Tropical Deforestation Emission Reduction Mechanism (TDERM): A Discussion Paper

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Tropical Deforestation Emission Reduction Mechanism

A Discussion Paper

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Tropical Deforestation Emission Reduction Mechanism

Executive Summary

Tropical deforestation is a major source of greenhouse gas emissions, threatens biological diversity, and has devastating impacts upon forest dependent peoples. Human induced climate change is projected to cause significant adverse effects on tropical forests where there is a decline in precipitation. As a consequence it is vital that means are found to incentivise and reward reduced deforestation in order to assist in the task of preventing dangerous climate change and thus achieve the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC).

A proposal for a hybrid market linked Tropical Deforestation Emission Reduction Mechanism (TDERM) under the UNFCCC and its Kyoto Protocol is outlined that can effectively incentivise and reward efforts to simultaneously meet the twin goals of:

- Reducing emissions from deforestation in tropical developing countries.
- Protect biological diversity and ecosystem services intrinsic to tropical forests.

The mechanism proposed here would raise sufficient funds to bring about substantial reductions in deforestation and related emissions, which would be additional to the deep Annex I Party emissions reduction targets required in future commitment periods of the Kyoto Protocol which are necessary, but not sufficient, to limit warming to below 2^{o}C above pre-industrial levels. The TDERM proposed here avoids many of the difficulties of proposals to reward and incentivise deforestation reductions that are directly linked to the market.

General Issues in Designing a Mechanism

In order for a mechanism to be successful its design and operation will need to take account of and resolve a number complex scientific, technological, and methodological and equity issues. These issues include:

- The potential scale affects of deforestation on the carbon market. Directly connecting efforts to reduce deforestation to the Kyoto trading system carries with it a large risk that high volumes of low cost deforestation credits enter the market, increasing supply and lowering the price and poses a substantial risk of destabilizing the carbon market.
- The need for a substantial volume of reliable finance. Raising funds through the carbon market offers the possibility of substantial volumes of funds at scale to reward or incentivise reduced deforestation.
- The need to reduce leakage effects, hence the need for widespread coverage of tropical deforesting countries and for national-level accounting. A focus on capacity building for countries to develop a national emissions approach with effective monitoring and verification and institutional support is essential for any mechanism.

- Uncertainty in deforestation emission estimates substantially exceeds uncertainty in measuring industrial greenhouse gases.
- Intrinsic problems with the establishment of baselines and hence in estimating 'real' reductions. Establishing credible historical emission baselines from which to estimate reductions in deforestation rates will likely be difficult, due to the poor quality of data and the lack of comprehensive monitoring in many countries.
- The need for monitoring and verification of emissions and of changes in deforestation and degradation activities. Consistent monitoring systems that meet a set of internationally agreed standards will need to be established in developing countries to ensure the integrity of emission reductions from deforestation.
- The potential for impermanence of accounted emission reductions from deforestation. Any mechanism developed to provide incentives to reduce emissions from deforestation needs to ensure that reductions are permanent and that where this is not the case, for whatever reason, corrections can be made.
- The need for an emissions accounting approach that provides incentives to reduce emissions and protect biodiversity. It is important that the accounting system for deforestation emissions provides incentives to protect forest and to reduce emissions. The overall methodological approach should ensure that only the carbon losses from deforestation activities are taken into account in the estimation of emissions and not any potential carbon gains resulting from subsequent land uses. A significant source of greenhouse emissions from deforestation comes from peat lands and palm oil production and it is essential that the accounting approach provides incentives to protect peat land forests.
- The need to protect the rights of indigenous and forest peoples and to ensure that these peoples receive an equitable and fair share of the incentives and rewards for reducing deforestation.
- The need to avoid perverse incentives. It is important that any mechanism does not create incentives to increase the rates of deforestation before the system starts.
- The need to address the drivers of deforestation and assist developing countries to implement national policies and measures to ensure effective governance for forest protection.

Tropical Deforestation Emission Reduction Mechanism: Hybrid Market-Linked Fund

The Tropical Deforestation Emission Reduction Mechanism attempts to address many of the issues outlined above and fund sustainable and lasting reductions of emissions from tropical deforestation in participating countries to meet both climate and biodiversity objectives in the second commitment period of the Kyoto Protocol and beyond.

The TDERM would provide funding for forest protection driven by a mandatory minimum contribution from Annex I Parties to meet a percentage of their emission reduction obligations. A new unit for Annex I countries to be used for compliance with emission obligations would be created – "Tropical Deforestation Emission Reduction

Units (TDERUs)" set at a market rate by the *Tropical Deforestation Emission Reduction Mechanism.* The proceeds of the sale of TDERUs would be used by the TDERM to fund and reward reductions in emissions from participating developing countries and provides a reliable source of funding to reduce deforestation.

In order to guarantee a volume of funds, Annex I Parties would be required to meet a fixed part of their emissions obligations (X%) using TDERUs purchased from the mechanism. No strong recommendation here is made for 'X' except that it needs to be set at a level that ensures sufficient funds to significantly reduce deforestation and that the setting of this number needs to be done in conjunction with the establishment of the post-2012 emission reduction targets on industrial greenhouse gases for the Annex I as whole. This is essential to avoid the negative scale effects on the carbon market (which would likely lower the overall price of credits and undermine efforts to invest in cleaner energy technologies).

In addition to the mandatory minimum level of contributions (X%), Annex I Parties could elect to purchase and hold up to a maximum of Y% of their base year emissions by purchasing TDERUs from the Mechanism. The setting of an upper limit on the amount of TDERUs that can be used towards compliance with emission obligations by Annex I Parties would transparently address the scale effect issues discussed previously.

The Mechanism would be required to disburse its funds for verifiable reductions in deforestation emissions by developing countries, who participate according to their differentiated capacities.

The major elements of the proposed *Tropical Deforestation Emission Reduction Mechanism* are:

- ***A new international trading unit.*** A new Tropical Deforestation Emission Reduction Unit (TDERU) would be created for use in the Kyoto trading system by Annex I Parties to meet their emission reduction obligations. The new units (TDERUs) would be issued by the proposed *Tropical Deforestation Emission Reduction Mechanism*.
- ***Mandatory minimum***. Annex I Parties would be required to purchase and to hold a minimum amount of TDERUs, equivalent to X% of their base year emissions (times the number of years in a compliance period – 5 years). This would ensure that the Mechanism has a significant level of funding.
- ***Limit on supply.*** The supply of TDERUs would be limited to an agreed maximum percentage (Y%) of Annex I base year emissions to be issued annually. The Y% limit would need to be set to ensure sufficient funds were available to substantially reduce deforestation. A carbon price in the Kyoto second commitment period of €20/t CO_2e, and Y=3% limit could generate around €14 billion/year.
- ***Sale price set by auction***. The price of TDERUs could be determined by auctioning or by setting a price linked to the world market price for Kyoto units.

- ***Proceeds of TDERU sales used to reward or incentivise reductions in all eligible countries***. The Mechanism would use the proceeds from the sale of TDERUs to reward and incentivise deforestation reduction activities in all eligible developing countries, through modalities tailored for the wide range of different capacities of countries, including those with low deforestation rates. The modalities and rules for rewarding and incentivizing countries would ensure that funds would be distributed to the appropriate stakeholders to ensure both equitable benefit sharing and that they are provided with the right incentives to maintain forests over time.
- ***Portfolio performance approach to overall emission reductions***. The Mechanism would be required to reduce deforestation emissions (measured in CO_2 equivalent tonnes) by a multiple of the total TDERUs issued and as a portfolio of its overall activities. The portfolio performance approach should permit the Mechanism to tailor investments to the widest range of countries, capacities and circumstances, whilst ensuring that overall emissions are reduced substantially. A discount factor is used between TDERUs and the emission reductions from deforestation as a proxy for pragmatically resolving several kinds of uncertainty such as emissions estimation, baseline, and permanence concerns. It is very likely that there will be significant difference between the price obtained for a TDERU (€/tCO_2e) and the average cost of reducing deforestation: if €20/tCO_2e were the price of TDERU then a factor three discount would imply that average costs of reducing deforestation by the mechanism would need to be around €6-7/tCO_2e. Within the portfolio performance approach the use of discount factor would enable the Mechanism to expend resources on preventing deforestation in countries where it is not yet a large problem, yet still yield an overall substantial reduction in emissions from the entire portfolio of activities.
- ***Pre-2013 incentives***. In order to provide incentives before the end of 2012 the TDERM could be established latest by 2009 and be authorized to issue for sale a limited volume of TDERUs ahead of the beginning of the second commitment period in 2013. For example forward sale of TDERUs equivalent to 0.5% of Annex I base year emissions at a price of €20/tCO2e could raise over. €2 bn/year. If these were spent on activities that reduced deforestation at a cost of ca €7/tCO2e this could reduce deforestation in the period before 2013 by about 0.6 million ha/year Sufficient progress could be made in developing the mechanism within a year that could justify holding an initial auction of TDERUs by the end of 2008.
- ***Governance structure***. The complexity of the deforestation issue and the volume of funds that is required dictates that a robust governance system under the authority of the COP and/or COP/MOP is established to make decisions on policies, procedures, guidelines and criteria for incentivizing and rewarding reductions in deforestation emissions. Hence the TDERM proposal needs a governance structure which will support the operationalization of the Mechanism. Overall policy would be established by the COP and/or COP/MOP.
- ***Equitable benefit sharing***. To implement the TDERM at the national level, appropriate governance structures and participatory processes are required that include recognising the rights of all indigenous and forest peoples. Incentives for

reducing deforestation need to be distributed to the appropriate stakeholders to ensure equitable benefit sharing.

- ***Different Capacities and States of Development and Governance***. The Mechanism would establish different modes of funding for rewarding deforestation reduction efforts depending on the ability to report, monitor and verify emission reductions reliably. The performance portfolio approach, and separate funding windows for countries with different capacities and states of development and governance, would allow the Mechanism to fund activities that prevent deforestation from expanding in places with currently low deforestation rates, as well as achieve substantial overall reductions in deforestation. Funding should not be limited to countries where reductions in deforestation emissions is cheapest, nor countries with greater monitoring capacities and associated lower risks of impermanence.

Conclusions

Including deforestation reduction credits in the international trading system on a fully fungible basis has large risks. In any event, a market system would not be open, in the foreseeable future, to all countries in which deforestation occurs due to capacity limitations in relation to the fundamental issues of the scale of credits, emission monitoring, verification and compliance, or in relation to governance issues. As it appears very likely that the great majority of countries in which deforestation occurs are unlikely to be in a position to meet these requirements a mechanism that provides for the broadest range of options is needed. The Tropical Deforestation Emission Reduction Mechanism allows all tropical deforestation countries to participate, even with their varying levels of capacity. The main benefits of the mechanism are:

- ***Benefits to climate and biodiversity protection -*** directs funds to actions that will meet both climate and biodiversity objectives.
- ***Scale effects on the Annex I emission targets -*** by limiting the amount that deforestation reductions can be used by the Annex I Parties to meet their commitments, the effects on fossil fuel and other greenhouse gas emissions reductions that are needed can be quantified and limited.
- ***Pragmatic accounting for uncertainties –*** the use of the portfolio approach combined with a discount factor deals pragmatically with the uncertainties relating to emissions estimation, baselines, and permanence.
- ***Ensures stability of market -*** due to the risks associated with full access to the trading system, the TDERM would issue, in effect, compliance units to Annex I Parties which could not be challenged at price and therefore not affect the stability of the overall market.
- ***Full access by the widest range of countries -*** provides funds to the greatest number of developing countries with tropical forests, including countries with varying capacities and governance structures, differing abilities to accurately report, monitor and verify emission reductions, and countries with high and low rates of deforestation.

- ***Reliable source of funds -*** a significant and steady stream of funds would be available through the mandatory minimum commitments made by Annex I Parties as part of their overall emission reduction targets.
- ***Engages indigenous and forest peoples -*** will motivate and facilitate greater control of forest resources by indigenous and forest peoples and will start to address the problem of local communities becoming sidelined.
- ***Capacity building and institutional support –*** reliable funding will be available which can support institutional capacity building needs of developing countries.

Tropical Deforestation Emission Reduction Mechanism
A Discussion Paper

Introduction

This paper presents an overview of issues related to the design of policies that aim to reduce emissions from deforestation[3] in developing countries from within the international climate change regime. It concludes by presenting a proposal for a funding mechanism to effectively incentivise and reward efforts to reduce emissions from deforestation, principally in tropical developing countries.

The starting point for the analysis in this paper is that any mechanism adopted to address tropical deforestation must simultaneously meet the twin goals of preserving biological diversity and effectively contributing to global efforts to reduce emissions to a level that would prevent dangerous interference with the climate system. There are many complex scientific, technological, methodological and equity issues that surround the deforestation issue. The design, governance and operation of such a mechanism must also take into account the rights, and protect the livelihoods, of indigenous people and local forest dependent communities. The design of any effective policy instrument in this area must fully account for these issues.

The paper is divided into three parts:

Part I describes the background and context of the deforestation issue in the context of global efforts to prevent dangerous climate change.

Part II highlights the many scientific, technological, methodological and equity issues that need to be considered and accounted for in the design and operation of any mechanism to address tropical deforestation.

Part III introduces a proposed *Tropical Deforestation Emission Reduction Mechanism* (TDERM). Under this proposal, Annex I Parties would be required to contribute to deforestation reductions by purchasing, at market rates, an agreed percentage of their emission reduction obligations. Under this mechanism, deforestation reductions do not enter the carbon market on a fully fungible[4] basis, which, as will be elaborated below, would allow all eligible developing countries[5] to participate, even with their varying levels of capacity.

[3] Deforestation is defined here as the conversion of forested land to non-forested land.
[4] Full fungibility means the deforestation units would be equivalent to other Kyoto Protocol units, thus these units could be mutually substituted in order to comply with emission reduction obligations.
[5] A developing country would need to be deforesting to be eligible for incentives and rewards under the proposed mechanism.

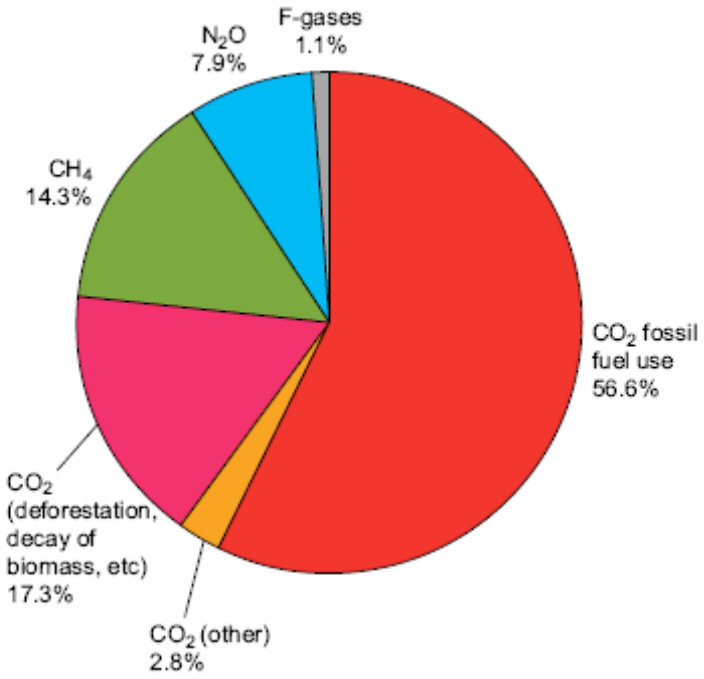
Part I: Background

Tropical Deforestation: Threat to Biodiversity and to the Climate

Tropical deforestation threatens a substantial portion of the Earth's biological diversity. The rate of species loss associated with this threat is estimated to be 100 to 1000 times greater than is considered normal in evolutionary time and, unless halted, will likely result in an unprecedented mass extinction (Myers, Mittermeier et al. 2000). Forest destruction also disrupts the lives and livelihoods of millions of forest dwelling people.

Tropical deforestation and degradation is a major source of greenhouse gas (GHG) emissions, in addition to its devastating impacts on people and biodiversity. For the 1990s, an estimated 5.9 $GtCO_2e$ was emitted due to deforestation. While the uncertainty range associated with this estimate is large (1.8-9.9 $GtCO_2e$), it is clear that deforestation is contributing significantly to global warming.[6] The Intergovernmental Panel on Climate Change (IPCC) recently estimated that GHG emissions from deforestation constitute about 17% of the global total in 2004, albeit with a large uncertainty range (Rogner, Zhou et al. 2007).

Figure 1: Global Greenhouse Gas Emissions in 2004[7]



Source: IPCC (Rogner, Zhou et al. 2007) (Figure 1.1b)

[6] 5.9 $GtCO_2e$ is equal to about 25% (or 8%-42% of fossil fuel emissions taking into consideration the uncertainty range) of the fossil fuel and cement emissions for the same period.

[7] Only gases and sources covered by the UNFCCC and its Kyoto Protocol are counted; figures do not include Ozone Depleting Substances (Montreal Protocol gases).

Interactions between Forest Loss and Climate Change

The loss of tropical forests contributes to the build-up of greenhouse gases in the atmosphere, particularly carbon dioxide, and hence to human induced global climate change. In turn, global climate change is projected to adversely affect tropical forests and related ecosystems where these changes lead to reductions in precipitation(Cowling, Betts et al. 2004; Cox, Betts et al. 2004) (Miles 2002; Miles, Grainger et al. 2004; Salazar, Nobre et al. 2007). Forests are likely to face an increased risk of forest fires, more intense droughts and more frequent floods associated with El Niño, and a greater threat from diseases and insects. Recent unusual droughts in the Amazon have exacerbated concern over the potential effects of climate change on forests (Nepstad, Lefebvre et al. 2004; Giles 2006). This enhanced vulnerability will likely contribute to greater rates of deforestation and degradation and the associated GHG emissions, completing the devastating cycle.

Furthermore, loss of forests brings about adverse regional climate changes affecting rainfall. Scientific research over the last decade or so indicates that if the Amazon loses a significant fraction of its forest cover it could collapse. Changes in the forest cover could precipitate local changes in the climate, particularly drying and warming, resulting in a shift away from a forest to a savannah or grassland ecosystem[8] (Cochrane, Alencar et al. 1999; Nepstad, Carvalho et al. 2001; Sternberg 2001; Oyama and Nobre 2003). Increased conversion of forest to pasture and cropland is also projected to have an adverse effect on the remaining forests (Sampaio, Nobre et al. 2007). To date, 17% of the Amazon has been deforested, while it is estimated that another 10 to 23% has been severely damaged by the logging industry (Asner, Knapp et al. 2005). There is some suggestion that losses of more than 25-30% could lead to a collapse to grassland or savannah system (Alcock 2003), however this is uncertain.

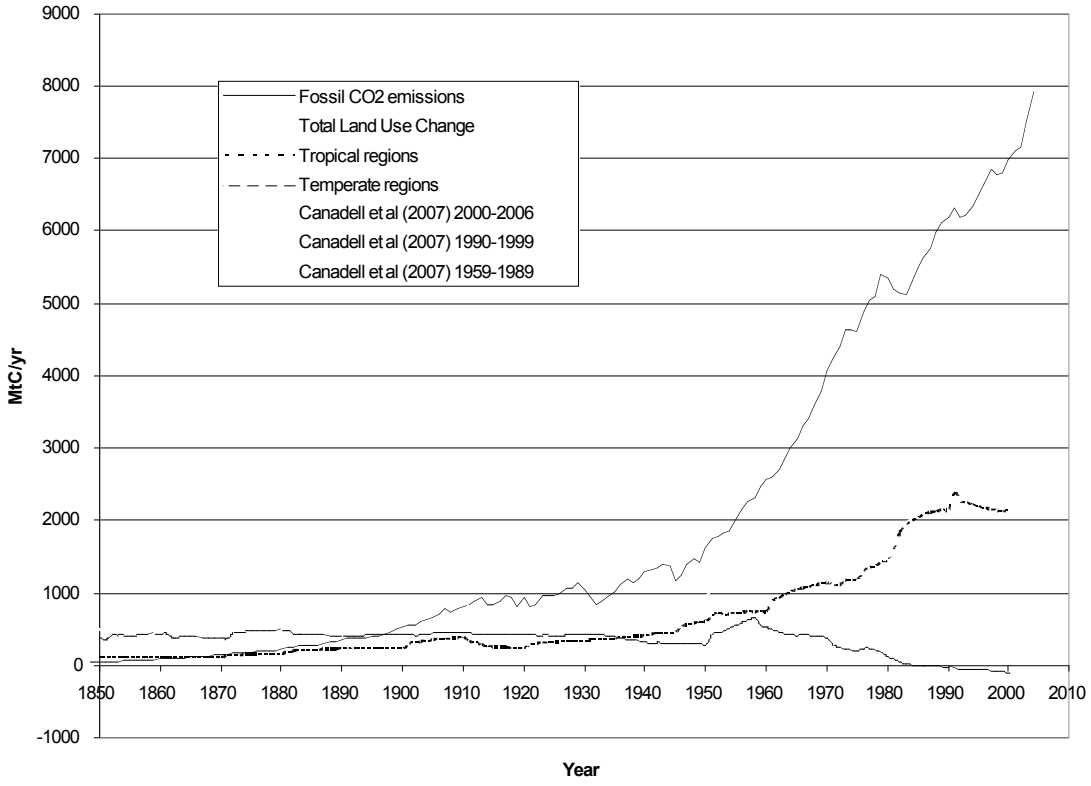
Deforestation Emissions in Context

The changing pattern and magnitude of carbon dioxide (CO_2) emissions from fossil fuels and land use change for the period 1850-2006 are shown in Figure 2. Over this period, fossil CO_2 emissions have added a total of about 330GtC to the atmosphere, while land use change (mostly deforestation and wood harvesting) added about 158 GtC (Canadell, Le Quere et al. 2007). Since the beginning of the 20th century, fossil emissions have been the dominant source of CO_2 emissions, while the share of land use change CO_2 emissions has decreased. As a fraction of total CO_2 emissions, land use change CO_2 emissions declined from over 55% of the total in 1900 to just under 25% in 2000. During this period, and particularly since the 1960s, the regional sources of deforestation emissions shifted from the temperate to the tropical regions. Over the last few decades, deforestation emissions have remained at their historically high levels. Recent work by Canadell *et al*. (2007) on emissions from 1959 to 2006 indicates that deforestation emissions have remained at roughly the same levels over the past two to three decades.

[8] http://www.whrc.org/southamerica_fire_savann_index.htm

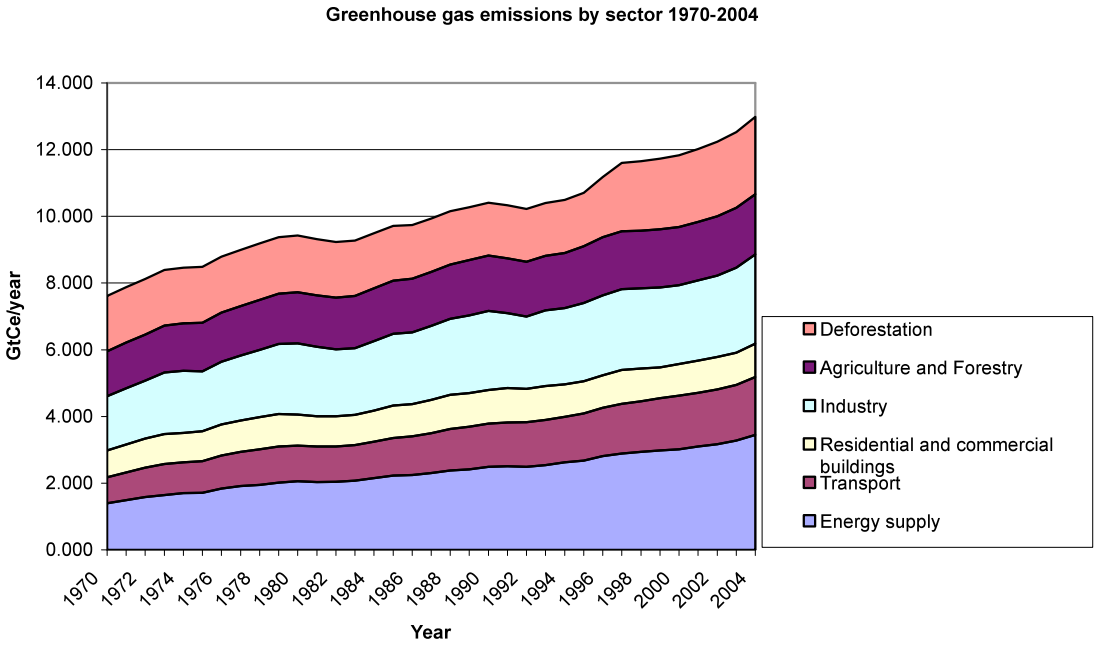
The estimated emissions from deforestation by Canadell *et al*. (2007) are lower than, and update those of Houghton, (2003), using more recent data from the FAO Global Forest Resource Assessment 2005 (FAO 2005). This does not, however, diminish the significance of tropical deforestation, as unabated deforestation emissions would significantly add to the warming over the next century. Figure 3 shows the estimated relative role of deforestation emissions compared to other sectors for the period 1970-2004.

Figure 2: Fossil and Land Use Change Emissions 1850-2000



Sources: Land use change emissions time series to 2000 from Houghton (2003) and averages for the periods 1859-1989, 1990-1999 and 2000-2006 from Canadell *et al*. (2007). Fossil emissions to 2004 from Marland *et al*. (updated) (2005). Houghton and Marland data accessed at http://cdiac.ornl.gov/trends/ . Note the new deforestation (land use estimates) of Canadell *et al*. (2007) update the estimates of Houghton (2003).

Figure 3: Sectoral Trends in Emissions



Source: EDGAR database (Olivier, Van Aardenne et al. 2005; Olivier, Pulles et al. 2006) http://www.mnp.nl/edgar/global_overview/ . Deforestation includes CO_2 emissions from decay (decomposition) of above ground biomass that remains after logging, CO_2 from peat fires and decay of drained peat soils, and methane and nitrous oxide emissions associated with deforestation. Note that the emissions attributed to deforestation are higher than those cited above due to several factors.

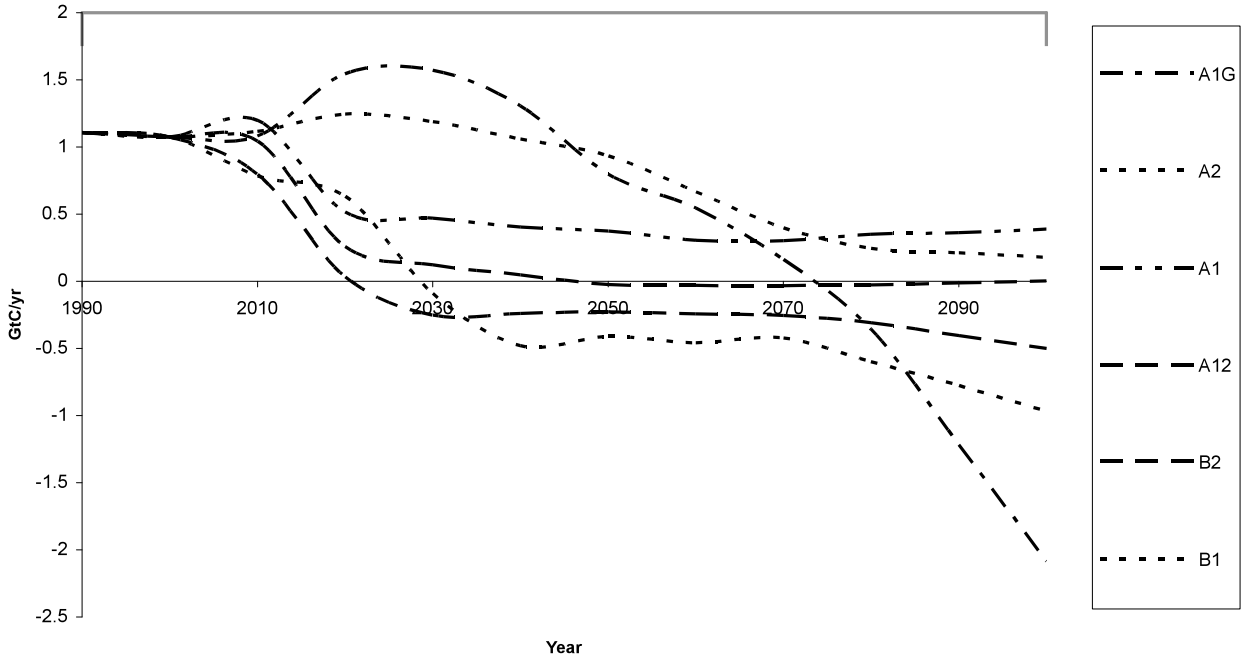
Limiting global warming to at or below a 2°C increase will require limiting total cumulative greenhouse gas emissions over the 21st century to around 500GtC. In the absence of mitigation, industrial emissions are projected to be on the order of 2-4 times this amount. The high end of the IPCC SRES range of scenarios for deforestation emissions (A2)[9] (Morita, Nakicenovic et al. 2000; Nakicenovic and Swart 2000) has deforestation emissions close to 90 GtC or nearly 20% of this budget to 2100. The range of IPCC SRES deforestation emission scenarios is shown in Figure 4. These scenarios include an increase (A1G), a roughly stable level for about fifty years (A2), declining but significant levels until 2100 (A1), and a net sink after the 2020s (B1 and B2).[10] One of the characteristics of policy scenarios, even non-intervention scenarios using simple integrated assessment models, is that often the deforestation source is assumed to be slowed and stopped and then a net uptake of carbon is assumed to take place. This

[9] The SRES scenarios are non-mitigation emissions scenarios based on the quantification by economic and energy system models of four different qualitative, internally consistent story lines: B1 is oriented around sustainable development within a global world economy; B2 is also oriented around sustainable development but at a local or regional level; A1 represents a world of rapid technological development and economic globalization; and A2 represents a fragmented and regionalized world economy with lower economic growth rates.

[10] Note the large difference between the estimates of Houghton (2003) and the SRES assumed deforestation levels in the 1990s. Canadell *et al*. (2007) estimate land use change emissions in the 1990s to have been about 1.6GtC/yr and 1.5 GtC/yr for the period 2000-2006.

pattern can be seen in the IPCC SRES scenarios (Nakicenovic and Swart 2000) and in later work, for example, by the German Advisory Council on Global Change (WBGU) (Graßl, Kokott et al. 2003).

Figure 4: SRES Deforestation Scenarios



Source: IPCC SRES deforestation scenarios (Nakicenovic and Swart 2000). Note that the SRES assumed deforestation emissions in the 1990s are lower than those estimated by Canadell *et al*. (2007) (1.1GtC/yr vs 1.6 GtC/yr), reflecting improved estimation.

If one assumes that unabated deforestation emissions over the period to 2100 would release in the order of 100 GtC,[11] the resulting additional warming of the climate system would be around 0.15-0.25°C (Hare and Meinshausen 2006). With present warming at around 0.8°C above pre-industrial levels[12] and with a further warming of around 0.6-0.7°C committed due to present GHG concentrations, avoiding additional warming commitments are essential if we are to limit warming below 2°C.

Regional Significance and Distribution of Deforestation Emissions

Regional distribution and overall significance of deforestation emissions are significant factors to be considered when establishing a policy instrument to assist in reducing these emissions. The relative global significance of the extent of a country's deforestation could have a bearing on questions of what level of action countries may need to undertake, and what support may be needed. These questions should be considered in the context of other factors, such as capacity to act, per capita emissions and historical

[11] In carbon dioxide equivalent terms this is ca 367 GtCO2e.
[12] Total temperature increase from 1850–1899 to 2001–2005 is 0.76°C [0.57°C to 0.95°C] (IPCC, 2007).

responsibility. Including deforestation emissions (and removals) in comparative rankings of countries changes the relative ranking of different countries in terms of their present contribution to GHG emissions.

Table 1 lists the top 30 emitters of GHGs[13] with and without the inclusion of Land Use Change and Forestry (LUCF) emissions (or sinks) for the year 2000 (See Annex I of this paper for the complete global list).[14] It demonstrates that the total amount of deforestation emissions from a country can play a large role in determining its overall ranking as a global source of GHG emissions. To take three examples: Indonesia ranks 4th with its deforestation emissions and 15th without, Brazil 5th with and 8th without, and Malaysia 10th with and 35th without.

If all deforesting countries contributed a roughly similar amount to emissions, then this may not be important. Where there is a large asymmetry in the relative distribution of emissions, which in a market perspective can be seen as related to the potential supply of reduction units to a carbon market, a significant design issue exists. Without an adequate allocation system for incentives to reduce deforestation, a few countries may dominate the mechanism, and these countries may over proportionally take up financial resources intended to help reduce deforestation. On a country by country basis, a large asymmetry in the distribution of deforestation emissions exists (Table 2). According to the CAIT database, in 2000 82 countries accounted for less than 20% of global deforestation emissions and two countries for more than 45%. The distribution of emissions may also have a bearing on policy, particularly where the biodiversity protection objective is as important as emissions reductions.

[13] The greenhouse gases included in these calculations are those reported under the UNFCCC (CO_2, N_2O, CH_4, PFCs, HFCs and SF_6) and not those controlled by the Montreal Protocol (Ozone Depleting Substances).

[14] Data from the World Resources Institute CAIT 4 database at http://cait.wri.org/ . LUCF activities reported in CAIT are best estimates of all such activities and are not limited to the Kyoto LUCF activities.

Table 1: GHG Emissions and Land Use Change and Forestry in 2000

Country	GHG (incl. LUCF) Mt CO_2e	Rank (incl. LUCF)	GHG (excl. LUCF) Mt CO_2e	Rank (excl. LUCF)	Source/Sink Mt CO_2e	% of industrial GHG emissions
United States of America	6,469	1	6,872	1	-403	-6%
China	**4,916**	**2**	**4,963**	**2**	**-47**	**-1%**
European Union (25)	4,721	3	4,742	3	-21	0%
Indonesia	**3,068**	**4**	**505**	**15**	2,563	508%
Brazil	**2,222**	**5**	**850**	**8**	1,372	162%
Russian Federation	1,970	6	1,916	4	54	3%
India	**1,849**	**7**	**1,889**	**5**	**-40**	**-2%**
Japan	1,356	8	1,352	6	4	0%
Germany	1,013	9	1,013	7	0	0%
Malaysia	**856**	**10**	**157**	**35**	699	446%
Canada	749	11	684	9	65	9%
United Kingdom	657	12	659	10	-2	0%
Mexico	**623**	**13**	**526**	**12**	**97**	**18%**
Italy	529	14	532	11	-3	-1%
Korea (South)	**520**	**15**	**519**	**13**	**1**	**0%**
France	512	16	518	14	-6	-1%
Myanmar	**508**	**17**	**83**	**48**	425	513%
Australia	496	18	491	16	4	1%
Iran	**484**	**19**	**476**	**18**	**8**	**2%**
Ukraine	482	20	482	17	0	0%
South Africa	**419**	**21**	**418**	**19**	**2**	**0%**
Nigeria	**388**	**22**	**193**	**30**	195	101%
Venezuela	**384**	**23**	**240**	**27**	144	60%
Turkey	376	24	355	22	21	6%
Spain	373	25	382	20	-9	-2%
Poland	371	26	373	21	-2	0%
Congo, Dem. Republic	**369**	**27**	**52**	**75**	317	614%
Saudi Arabia	**354**	**28**	**354**	**23**	**0**	**0%**
Argentina	**344**	**29**	**289**	**24**	**55**	**19%**
Pakistan	**319**	**30**	**286**	**25**	**33**	**12%**

Source: CAIT 4 database available at http://cait.wri.org .

Note: Non Annex I countries are in **bold** type. A negative amount in column 6 (Source/Sink Mt CO_2e) denotes a sink (removal) and a positive denotes a source (emission). The last column shows the LUCF source or sink as a percentage of industrial GHG emissions. This table of the highest 30 net emitters accounts for about 82% of the year 2000 net emissions (84% of industrial emissions) and about 74% of global deforestation emissions.

Table 2: Distribution of Deforestation Emission in 2000

Country's fraction of deforestation emissions	No. of countries in this class	Proportion of global emissions
<0.1%	42	1.3%
<1%	40	15.1%
<10%	14	35.8%
>=10%	2	47.8%
All	98	100.0%

Source: CAIT 4.0 database.

Historical Overview and Present Context for Policy

Deforestation and the related emissions have been an important part of the scientific and political discussions since the beginning of the formal international climate convention discussions in 1990, both because of the magnitude of emissions and because of the adverse biological and other consequences of deforestation. During the Rio Process many industrialized countries and analysts raised this issue, in an attempt to obtain resources to curb deforestation. Many countries challenged these attempts to include deforestation obligations in the climate regime, and effectively prevented any serious discussion of how to deal with this question within the context of the UNFCCC, or elsewhere. The general commitment of all Parties to the UNFCCC to protect and conserve reservoirs of carbon (Article 4.1(d)) is all that remains from these efforts. However, even this obligation has clearly not been fulfilled.

The issue arose again in the context of the Kyoto Protocol negotiations in a different way, with some proposals to permit industrialized countries (Annex B of the Kyoto Protocol)[15] to obtain credits for avoided deforestation[16] projects towards their emission obligations. The benefits of this idea were argued to be the protection of biodiversity and the low cost of carbon credits supplied from avoided deforestation projects (Kremen, Niles et al. 2000). The main disadvantages of the project-based approach related to questions about its overall efficacy in achieving biodiversity objectives when deforestation activities could simply move outside of the project boundaries. Avoided deforestation projects are intrinsically subject to leakage and baseline uncertainties (what would deforestation have been in the absence of the projects), with the former potentially undermining "net" gains in biodiversity protection, and both reducing the potential for the emission credits obtained to reflect real overall emission reductions (Richards and Andersson 2001; Richards and Stokes 2004).

Questions arose as to the implications of the scale of the likely credits from project-based avoided deforestation crediting approaches in relation to efforts to reduce fossil fuel emissions when combined with their low cost. The low costs of these credits would have

[15] Annex B Parties are those industrialized countries that have Quantified Emission Limitation or Reduction Obligations or Commitments (QERLOs) under the Kyoto Protocol.
[16] Avoided deforestation refers to reducing deforestation relative to an assumed baseline, i.e. avoiding deforestation that would have otherwise happened.

had the effect of decreasing investments in reducing emissions in industrial sectors, without a corresponding unambiguous benefit to overall greenhouse gas reductions (Lashof and Hare 1999). This latter problem was argued to be quite substantial with respect to the joint emission reductions from fossil fuels and industrial sources and from deforestation required to limit warming to low levels approaching the European Union's 1996 target of 2°C (Lashof and Hare 1999). As a consequence of these and other considerations project-based, avoided deforestation activities were not included in the Kyoto Protocol at the time of its adoption in 1997. Efforts during the negotiations of the Marrakech Accords for avoided deforestation projects to be an eligible activity within the Clean Development Mechanism (CDM) also failed, ultimately for the same reasons.

During the Kyoto Protocol negotiations (1995-1997), many Annex B Parties sought to receive credit for the removal of carbon through, so-called, sinks in the Land-Use, Land-Use Change and Forestry (LULUCF) sectors of their emissions accounts. The result of these discussions was ultimately codified in Article 3.3 of the Kyoto Protocol, which requires that Annex B Parties account for their afforestation, reforestation and deforestation activities from 1990 onwards. Article 3.3 created a disincentive for Annex B Parties to deforest their own territories, with increased deforestation exacting a strong penalty on that country. Article 3.4 provides for the voluntary inclusion of different kinds of activities, such as forest management and agricultural soils. These activities, once nominated by a Party, must be included in their accounting systems and are counted towards compliance. Under Article 3.7, a country with a net source from its entire IPCC Land-Use Change and Forestry reporting category in its base year is allowed to add land use change emissions (LUC)[17] (IPCC 1996) to its Annex B assigned amount, effectively increasing its allowed industrial emissions (the basis for the assigned amount).[18]

With the entry into force of the Kyoto Protocol in February 2005, discussions began in earnest on international climate action after the first commitment period of the Protocol ends in 2012. At the 11th Conference of the Parties to the UNFCCC (COP) and the 1st Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP) in Montreal (November 2005), a number of developing countries tabled a proposal for action on deforestation.[19] Specifically, Papua New Guinea (PNG) and Costa Rica proposed to include addressing emissions from deforestation under the Convention using a national emissions approach. This was welcomed by many Parties and Observers primarily because of the new focus on a national emissions approach which resolved some of the outstanding issues from the previous 'avoided deforestation' discussion. The key to the success of the PNG and Costa Rica proposal will be the development of a mechanism that can deliver an appropriate level of financing to reduce deforestation. In this context, the entry of deforestation reductions into the international carbon markets was put forward as an option. As will be discussed below there are, however, many

[17] Land Use Change emissions include deforestation and the removals by processes such as woody vegetation encroachment on abandoned land, as defined in the IPCC 1996 Reporting Guidelines (IPCC, 1996).

[18] These are the countries that could use Article 3.7: Australia, Denmark, Ireland, Netherlands, and the United Kingdom of Great Britain and Northern Ireland.

[19] *Reducing emissions from deforestation in developing countries: approaches to stimulate action: Submission from Parties*, available at http://unfccc.int/resource/docs/2005/cop11/eng/misc01.pdf .

unresolved and indeed fundamental risks that make these market proposals problematic at best.

Many proposals have been put on the table for reducing emissions from deforestation consisting of both market and non-market options, voluntary participation and a requirement for deeper Annex I emission reductions targets.[20] However a number of issues still remain with regard to the scale of emission reductions, technical, scientific and methodological issues, as well as the general design of any mechanism to reduce emissions from deforestation. These issues will be explored further in the following section.

Part II: General Issues in Designing a Mechanism

It appears possible to design a mechanism to reduce emissions from deforestation through a national emissions approach that **simultaneously** provides effective incentives to reduce deforestation emissions and forest degradation, reduces biodiversity loss and protects forest livelihoods and values; however a number of issues will have to be addressed in order to achieve these goals. These issues are fundamental to achieving the climate, biodiversity and equity objectives, and will be important in whatever mechanism is chosen to reduce emissions from deforestation. The scientific, technical and methodological issues include: scale of implementation, leakage, uncertainties in deforestation emissions, baselines, monitoring and verification, permanence and accounting and are explained in greater detail below. Furthermore, consideration must be given to the needs, rights and concerns of indigenous peoples and local communities, ensuring the highest protection of biodiversity, as well as ensuring that a mechanism allows for the broadest participation by eligible developing countries. The drivers of deforestation, though difficult to identify and address, also need to be considered. Geist and Lambin (2002) have identified both proximate and underlying forces for tropical deforestation in varying geographical and historical contexts. They conclude that no one policy for reducing deforestation exists.

A mechanism to reduce emissions from deforestation must deal with two broad classes of deforestation-related policy problems:

- Reducing, and ultimately, halting deforestation: This class of problem lends itself fairly readily to treating deforestation as an emissions problem and connecting it in some way to the UNFCCC and Kyoto Protocol emissions control architecture, so as to provide the incentives needed to reduce emissions. Different choices in the emissions reporting architecture can affect the relative efficacy of achieving biodiversity objectives.

[20] A narrative of each of the various other proposals put forward by Parties and NGOs, as well as a comparative table are included in Annex II to this paper for reference.

- Protecting extant forest in regions where deforestation is low, starting to occur or is not active but imminent in the future: In this case forests may be protected but local authorities struggle with insufficient resources or capacity to adequately safeguard them and are unable to provide incentives for them to be maintained. This issue does not lend itself as easily to an incentive system based on reduced emissions (unless one assumes that a baseline reference case is the removal of these forests, which would create perverse incentives to inflate the baseline deforestation), but is nevertheless an important problem.

Scale Effects of Deforestation

Directly connecting efforts to reduce deforestation to the Kyoto trading system carries with it a large risk that high volumes of low cost deforestation credits will enter the market, increasing supply and lowering the price. This has been termed the "*scale effect*" and poses a substantial risk of destabilizing the carbon market. Other issues, such as emissions uncertainties and permanence concerns, which would also affect the stability of the carbon market, are discussed below.

Meeting a climate target, such as the EU 2°C goal, means that substantial emission reductions have to be made from both the energy and industrial sources of greenhouse gases as well as from deforestation emissions. Less action on deforestation requires more action on energy related emissions and vice versa. In an ideal world, if emission targets are set appropriately and, in so doing, all relevant uncertainties accounted for, it would be plausible that all sectors could be included in the same carbon market and units generated by each sector could be fully fungible. In such context there would be the ability for trade-offs between the sectors. In other words, if one could obtain credits for more rapid reduction in deforestation rates than the agreed deforestation targets, then there would be less rapid reductions in energy-related emissions.

However, there is a clear and significant risk that emission reduction targets would not be set appropriately and that the uncertainties peculiar to the accounting of land use change emissions would not be accounted for properly and fully. The end result of a fully fungible system between fossil fuel and industrial emissions and those from deforestation is likely to be less action on fossil fuel and industrial emissions than is necessary to meet the climate goals. For example, if deforestation credits were awarded with respect to a business as usual baseline, and allowed to be added to the emission allowances of industrialized countries, much higher fossil fuel emissions than would have otherwise happen will occur. There will be enormous pressure to do just this in the negotiations on deforestation in the post-2012 system, as there was during the Kyoto negotiations.

The Kyoto Protocol is based on an international emission trading system and domestic implementation systems (which may also be based on emissions trading). Putting a price on carbon is the main effective signal to the market to invest in lower carbon technologies. Weakening of this price signal reduces the incentive to invest in cleaner technologies.

The scale effect and a number of other factors militate strongly against the establishment of deforestation reductions, and the units generated from this sector, as a fully fungible part of the international trading system. The policy dilemma however is that the carbon market offers perhaps the only visible source of sufficient funding that comes close to matching the resources required to reduce deforestation significantly and quickly. The Mechanism proposed below addresses this dilemma and proposes a hybrid market-linked fund.

Volume and Reliability of Financing

To significantly reduce deforestation, reliable funding must be available to a substantial number of the developing countries in which tropical deforestation occurs. Estimates of the volume of funding required to significantly reduce deforestation vary by region and with the economic accounting framework used. The costs depend on many factors including the cause of deforestation; the opportunity cost of forests and positive incentives paid to the individual or institutional landowner to change land practices (Karousakis 2007). The Stern Review on the Economics of Climate Change (2006) argued that the opportunity cost of forest protection in eight countries, accounting for 70 percent of the emissions from deforestation, amounts to approximately US$5 billion per annum at present, and will increase over time. Obersteiner *et al*. (2006) have argued that the total volume of funds required to reduce deforestation by 50% globally is around US$33 billion annually. A report prepared for the UNFCCC found that an indicative estimate of the cost of reducing deforestation and forest degradation in non-Annex I Parties to zero in 2030 is US$12 billion (UNFCCC 2007).[21] Regardless of the estimates used, it is clear that large multi-billion dollar flows will be needed on a regular and reliable basis to provide the incentives necessary to bring down the rate of deforestation as well as provide support for national capacity building, monitoring and verification systems. It is also clear that public sector funds are limited and not sufficient to address a problem of this scale as has been seen in other international treaties relying on voluntary action.

Two possible financing options have been proposed: establishing a fund or raising capital through the carbon markets. Hybrids of these two options also exist (one such mechanism is elaborated on in Part III of this paper). A system based on incentives through a fund would be simple to design and implement. A country may prefer to deal with the prospect of a default on obligations through agreements with international financial institutions rather than through the carbon market. For example, under the carbon market approach a country would likely have to purchase credits at the market rate to replace credits lost if they failed to meet their deforestation emission obligations. However, a fund would provide little incentive for developed countries to contribute, as they obtain nothing in return. The concern with funds is that voluntary contributions of public funds are limited and unlikely to be able to provide the resources needed for a problem of this size. Furthermore, a robust monitoring and compliance mechanism

[21] The report is available at http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/background_paper.pdf .

would be necessary to ensure that funds are used for addressing deforestation and yield positive results.

The potential payoffs of a carbon market may be greater; however, the threshold for meeting the minimum essential capacities needed to participate in the market is also higher. Access to a trading system on a fully fungible basis would require high levels of monitoring, reporting, and verification standards and implies adherence to a binding compliance system. This triggers some concerns about equity, as many countries will lack the capacity and means to participate in a market system. Allowing deforestation credits to enter the Kyoto trading system directly, on a fully fungible basis, entails a broad array of risks (Schlesinger 2006). If requirements for deforestation credits were less than those for the other types of credits in the trading system, they would destabilize the carbon market by undermining its environmental integrity. In practice, only a few developing countries may be able, or are willing, to meet these requirements. If a sound and strong carbon trading market is to be built and maintained, then a deforestation reduction mechanism cannot be substantially, let alone, exclusively based on fully fungible trading of deforestation units, otherwise it would exclude a large number of these countries: an unacceptable and inequitable outcome.

For those countries that have the capacity and are willing to accept the stringency of market access there are advantages that could outweigh the disadvantages. For those countries in which deforestation occurs willing to accept Kyoto Protocol Annex B type compliance provisions and for whom emission monitoring and verification can be achieved at the required level, there is no compelling legal or political objections to allowing access to the carbon market, given that deforestation is already included in Annex B commitments under Kyoto Protocol Articles 3.3 and 3.7.[22]

Another financing question is how other market impediments are effectively removed (e.g. agricultural subsidies) which will impact on a country's ability to reduce deforestation (Karousakis 2007). A report from Jubilee Australia (2007) identifies that deforestation in the Asia-Pacific region is a direct consequence of the expansion of the exploitative industry and that International Financing Institutions (IFIs) have encouraged developing nations to adopt this exploitative behaviour, causing adverse social and environmental impacts. A number of governments have adopted laws to protect forests, but all developing country governments need to look at national policies and measures to ensure effective governance for forest protection.

Leakage

Leakage occurs where an activity stopped in one place moves to another, with overall emissions either unaffected or not reduced as much as in the absence of leakage. Project-based and sub-national level activities (where activities are undertaken in states or provinces) are also prone to significant leakage effects. Leakage may occur, and in many cases is likely to occur, across international boundaries. Where deforestation has been

[22] Kyoto Protocol Article 3.3 accounts for afforestation, reforestation and deforestation; Article 3.7 provides for countries with a net source from land use change and forestry in 1990 to add to their land use change in the base year to their allowed emissions. See page 28 of this paper.

stopped in one country, due to the dynamics of commodity markets for products, such as soybean, palm oil and beef, or shifting settlement patterns, it may occur in another country where such patterns cross national boundaries.

Adopting a national-level approach to reducing deforestation will reduce leakage within a country, but is unlikely to address leakage that occurs at the international level. Deforestation is not reduced if protecting forests in one country merely leads to increased logging in another. As a consequence, a deforestation reduction mechanism needs widespread participation by countries with tropical forests in order to reduce leakage of activities as much as possible.

National Emissions Approach

A national emissions approach substantially reduces problems relating to leakage (but does not eliminate them). It also reduces the baseline or additionality issues, although they remain formidable. Substantial issues still remain, however, as data quality is often not good; baseline deforestation rates are not well-known; emission factors are not well understood at present; risks of adverse changes in carbon stocks due to climate variability and climate change; and land tenure questions for land holders and indigenous people would need to be addressed. The benefits of a national approach include: unambiguous benefits for biodiversity protection, if emission reduction targets are met and exceeded and a high likelihood of real, verifiable and monitorable emission reductions that would contribute to the overall aim of stabilizing CO_2 concentrations. The focus on emissions from forests at the national level would also provide incentives to reduce activities that degrade forests. A focus on capacity building for countries to develop a national approach is essential for any mechanism, particularly to build national institutional capacity and legal frameworks to monitor and protect forest areas.

Emissions Uncertainty

A high degree of uncertainty exists in relation to the actual rate of deforestation and the consequent emissions (Achard, Eva et al. 2002; DeFries, Houghton et al. 2002; Houghton and Hackler 2002; House, Prentice et al. 2003; Achard, Eva et al. 2004; Ramankutty, Gibbs et al. 2007). Detailed forest biomass studies have not been conducted in all tropical forest countries, which makes estimating different carbon pools (above-ground biomass, below-ground biomass, dead wood, litter, and soil organic matter) problematic. Below ground biomass losses from deforestation would need to be included in the estimates of deforestation emissions to ensure that all important emission sources are accounted. Technological and forest monitoring capacity, and capacity to govern forested areas vary significantly between tropical countries with large forest tracts and/or high emissions from deforestation (DeFries, Achard et al. 2007).

With varying degrees of predictability, deforestation rates in a given country also vary from year to year in response to a range of factors. For instance, deforestation rates in the Brazilian Amazon decreased by about 30% in 2004-2005, compared to 2003-2004. Yet, even with a 30% reduction, this translates to about 1.9 million hectares of destroyed forest and at least 190 million tons of emitted carbon. Historical trends for Brazil show that deforestation rates can rise and fall dramatically without ever reaching a rate that

could be considered low. Part of the reduction in deforestation rates in Brazil can be attributed to improved law enforcement and governance. However, international resources are needed to protect forests not only in Brazil, but in any tropical country where forest destruction rates are high.

Baselines and Reduction Levels

There are two broad issues surrounding the question of baselines for measuring and assessing progress as a basis for providing incentives to reduce emissions. The first, and simpler, issue is the estimation of emissions for a historical base period to establish an emissions baseline against which future emissions can be compared with confidence. Establishing credible historical emission baselines from which to estimate reduced deforestation will likely be difficult, due to the poor quality of data and the lack of comprehensive monitoring in many countries, which may inhibit the involvement of countries with low rates of deforestation, thus raising possible equity concerns.

The second and perhaps more fundamental issue is the question of whether or not to use a projected future reference baselines for deforestation emissions to estimate and reward reductions. An increasing reference baseline would imply an assumption of continuing deforestation and a built-in incentive to inflate such reference baselines: the higher the reference baseline assumed, the easier it would be to generate "reductions" and hence rewards. A decreasing reference baseline is also not without significant issues, and could easily be manipulated to exaggerate emissions in the absence of policy interventions. As can be seen from the SRES scenarios in Figure 4 above, there is a wide range of deforestation scenarios absent specific policies considered plausible in the scientific literature. There is no easy and perfect solution to this set of problems, as reference baselines are essentially counterfactual. Neither approach is ideal. However, reduction measures with respect to minimum levels over the last few decades would usually produce an unambiguous benefit through real reductions. Thus, a reference approach based on well-established historical emissions is to be preferred. See below for a short case study on the implications of different baselines in relation to historical deforestation data for the Brazilian Amazon.

Adopting a conservative approach to establishing country-specific historical emissions baseline and requiring that future emissions are progressively reduced below this level in order to generate continuing incentives is a likely key to success. In effect, this would require countries to make a fair effort, relative to their economic and other circumstances, to reduce their own emissions before they receive credit. It is important that any mechanism does not create incentives to increase the rates of deforestation before the system starts. Once a country has entered the system and has started receiving incentives for reducing emissions, it is fundamental that emissions are not increased above the agreed levels in future periods. Agreed reduction levels would also need to be increased at each time period in order to prevent the system from merely slowing and deferring deforestation. Reductions would also need to reflect the increasing responsibility of countries to reduce emissions, as their economic circumstances and the global climate regime evolve.

Baseline Issue – A Brazilian Amazon Case Study

The problems involved in determining a baseline from which to impute reductions of emissions to determine the level of action that can be rewarded or incentivized can be illustrated by the example of the Brazilian Amazon. Figure 5 shows a time series of historical deforestation data compared to averages over different periods (last 19 years, last 10 and last 5 years), and with the trends over the same periods projected to 2020. A future baseline based on the trend of the last five years (2002-2006 trend) would end deforestation in 2014. Whilst this would be a very desirable outcome, environmentally it provides virtually no incentive for action if used as a reference case from which to calculate emission reductions to be rewarded. A reference case based on the last ten years as advocated by some (Brown, Hall et al. 2007) (1997-2006 trend projected) would increase deforestation rates towards the historical maximum by 2020 and, if used, would reward continued deforestation at above present levels.

Table 3: Average Deforestation Rates – Brazilian Amazon

Period	Average loss (km2/yr)	Rate of increase (decrease) (km2/yr/yr)

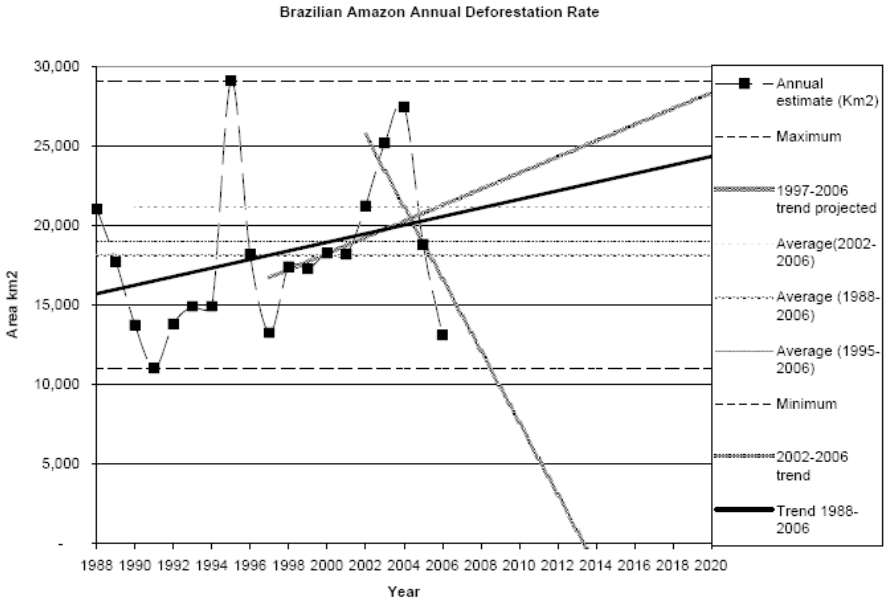


Figure 5: Historical Deforestation in the Brazilian Amazon, 1988-2006. Historical deforestation rates are shown in area of forest lost per year. Maximum and minimum rates over the period are shown along with average losses for the entire period, the last ten years (1997-2006) and the last five years (2002-2006). In addition, the trends over each of these periods are projected to 2020. It can be seen that there is no ideal baseline based on trends or averages over the recent period that would, with confidence, provide a robust estimate of emissions reduced or avoided from a reference baseline of projected emissions. Source: Brazilian Institute of Space Research (INPE) - Brazilian Amazon Monitoring by satellite

Monitoring and Verification

In order to provide the correct signals to countries, and to ensure that there is compliance with agreements, there will need to be rigorous, solid and reliable monitoring and verification of actions to reduce emissions. At present, arguably, there is not yet adequate monitoring and measurement of deforestation for these purposes; hence any system would need to rectify this situation. Consistent monitoring systems that meet a set of internationally agreed standards will need to be established in developing countries to ensure the integrity of emission reductions from deforestation. An important issue relevant to policy design is the relative stringency of emissions monitoring and verification requirements. A higher level of stringency would provide higher confidence in outcomes, but would only be appropriate for some countries and not for others. With an incentive system oriented around emission reductions the volume of reductions accounted and payments made for these on a unit basis would need to be related to the stringency and accuracy of the emissions monitoring and verification applied by each country. An effective monitoring and verification system is an integral part of an effective mechanism to reduce emissions from deforestation.

Permanence

Any mechanism developed to provide incentives to reduce emissions from deforestation needs to ensure that reductions are permanent and that where this is not the case, for whatever reason, corrections can be made. Where emissions are the main metric, there are a variety of tools that can be used to insure against a loss of permanence (e.g. inadvertent loss of carbon from forest fires, forest degradation and decay, or an increase in deforestation emissions above the agreed level for a country). Tools include insurance facilities, discounting, and setting aside agreed proportions of the emissions reductions generated, all of which could be used in a fund or a market-based approach to reward reductions in deforestation. For purely market-based approaches, there would also need to be a liability component to the system.

Accounting

It is important that the accounting system for deforestation emissions provides incentives to protect forest and to reduce emissions; hence the overall methodological approach should ensure that only the carbon losses from deforestation activities are taken into account in the estimation of emissions and not any potential carbon gains resulting from subsequent land uses. In this context, a "gross" emissions accounting approach would deal directly with deforestation losses and is preferable to a "net" accounting approach. The latter has the potential to permit ongoing deforestation at a national level where for example, plantations on formerly deforested land are sequestering large amounts of carbon. At best the net approach would result in a weaker incentive to reduce and stop deforestation compared to a gross accounting approach focused on deforestation activity as a source of emissions only.

Forest degradation, which is often a precursor to deforestation, is also an issue which needs to be addressed. However, technical and definitional problems associated with degradation pose challenges to its inclusion in a mechanism for the second commitment

period. Nevertheless, there is a risk that without proper accounting of the effects of degradation substantial releases of carbon could occur from forests for which rewards have been given for protection (Karousakis, 2007).

At present, discussions are focused on accounting for carbon emissions from above ground carbon stock only, as there are a number of difficulties with measuring soil carbon. However, for a number of South-East Asian countries, a significant source of GHG emissions comes from the deforestation and the drainage of peat lands. In South East Asia, 12 million hectares (45%) are currently deforested and mostly drained (Hooijer 2006). In countries such as Indonesia, a significant source of greenhouse emissions from deforestation comes from peat lands and palm oil production is one of the major drivers of their deforestation. Therefore it is essential that a mechanism to reduce deforestation includes incentives to ensure the protection of peat land forests.

A full-carbon accounting approach has also been proposed where all fluxes of greenhouse gases and stocks of carbon are accounted across a national territory. Whilst there are a number of legal, technical, political and scientific problems that still need to be resolved (Persson and Azar 2004), including very large inter-annual variability in carbon fluxes (Tian, Melillo et al. 1998; Tian, Melillo et al. 2003), a fundamental problem with this accounting approach is that it would permit the accounting of sequestered carbon on already cleared land and reduce or pervert the incentives to reduce deforestation,

Rights of Indigenous and Forest Peoples

Any mechanism which reduces emissions from deforestation must take into account both in principle and in its operation the rights of forest and indigenous peoples. Some of the current proposals make mention of the need to include local communities, however there is a real risk that an international agreement will do nothing to benefit indigenous and forest peoples.

The land and resource use rights of many indigenous peoples have frequently been usurped or grossly infringed in the past (May, Boyd et al. 2004; Coalition 2006; Griffiths 2007).[23] A concern is that by ascribing a carbon value to natural vegetation, the land and resource use rights of indigenous people may again be forfeited, even if the vegetation is conserved. At a minimum, indigenous and forest people may not receive an equitable share of the value of the carbon.

Due regards needs to be given to rights, social and livelihood issues in order to avoid land conflicts, exclusionary models of forest conservation, violations of customary land and territorial rights. Clear provisions would need to be established that respects the UN Declaration on the Rights of Indigenous Peoples.[24] In particular, land and resource use and ownership rights of indigenous and forest peoples' needs to be recognised. Discussions on policies and future mechanisms must empower these people to be directly engage in international and national processes on future mechanisms and approaches to

[23] http://www.wrm.org.uy/GFC/CANNOTSAVEIT.pdf
[24] http://www.iwgia.org/sw248.asp

reduce deforestation. Human rights, free prior and informed consent, equitable benefit sharing, respect for traditional knowledge, and land tenure security all need be central components of policy discussions on reducing emissions from deforestation.

Prioritising High Biodiversity Value Forests

Biodiversity conservation should be a guiding principle for any mechanism developed to reduce emissions from deforestation. Intact forest landscapes and other natural forests with high biodiversity values (HCV) should be given priority for protection under deforestation reduction incentive mechanisms (Greenpeace 2006). In order to ensure the protection of these key biodiversity areas, as well as other multiple benefits (social and environmental) arising, it is important to guarantee that funds are being spent appropriately, and that solid investments are made on strengthening governance, conservation policies and high quality monitoring systems from reducing deforestation. It will therefore be necessary to include strong environmental and social principles and criteria to adhere to in order to be eligible for funding under a mechanism. These criteria should be developed which are consistent with the Convention on Biological Diversity (CBD) in order to ensure the full benefits to forest biodiversity. For example, standards for ensuring biodiversity protection could be defined by building on the high conservation value forests (HCVF) concept as defined by the Forest Stewardship Council.[25]

In order to ensure the widest participation of countries, and to increase the incentive for best practice, countries would receive funding once they have demonstrated that they meet the minimal criteria. Funding could increase depending on achieving the higher levels of standards, thereby providing countries extra incentives to protect and conserve their HCV forests. These criteria should therefore be incorporated into the institutional design of a financing mechanism to reduce emissions from.

Discussion

Under the Kyoto Protocol, deforestation is already included in Articles 3.3 and 3.7, taking a national approach to reduce tropical deforestation emissions is possible if, and only if, a non-Annex I Party is interested in making a declaration under the Convention that it intends to be treated as an Annex I Party.[26] The Party would then propose a target and Annex B is amended accordingly. In this case the relevant Article 3.7 provision would apply to the calculation of the initial emissions allocation of the Party and Article 3.3 would register emissions from deforestation during the commitment periods. It appears unlikely at present that one of the major non-Annex I Parties with deforestation emissions would choose such a route to entry, although it would be feasible for some

[25] http://www.fscus.org/

[26] Article 1.7 of the Kyoto Protocol states that a Party that has made a notification under Article 4, paragraph 2(g), of the Convention that it intends to be bound by the provisions of the Convention relating to Annex I is for the purposes of the Protocol an Annex I Party. The COP/MOP would then have to agree on a target (most likely, an increase in emissions above 1990 levels for a developing country) and amend Annex B accordingly.

(e.g. Brazil or Costa Rica). Another route is a project based approach, however there remains significant challenges with regard to project based activities which do not provide any benefits for the climate or biodiversity.

A number of problems associated with a purely market approach have been identified, including:

- Large amounts of carbon credits from reduced deforestation would reduce the incentive to invest in energy sector changes which are critical to stabilizing CO_2 concentrations;
- Risks from adverse changes in carbon stocks due to climate variability and climate change;
- Substantial data gaps;
- Substantial monitoring requirements in order to ensure that verifiable emission reductions occur and the means for this are, at present, not available in the vast majority of countries (These issues are not limited to resource availability needs alone); and
- Land tenure questions for land holders and indigenous people would need to be addressed.

The conclusions of the preceding analysis show that including deforestation reduction credits in the international trading system on a fully fungible basis has large risks. In any event, a market system would not be open, in the foreseeable future, to all countries in which deforestation occurs due to capacity limitations in relation to the fundamental issues of the scale of credits, emission monitoring, verification and compliance, or in relation to governance issues. As it appears very likely that the great majority of countries in which deforestation occurs are unlikely to be in a position to meet these requirements a mechanism that provides for the broadest range of options is needed. Part III of this paper provides an option for a national mechanism which allows all tropical deforestation countries to participate, even with their varying levels of capacity.

Part III: A Tropical Deforestation Emission Reduction Mechanism

The concept developed here for a *Tropical Deforestation Emission Reduction Mechanism* (TDERM) under the UNFCCC and the Kyoto Protocol, attempts to address many of the issues discussed in Part II of this paper. The purposes of this mechanism is to fund sustainable and lasting reductions of emissions from tropical deforestation in participating countries to meet **both** climate and biodiversity objectives in the second commitment period of the Kyoto Protocol and beyond. The operationalization of the mechanism needs to ensure that clear provisions are established that recognise indigenous and forests peoples' rights to forest resources and ensuring equitable benefit sharing with them in relation to those rights.

Major Elements

The major elements of the proposed *Tropical Deforestation Emission Reduction Mechanism* are:

- *New international trading unit*. A new Tropical Deforestation Emission Reduction Unit (TDERU) would be created for use in the Kyoto trading system by Parties to meet their obligations. The new units (TDERUs) would be issued by the proposed *Tropical Deforestation Emission Reduction Mechanism*. The new unit would have several important properties and limitations.
- *Mandatory minimum*. Annex I Parties would be required to purchase and to hold a minimum amount of TDERUs, equivalent to X% of their base year emissions (times the number of years in a compliance period – 5 years).[27] The upper limit would make transparent the scale issue and the lower limit would ensure that the Mechanism was subscribed to with a significant volume of funds.
- *Limit on supply*. The supply of TDERUs would be limited to an agreed maximum percentage (Y%) of Annex I base year emissions to be issued annually. The Y% limit would need to be set to ensure sufficient funds were available to progress towards the objective of substantially reducing deforestation. Table 4 below shows that for a relatively low carbon price in the Kyoto second commitment period of €20/t CO_2e, a 3% limit could generate around €14 billion/year.
- *Sale price set by auction.* The price of TDERUs could be determined by auctioning or by setting a price linked to the world market price for Kyoto units.[28] To ensure the smooth operation of the new Mechanism, it could be required for compliance purposes that an Annex I Party hold an increasing fraction of its required minimum TDERUs at the end of each year.

[27] For a five year commitment period the total amount TDERUs required to be held would be 5 x X% of the base year emissions.

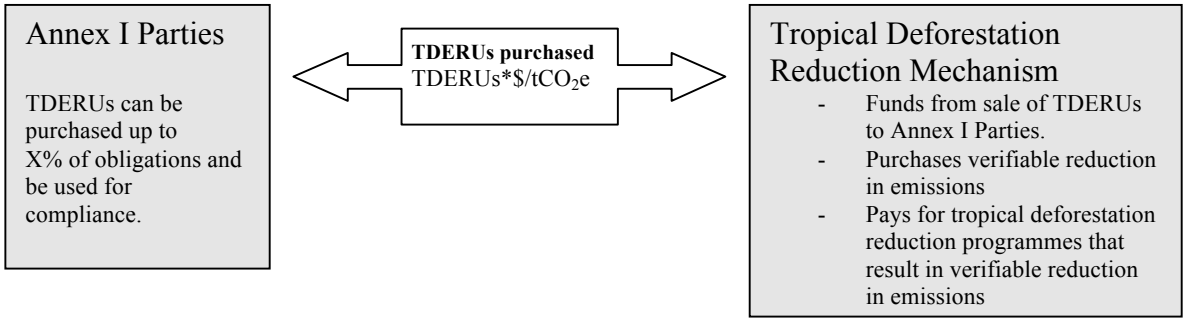
[28] The restriction to Kyoto units rather than broader possibilities is by design: The link between Annex I emission obligations and the usage of TDERUs is an intrinsic element of the mechanism proposed.

- *Proceeds of TDERU sales used to reward or incentivise reductions in all eligible countries*. The Mechanism would use the proceeds from the sale of TDERUs to reward and incentivise deforestation reduction activities in all eligible developing countries, through modalities tailored for the wide range of different capacities of countries. Incentives would be linked to the achievement of verifiable emission reductions by the deforesting country. The modalities and rules for rewarding and incentivizing countries would ensure that funds would be distributed to the appropriate stakeholders to ensure both equitable benefit sharing and to ensure that these stakeholders are provided with the right incentives to maintain forests.
- *Portfolio performance approach to overall emission reductions.* The Mechanism would be required to reduce deforestation emissions (measured in CO_2equivalent tonnes) by a multiple of the total TDERUs issued as a portfolio of its overall activities. The overall discount[29] factor is a key policy decision for the mechanism and hence of its governing body. The requirement for a discount factor is motivated by several factors:
    - Account for uncertainties in emissions, baseline uncertainties and permanence risks.
    - Within the portfolio performance approach it would enable the Mechanism to expend resources on preventing deforestation in countries where it is not yet a large problem, yet still yield a substantial emission reduction from the entire portfolio of activities.
    - There is a large and significant difference between the cost of reducing industrial emissions and the cost of reducing deforestation. As a consequence it is very likely that there will be significant difference between the price obtained for a TDERU (€/tCO_2e) and the average cost of reducing deforestation.
- *Pre 2013 incentives.* In order to provide incentives before the end of 2012 the TDERM could be established latest by 2009 and be authorized to issue for sale a limited volume of TDERUs ahead of the beginning of the second commitment period in 2013. For example forward sale of TDERUs equivalent to 0.5% of Annex I base year emissions at a price of €20/tCO_2e could raise over. €2 bn/year. Sufficient progress could be made in developing the mechanism within a year that could justify holding an initial auction of TDERUs by the end of 2008. The focus on the pre 2013 work should be on institutional capacity building and monitoring and verification, as well as pilot initiatives to implement actions at the national scale.
- *Governance structure.* The complexity of the deforestation issue and the volume of funds that is required dictates that a robust governance system under the authority of the COP and/or COP/MOP is established to make decisions on policies, procedures, guidelines and criteria for incentivizing and rewarding reductions in deforestation emissions. Hence the TDERM proposal needs a governance structure which will support the operationalization of the mechanism. Overall policy would be established by the COP and/or COP/MOP.

[29] This is sometimes referred as discount factor in relation to deforestation credits in other policy models.

A schematic of the operation of the mechanism is shown in Figure 6 below.

Figure 6: Operation of Tropical Deforestation Reduction Mechanism



Hybrid Market Linked Fund

Under the mechanism the core funding for forest protection would come from a mandatory minimum contribution from Annex I Parties to meet a percentage of their emission reduction obligations. A new unit for Annex I countries to be used for compliance with emission obligations would be created – "Tropical Deforestation Emission Reduction Units (TDERUs)" set at a market rate by the *Tropical Deforestation Emission Reduction Mechanism.* The unit prices paid by Annex I Parties for TDERUs could be set by auction or in some other way that links the price to a measure of the world market price for Kyoto units at the time of sales. The proceeds of the sale of TDERUs would be used by the TDERM to fund and reward reductions in emissions from participating developing countries. The TDERM itself would require a governance mechanism to decide upon the rules and modalities for the disbursement of these funds and this is discussed below.

The establishment of a new unit whose price is linked essentially to the prices of industrial greenhouse gas units provides avoids the negative scale effects on the carbon market of large volumes of deforestation credits sold on the open market (which would likely lower the overall price of units and undermine efforts to invest in cleaner energy technology). On the other hand the revenue from the sale of the TDERUs should provide a solid and reliable source of funding for developing nations with tropical forests.

In order to guarantee a volume of funds, Annex I Parties would be required to meet a fixed part of their emissions obligations (X%) using TDERUs purchased from the mechanism. No strong recommendation here is made for 'X' except that it needs to be set at a level that ensures sufficient funds to significantly reduce deforestation and that the setting of this number needs to be done in conjunction with the establishment of the post-2012 emission reduction targets on industrial greenhouse gases for the Annex I as whole to address the 'scale effect'. Table 4 shows a simple calculation, assuming a carbon price of €20/tonne CO_2, a 2% level could generate on the order of €9 billion/year.

In addition to the mandatory level of contributions (X%), Annex B Parties could elect to purchase and hold up to a maximum of Y% of their base year emissions by purchasing TDERUs from the Mechanism. As for the 'X', 'Y' would need to be determined after analysis of the likely funding requirements for deforestation reductions and the Annex I targets as whole would also need to have accounted for a likely usage rate by the Annex I Parties of this option. The setting of an upper limit on the amount of TDERUs that can be used towards compliance with emission obligations by Annex I Parties would transparently address the scale effect issues discussed previously.

An important property of the TDERUs proposed here is that they would in effect be a hard currency for compliance purposes, irrespective of the performance of the mechanism in actually reducing emissions from deforestation. The Mechanism would however be required to disburse its funds for verifiable reductions in deforestation emissions by developing countries, who participate according to their differentiated capacities.

Table 4 shows some illustrative examples of the value of TDERUs for different percentage assuming AAU prices of 20 €/tCO_2e in 2013-2022.[30] This table also shows the deforestation emission reductions that would be leveraged by the TDERM with a cost differential of between 2 and 5 between the assumed TDERU issue price and the cost of reducing deforestation in different regions.[31]

Table 4: Illustrative Examples of Values of Different TDER Limits

% of 1990 base year Annex I industrial gas emissions (22.8 $GtCO_2e$/yr)[32]	Value of TDERUs € Bn/yr at 20€/tCO_2e	TDERUs allowed $MtCO_2e$/ yr	Actual deforestation emission reductions $MtCO_2e$/yr (Discount factor 3)	Deforestation reduction (in million hectares)[33] (550 tCO_2e/ha)	% of deforestation reduction in comparison to average[34]
1%	4.6	228	685	1.24	10%
2%	9.1	456	1369	2.49	19%
3%	13.7	684	2054	3.73	29%
4%	18.2	912	2738	4.97	38%
5%	22.8	1140	3423	6.22	48%

The relationship between the Y% limit on issuance of TDERUs, price and the total volume of funds available is shown in Figure 7. A higher expected price for TDERUs

[30] Estimates of permit prices at global level vary substantially depending upon the assumed targets, economic growth rates and the model used. The assumption here is at the lower end of the range in the literature for emission trajectories that get to below 450 ppmv CO_2e.

[31] IPCC AR4 suggests that costs for reduced deforestation are much lower than the assumed unit price for TDERUs assumed here (20€/tCO2e). Assuming costs of reducing deforestation are a factor 2-5 lower than this price (4-10 €/tCO2e) spans a plausible range for illustrative purposes here.

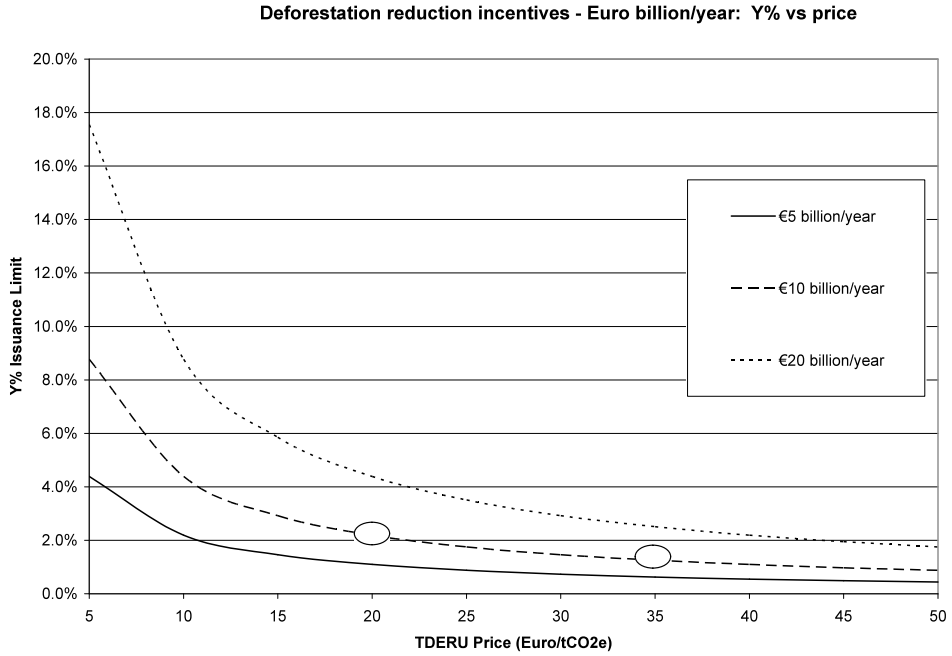
[32] 1990 Annex I industrial gas emissions UNFCCC,

[33] In spite of uncertainties, it is important to transform TDERUs into hectares of rainforest – 100 and 150 tCO_2e/ha are used here to reflect the range of actual carbon content in different real tropical forest biomes; numbers shown over a 5-year period.

[34] Considering an approximate average of 13 million hectares/year (65 million ha/5-year) of gross deforestation (FAO, 2005).

lowers the Y% limit that would be required to bring any given level funds into the TDERM.

Figure 7: Volumes of Funds: Y% Limit and TDERU Price



This figure shows the relationship between the TDERU price and Y% limit on TDERU issuance in relation to three different total fund levels - €5, 10 and 20 billion/year. Highlighted are two prices €20/tCO2e and €35/tCO2e for a funding level of €5, 10 and 20 billion/year.

Portfolio Performance Approach

The Mechanism would be required to report to the UNFCCC/KP on the overall performance of its portfolio of deforestation activities to demonstrate that the emission reductions achieved (in tCO_2e) exceed the face value of the TDERUs issued (in tCO_2e) for each period. The portfolio performance approach should permit the mechanism to tailor investments to the widest range of countries, capacities and circumstances, whilst ensuring that overall emissions are reduced substantially. This includes those countries with high levels of deforestation as well as countries with low levels.

Performance requirements can be enforced by the COP/MOP. A risk with the TDERM mechanism is that it would obtain large volumes of funds but not expend them efficiently or that the overall level of reductions obtained would fall short of that required under the portfolio performance requirement. One option should this occur; after annual reporting processes had been exhausted would be a suspension of the rights of TDERM to issue TDERUs. The existence of such an option would create an incentive within the governance system of the mechanism to fulfil the portfolio performance requirement.

Discount factor

To operationalise the TDERM, a critical part of the concept is a discount factor for deforestation reductions compared to TDERUs. The emission units (TDERUs) purchased by Annex B Parties would in theory be significantly less than the deforestation reductions achieved with the proceeds of the sales of the TDERUs as the world market prices for these units can be expected to exceed the costs of deforestation reductions measured per tonne of CO_2 reduced. Embedding this into the TDERM structure within the portfolio approach proposed, in effect discounting the emission reductions from deforestation, would enable setting aside concerns over uncertainties in measurements, permanence, liability and security in a pragmatic way. In other words the existence of a portfolio approach with a discount factor is explicitly used as a proxy for resolving several kinds of uncertainty and to provide incentives for improving capacities to verifiably report emissions (see below).

No specific discount factor is proposed here as it needs to be the subject of further work taking into account estimated market prices for Kyoto units post 2012 and costing of deforestation reductions. A discount factor of at least three would seem reasonable as an example here: if €20/tCO_2e is the price of TDERU then a factor three discount would imply that average costs of reducing deforestation by the mechanism would need to be around €6-7/tCO_2e. The latter costs are of the order of those found in the literature for deforestation reductions.

Different Capacities, States of Development and Governance

The TDERM would establish different modes of funding for rewarding deforestation reduction efforts depending on the ability to report, monitor and verify emission reductions reliably. At one end of the scale would be countries able to meet high reporting standards and willing to accept compliance costs should emissions increase above the levels agreed with the Mechanism. In these cases there would be higher confidence that the emission reductions reported for these countries will be real and permanent. The Mechanism could pay countries at this end of the scale a higher price for deforestation emission reductions. At the other end of the scale would be countries unable to meet such high standards. These countries would receive direct funding for agreed programmes that reduced deforestation at the national level. They would have much lower reporting and compliance standards than those at the other end of the spectrum. In these countries there would be lower confidence that reported emission reductions are maintained. The incentive for developing countries is therefore to reach higher levels of reporting, monitoring and verification to receive more financial benefits.

Separate funding windows for different regions, and possibly different countries within regions, are needed to reflect this spectrum of ability. Each window would have different funding programmes, reporting and compliance provisions tailored to the particular capacities and circumstances of the countries included in its purview. This tailoring will ensure that funding is balanced across regions and allow for the involvement of indigenous and forest peoples. The performance portfolio approach, and separate

funding windows, would allow the Mechanism to fund activities that prevent deforestation from expanding in places with currently low deforestation rates, as well as achieve substantial overall reductions in deforestation. Funding should not be limited to countries where reductions in deforestation emissions is cheapest, nor countries with greater monitoring capacities and associated lower risks of impermanence.

The TDERM could have a small dedicated community forest fund to pay for forest protection and environmental services, including capacity building for training for local communities and technical assistance. Alternatively, it could provide guidance on the proportion of funds received that should be transferred to indigenous or forest peoples that have land or resource use rights.

Governance Structure for TDERM

The complexity of the deforestation issue and the volume of funds that is required dictates that a robust governance system under the authority of the COP and/or COP/MOP is established to make decisions on policies, procedures, guidelines and criteria for incentivizing and rewarding reductions in deforestation emissions. Whilst this would undoubtedly add overhead costs to the system proposed it may also yield larger benefits in terms of ensuring that the system works effectively for all Parties concerned.

The TDERM could be established with a similar governance structure to the Montreal Protocol's Multilateral Fund, which assists developing countries to phase out the use of ozone depleting substances (see below). As the TDERM is designed to assist developing countries to reduce emissions from deforestation and at the same time is linked to the Kyoto trading system and Annex I obligations it would seem appropriate for there to be equal representation of developed and developing countries with majority decision-making system. Whilst the overall policies of the TDERM would need to be set by the COP and/or COP/MOP, an Executive Committee would need to be established with its own Terms of Reference to be negotiated by the Parties.

The Executive Committee of TDERM would for example, set policies for the operation of the mechanism so that it could include countries with both high and low rates of deforestation, whilst meeting the portfolio performance requirements set by the COP and/or COP/MOP. This Executive Committee will assess the national programmes on reducing emissions from deforestation and allocate funding. The funding will be based on the policies, procedures, guidelines and criteria of the TDERM, with some portion allocated to assist Parties in institutional strengthening (capacity building) and monitoring, reporting and verification, which is needed especially pre-2012. An independent technical review body could be established to ensure funding to reduce emissions from deforestation is effective. The Executive Committee would need to report annually to the COP and/or COP/MOP on its progress. To ensure transparency and accountability to all stakeholders, similar to the CDM and Joint Implementation activities, a compendium of decisions which establishes the rules, policies and procedures and all the decisions relating to the approval of funding should be publicly available.

The independent technical review body of the TDERM could be hosted by the UNFCCC Secretariat.

Montreal Protocol Multilateral Fund

The Montreal Protocol Multilateral Fund (MPMF) provides funds to help developing countries comply with their obligations under the Protocol to phase out the use of ozone-depleting substances (ODS) at an agreed schedule. It embodies the principle agreed at the United Nations Conference on Environment and Development in 1992 that countries have a common but differentiated responsibility to protect and manage the global commons. Developed countries agreed to contribute to the Fund in order to help Article 5 countries achieve the Protocol's goals. This global consensus forms the basis of the operation of the Multilateral Fund that confines the liability of the Fund to costs essential to the elimination of the use and production of ODSs. An important aspect of the Fund is that it funds only the additional (the so-called 'incremental') costs incurred in converting to non-ODS technologies.

The Fund is managed by an Executive Committee with an equal representation of seven industrialised and seven Article 5 countries which are elected annually by a Meeting of the Parties. The Committee reports annually to the Meeting of the Parties on its operations. The Fund provides finance for activities including the closure of ODS production plants and industrial conversion, technical assistance, information dissemination, training and capacity building aimed at phasing out the ODS used in a broad range of sectors. National governments develop national plans of actions for ending their use of ODSs which identify activities and actions that the nation would like to see funded by the MPMF. The MPMF then conducts an analysis and cost assessment of the various activities to determine which activities are funded and how much funding they should receive.

Source: About the Multilateral Fund: Overview
http://www.multilateralfund.org/about_the_multilateral_fund.htm

Pre 2013 incentives

The urgency and irreversibility of the adverse effects of deforestation on biodiversity and ecosystem services, as well as the lead time required for capacity building, emissions monitoring and the development of national deforestation reduction programmes supports the delivery of incentives for action before the beginning of the second commitment period in 2013. It is important that pre 2013 incentives based on the hybrid market linked funding model presented here are accounted for in the setting of commitments for the Annex I Parties to avoid a degradation of the level of action on fossil fuel and industrial greenhouse gas emissions. One option would be to permit the issuance and sale of a limited number of TDERUs ahead of the beginning of the second commitment period in 2013. For example, a forward issue TDERUs equivalent to 0.5% of Annex I base year emissions each year between 2009 and 2012 could raise €9bn if sold at a price of €20/tCO_2e(ca. €2.3 bn/year). If these were spent on activities that reduced deforestation at a cost of ca €7/tCO_2e this could reduce deforestation in the period before 2013 by about 0.6 million ha/year. The focus on the pre 2013 work should be on institutional

capacity building and monitoring and verification, as well as pilot initiatives to implement actions at the national scale.

Conclusions and further issues for consideration

As outlined the Tropical Deforestation Reduction Mechanism proposed may assist in solving a number of issues outlined below.

- *Scale effects on the Annex I emission targets and carbon market.* By limiting the amount that deforestation reductions units can be used by the Annex I Parties to meet their commitments[35] the effects on fossil fuel and other greenhouse gas emissions reductions that are needed can be quantified and limited. The creation of a the new unit, TDERUs, in the way proposed would limit adverse effects on the carbon market and at the same time provide reliable funding to reward reductions in tropical deforestation.

- *Uncertainty in relation to emissions estimation, reporting and verification.* The performance portfolio approach would require reporting and verification but not to the same level as with a full trading system e.g. for Annex I Parties with deforestation, afforestation and reforestation emissions and removals.

- *Baselines*. Baseline and reference path deforestation emissions would still need to be rigorously set, regularly reviewed, monitored and verified as otherwise the system would permit ongoing high levels of deforestation. However with the TDERM oriented at achieving overall absolute reductions in deforestation emissions from recent levels, and working within an overall portfolio approach these issues would be less significant for the overall performance of the system.

- *Full access by the widest range of countries to funds and incentives.* The proposed mechanism would create the possibility for all developing countries with deforestation emissions to obtain funds to assist in reducing these in a verifiable manner, including those with low deforestation levels as well as those with high.

- *Engage local communities and indigenous people.* The TDERM should motivate and facilitate greater control of forest resources by forest peoples and will start to address the problem of local communities becoming sidelined. Clear rules need to ensure that indigenous and forest peoples' livelihoods and cultures are not being undermined.

- *Architecture.* In principle the TDERM could be set up under either the Kyoto Protocol or the UNFCCC or even as a free standing entity, however it would seem most efficient under the Kyoto Protocol as this has the institutional basis for all

[35] TDERUs that can be purchased are added to the allowed emissions of Annex I Parties.

relevant reporting and monitoring and by design the system is driven by the Annex B commitments under the Protocol.

- *Reliable source of funds.* The principal source of funds is supplied from Annex B Parties through the allowance to meet a minimum X% and maximum Y% of their obligations.

- *Capacity building and institutional support.* Reliable funding will be more readily available which can support capacity building needs of developing countries.

Further questions to be considered

There are a number of questions which need be considered further with regard to this proposal. These include, but are not limited to:

- The basis for establishing the mandatory 'X'% and upper limit 'Y'% for the issuance of TDERUs in relation to expected carbon prices, the costs of reducing deforestation and the overall volume of funding required.
- The operationalization of the portfolio approach to ensure that real emissions reductions occur.
- The discount factor to be applied for the TDERM as a whole.
- How to ensure that appropriate benefit sharing occurs in practice.
- Compliance incentives for the TDERM as whole. There may be a need to develop additional incentives to the TDERM to comply with the portfolio reduction requirement.

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Annex I: Emission Data

Country	GHG (incl. LUCF)	Rank (incl. LUCF)	GHG (excl. LUCF)	Rank (excl. LUCF)	Source/Sink MtCO2e	% of industrial GHG emissions
United States of America	6,469	1	6,872	1	-403	-6%
China	4,916	2	4,963	2	-47	-1%
European Union (25)	4,721	3	4,742	3	-21	0%
Indonesia	**3,068**	**4**	**505**	**15**	2,563	508%
Brazil	**2,222**	**5**	**850**	**8**	1,372	162%
Russian Federation	1,970	6	1,916	4	54	3%
India	1,849	7	1,889	5	-40	-2%
Japan	1,356	8	1,352	6	4	0%
Germany	1,013	9	1,013	7	0	0%
Malaysia	**856**	**10**	**157**	**35**	699	446%
Canada	749	11	684	9	65	9%
United Kingdom	657	12	659	10	-2	0%
Mexico	623	13	526	12	97	18%
Italy	529	14	532	11	-3	-1%
Korea (South)	520	15	519	13	1	0%
France	512	16	518	14	-6	-1%
Myanmar	**508**	**17**	**83**	**48**	425	513%
Australia	496	18	491	16	4	1%
Iran	484	19	476	18	8	2%
Ukraine	482	20	482	17	0	0%
South Africa	419	21	418	19	2	0%
Nigeria	**388**	**22**	**193**	**30**	195	101%
Venezuela	**384**	**23**	**240**	**27**	144	60%
Turkey	376	24	355	22	21	6%
Spain	373	25	382	20	-9	-2%
Poland	371	26	373	21	-2	0%
Congo, Dem. Republic	**369**	**27**	**52**	**75**	317	614%
Saudi Arabia	354	28	354	23	0	0%
Argentina	344	29	289	24	55	19%
Pakistan	319	30	286	25	33	12%
Thailand	313	31	265	26	48	18%
Colombia	267	32	160	34	106	66%
Zambia	**263**	**33**	**28**	**95**	235	853%
Peru	**257**	**34**	**70**	**58**	187	268%
Taiwan*	236	35	236	28	0	0%
Philippines	**225**	**36**	**130**	**39**	95	73%
Netherlands	215	37	216	29	-0	0%
Uzbekistan	181	38	181	31	0	0%
Egypt	180	39	177	32	3	2%
Kazakhstan	164	40	164	33	0	0%
Nepal	**155**	**41**	**32**	**88**	124	391%
Papua New Guinea [1]	**155**	**42**	**9**	**138**	146	1622%

Country	GHG (incl. LUCF)	Rank (incl. LUCF)	GHG (excl. LUCF)	Rank (excl. LUCF)	Source/Sink MtCO2e	% of industrial GHG emissions
Sudan	153	43	122	43	31	25%
Belgium	147	44	147	36	0	0%
Czech Republic	143	45	143	37	0	0%
Cambodia	**130**	**46**	**74**	**56**	56	76%
Algeria	129	47	127	40	3	2%
Cote d'Ivoire	**125**	**48**	**34**	**84**	91	268%
Bolivia	**123**	**49**	**39**	**81**	84	213%
Romania	123	50	124	41	-1	-1%
United Arab Emirates	119	51	119	45	0	0%
Greece	118	52	121	44	-3	-2%
Cameroon	**113**	**53**	**36**	**83**	77	214%
Korea (North)	113	54	112	46	1	1%
Bangladesh	113	55	122	42	-9	-8%
Ecuador	**101**	**56**	**42**	**80**	59	140%
Madagascar	**97**	**57**	**37**	**82**	60	163%
Iraq*	97	58	97	47	0	0%
Chile	97	59	81	49	16	19%
Angola	93	60	75	54	18	24%
Belarus	86	61	80	51	6	7%
Vietnam	85	62	134	38	-49	-36%
Guatemala	**83**	**63**	**26**	**97**	57	215%
Tanzania	82	64	68	60	15	22%
Zimbabwe	**81**	**65**	**34**	**85**	47	140%
Austria	80	66	81	50	-1	-1%
Hungary	75	67	76	53	-1	-1%
New Zealand	74	68	71	57	3	4%
Israel	74	69	74	55	0	0%
Portugal	74	70	80	52	-6	-7%
Finland	68	71	69	59	-1	-1%
Ethiopia	67	72	59	70	9	14%
Denmark	67	73	67	61	-0	0%
Kuwait	67	74	67	62	0	0%
Syria	67	75	67	63	0	0%
Nicaragua	**66**	**77**	**13**	**119**	54	426%
Uganda	**66**	**76**	**27**	**96**	39	146%
Sweden	66	78	66	64	0	0%
Ireland	64	79	66	65	-2	-3%
Turkmenistan	64	80	64	66	0	0%
Morocco	62	81	59	69	3	4%
Kenya	61	82	49	77	12	24%
Serbia & Montenegro	60	83	60	68	0	0%
Bulgaria	60	84	62	67	-2	-3%
Panama	**58**	**85**	**11**	**128**	48	452%
Libya	57	86	57	72	1	1%
Singapore	57	87	57	71	0	0%

Country	GHG (incl. LUCF)	Rank (incl. LUCF)	GHG (excl. LUCF)	Rank (excl. LUCF)	Source/Sink MtCO2e	% of industrial GHG emissions
Azerbaijan	55	88	55	73	0	0%
Paraguay	54	89	33	86	21	62%
Sri Lanka	**54**	**90**	**24**	**102**	30	122%
Ghana	**52**	**91**	**24**	**104**	28	117%
Switzerland	51	92	52	76	-0	-1%
Norway	51	93	54	74	-3	-6%
Slovakia	50	94	47	78	3	6%
Benin	47	95	10	129	36	352%
Liberia	43	96	3	153	39	1231%
Guyana	**39**	**97**	**4**	**149**	35	831%
Tunisia	35	98	31	90	4	12%
Cuba	35	99	44	79	-9	-20%
Central African Republic	34	100	25	101	9	36%
Malawi	**34**	**102**	**7**	**142**	27	367%
Mali	34	101	26	99	8	31%
Laos	**34**	**103**	**10**	**130**	24	229%
Qatar	33	104	33	87	0	0%
Oman	31	105	31	89	0	0%
Botswana	**31**	**106**	**12**	**123**	20	171%
Honduras	**30**	**107**	**13**	**118**	18	136%
Yemen	30	108	29	92	0	1%
Dominican Republic	29	109	29	91	0	0%
Mozambique	29	110	20	108	9	47%
Trinidad & Tobago	28	111	28	93	0	0%
Mongolia	28	112	28	94	1	2%
Guinea	27	113	17	113	10	62%
Croatia	26	114	26	98	-0	-1%
Afghanistan	25	115	16	114	9	54%
Estonia	25	116	23	105	2	10%
Jordan	24	117	24	103	0	0%
Belize	**23**	**118**	**2**	**160**	21	1014%
Chad	23	119	20	107	3	17%
Senegal	23	120	19	110	4	19%
Burkina Faso	22	121	21	106	1	3%
Costa Rica	**21**	**122**	**11**	**124**	10	88%
Congo [1]	**21**	**123**	**11**	**127**	10	91%
Slovenia	20	124	19	109	1	6%
Lithuania	19	125	16	116	3	20%
Sierra Leone	**19**	**126**	**6**	**147**	13	242%
Lebanon	18	127	18	111	1	3%
Bosnia & Herzegovina	18	128	18	112	0	0%
Togo	**17**	**129**	**8**	**141**	9	108%
Bahrain	16	130	16	115	0	0%
El Salvador	15	131	11	125	4	37%
Jamaica	15	132	13	120	3	21%

Country	GHG (incl. LUCF)	Rank (incl. LUCF)	GHG (excl. LUCF)	Rank (excl. LUCF)	Source/Sink MtCO2e	% of industrial GHG emissions
Mauritania	15	133	15	117	0	0%
Latvia	14	134	10	134	4	41%
Rwanda	**13**	**135**	**6**	**146**	8	136%
Niger	12	136	12	121	1	6%
Namibia	12	137	10	133	2	23%
Macedonia, FYR	12	138	12	122	0	0%
Haiti	11	139	9	137	2	22%
Moldova	11	140	11	126	0	0%
Gabon	**11**	**141**	**7**	**143**	4	51%
Burundi	**10**	**142**	**3**	**154**	7	252%
Georgia	10	143	10	131	0	0%
Tajikistan	10	144	10	132	0	0%
Kyrgyzstan	10	145	10	135	0	0%
Luxembourg	9	146	9	136	0	0%
Brunei*	9	147	9	139	0	0%
Cyprus	8	148	8	140	0	1%
Albania	7	149	6	145	1	12%
Armenia	7	150	7	144	0	0%
Equatorial Guinea	**7**	**151**	**2**	**161**	4	210%
Eritrea	5	152	5	148	0	0%
Mauritius	4	153	4	150	0	0%
Suriname	4	154	4	151	0	0%
Guinea-Bissau	**3**	**155**	**2**	**159**	1	57%
Iceland	3	156	3	155	0	0%
Fiji [1]	3	158	3	157	0	8%
Lesotho	3	157	3	156	0	0%
Malta	2	159	2	158	0	0%
Bahamas	**2**	**160**	**2**	**162**	0	0%
Antigua & Barbuda	**2**	**161**	**2**	**163**	0	0%
Djibouti	**2**	**162**	**2**	**164**	0	0%
Barbados	**2**	**164**	**2**	**165**	0	0%
Swaziland	2	163	3	152	-2	-55%
Bhutan	**1**	**165**	**1**	**167**	0	0%
Gambia	1	166	2	166	-0	-20%
Uruguay	1	167	26	100	-24	-96%
Maldives	1	170	1	169	0	0%
Seychelles [1]	1	168	1	168	0	0%
Vanuatu	**1**	**169**	**1**	**170**	0	0%
Cape Verde	1	171	1	171	0	0%
Solomon Islands	**1**	**172**	**0**	**175**	0	67%
Comoros	0	175	0	174	0	0%
Saint Lucia	0	173	0	172	0	0%
Samoa [1]	0	174	0	173	0	0%
Grenada	0	176	0	176	0	0%
Dominica	0	180	0	180	0	0%

Country	GHG (incl. LUCF)	Rank (incl. LUCF)	GHG (excl. LUCF)	Rank (excl. LUCF)	Source/Sink MtCO2e	% of industrial GHG emissions
Palau	0	177	0	177	0	0%
Saint Vincent & Grenadines	0	178	0	178	0	0%
Tonga	0	179	0	179	0	0%
Kiribati	0	184	0	184	0	0%
Nauru	0	183	0	183	0	0%
Saint Kitts & Nevis	0	181	0	181	0	0%
Sao Tome & Principe	0	182	0	182	0	0%
Cook Islands [1]	-	185	-	185	0	0%
Niue [1]	-	186	-	186	0	0%
Total MtCO2e	45,941		38,349		7,592	
Total MtCe	12,518		10,449		2,069	

Source: CAIT 4 Database: http://cait.wri.org .

Annex II: Comparison of Proposals for Reducing Emissions from Deforestation

There are a number of proposals initiated by Parties and NGOs to address ways to reduce emissions from deforestation. All approaches discuss ways to voluntarily reduce emissions from deforestation in developing countries and most incorporate a national emissions approach. The majority adopt market-based mechanisms as the preferred option for financing (e.g. Coalition for Rainforest Nations, Costa Rica and other Latin American countries and Compensated Reductions). Whilst other proposals prefer a fund option not linked to any trading, such as Tuvalu's Forest Retention Scheme and Brazil's proposal. Furthermore, India's proposal 'Compensated Conservation' attempts to provide incentives for conserving and protecting existing forests. A mechanism to reduce emissions from deforestation will need to meet the needs for all countries due to the diversity of national circumstances. Finding one solution to address the needs of all countries whilst also ensuring the integrity of the climate system will be difficult. Thus, while developing various approaches to address the different needs will make this sector very complex, it is necessary. Negotiations need to reflect this fact and not push one mode of operation over another.

Market Approaches

Coalition for Rainforest Nations - REDD Mechanism

The Coalition for Rainforest Nations (CfRN) proposed REDD mechanism is designed to address both deforestation and degradation emissions that result in gross reductions measured against a reference scenario. The reference scenario will be made by estimating a reference emission rate that will be applied against a development adjustment factor. It could be developed through either a market or a non-market policy approach. The market approach would allow deforestation credits to be fully fungible with other gases and sources under the Kyoto trading system. A stablisation fund, to complement the REDD Mechanism is proposed to support countries that have low rates of deforestation and want to maintain their existing forest areas. As well as an enabling fund to support countries build capacity to participate in approaches for reducing emissions from deforestation for the pre-2012 period.

Compensated Reductions

Santilli *et al*. (2005) propose the concept of *Compensated Reductions* (CR), where tropical countries that reduce deforestation rates below a historical baseline receive internationally tradable carbon offsets as compensation. Once having received compensation, countries would agree not to increase deforestation in future commitment periods (provided that Annex I Parties fulfill their obligations). The CR approach works well for countries with high historical rates of deforestation. To facilitate options for countries with low rates of deforestation, an option for positive incentives, such as undertaking CDM Afforestation and Reforestation activities at the project or national level, are considered.

Avoided Deforestation Carbon Fund (ADCF)

This concept has been proposed by a number of Latin American Countries for a mechanism to provide resources to developing countries for the implementation of activities that directly reduce emissions from deforestation in and the maintenance of forest cover and avoid carbon stock loses. The activities funded by the ADCF would generate credits and provide participants with an entry into the carbon market (e.g. through the CDM) that would, in turn, entail additional resources and incentives.

The Nested Approach

The main component of the Nested Approach proposal is an integrated approach to reward emission reductions from deforestation, and eventually degradation, by allowing participation by developing countries as well as public and private entities for lowering deforestation rates. The Nested Approach is a double baseline-and-credit mechanism which allows fully fungible credits to be created through a national as well as sub-national or project level activities. Project level activities can be undertaken regardless whether the host country has negotiated and registered a national emission target level.

Non-Market approaches:

Brazilian funding mechanism

Brazil propose to establish a mechanism under the Convention aimed at providing positive incentives for the net reduction of emissions from deforestation in developing countries that voluntarily reduce greenhouse gas emissions. The proposal is based on the actual demonstration of reduced emissions from deforestation by comparing the rate of emissions from deforestation to a certain past-time period with a reference emission rate. Financial incentives are provided by Annex I countries voluntarily contributing to the mechanism. All the reduced emissions of a country are added together for an agreed period and the total tonnes converted into a monetary sum and divided among the participating developing countries in the same ration as the emissions reductions achieved. The proposal is not linked to the concept of maintenance of carbon stock on forest land.

Tuvalu's Forest Retention Incentive Scheme

Tuvalu proposes a Forest Retention Incentive Scheme established under the Convention to provide incentives to communities for protecting and retaining forests. There are three components to this scheme which include a Community Forest Retention Trust Account; Forest Retention Certificates; and an International Forest Retention Fund to provide funding for communities to set aside forest areas or manage them in a sustainable manner. Communities could draw on a prescribed percentage to establish measures to combat and reduce deforestation and degradation, granted *ex poste*.

Compensated Conservation

The *Compensated Conservation* mechanism proposed by India aims to compensate countries for maintaining their carbon stocks as a result of conservation and increased or improvements of the forest cover. The financing would be linked to verifiable carbon through ODA, GEF, or Climate Change Adaptation Fund, but would be kept outside the Clean Development Mechanism. The incentive for maintaining baseline stock would act as an insurance cover against loss of associated carbon stocks. India propose the baseline

to be fixed at 1990 or another appropriate level and want a net approach to accounting to take into account the removals.

Agreement on Acknowledging the Value of the Forest and Ending Amazon Deforestation, Brazil

The proposal developed by non-government organizations in Brazil to support action to reduce deforestation to zero by 2015 in the Amazon through a national initiative by adopting a system of reduction targets. The agreement is based on regulatory and economic instruments, strengthening monitoring, control and tax measures and establishing and strengthening forestry governance. States receive financial incentives for effective reduction of deforestation and achievement of reduction targets through forestry management and payment for environmental services. Financial incentives are delivered through a fund established using private and public capital.

Dual Market Approach, CCAP

The Dual Market Approach proposed by the Centre for Clean Air Policy is a hybrid approach combining funding for short-term actions to prepare developing countries for participation in the post-2012 period. The REDD system would be a new and separate market from the current Kyoto carbon market and REDD units would not be directly fungible with the Kyoto market. Annex I countries commit to dual post-2012 targets and meet a portion of their post-2012 reduction target through the REDD program. Developing countries have a 'no-lose' option to create programs. The dual market approach allows REDD time to develop and stabilise before any linking with the Kyoto market, which protects the integrity of the existing market.

Table 5: Main Features of the Proposals for Reducing Emissions from Deforestation

Proposal/ Issues	TDERM	Coalition of Rainforest Nations	Brazilian Fund	Tuvalu - Forest Retention Scheme	India - Compensated Conservation	Compensated Reductions	Nested Approach	CCAP Dual Markets
Scope	Deforestation	Deforestation and degradation	Deforestation	Deforestation and degradation	Forest Conservation	Deforestation (and degradation)	Deforestation (and eventually degradation)	Deforestation and Degradation
Instruments	UNFCCC or KP	UNFCCC or KP	UNFCCC	UNFCCC	Outside of KP CDM	UNFCCC or Kyoto Protocol	KP (CDM market)	Dual Market in Convention
Financing	Hybrid market-linked fund	Market + non-market	Non-market	Non-market	Non-market	Market	Market	Non-linked market
Reference period	Historical	Historical	Historical	Emission trends	Fixed at 1990 or other level	Historical	Not discussed	Not discussed
Scale	National	National (CDM - project)	National	National - not explicit	National	National	National and sub-national	National
Early action	Pre-2012 through limited TDERUs to support capacity building activities	Establish legal framework to credit 'early action' (pre-2012).	Not discussed	Not discussed	Not discussed	Early action rewarded post-2012	Voluntary early action – rewarding through credits	Begin establishing and reporting LULUCF inventories
Liability	Discount factor and portfolio performance approach	Banking borrowing, ex post crediting	Borrowing	Not discussed	Insurance	Banking insurance, ex post crediting	Acquiring REDD credits; over-comply or adjustment of reference level	Discounting or reductions retired
Monitoring and Verification	Combination	Remote sensing	All options	Not discussed	Remote sensing coupled with ground verification	Combination	Not discussed	Not discussed
Accounting	Gross	Gross	Gross	Not discussed	Net	Not discussed	Not discussed	Not discussed