected in the Articles 3.3, 3.4 and 3.7 of the Kyoto Protocol. They have some deficiencies, which partly result from the complexity of both, the negotiations and the fact that the LULUCF sector is different from the other sectors, for which most of the regulations were designed. Examples are the bi-directionality of carbon fluxes (emissions and removals), the challenge of quantification, and the limited human influence on them (Schlamadinger, Bird et al. 2007). However, much experience on GHG quantification and reporting for the LULUCF sector has been gained in the meantime, which should be integrated into the design of the future compensation mechanism. There are several parallels to the issues debated today, leading to the conclusion that these articles and the related procedures should be examined to what extend they can serve as a blueprint its design in a post-2012 regime.

4.1 How do Article 3.3 and 3.4 work? Treatment of LULUCF in Annex-I countries

On invitation of the Marrakech COP 7, the IPCC developed in a Good Practice Guidance for LULUCF (IPCC 2003), a sophisticated reporting scheme that distinguishes between different land-use-categories without getting lost in the jungle of definitions (see Table 2; Figure 2). The objective was to avoid double-counting and enable all countries to perform a sound, comprehensible and verifiable reporting on all terrestrial sinks and sources.

Table 2: Land use categories and land use change activities of the Kyoto Protocol (IPCC 2003)

land use category (IPCC GPG LULUCF)		new land use							
		managed forest land	unmanaged forest land	cropland	managed grassland	unmanaged grassland	wetland	settlements	other land
previous land use	managed forest land	FM / GM / CM		D	D		D	D	D
	unmanaged forest land	FM		D	D		D	D	D
	cropland	A/R		CM / RV	GM / RV		RV	RV	
	managed grassland	A/R		CM	GM / RV		RV	RV	
	unmanaged grassland	A/R		CM	GM			RV	
	wetland	A/R		CM	GM		RV	RV	
	settlements	A/R		CM	GM / RV		RV	RV	
	other land	A/R		CM / RV	GM / RV		RV	RV	

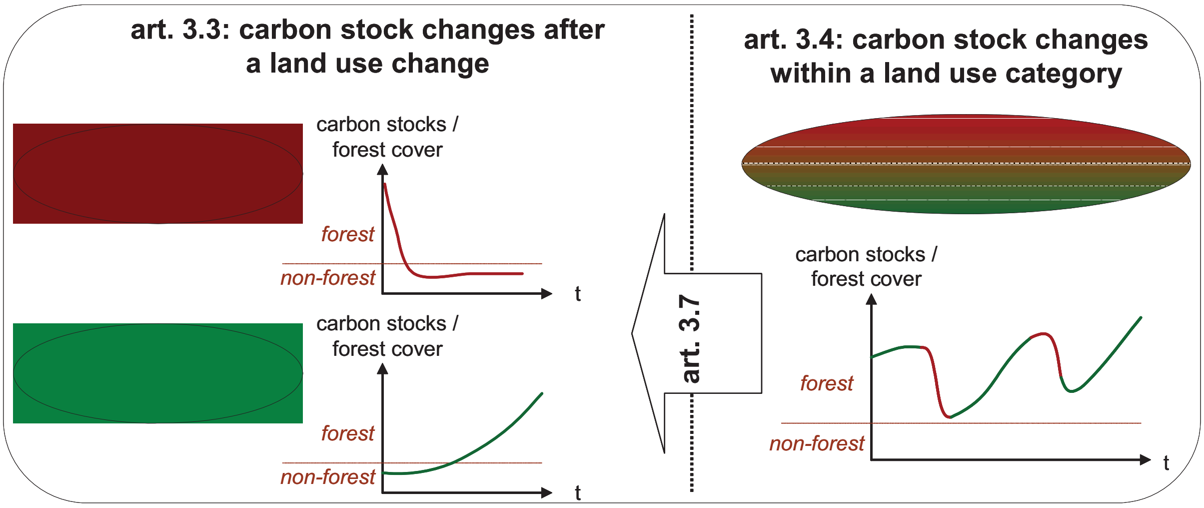
All units of land subject to direct human-induced A/R activities are considered to be managed forests; therefore unmanaged forest land cannot result from an A/R activity. Similarly, it is assumed that all units of land subject to direct human-induced D activities are managed lands. This includes natural D followed by a change to a managed land use.

Article 3.3, as elaborated at COP 6 bis (Bonn) and COP 7 (Marrakech), requires that all changes of GHG reservoirs, sinks as well as sources, resulting from direct human-induced **land-use changes** are to be included in the national GHG inventories. Such changes can be afforestation, reforestation, and deforestation (ARD). If in sum ARD activities result in GHG removals and thus represent a sink, the reduction target of the Party is reduced by that amount for the corresponding commitment period; respectively, if emissions exceed the removals the reduction target will increase by the same amount.

While accounting for land use change is mandatory in the first commitment period, Annex-I countries were granted the option to apply Art. 3.4 for land **use categories which remain under their current use**, in other words, to account for the stock changes where no land use occurs, but significant changes of sequestered GHG may have taken place due to human-induced activities. In case the land-use categories chosen represent a sink during the commitment period, the country in question is allowed to account a capped amount of these reductions against its respective GHG emission target. In case a country chooses to apply Article 3.4., it is automatically obliged to continue reporting in further commitment periods.

Art. 3.7 allows for partially offsetting emissions resulting from LUC by improving carbon stocks in remaining land use categories (see Figure 2). The amounts each country can use for this purpose during the first commitment period are fixed in an appendix to Decision 11/CP.7.

Figure 2: Schematic scope of LULUCF as dealt with under the KP for Annex-I countries



4.2 Accounting and reporting

The accounting rules applied for forest activities under Article 3.3 and 3.4 are based on the principle of gross-net-accounting and refer only to the respective commitment period, i.e. they are not compared to a base year or period as this is the case in net-net-accounting. This has been criticized because the gross-net-accounting principle does not take into account altered long-term environmental conditions such as elevated CO_2 concentrations, increased length of vegetation periods or nitrogen immissions which may lead to accelerated growth (Schlamadinger, Bird et al. 2007). Since such effects are not "human-induced" a pragmatic approach was chosen – an individual cap for each party who decides to apply Article 3.4 is listed in the Annex Z of the Bonn agreement. Interestingly most European countries who initially opposed to the inclusion of land use accounting in the Kyoto regulations chose to apply Article 3.4, while Canada as a major supporter chose not to.

REDD reference levels as discussed by the Parties automatically imply net-net accounting. Given these flaccidities and the desirability of a consistent approach on land-use accounting it would make sense for Annex I countries to switch to net-net accounting. The present country caps, which represent political compromise, would become obsolete as well[4].

[4] The authors are aware that it will be difficult to convince Annex I Parties who chose to apply Article 3.4 to switch to net-net accounting due to the uneven forest age-class distributions in most of these countries. On the other hand, gross-net accounting was mainly a compromise with the intention to facilitate an agreement. Thus, we argue that concerning LULUCF the same and scientifically sound rules for accounting should apply to all Parties.

Table 3: Summary of the differences in LULUCF activities (adapted from UBA 2007)

article	activity	application	limits	accounting
Art. 3.3	afforestation	mandatory	no limit	gross-net
	reforestation			
	deforestation		not accounted if compensated through removal between 1990 & 2008 (Art. 3.7)	
Art. 3.4	forest management	voluntary	country cap (Bonn Agreement, Annex Z)	
	revegetation		no limit	net-net

It is good practice to distinguish for each year of the commitment period between afforestation and reforestation, deforestation, forest management, cropland management, grazing land management and revegetation activities under Articles 3.3 and 3.4, as well as to remove potential overlaps and gaps between them. All areas must be attributed to only one single activity at any given point in order to avoid double counting. Reporting takes place in the form of the common reporting format tables in the annual national inventory reports which are subject for intensive review by experts. This continuous reporting and the obligation to balance all areas once accounted for address the prevailing issue of permanence. Of course, a major provision is that there will be a post-Kyoto agreement with future commitment periods.

In recognition of lacking data, experience and many reporting deficiencies, IPCC defined three methodological tiers for estimation and reporting GHG emissions and removals for each pool and its compartments – higher quality of data and methods used lead to higher reporting tiers and require more resources as well as technical and institutional capacities (IPCC 2003):

- Tier 1 uses basic methods and default emission factors provided by the IPCC Guidelines.
- Tier 2 applies emission factors and activity data which are defined by the country for the most important land uses / activities; stock-change methodologies based on country specific data may be applied as well.
- Tier 3 requires the use of higher-order methods, including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at subnational to fine grid scales.

This tiered approach takes into account that the technical and institutional capacities as well as the natural conditions vary considerably among Parties and that there are still black boxes, e.g. the complicated quantification of carbon fluxes and pools in soils; it encourages countries to initiate reporting and at the same time provides incentives for quality improvements.

4.3 Accounting under the proposed mechanism

The idea of REDD is to provide *positive incentives* for non-Annex I-countries who voluntarily reduce their emissions from the land use sector, with the intention to finally address this significant source of GHG. How is this issue dealt with in Annex-I countries? Article 3.3 and 3.4 indirectly provide positive incentives: If Annex-I countries increase carbon storage in their land use categories, they can reduce their agreed emission reduction targets, which were individually negotiated in Kyoto and refer to the GHG emissions from all sectors: industry, traffic, households. If certain land use categories in a country prove to be a sink they can be used for compliance with the respective country's Kyoto target.

Since non-Annex I countries currently do not have such targets, there is a need for agreeing **individual sectoral reduction targets** for GHG emissions from the land use sector of these countries – the reference rate. In contrast to the situation of developing countries, industrialized countries' LULUCF targets are part of their overall cross-sectoral emission reduction targets. For non-Annex I countries, there would be an incentive to set ambitious sectoral reduction targets because they represent the maximum of compensation payments a country can receive. On the other hand, there is a need for liability, continuity and incentives for compliance in future commitment periods. There should be a liability for the emission reductions achieved in previous commitment periods. Thus, countries with ambitious national targets can gain more but at the same time take on higher responsibility for the forest area they conserved in previous commitment periods.

A major problem in the expert discussions is the technical feasibility of monitoring and reporting on degradation. The inclusion of degradation as covered through Article 3.4 implies the need to monitor and report on **stock changes** in remaining land use categories. In contrast to land-use changes which can be monitored more easily and cost-efficiently through remote sensing techniques, there is a need for ground truthing, e.g. by installing permanent forest inventory plots. However, remote sensing does not give accurate information on the amount of GHG stored in forests or lost though deforestation either, and any compensation mechanism relies on such information. The experience made so far by Annex-I countries shows how difficult it is to somewhat accurately measure carbon stocks, even with sophisticated inventory systems and sound science behind it.

The question is what level of uncertainty is tolerable and operational. Efforts and costs increase with the accuracy of reporting. It is obvious that it is impossible to install a 2*2 km grid on the forests of the Congo Basin. Even in countries with profound experience in forest monitoring, like Germany, there remains an uncertainty level of ±8 percent (Strogies, Gniffke et al. 2006). On the other hand it appears to be a question of capacity to install a statistically significant number of ground inventory plots. In both industrialized and developing countries, there is a trade-off between discounts to be applied for measurement uncertainties and the corresponding value loss of emission allowances, respectively credits.

The stepwise implementation of Article 3.3 and 3.4 is a dynamic feature of LULUCF accounting under the Kyoto Protocol: Parties were given time to get ready and install suitable inventory systems. Until 2006 they had the choice to immediately report on stock changes if they were capable to do so, or to wait with reporting until the beginning of the second commitment period. As an incentive to get ready quickly, countries applying 3.4 were allowed to choose land-use activities to report and reduce their reduction target up to the capped amount. Based on the tiered approach provided by the IPCC GPG for LULUCF (IPCC 2003), the measurement discount can be reduced with increasing quality and accurateness of national reporting.

5 Discussion

Land-use emissions play a prominent role among developing country emissions. In countries like Brazil or Indonesia, the share of land use within total GHG emissions is in the order of 60 to over 80 percent (see Table 1). The proposal presented advocates for a consistent treatment of land-use related emissions and uptakes in both developing *and* industrialized countries. The system is flexible in the sense that not all compartments need to be accounted for in the first place. With a stepwise approach for land-use reporting, like under the Kyoto Protocol, capacities can be built up and learning-by-doing is facilitated. At the same time, with the stepwise introduction of land-use accounting, perverse incentives for emissions leakage to other compartments or later periods can be avoided, because all pools will eventually be accounted for in the long run.

The way by which LULUCF-related changes of carbon stocks were agreed for Annex-I countries could serve as a blueprint for the design of a comprehensive land use compensation mechanism. Once adapted to the special needs of developing countries, it would take into account all relevant aspects of GHG fluxes from forests. An iterative approach would allow to start with a reduced scope focusing on land use changes (ARD) which are relatively easy to monitor; thus giving time to install monitoring systems capable to quantify carbon stock changes in managed forests that do not fall below the threshold of the national forest definition.

The precondition for international consistency however, is to switch Annex I accounting rules from gross-net to a net-net system. For most Annex I countries, this will be a political sacrifice. Given the need to integrate a growing number of today's developing countries under the climate regime, it appears necessary to define common and consistent land use accounting rules for all countries.

In 1997, with Article 3.3 and 3.4, despite the scientific uncertainties, the Parties agreed on a learning-by-doing strategy for Annex I. Instead of aiming for a perfect accounting system of land use in developing countries right from the start, the Parties should show political courage and allow for a learning phase in developing countries too. Technical challenges must be addressed, but they should not prevent early action. The IPCC has developed a suitable approach for monitoring and reporting on 3.3 and 3.4 – a tiered approach, taking into account the availability and quality of data, which in a modified form could be applied to developing countries. Improving data quality and monitoring, i.e. by installing permanent forest inventories lead to a higher tier with a reduced measurement discount. In achieving this, there is potential for South-South and South-South-North partnerships.

The strength of the proposed system is that a transition from a developing country with a sectoral baseline-and-crediting system to a country with an overall cap-and-trade system is not linked to a switch in the reporting system. In order to make the transition smoother, the few A/R CDM activities that will emerge before 2012 need to be included under the sector baseline. Once the government takes over liability for the land use sector, these projects will become subnational JI-type activities.

The transition from A/R CDM to JI will only occur once the first credits have been compensated. Developing countries should not be held liable in their first commitment period for not meeting their forest sector targets. However, once they have received benefits, e.g. by selling carbon credits, they should be held liable, in order to ensure the permanence of the emission reductions. There are several options to securitize liability, e.g., by creating buffers or contributing to an international insurance mechanism.

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Chapter X

The Climate Stabilization Fund – Global Auctioning of Emission Allowances to help Forests and People

Michael Dutschke[1]

Abstract

The initial research interest in the layout of this chapter was to secure sufficient finance for reducing emissions from deforestation and degradation in developing countries under the UN Framework Convention on Climate Change. After analyzing the interest groups involved in the REDD discussion, the author proposes a Climate Stabilization Fund, based on proceeds of an international allowance auction. The auction-based model proposed fulfils a whole variety of goals besides providing financial proceeds, including a gradual long-term integration of developing countries into shared responsibility for confronting climate change.

1 Scope of an REDD Mechanism

During the actual first commitment period of the Kyoto Protocol, reducing emissions from the land-use sector in developing countries has not played a role, even though roughly 20 percent of all anthropogenic greenhouse gas emissions are estimated to originate in deforestation (Nabuurs, Masera et al. 2007). For the period after 2012, the parties to the U.N. Framework Convention on Climate Change (UNFCCC) plan to incentivize policies and activities to reduce emission from deforestation and degradation (REDD) in developing countries. Decision 1/CP.13 of the Bali Conference of the Parties (COP 13), the “Bali Roadmap” gives a prominent role and a tight timeframe to REDD. Together with the worldwide emission reduction targets, the REDD mechanism was to be decided in December 2009 during the Copenhagen COP 15.

The Copenhagen Conference was determined to deceive the high expectations put on it in any case. Nevertheless, it failed to a degree even the most pessimistic observers had imagined. The only far-reaching document agreed was a non-paper called the “Copenhagen Agreement”, which is a common denominator between the US and different developing countries. The COP/MOP has "taken note" of this document, and Parties may now sign up to the Copenhagen Accord, which could eventually build a platform for further common agreements.

The main achievement of the Copenhagen Accord is to concretize the ultimate objective of Article 2 of the Convention, the "(...) stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". These levels have now been defined as the

[1] An earlier version of this article was published in W.L. Filho, F. Mannke (eds), Interdisciplinary Aspects of Climate Change, Peter Lang Scientific Publishers, Frankfurt and New York 2009.

ones that keep the global mean temperature below 2 degrees C. Implicitly, this goal not only covers greenhouse gases, but also albedo (the degree of reflection or absorption by the earth's surface) and heat-flow effects that are also held responsible for global warming, but for which robust scientific evidence is yet lacking.

On the other hand, the timeframe mentioned in Article 2 (*"time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner") has not been addressed. Not even the turning point of emissions increase was stipulated between the years 2015 and 2020, as recommended by the IPCC. Fixing the temperature target at 2 degrees does not leave many choices. Nevertheless, the formulation of "achieving the peaking of global and national emissions as soon as possible" leaves too much leeway for pseudo-scientific political debate.

The crunch issue of "who pays the bill?" has finally been addressed. Pledges by developed countries were added up and corrected upwards to become a sum of 30 billion US$ during the remaining three years of the current Kyoto commitment period. The targeted amount, if pledged, will certainly provide an incentive for developing countries to get on track (and to sign the Copenhagen Agreement). The big carrot of 100 million US$ per year as from 2020 however, lies too far in the future, and it has not been substantiated by any concrete financing proposal. Finance will go to "enhanced action on mitigation, including substantial finance to prevent deforestation (REDD-plus), adaptation, technology development and transfer and capacity-building".

Binding emission targets until the year 2020 should be declared by developed countries before February 2010, an ambitious date, which was failed by most parties. Nevertheless, the formulation seems to imply the continuation of the Kyoto Protocol, as demanded by the developing countries. On the other hand, developing countries have given in on the point of making their committed mitigation actions (NAMAs – Nationally Appropriate Mitigation Actions) verifiable, albeit under national monitoring, reporting and verification.

It has become clear during the session that paradigmatic change is underway. When the US withdrew from Kyoto in 2001, they, together with the reluctant Russia, were accused of holding the climate hostage. With the emerging economies surpassing Annex I emissions, these are now in the position to do so, and China's negotiation strategy speaks a clear language on that. Industrialized countries are no longer in the driver's seat. The power game we are currently observing goes to the detriment of the least developed and small-island countries that will suffer first from climatic change.

Negotiating Parties are currently navigating on eye-sight. There is a remarkable lack of trust. As seen above, for REDD to be successful, it needs to cater for a variety of concerns and provide incentives for the most diverging country situations.

Today, international negotiations actually circle around methodological issues for REDD, like international leakage, permanence and the determination of national emission reference levels. The author argues that these are second-order questions, because the basic incentive structure for REDD remains unclear. The first-order question is a distributional one. A future REDD can be either participative or non-participative. The degree of participation will have repercussions on scope and size of a future REDD Mechanism. Only once these can be assessed, second-order methodological questions can be answered.

Participative REDD Mechanism: An all-in approach will be the first-best option. It will be most effective, because emissions and uptakes will be accounted for across different country situations. A participative mechanism will also be most carbon efficient, because it will offer most supply transparency. Under this option, cross-border carbon leakage will not occur, because emissions are accounted for wherever they occur. As long as any form of compensation for carbon services are involved, baselines will remain an issue. Monitoring will be most cost-efficient on a large scale, because the increased demand for satellite-based imagery will drive remote sensing technology development. Three levels of permanence need to be distinguished for REDD: (1) Permanence within country borders will be provided for, as long as the particular country party remains within the system. (2) Permanence on a global scale can be expressed as the risk that above certain temperatures increase thresholds, terrestrial carbon stocks may release more carbon than they sequester, an effect that has been known under the keyword “savannization”. Little is known about these thresholds for the forest dieback to occur, and latest studies suggest that tropical forests are not as sensitive as initially expected (Gullison, Frumhoff et al. 2007). Should dieback occur, losses might eventually be temporary, due to the extension of vegetation zones. From the atmospheric point of view, a savannization in parts of the tropics might be compensated by increased cover and density of boreal forests in tundra and taiga ecosystems, at least over the longer run. (3) For tropical countries where savannization potentially occurs, global warming may lead to imbalances or even debits in any given REDD compensation system. To cater for this concern, monitoring methodologies for factoring out non-direct human influences and / or an international climate insurance mechanism could be helpful.

Partial REDD Mechanism: A non-participative approach will be much smaller in scope. It will create fewer incentives, only include some developing countries, and raise specific methodological issues, like international leakage, time consistency of reporting, and transitional problems for countries that graduate to a higher responsibility in the climate regime, among others. In the case of the afforestation & reforestation Clean Development Mechanism (A/R CDM), a partial flexible mechanism led to failure, because the precautions taken in its design are so prohibitive that hardly any projects get off the ground.

2 Interest groups in REDD negotiations

We will review the interest groups involved in the negotiations, and contrast their individual interest with the ultimate objective of the Climate Convention to stabilize greenhouse gases (GHGs) in the atmosphere “at a level that would prevent dangerous anthropogenic interference with the climate system”. They all suffer from the classical prisoners’ dilemma in environmental politics: *If I do not know for certain, whether my neighbour will really protect the climate, why should I take the pain to do so?* Fully acknowledging that each single country’s circumstances are different, the following paragraphs will identify the stakes and interests of “archetypical” country categories in REDD. The last paragraph summarizes the preconditions for broad participation.

2.1 Annex I – industrialized country parties

Annex I represents the group of countries that were part of the Organization of OECD in 1992 plus the former Soviet Union. The UNFCCC and the Kyoto Protocol both have cemented this static division between “rich’ and “poor” emitters. Meanwhile however, Hungary, South Korea and Mexico have joined OECD, and several others are set to follow. Annex I representatives readily admit that their countries have been historically responsible for the bulk of the greenhouse effect. This is why the Kyoto Protocol during the first commitment period set quantitative emission limitations for Annex I only. When the Kyoto Protocol was negotiated, differentiated commitments and the means of compliance were conflictive, especially the inclusion of forest-related mitigation activities (Jung, Michaelowa et al. 2004). The European Union has widely seen itself as a clean energy technology provider, which is why it largely opposed the inclusion of sinks and sources from land use in any compensation mechanism. In spite of its more constructive approach on REDD today, apprehension subsists that emission reductions in the energy and transport sectors could be bypassed by assumingly “cheap” emission reductions from land use, land-use change and forestry (LULUCF). Instead of giving too much mention to the different Annex I country groupings that were influential during the negotiations around the first commitment period, we will concentrate on Annex-I Parties’ interests with respect to REDD after 2012. Since 2002, the issue of stopping tropical deforestation has become fashionable in public opinion. Environmental NGOs are most influential in European decision making; to a lesser extend so in the US. NGO agenda setting focuses on biodiversity and socioeconomic issues, which could already be observed during the discussion around the A/R CDM. In spite of the fact that the idea of offsetting emission targets by mitigation activities abroad was first brought up by Norway, among European negotiators still some skepticism towards markets can be felt. This explains the tendency to impose safeguards that run counter carbon efficiency. Canada, the US and Australia, on the other hand, traditionally believe in offset mechanisms. Nevertheless, with full market integration of credits from REDD, neither one of these sides can be too sure: Should emission targets be too lenient for future commitment periods, it would be quite likely that in the mid term, credits from REDD could flood the market. With stringent binding targets, Annex I countries might end up seeing themselves in the hands of developing country governments, some of which they consider corrupt and inefficient, to provide the much-needed offsets from REDD. It is however in the interest of Annex I countries to get developing countries to take their appropriate share in the responsibility for global climate change mitigation. Practical proposals from Annex I go into the direction of “demonstration activities”. In order to gain trust in administrative and technical capacities of developing country parties to really bring down emissions in their land use sector. In Bali, influential Annex I countries committed to investment in REDD activities and capacity building in tropical countries via the World Bank’s Forest Carbon Partnership Facility (FCPF) and direct transfers. Nevertheless, no regulation has been found so far, whether these early activities will be accounted under a post-2012 climate regime. This will limit private-sector willingness to take high stakes in REDD business. Advanced representatives of Annex I countries today see the necessity of a “global deal” involving REDD (Stern 2008). Yet no leadership initiative comes from Annex I on REDD.

2.2 Coalition for Rainforest Nations – CfRN

The CfRN gathered around a proposal by Papua New Guinea supported by Costa Rica, and it has taken on board a variety of tropical and sub-tropical countries. It is a sub-grouping among G77 countries, but it has developed remarkable leadership. The initiative is welcome and carefully supported by most Annex I Parties. Nevertheless, inside the Coalition there are centrifugal forces with respect to the different country circumstances. These will become virulent once any substantial funds will have to be shared. There are countries on all different stages of the forest transition curve (Rudel, Coomes et al. 2005); the Congo Basin countries, where deforestation is no major issue yet, but which are threatened by deforestation and degradation and want support for sustainable resource use, countries where deforestation is a day-to-day reality, like PNG or Indonesia, and countries where deforestation is declining or where forest cover even increases, like Costa Rica. Besides this baseline issue, institutional capacities and legal instruments to implement REDD differ widely among partners to the Coalition. There are also different interests regarding national or sub-national implementation of REDD activities. So far, the CfRN has been very prudent in representing a constructive common negotiation position. There is a risk in subdividing this group by allocating public funding to a selected subsection of this group only. Apart from the REDD issue, the CfRN does not represent any common standpoint towards a future climate regime.

2.3 Alliance of Small Island States – AOSIS

The small island states can be assumed to represent the conscience of humanity, because climate change is an existential threat for them, and most of them do not have the means to protect themselves. It is in their best interest not to disregard terrestrial carbon stocks. In UNFCCC negotiations, they are represented by the state of Tuvalu, who opposes any trade-off between industrial emissions and REDD credits. Were the latter allowed to offset emissions in other sectors, leakage (or “displacement”, in REDD jargon) would be a main concern.

2.4 Least Developed Countries – LLDC

At the lowest range of development, there are countries that are practically excluded from the benefits of globalization, or they participate in international trade with only one or few assets. Countries like the Ivory Coast have nothing to loose. They hardly participate in international economy, and they are busy managing their own internal disorder caused by a vacuum of power in situations where mobility has increased and different ethnics mix. They are used to receive the remainders from rich men’s tables. Their economic hope is the exploitation of their natural resources, because it requires little investment in capital stocks. Property rights can usually not be enforced in these countries, as some of them lack basic features of nation-states. If at all, deforestation occurs illegally or semi-legally.

Climate change has an extremely low priority for LLDC representatives, because living conditions of their populations hardly translate into trade receipts or state budgets (and vice-versa).

These countries’ preference in the negotiations will be an ODA-like fund to direct investment allocation in REDD according to equity principles. They are the ones to insist that REDD funds be “new and additional” to existing obligations of industrialized countries, which makes it likely that a new debate over funding additionality will arise.[2] As the exploitation of natural forests is only just beginning, at least in the Congo basin, a growth baseline is promoted by these negotiators.

[2] See chapter V

2.5 Developing countries – Group of 77

In contrast to industrialized nations, developing countries (G77) came late to the party. Most industrialized countries in their history have profited massively from deforestation. In European history, timber was used for mining, iron smelter, and for ship building in the colonial phase. Today's deforestation in developing countries mainly serves export purposes to cover Annex I demand for tropical timber, meat, soybeans, rubber or palm oil. Long-term maintenance of the forest resource only becomes interesting when timber increases in value and the resource starts to become scarce. However, as long as there is unprotected natural forest left in the world, logging companies will continue plundering them.

Underprivileged rural poor benefit from unclear tenancy and often invade areas that were previously opened by logging companies. Marginal charcoal production or slash-and-burn agriculture offer a living. Stopping deforestation and its social environment may thus lead to unrest.

For REDD to offer an alternative income source for maintaining and protecting forests stocks a complete shift in forest governance is required. A monitoring system has to be built up, property rights have to be enforced. Is it really worth all this effort? How much is in for the individual negotiator's country and how reliable is this source of income? Will Annex I countries really commit to emission cuts so deep they rely on complying them with the help of REDD credits? After all, the initial experience was not so good. In the run-up to the Milan decision on A/R CDM, the EU achieved to include temporary crediting as well as social and environmental safeguards, but when it came to implementing those projects, EU backed up and blocked any A/R credits from being imported into its emissions trading system.

This time, DC negotiators want to see real commitment, before they become engaged. They ask for deep targets, before they can agree on participation in an REDD mechanism. Nevertheless, future targets and REDD will are being jointly negotiated. This is why Brazil as a leader among G77 promotes a voluntary fund. Once they know how much money is in, it is easier to assess risks and chances of participation.

On the other hand, there is competition between DCs for REDD funds A strict denial can therefore lead to isolation, as the benefits, in case there will be, will go to other developing countries.

2.6 Emerging economies

Representatives of emerging economies see themselves in a delicate position: Structural change is underway in their countries. There is a need to liberate rural workforce and to deepen the integration of broad layers of the society into the market economy. A modernization and intensification of the primary sector is overdue in the interest of economic development. These countries are approaching the lower turning point of the forest transition curve. Nevertheless, rural elites are still powerful. As land prices are low, producers of agricultural goods benefit from low factor costs. In order for rural modernization to occur, economic incentives are needed, and a compensation for land-management based mitigation would come in handy.

On the other side, representatives of emerging economies are being incited to take over a higher degree of responsibility in the climate regime. The 4th IPCC Assessment Report leaves no doubt that emission reductions in industrialized countries only will fail to reach the ultimate goal of the Climate Convention, which is the stabilization of the level of greenhouse gases in the atmosphere. Agreeing to a land-use target may be seen as a first step in this direction. There is a risk that other sectors will be expected to follow suit. In the phase of rapid industrialization however, this may deteriorate the country's competitiveness towards non-restricted developing countries. There are two possible solutions to this dilemma:

1) Postpone participation as long as possible and offer contribution in the REDD Mechanism as a last-minute compromise (the current Brazilian position).
2) Promote differentiated targets for all countries. This latter option offers a long-term solution, but it will weaken the Group of 77 as a negotiation group. In order for such a proposal to be acceptable, it will need to be linked to reliable and long-term north-south transfers.

2.7 OPEC countries

The most vocal country representatives for the OPEC group are the ones of Saudi Arabia. Compensating developing countries for REDD bears some similarities with the OPEC approach of "response measures". The argument is that emission reduction policies will in the long term lead to a decline in petrol demand, and countries mainly depending on oil export will have costs to restructure their economies (Barnett 2001). REDD may be considered a mute acceptance of this principle. Additionally, REDD does not lead to a decrease in oil demand. We may therefore expect low-level support from OPEC countries for REDD policies. Solidarity with the group of developing countries may also be seen as a strategy to avoid being singled out as countries that given their high emissions per capita and per-unit GDP would be among the first to graduate to Annex-I countries and take over climate targets.

3 Criteria for compromise

Negotiating Parties are actually navigating on eye-sight. There is a remarkable lack of trust. As seen above, for REDD to be successful, it needs to cater for a variety of concerns and provide incentives for the most diverging country situations. A viable compromise needs to square the circle according to the principles of (1) effectiveness, (2) efficiency, and (3) equity (Stern 2008).

1. Effectiveness: REDD shall not distract attention from the need to reduce emissions from fossil sources, which are the main drivers of the greenhouse effect;
2. Efficiency: REDD funds shall be concentrated where most emissions can be avoided;
3. Equity: Transfers need to be reliable and accessible to all countries, where they are needed.

First and utmost, any compromise needs to create trust. Therefore, it shall involve all country parties. It shall allocate emission allowances where they are most effective for the creation of wealth, while observing the principle of equity. The system to be created should be compatible with UNFCCC rules and procedures so far, and it should be open to future modifications without creating inconsistencies.

3.1 A proposal for action

The actual Kyoto Protocol system of tradable emission allowances (Assigned Amount Units – AUUs) has produced several imbalances, notably the so-called "windfall profits". This term describes profits that do not result from the operative performance of an enterprise, but which result from the possibility to sell allowances. A good example are the EU power utilities that in the first EU trading period received EU Emission Allowances for free, but still factor opportunity costs from not selling these allowances into actual electricity prices. As electricity is no internationally tradable good, there was no possibility for competitors to undercut these electricity prices

On the other hand, the fight against climate change and its effects can only be won with the help of massive North-South transfers in pursuit of the ultimate objective of the Climate Convention of stabilizing the greenhouse gas (GHG) level in the atmosphere.

The IPCC estimates that at CO_2 prices below 100 US$, the mitigation potential from forestry until 2030 is nearly 14 Gt CO2e, half of which can be found in developing countries (Nabuurs, Masera et al. 2007). The opponents of including these emission reductions and carbon uptakes as credits under an international allowance trading system fear that these would disrupt the market. Nevertheless, the actual allowance market is far from being perfect (as exemplified above), and it is not an end in itself. What is true is that the low-cost fraction of these emissions would compete with emission reductions in the energy and transport sectors. In case of open competition, REDD credits could well be the preferred option, and emission reductions in other sectors might be neglected for some years. It may be argued that technological progress will make industrial emission reductions cheaper in the future. Mitigation potentials from deforestation and forest degradation are finite[3] and should therefore be used first. A recent study finds that, when banking is allowed, an unregulated inclusion of REDD into the carbon market would bring compliance costs down, but would definitively not lead to market flooding (Piris Cabezas and Keohane 2008). In order to balance the diverging goals of increased energy efficiency and at the same time mobilize GHG benefits in the land-use sector, some authors propose different means to limit market access for land-use related carbon credits (Hare and Macey 2007; Ogonowski, Helme et al. 2007). Limiting market liquidity will in any case lead to a lower price for REDD credits and a lower investment in REDD policies than would be efficient from a global climate change mitigation perspective.

This chapter presents a simple model that provides sufficient finance for REDD and adaptation, without competition towards other targets under the Climate Convention. In line with the "triple e" (effectiveness, efficiency, equity) criteria above, it shall further fulfil the following requirements:

- Achieve early REDD
- Secure long-term finance for non-market goals
- Harness private-sector contributions for REDD
- Create incentives for industrial GHG reductions
- Make REDD and other emission reductions work in parallel

3.2 The main elements

The proposal departs from the general agreement that two degrees C above pre-industrial levels is the maximum increase in temperature that may still be acceptable during this century. The widely agreed time horizon for achieving stabilization is the year 2050. By then, the GHG concentration level should be down to 50% today's level, equivalent to a target GHG level of 450 ppm CO_2 equivalents.[4] We should consider the amount of greenhouse gases allowable until reaching the concentration level to be our worldwide GHG budget. This idea was first expressed under the concept of "Greenhouse Development Rights" (Athanasiou, Kartha et al. 2006). In the

[3] Natural forest systems with their old-growth carbon density and biodiversity take centuries to recover, and can thus be seen as non-renewable resources in the policy scope.

[4] Scientific discussions actually question, whether 450 is a "safe" level for reaching the 2-degrees target. Athanasiou, T., S. Kartha, et al. (2006). Greenhouse Development Rights. An approach to the global climate regime that takes climate protection seriously while also preserving the right to human development. United States, EcoEquity, San Francisco, CA (United States); EcoEquity, Earth Island Institute, San Francisco, CA (United States); Christian Aid, London (United Kingdom); Stockholm Environment Institute SEI, Stockholm (Sweden): 10. Baer, P., T. Athanasiou, et al. (2007). The right to development in a climate constrained world. Berlin / DE, Heinrich Böll Foundation, ChrstianAid, Stockholm Environment Institute: 100.

present chapter however, this approach is carried further and operationalized. In 2000, 48 percent of all greenhouse gas (GHG) emissions came from developing countries (Baumert, Herzog et al. 2005). With the steep increase in China's emissions, we can safely assume that half of all GHG emissions today come from developing nations not included in Annex I of the UNFCCC.

Departing from the budget approach, the core elements of the proposal for the Climate Stabilization Fund (CSF) are the following:

1) The Conference of the Parties agrees on a global emission budget until 2050 in tons of CO_2 equivalents, derived from a "safe" target temperature level (e.g. 2 degrees C above pre-industrial levels);
2) For the forthcoming 2nd commitment period (CP2), a global emissions target is derived as a fraction of the budget. This fraction is determined in a fashion that global emissions are set to decline after the year 2020.
3) Initially 50% of the allowances under the CP2 target are allocated free of charge to developing countries. These free Assigned Amount Units (f-AAUs) are non-tradable.
4) Until 2050, the share of f-AAUs is gradually decreased to zero.
5) The UNFCCC Secretariat will start auctioning the 50% of AAUs that have not been allocated to developing countries. In a five-year commitment period, each year, one-fifth of the tradable AAUs would be auctioned.
6) UNFCCC Parties would automatically qualify as bidders, but transnational enterprises and sector organizations may also register. Under Kyoto, enterprises are only trading on a secondary market. It may however be attractive to them to participate in the primary market too, thereby increasing market liquidity.
7) Banking: Unused AAUs can always be carried over to the subsequent commitment period, independently whether these are tradable, or f-AAUs.
8) A share of the auction benefits realized covers administrative expenses and the cost of the UNFCCC compliance branch.
9) The proceeds of these auctions are used for purposes that are not directly producing GHG benefits or for GHG benefits or that the international community wants to keep outside the market for emission reductions. In the first category, there is capacity building for national inventories, improvement of governance structures, and adaptation to inevitable climate change. In the second category, there are emission reductions from land use, commonly referred to as REDD.

The Climate Stabilization Fund can offer a common roof for all the existing funds under the Kyoto Protocol, including the Special Climate Change Fund, and the Adaptation Fund.

3.3 Calculation

In order to get an idea about the quantities to divide, we resort to IPCC estimates. There is growing consensus on a stabilization level at 2 degrees C above pre-industrial levels to be reached by the middle of this century, with reductions between 50 and 85 percent of current emissions.

Current annual emissions are roughly 20 Gt CO_2e (Stern 2008). Cumulative allowable emissions for the lowest IPCC stabilization scenario amount to 1,000 Gt CO_2e over the whole century. During the first 9 years of this century, the world will have emitted roughly one-third of the century budget (Allen, Frame et al. 2009). Before the end of the first Kyoto commitment period, global emissions will easily have surpassed 45% of this budget. The budget for the remainder of the century will thus be around 630 Gt CO_2e, only 7.6 Gt CO_2e on annual average. We assume a lower annual average for the second half of this century, say 5 Gt CO_2e. The stabilization budget for this pathway between 2012 and 2050 is in the order of 380 Gt CO_2e of GHG emissions, which would leave us with an annual average of 10.3 Gt CO_2e between 2013 and 2050. Assuming a low price range of 10 – 50 EUR per ton CO_2e and an initial 50% free allocation to developing countries, the proceeds will be in the range of 50 to 250 billion EUR per year. In the same pace that the commitment period budgets decline, the share of AAUs auctioned increases, thus stabilizing the auction receipts. The opportunity costs for halving emissions from deforestation have been estimated in the order of 2 – 22 billion EUR annually (Stern 2008). The remaining amount for technology transfer and adaptation surpasses the actually available funding for this purpose by orders of magnitude.

3.4 Institutional design

Given the experience so far, there is much resilience against creating yet another institution under the UNFCCC. Therefore, the CSF shall be institutionally as simple as possible. The simpler issue is auctioning of allowances, the other is the administration of the fund itself. There are two basic options for it: an international fund, and a national fund.

3.5 Auctioning

Theoretically, one auction per commitment period could be sufficient for the primary allocation. At least in an initial phase, it is recommended to opt for higher market transparency and auction a pro-rata share on an annual basis. This auction occurs on an electronic platform, in order to keep transaction costs low. The auctioneer should not be an interested party, which is why the UNFCCC Secretariat is the natural choice. It keeps an AAU registry account for every registered bidder. Country Parties are represented by their national focal point. These may need to deposit confidentially an authorized budget item allocation by their respective treasury ministry for the maximum allowance purchase bid.

3.6 An international Climate Stabilization Fund

For the distribution of revenues, several creative solutions can be found. The World Bank is one option, but not necessarily the preferred one. Currently, the Bank is a trustee for the Forest Carbon Partnership Facility (FCPF), a much smaller exercise aimed at gaining experience on future allocation systems for REDD. It consists of the Readiness Fund on the one hand and the Carbon Fund on the other. REDD country readiness is an upfront investment in the infrastructure needed. The Carbon Fund will tender emission reductions from REDD according to price and minimum quality. It will acquire these credits from states and from subnational activities as appropriate. For the management of REDD finance, the FCPF could be scaled up or at least serve as a blueprint. In order to achieve an equitable distribution, the CSF could be subdivided in continental branches, according to the continents' share in total terrestrial carbon stocks, but independent from their actual variation. Based on country and activity baselines, each branch would seek for the most cost-efficient investment within its respective continent.

The disadvantage of an international solution is that it creates a monopoly. Also would all countries involved try to maximize their influence. The institutional structure could thus become intransparent and bureaucratic. In spite of the theoretical advantage of being a one-stop shop, the lack of competition may lead to inefficiencies.

3.7 National CSF agencies

Besides the problems depicted that may arise with a global institution, national governments are generally unwilling to leave the decision over billions of dollars to a supra-national institution. Alternatively, the revenues could be channelled into a dedicated budget line within national budgets, which is documented to the Climate Secretariat and used according to REDD principles, under the discretion of the country's legislative body. In this case, only states would be eligible for bidding at the allowance auction. Bidding states could opt for clustering, which is likely to occur in the case of the EU.

The use of the national CSF agencies needs to comply with the principles agreed upon internationally, and it is reported to the Climate Secretariat. Each country would choose where to direct the funds, and which criteria and standards would be applied for sustainable forest management, community participation, and biodiversity conservation. The choice of the target countries would be determined by the experiences gained from ODA. All countries bidding for emission allowances (including advanced developing countries) have CSF agencies, which may lead to healthy competition among themselves. Another advantage is that the CSF is clearly separated from and additional to ODA, while facilitating synergies between both.

4 Discussion

Allocating emission allowances via an auction is not a new idea (e.g. EU_Commission 2008; Fuentes 2008). Most proposals however suggest national auctioning to private bidders after an emissions target has been fixed. In contrast, under the current proposal, no negotiated national target is set. This bears the risk that economically potent states might acquire and withhold allowances. In the existing allowance trading systems, no monopolistic behaviour has been observed so far. As the long-term budget is commonly known and price formation is transparent, there is little risk for asymmetric information at the scale needed to provide sufficient incentive for the formation of a carbon monopoly. Additionally, annual auctions will allow for fine-tuning by the market regulator (the Conference of the Parties) if needed.

Without the necessary market narrowness, auctions will not produce the desired results. It will result from a global commitment period target. The underlying market signals are provided by the long-term emission budget.

Politically, the proposed model has good chances to be implemented. This is so, because to a national electorate, global emission limits are easier to communicate than national ones, and a long-term stabilization goal is easily accessible to common sense. Today’s politicians who decide on the long-term target are unlikely to be punished by their voters. From a political economy point of view, this is the explanation why the US is backing the Japanese and European proposal for a global reduction target of 50% by the year 2050 (Black 2008; G8 2008).

The same effect occurs with the integration of non-Annex I countries into the climate regime. Since the IPCC Fourth Assessment Report, there is no doubt that Annex I emission reductions alone will not stop global warming, unless developing countries take over responsibilities. Allocating most of their emissions freely during the first years is an acceptable solution under the prevailing short-term perspective of political decision-making. The “carrot” in this proposal is the reliable, long-term transfer of funds from north to south. Countries refusing to take over responsibility will not benefit from CSF payments.

A differentiation within non-Annex I countries is due anyway. Index-based models like “Graduation and Deepening” (Michaelowa, Butzengeiger et al. 2005) or trigger-based distributions (Winkler, Brouns et al. 2006) can be applied in a fair sharing of the reduction burden among developing countries. Initially, it is important to avoid perverse incentives while non-Annex I countries are not fully integrated. As a base year, the year 2010 could be chosen, which is the year that overall emissions from Annex I and non-Annex Parties are expected to be equal. The individual allocation to non-Annex I Parties could be allocated according to two principles: (1) A per-capita survival emission could be determined as a share of the 2050 estimated per-capita emission. For low-emitting countries, this will be equivalent to a growth cap. (2) For the first commitment period, stabilization on the estimated 2010 level could be envisaged. For fast-growing economies above the survival emissions, this will require participation in the auctioning system to the extend they overshoot their stabilization level. In any case, the preservation of terrestrial carbon stocks will help developing countries offset their own emissions and save on f-AAUs.

CDM and Joint Implementation (JI) activities will converge, because the system is now closed. This means that the host country will have an eye on the additionality of mitigation activities, because non-additional activities will be financed out of the host country’s f-AAU allocation. Seen from another angle; project-based activities will allow developing countries to convert f-AAUs into freely tradable emission permits.

Sharing the same budget however means that common accounting procedures are needed. An end to the split treatment of land use sinks and sources for Annex I and non-Annex I countries is overdue. Adapting Annex I land use accounting (like foreseen in Kyoto Protocol Article 3 paragraphs 3 and 4) for developing country Parties (Dutschke and Pistorius 2008) may be a common ground.

The proposal of the Climate Stabilization Fund is both simple and commonsense. It does not disrupt existing flexible compliance mechanisms, closes the divide between industrialized and developing countries, reduces international leakage, and makes bargaining around national targets for Annex I obsolete.

It can be observed nevertheless that Annex I countries are already allocating allowance auctioning receipts into their national budgets. There is strong pressure for these funds to be recycled into the national economy, instead of serving for the much needed north-south transfer.

Allowance banking is a central feature of the Kyoto Protocol compliance system that needs to be preserved in order for the CSF to work. It offers an incentive for developing countries to bank their f-AAUs towards compliance with tighter future targets. The value of f-AAUs will be the one of AAUs, discounted by the number of years, before they will be used for compliance. REDD activities undertaken on a national or subnational level will increase the number of bankable f-AAUs. This means that on the long run, carbon benefits from forestry will enter the emissions trading system.

5 Variations and further research

The proposed model offers flexibility for possible adaptations and variations. For its functioning, it is unimportant whether the long-term budget is binding or non-binding. In order to secure environmental integrity however, it is recommended to change the long-term budget only in case new scientific evidence is detected by the IPCC, similarly to the treatment of the global warming potential of different GHGs, which is now beyond reach of political negotiation.

The feature of non-tradability of f-AAUs is intended to safeguard survival emissions and to avoiding industrialized countries from buying up freely allocated amounts without any underlying mitigation activity. This regulation could be loosened in the sense that trading is allowed between developing country Parties, as long as these are entitled to receive f-AAUs. The advantage would be that the present value of f-AAUs would increase and so would the pressure for carbon-efficiency.

It is conceivable that after one or two commitment periods of financing REDD through the CSF, the compliance market can safely be opened up to REDD credits. In this case, more finance would become available for adaptation and other common tasks that are non-quantifiable in carbon metrics.

Immediately starting AAU auctions, before the commitment period for which they are issued, is an elegant solution to the need of upfront finance in REDD, besides assisting country parties in mid-term carbon planning. Again, the CSF does not depend from the moment in time when allocation takes place, as long as it is *before* the respective commitment period.

As the current debate around REDD is highly polarized between market and non-market instruments, the CSF should not be confused with a non-market solution. The scope of the present article was on how to collect the amount needed for REDD. Spending should be based on a competitive tendering system, in order to identify the low-cost opportunities first. It is conceivable that for equity considerations, the distribution of funds among world regions could be politically predetermined.

Further research should look into indicators for gradual phase-out of f-AAUs for advanced developing countries and the distribution of the Climate Stabilization Fund. There should be limits to arbitrariness which goals to finance with it, and how to divide the cake.

With the focus of this paper being on REDD finance, the author encourages further debate on potential co-benefits of the Climate Stabilization Fund model.

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Conclusions

The way ahead for climate and forests

1 Global tasks in climate policy

By the end of 2012, when the first Kyoto commitment period ends, 20 years of climate policy will have had little climatic effect (Böhringer and Vogt 2002). Yet, the political effect is undeniable. Climate change recognized as a fact, and there is a dynamic of policies and measures for mitigating the greenhouse effect, even in developing countries. Confronting climate change by reducing deforestation ranks high in public opinion. There has been a paradigmatic change from skepticism towards land-used based mitigation towards the full inclusion of forestry in the toolbox of future mitigation activities. While we are still in the phase of policy design, some practical and methodological experience has been gathered, most of all on the project level.

The task for climate policy is enormous: Within four decades, the world economy needs to de-carbonize by at least 50 percent, the G8 acknowledged at its 2007 summit. A temperature increase of two degrees in comparison to pre-industrial mean temperatures will be difficult to reach. Findings resumed by the IPCC suggest that even limiting the mean temperature increase to two-degree Celsius will be anything else than a “safe landing”, because the resulting variations in local temperature and precipitation levels have yet unforeseeable consequences (Solomon, Quin et al. 2007). Already, predictions from the 2007 IPCC Fourth Assessment Report seem to be outdated regarding the velocity of arctic ice melting. The “window of opportunity” to reach climate stabilization within this century is expected to close between 2015 and 2020 (Stern 2006).

Current emissions from forestry are estimated at 20 percent of human greenhouse gas emissions. Taken together with agriculture, land use causes approximately one third of the global warming problem. AFOLU is the biggest single emission sources. What is also true is that half of global anthropogenic emissions originate in developing countries. The smallest fraction of these emissions could be denominated “survival emissions” (Mwandosya 1999). This increasing share reflects developing countries’ role in the international labor division. The bulk of these emissions come from oil and gas drilling, coal mining, production of consumer goods for northern countries, and a large amount from deforestation and degradation. As a conclusion, it appears to be an unbearable risk to spare any field of mitigation action, just because it seems methodologically complex or politically inopportune.

2 Lessons learned

The stabilization of greenhouse gases in the atmosphere, the ultimate objective of the Climate Convention, is the leitmotif of this book. All methodological concerns about additionality, baselines, or the temporality of land use mitigation are motivated by the concern to maintain the protective function of the atmosphere for humankind and its environment. Chapter 1 demonstrates how the definition of the timeframe for human intervention determines the scope and nature of mitigation activities. This is especially true for the management of natural resources. In an advanced stage of the debate, chapter 10 concludes under which circumstances forestry will be able to contribute to the stabilization goal.

2.1 What is special in climate forestry?

Mitigation in land use and specifically the forest sector is different from any other human mitigation activity. According to (Schlamadinger, Bird et al. 2007) there are three characterizing factors of LULUCF:

(1) **Saturation** tells us that forestry mitigation can be used only once for a limited number of hectares. The potential for fossil GHG emissions is much higher than the total hypothetical potential of forests to sequester these.

(2) **Non-permanence** is a relative term. Nothing in life is permanent. In climate change mitigation, we are looking at human activities within the next 50 – 100 years. The effects of human-induced global warming may also lead to a loss of sequestered carbon.

(3) The **limited degree of human control** over carbon flows: Limited human control over terrestrial vegetation cover is an argument for caution related to expected mitigation effect in every particular case. Land managers can do everything right and still experience unforeseeable losses from extreme weather events, pest, plagues, or fire. In addition, measurement uncertainties are higher in land-use mitigation activities than in most other GHG mitigation activities, in spite of big advancements in monitoring.

Forestry activities are extremely case-specific. No common forest definition could be agreed under the UNFCCC, except area, height, and density. Yet some species (e.g. palms) are considered trees in one place and agricultural plants in the other. Depending on soils and water availability, activities effective for climate change mitigation in one place may turn out to be detrimental in the other.

Chapter 1 identified two forest trade-offs, in mitigation and adaptation, both of which act on a differentiated timescale within this century.

(1) The mitigation trade-off: Accounting for forest mitigation could possibly defer mitigation options in industry, transport, and households. Costs for the preservation of forests are lowest at present and will increase over time. Restoration of natural forests lost today is unavailable at whatever cost in the future. Implementation costs for afforestation and reforestation remain constant, while advances in plant genetics result in a tendency for improved yields. Technological mitigation options tend to be more expensive per unit emission reduction at present and with cost decreases over time. The risk is to neglect efforts for technology improvement while taking advantage of cheap and available forestry potentials.

(2) The adaptation trade-off has two aspects: (a) A higher forest cover will increase the resilience against climate change (CBD 2008), while (b) failure to reduce GHG sources in other sectors may lead to a die-off of terrestrial carbon stocks in certain areas like the Amazon (Malhi, Roberts et al. 2008). Here we move on uncertain grounds. On the positive side, the multiple effects of forest systems on microclimate and livelihoods may increase natural and human resilience against higher temperature levels. Additionally, the fertilization effect CO_2 and N_2O is currently estimated to lead to higher carbon sequestration in terrestrial biomass. However, the tipping point remains unknown, when climate change effects lead to large-scale die-offs due to a lack in rainfalls or run-off waters from glaciers (Seppälä, Buck et al. 2009).

2.2 Land use is interrelated to activities in other sectors

Land use interacts with other sectors and within itself (Obersteiner and Havlik 2009): There is pressure on land resources by food production, infrastructure and urban spread, bioenergy, and timber demand. It will become increasingly difficult to strike the right balance between use and non-use of terrestrial resources.

With the world population heading for nine billion in the middle of this century, food production will exert high pressure on forests (FAO 2002). Western meat-based nutrition patterns are extremely area intensive, and they are adopted by a growing number of people worldwide. The agricultural area expansion will occur exclusively in developing countries, most of all in Sub-Saharan Africa and Latin America (Easterling, Aggarwal et al. 2007), where it will compete with forestry, energy biomass production, and conservation.

In case energy efficiency is not dramatically improved, biomass will not be able to cover the increasing worldwide energy demand. Demand-side management for the use of biomass energy is an unexplored field, because the indirect emission reductions from deforestation or degradation were not eligible for crediting under the CDM (Jürgens, Schlamadinger et al. 2006).

2.3 Methodological progress

Over the years, project developers have proposed methodological approaches for securing environmental integrity, i.e. that the environmental goal to reduce the greenhouse gas effect is the fundamental criterion for any mitigation activity. It has become clear however that methodologies are no more than tools within a larger framework. The permanence risk can be addressed differently, depending on whether developing countries bear the ultimate liability for their terrestrial carbon stocks or not. Baselines look different, whether they refer to single activities or on a national or even international level. Experience has shown that methodologies can adapt to any political rules and modalities, provided by policy decision makers. As evidenced under A/R CDM, at times this leads to a degree of complexity that contradicts the original purpose (see chapter III). The policy message to safeguard environmental integrity has been widely implemented by the experts. The message to policymakers from practitioners is to keep regulatory systems simple and transparent.

2.4 Solutions need to be simple and pragmatic

In order to become implemented within the limited timeframe, the future climate regime needs to remain simple. In this book, we have demonstrated that the degree of complexity in the interplay between terrestrial systems and climate is virtually unlimited. However, political solutions are only workable in case policymakers can understand *and* communicate them. How can this contradiction be solved?

The UNFCCC process as a whole is science-driven, which is the reason for much of the criticism against it. The linkage between trace gas emissions and global mean temperatures or the fact that the current temperature increase is abnormal in geological terms is not comprehensible for single human beings. The trends projected by science cannot be experience in an individual lifetime. The solution found was the Intergovernmental Panel on Climate Change. It was established by UNEP and WMO in 1988. In its reports, the IPCC resumes the state of international research, with the mandate to be policy-relevant, but not policy-prescriptive. Authors and reviewers are nominated by governments. In 2010, the IPCC will start producing the Fifth Assessment Report on the state of the natural and social sciences on climatic change. This global research review intends to make sure that policymakers continue receiving up-to-date unbiased information.

As highlighted in chapter 1, climate change policy is at the limit of what democratic regimes with 4-5 year government terms can achieve. Theoretically, voters are unlikely to honor today's losses for the benefit of intergenerational equity (Böhringer and Vogt 2002; Sprinz 2009). The comforting message is that successful forest policy has traditionally set long-term incentives. One lesson from forestry CDM under the Marrakech Accords is that unavoidable technical complexities should be left to experts, instead of burdening the legal documents, another one that for a market instrument to work properly, liability needs to be properly regulated. Differently from the CDM, a REDD mechanism that relies on national instead of private liability requires more national institution building. There will be national monitoring, reporting and accounting, and the government – the REDD focal point – will need specific capacities for monitoring, reporting, verification and the assessment of subnational activities. A future system of accounting for greenhouse gas fluxes in land use must be *comprehensive* and *conservative* (Mollicone, Freibauer et al. 2007). *Comprehensiveness* means that the mechanism shall cover all relevant land uses and most countries of the world, including developed countries. *Conservativeness* will be expressed by only accounting for carbon stock variations that can be assessed at sufficient level of certainty. This will set an incentive to start by accounting for e.g. the reduction of emissions from deforestation and extend accounting stepwise, as monitoring capacities and data quality are improving (see chapter 9). Stopping deforestation is only the first step. On the long term, incentive payments will be needed for sustainable land management (Mollicone, Achard et al. 2007), in cases where positive externalities cannot be internalized, like nature conservation.

3 Concluding remarks

The chapters of this book have emphasized pragmatism and political enforceability. Some of the ideas presented were premature or even utopia at the time of their first publication, but turn out to be useful under today‘s changed political circumstances. The author perceives clear commonalities between the chapters:

1. Environmental effectiveness: There is a temptation to find political and economic solutions at the expense of the atmosphere. For instance, chapter 1 proposed minimum project duration for afforestation projects in order to avoid that the initial soil carbon losses are offset by sustained biomass growth in later years. At the same time, there are also trade-offs between different environmental goals, like terrestrial carbon sequestration, biomass use, less intensive organic agriculture, and biodiversity that call for dynamic optimization.
2. Efficiency: Investment in climate change mitigation competes with a variety of other international goals, like the eradication of poverty, food security, or the improvement of health systems, not to mention political goals of individual states. In order to minimize intra-generation and inter-generational distributional conflict, climate money needs to be spent in a cost-effective manner.

Market systems can only be effective distribution mechanism, if sufficiently regulated and monitored.

3. International equity: The importance of Annex I emission will be decreasing further in the future. The key to reaching the ultimate objective of the Climate Convention lies in today's developing countries. All mechanisms under the Climate Convention and its instruments need to establish the ultimate goal of equitable responsibility. Therefore, a transition pathway needs to be traced for emerging economies to take over ownership *and* liability.
4. Polluter-pays principle: The attribution of responsibility for climate change is not sufficiently framed in terms of country parties. Under the current international labor division, the implementation of the ppp can only be a long-term perspective. Development assistance has a vital role to play for fostering better governance in developing countries and increasing ownership of the climate policy process. For many developing countries, forests and forestry constitute an important part of the national patrimony. Governing it in a responsible way contributes importantly to sustainable social and economic development.

Although this issue has not been covered in this book, the author acknowledges the importance of socio-economic integration of climate mitigation and adaptation activities. The big advantage of environmental services markets, be they mandatory or voluntary, is their transparency. Mitigation activities that do not consider social concerns will not be successful on the long run. There is an important role of certification standards, one of which the author has co-authored.[1] However, for the sake of the simplicity, one should be careful not to overload high-level decisions with case-specifics rules. Trees are living beings and they have always coexisted with humanity. Every single forest is special in many respects, and natural resource management should take account of this individuality.

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