

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

M. DUTSCHKE¹ and T. PISTORIUS²

¹*BioCarbon Consult, Offenburg, Germany*

²*Institute of Forest & Environmental Policy, University of Freiburg, Germany*

Email: Michael@biocarbon.net and till.pistorius@ifp.uni-freiburg.de

SUMMARY

The present article 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.

Keywords: climate policy, post-2012, Kyoto Protocol, carbon accounting, LULUCF

Est-ce que le futur sera REDD? Comptabilité régulière du carbone dans l'utilisation de la terre

M. DUTSCHKE et T. PISTORIUS

Cet article est une contribution au débat international sur le mécanisme de compensation pour réduire les émissions provenant de la déforestation et de la dégradation de la forêt dans les pays en voie de développement (REDD). Le débat a constamment élargi son envergure depuis sa création, pour recouvrir maintenant la déforestation, la dégradation et la gestion forestière. Les auteurs recommandent un système de comptabilité unifié sans distinction entre les pays industrialisés et ceux en voie de développement, pour éviter les complexités méthodologiques et une marge d'erreur trop importante dans l'évaluation et l'analyse du carbone. Un tel système a été créé pour les pays Annex-1 par les articles 3.3 et 3.4 de Kyoto. Il permet une mise en action graduelle et reconnaît la nécessité d'autoriser un temps de croissance et d'apprentissage sur le terrain pour la première période d'action. Si ce système sert de modèle, la principale différence sera que les pays industrialisés ont des buts généraux, alors que les pays en voie de développement détermineraient plutôt un niveau de référence de secteur pour les émissions provenant de l'usage de la terre, suivant lequel les réductions d'émissions dans le secteur d'utilisation de la terre devraient être mesurées. Alors que les pays en voie de développement prennent de plus grande responsabilités quant au climat dans le futur, les rapports sur les émissions et les octrois d'usage de la terre n'ont pas affectés. Les articles 3.3 et 3.4 doivent être révisés du point de vue des modalités de comptabilité, plus précisément, la nécessité pour les pays Annex-1 de passer au système de comptabilité net-net, afin de développer un système complet. La façon dont la REDD a été conçue à Bali est restreinte au secteur seul de la foresterie dans les pays en voie de développement. Si ce mécanisme de la REDD devait être celui du futur, il créerait des obstacles méthodologiques, et fournirait des arguments aux opposants, pour justifier leur résistance à l'octroi de responsabilités accrues aux pays en voie de développement dans le sein du régime climatique.

Reducción de Emisiones por Deforestación y Degradación (REDD) a través del cálculo sistemático de carbono relacionado con el uso de la tierra

M. DUTSCHKE y T. PISTORIUS

Este artículo constituye una contribución al debate internacional sobre los mecanismos de indemnización para la reducción de emisiones por deforestación y degradación (REDD) en los países en vías de desarrollo. Desde sus comienzos el alcance del debate ha estado en constante aumento, y ahora cubre la deforestación, la degradación y la gestión forestal. En aras de evitar las complejidades metodológicas y las anomalías en los cálculos de carbono, los autores promueven un sistema unificado de cálculos que no distingue entre los países en vías de

desarrollo e industrializados. El tratado de Kioto ha creado un sistema de estas características para los países de Anexo I, en los Artículos 3.3 y 3.4, que permiten una implementación paso a paso y reconocen durante el primer período de compromiso la necesidad de la creación de capacidad y el aprendizaje a través de la actividad. Si este sistema sirve como plan de base, la diferencia primordial se resumirá en el hecho de que los países industrializados tienen objetivos globales, mientras que los países en vías de desarrollo determinarían un nivel sectorial de referencia para las emisiones del uso de la tierra, contra el cual la reducción de emisiones en el sector del uso de la tierra debe ser medido. Cuando los países en vías de desarrollo asumen mayores compromisos climáticos en el futuro, no afectará el sistema de informes sobre el cambio del uso de la tierra y emisiones. Para desarrollar un sistema integral, los Artículos 3.3 y 3.4 necesitan ser revisados para tomar en cuenta las modalidades de cálculo; es decir, los países de Anexo I tendrían que cambiar a un sistema de contabilidad 'neto-neto'. Tal como la REDD ha sido concebido en Bali, se limita únicamente al sector forestal de los países en vías de desarrollo, y si se utilizara este mecanismo de REDD como modelo para el futuro, crearía obstáculos metodológicos y proporcionaría nuevos argumentos para los que se oponen a una mayor responsabilidad de los países en vías de desarrollo dentro del régimen climático.

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 (COP11) 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 reduce 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?

This article proposes 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.

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 *et al.* 2005).

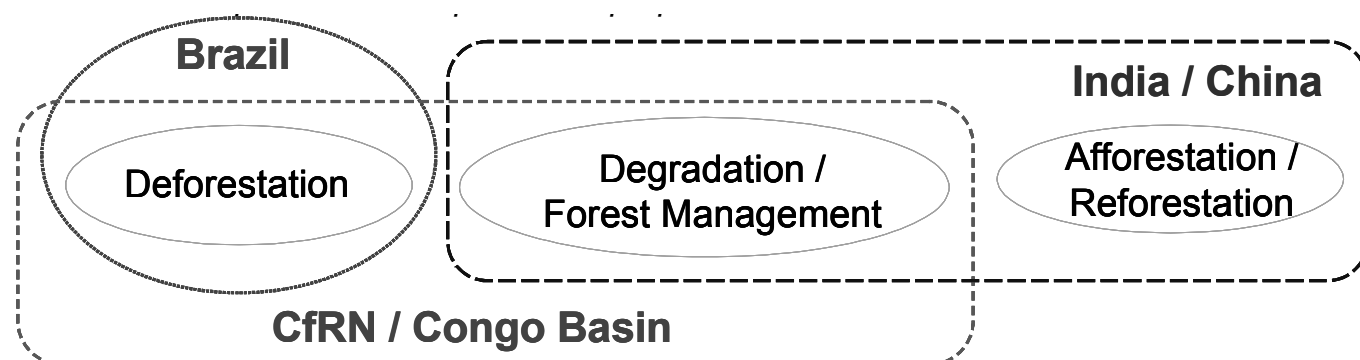
Consequently several countries proposed different scopes for the mechanism (see FIGURE 1). There were partial overlaps between the CfrN and the Congo Basin approaches and the ones of Brazil and India, but no common

TABLE 1 Net changes of forest area in selected countries [Karousakis 2007]

| | | 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)

FIGURE 1 Scope of the most prominent proposals



ground between the Indian and the Brazilian approach. The way these approaches were presented risked driving the negotiations to a deadlock.

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 losing 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 Solomonian 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-bracketed¹ 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

¹ Term from UN slang referring to the practice to put in square brackets text alternatives that have not been agreed upon by all Parties.

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 counter-productive to insist in having REDD *outside Kyoto*, when the same sectoral emissions are controlled under the Kyoto Protocol for Annex I countries.

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.² 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 *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

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.

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

² For the first commitment period, certain limitations apply.

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.

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 (Chomitz 2007, Geist and Lambin 2001). 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 definition problems. Under REDD, an upcoming contentious issue will be the definition of “degradation” (Penman *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.

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 *et al.* 2007, Schlamadinger and Marland 1998). 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 (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 *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 extent they can serve as a blueprint its design in a post-2012 regime.

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

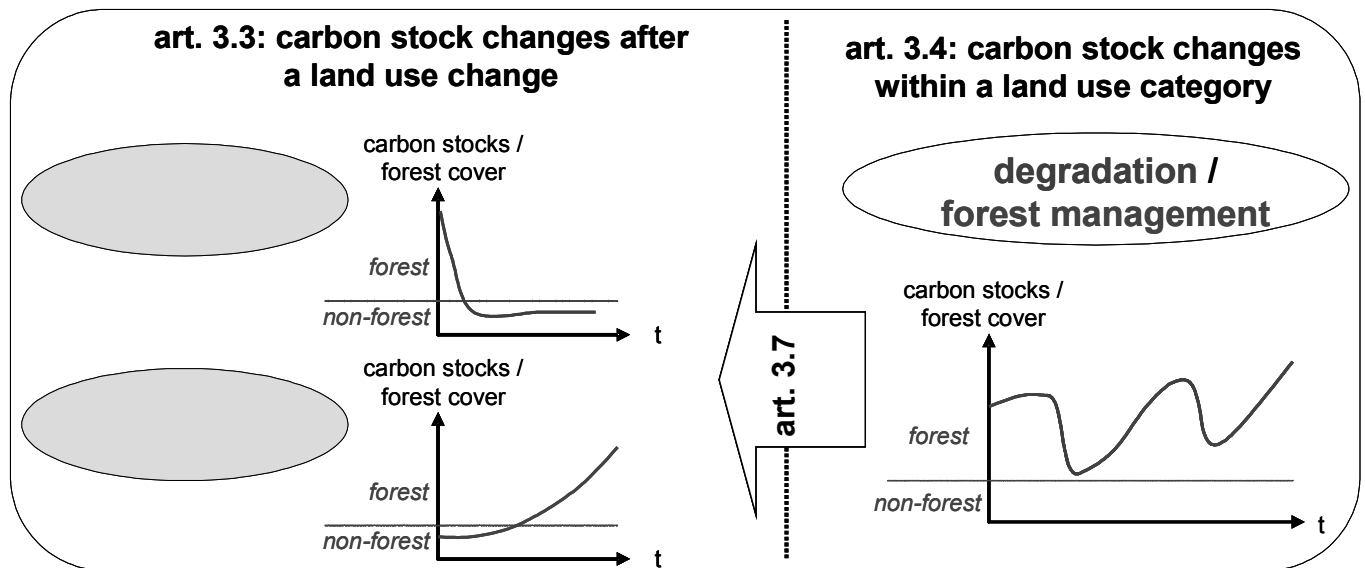
On invitation of the Marrakech COP 7, the IPCC developed in a Good Practice Guidance for LULUCF (IPCC 2003), a sophisticated reporting scheme that distinguishes between

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 |
| 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.

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



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.

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.

Article 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.

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 CO₂ concentrations, increased length of vegetation periods or nitrogen emissions which may lead to accelerated growth (Schlamadinger *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 well³.

³ 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 | | | |
| Art. 3.4 | forest management | voluntary | country cap (Bonn Agreement, Annex Z) | net-net |
| | revegetation | | no limit | |

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.

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 through 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 *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.

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.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude for the helpful comments and suggestions received from Bernd Winkler, Reinhard Wolf, Naomi Pena, Neil Bird and our anonymous peer reviewers.

REFERENCES

- CHOMITZ, K. M. 2007. At loggerheads?: agricultural expansion, poverty reduction, and environment in the tropical forests. World Bank, Washington, D.C., USA. <http://go.worldbank.org/155PA8IUZ0>.
- DESSAI, S. 2001. The climate regime from The Hague to Marrakeh: Saving or sinking the Kyoto Protocol? Tyndall

- Centre for Climate Change Research Working Paper 12. Norwich: 27
- GEIST, H. J. and LAMBIN, E. F. 2001. What Drives Tropical Deforestation? A meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. Louvain-la-Neuve, LUCC International Project Office, University of Louvain.
- GREENPEACE 2007. Carving up the Congo. Amsterdam, Greenpeace International: 100
- IPCC 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry (Task 1). Kamiyamaguchi, Hayama, Kanagawa, Japan, Intergovernmental Panel on Climate Change
- JUNG, M., MICHAELOWA, A., NESTLE, I., GREINER, S., and DUTSCHKE, M. 2004. Common Policy on Climate Change: Carbon Sinks, Domestic Stakeholders, and E.U. Foreign Policy. Global Warming and European Foreign Policy. P. G. Harris. New York, St. Martin's Press.
- KAROUSAKIS, K. 2007. Incentives to Reducing Emissions from Deforestation: Lessons Learned from Costa Rica and Mexico. Paris, OECD: 50
- KAROUSAKIS, K. and CORFEE-MORLOT, J. 2007. Financing Mechanisms to Reduce Emissions from Deforestation: Issues in Design and Implementation. Paris, OECD: 67
- PENMAN, J., GYTARSKY, M., HIRAISHI, T., KRUG, T., KRUGER, D., PIPATTI, R., BUENDIA, L., MIWA, K., NGARA, T., TANABE, K., and WAGNER, F. 2003. Definitions and methodological options to inventory emissions from direct human-induced degradation of forests and devegetation of other vegetation types. Kanagawa / JP, International Panel on Climate Change & Institute for Global Environmental Strategies.
- RUDEL, T.K., COOMES, O.T., MORAN, E., ACHARD, F., ANGELSEN, A., XU, J. and LAMBIN, E. 2005. "Forest transitions: towards a global understanding of land use change." *Global Environmental Change*(15): 23-31.
- SCHLAMADINGER, B., BIRD, N., JOHNS, T., BROWN, S., CANADELL, J., CICCARESE, L., DUTSCHKE, M., FIEDLER, J., FISCHLIN, A., FEARNSIDE, P., FORNER, C., FREIBAUER, A., FRUMHOFF, P., HOEHNE, N., KIRSCHBAUM, M.U.F., LABAT, A., MARLAND, G., MICHAELOWA, A., MONTANARELLA, L., MOUTINHO, P., MURDIYARSO, D., PENA, N., PINGOUD, K., RAKONCZAY, Z., RAMETSTEINER, E., ROCK, J., SANZ, M.J., SCHNEIDER, U.A., SHVIDENKO, A., SKUTSCH, M., SMITH, P., SOMOGYI, Z., TRINES, E., WARD, M., and YAMAGATA, Y. 2007. "A synopsis of land use, land-use change and forestry (LULUCF) under the Kyoto Protocol and Marrakech Accords." *Environmental Science and Policy* 10(4): 271-282.
- SCHLAMADINGER, B. and MARLAND, G. 1998. "The Kyoto Protocol: Provisions and unresolved issues relevant to land use change and forestry." *Environmental Science and Policy* 1(4): 313-327.
- STROGIES, M., and GNIFFKE, P. 2006. Submission under the United Nations Framework Convention on Climate Change. Dessau, Umweltbundesamt (Federal Agency for the Environment): 541
- UBA 2007. Kyoto-Protokoll: Untersuchung von Optionen für die Weiterentwicklung der Verpflichtungen für die 2. Verpflichtungsperiode, Teilvorhaben "Senken in der 2. Verpflichtungsperiode". Scientific Report: 293
- UNFCCC 2007. Reducing emissions from deforestation in developing countries: approaches to stimulate action. 2/CP.13. FCCC/CP/2007/6/Add.1