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Linkage between forest-based mitigation and GHG markets

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This document aims to provide input for the workshop on Linkage between forest-based mitigation and GHG markets, organized by IDDRI, taking place in Paris on 27 and 28 October 2008.

This article reflects the views of the author only.In putting this document online, IDDRI's aim is to disseminate works that it believes to be of interest to inform the debate.

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Introduction

According to the latest assessment report of the Intergovernmental Panel on Climate Change, deforestation and forest degradation contributed to 23% of global carbon dioxide emissions and 17% of global emissions of all greenhouse gases in 2004 (IPCC AR4 SPM, 2007). Despite significant uncertainties, these figures stress the relevance of addressing deforestation into the new global climate governance regime.

Deforestation is primarily a concern for tropical regions nowadays and FAO's Forest resource assessments (2005) highlight significant national disparities as a consequence of history, soil and climate conditions and current policies and socio-economic conditions. The Stern Review (2006) pointed to deforestation abatement as a must-seize opportunity to cut global greenhouse emissions with good cost/efficiency and numerous co-benefits.

Under the framework of the 2007 Bali Action Plan, the UNFCCC is now considering policy approaches to promote the reduction of emissions from deforestation and forest degradation, and also forest conservation, sustainable forest management and forestation ('REDD+'). At the same time, the European Union is engaged in a major review of its climate and energy legislation. The EU climate/energy package has entered into the final stages of negotiation and the outcome should provide funding for REDD+ actions on the long run through some sort of connection to carbon markets.

These are moments of historic significance both for world forests and climate protection, but significant challenges remain. This workshop focuses on one of these challenges: while mechanisms are being designed to connect greenhouse gas emission trading schemes and REDD+ actions, we must ensure that they enable broad and far-reaching actions while safeguarding against various sorts of unintended consequences.

This background paper intends to provide a rapid initial overview on three aspects of the linkage between forest-based mitigation and emission trading schemes: (*i*) the quantification of funding requirements for REDD+ actions, (*ii*) fund-raising on taxpayers and consumers in advanced economies, and (*iii*) mechanisms to transfer funds to support REDD+ strategies in participant countries.

Funding requirements

Forecasting the cost and potential quantitative achievements of REDD+ activities is overwhelmingly challenging. However it is necessary to estimate the orders of magnitude as reliably as possible in order to facilitate on-going deliberations on the design of a REDD+ mechanism. The following table recalls some of the recently published estimates.

Table 1 : Information on REDD+ potential emission reductions and funding requirements

Source	Activity	Unit cost (/tCO_2-eq)[1]	Emission reductions ($GtCO_2$-eq/yr)	Funding requirement (billion /yr)	Method/Comment
IPCC SR LULUCF 2000	Deforestation (20% abatement)		1,3 $GtCO_2$-eq/yr		
EU LULUCF EG 2001	Forestation		220-480 $MtCO_2$-eq/yr		Consideration of the potential scale of LULUCF activities in the CDM for the first commitment period
	Deforestation		220-770 $MtCO_2$-eq/yr		
	Other activities		180-370 $MtCO_2$-eq/yr		
Grieg-Gran, IIED, (2006), Grieg-Gran, IIED (2006b)	Deforestation (elimination in 8 selected countries)	1.40/tCO_2-eq	1.4 $GtCO_2$-eq/yr	2 b/yr	Opportunity cost of foregone land uses. Selective logging not foregone. Assumes perfect information on pressures. Administrative costs involve an extra 3-10/ha/yr, i.e. 0.2-0.7 b after 10 years.
		2.40/tCO_2-eq		3.5 b/yr	Same as above, revenue from forest products also foregone.
		5.50-7.50/tCO_2-eq		8-11 b/yr	Same, supposing higher agriculture returns.
Sohngen and Sedjo (2006), as cited in Trines (2007)	Deforestation (elimination)	20.00/tCO_2-eq	278 $GtCO_2$-eq cumulated		Opportunity cost. GTM model
Sathaye et al. (2007)	Deforestation	3.50/tCO2-eq in 2010 up 5%/yr till 2050	0.7 GtCO2-eq/yr		Compensation for the opportunity cost corresponding to drivers relevant to each region. GCOMAP model. Transaction costs not considered.
	Deforestation	7.00/tCO_2-eq in 2010 up 5%/yr till 2050	1,4 $GtCO_2$-eq/yr		
	Deforestation (elimination in Africa)	100.00/tCO_2-eq			
	Deforestation (elimination in Central America)	330.00/tCO_2-eq			
	Deforestation (elimination in South America)	380.00/tCO_2-eq			
	Deforestation (elimination in Asia)	730.00/tCO_2-eq			
IPCC WGIII AR4	All activities - Africa	Up to 15 - 35 - 70 /tCO_2-eq respectively	1.3–1.7-1.9 $GtCO_2$-eq/yr	Up to 19-60-137 b/yr	Based on three global forest sector models: GTM (Sohngen and Sedjo 2006), GCOMAP (Sathaye et al., 2007), and IIASA-DIMA (Benitez-Ponce et al. 2007)
	All activities - America		1.4-2.5-3.1 $GtCO_2$-eq/yr	Up to 20-89-223 b/yr	
	All activities – Asia		1.7-2.9-4.4 $GtCO_2$-eq/yr	Up to 25-101-314 b/yr	
	Forestation – all continents		1.2-2.0-2.8 $GtCO_2$-eq/yr	Up to 18-71-200 b/yr	
	Deforestation – all continents		2.1-3.2-3.8 $GtCO_2$-eq/yr	Up to 30-113-271 b/yr	

[1] Values reported in USD were converted in EUR using the exchange rate of September 10th, 2008: 1 EUR = USD 1.41. Figures are rounded to improve readability.

Source	Activity	Unit cost (/tCO_2-eq)[1]	Emission reductions ($GtCO_2$-eq/yr)	Funding requirement (billion /yr)	Method/Comment
	SFM – all continents		1.1-1.9-2.9 $GtCO_2$-eq/yr	Up to 16-67-202 b/yr	
	All activities – all continents		4.5-7.1-9.5 $GtCO_2$-eq/yr	Up to 63-250-673 b/yr	
Obersteiner et al. (2006)	Deforestation (50% abatement by 2025)	0.06-1.20/tCO2-eq	1.6 $GtCO_2$-eq/yr	0.1-2 b/yr	Balancing net present value of forest and non-forest land uses with a spatially explicit biophysical and socio-economic land use model. Supposing perfect information on deforestation pressures.
		15.00/tCO_2-eq		24 b/yr	Same with payments targeted to high pressure zones
		85.00/tCO_2-eq		135 b/yr	Same with no information, no targeting
Blaser & Robledo (2007)	Deforestation (elimination by 2030)	1.50/tCO_2-eq	5,8 $GtCO_2$-eq/yr	8.7 b/yr	Compensation of opportunity cost.
	Deforestation (65% abatement by 2030)	2.00/t CO_2-eq	3,8 $GtCO_2$-eq/yr	7.4 b/yr	Compensation of opportunity cost and livelihood improvement.
	SFM / degradation	0.85/tCO_2-eq	6.6 $GtCO_2$-eq/yr	5.7 b/yr	Optimization of forest ecosystems elastic capacity. Based on increased timber increment per region as estimated from silviculture experiences.
Sathaye et al. (2007) as cited in UNFCCC 2007	Deforestation (elimination)	8.00-55.00/tCO_2-eq	2.3 $GtCO_2$-eq/yr	18 - 130 b/yr	
	Forestation		18 – 94 $MtCO_2$-eq/yr (??)	0.6 – 5.5 b/yr till 2050	Corresponds to 52 – 192 million ha planted by 2050. Establishment costs 460 - 1120 per ha pending on site conditions, from ORNL (1995)
UNFCCC (2007), based on ITTO and FAO FRA	REDD (annihilation)	1.50/tCO_2-eq	5.8 $GtCO_2$-eq/yr	9 b/yr	Compensation for the opportunity cost corresponding to drivers relevant to each region.
	Tropical SFM on production forests in developing countries	1.00/t CO_2-eq	5.4 $GtCO_2$-eq/yr	5 b/yr	8.5/ha from ITTO expert panel (adjusted for inflation); extrapolation based on FAO FRA 2006
	Temperate and boreal SFM on production forests in developing countries	0.60/tCO_2-eq	1.1 $GtCO_2$-eq/yr	0,7 b/yr	14/ha from (Whiteman, 2006); extrapolation based on FAO FRA
	Forestation		43.5 – 108.7 $MtCO_2$-eq/yr in 2030	0.05-0.25 b in 2030	Area estimate from IPCC WGIII AR4 and establishment costs from ORNL (1995)
Kindermann, et al. (2008)	Deforestation (10% abatement)	1.00–2.00/tCO_2-eq	0.3-0.6 $GtCO_2$-eq/yr	0.3-1.2 b/yr	Based on three economic models of global land-use and management
	Deforestation (50% abatement)	7.00-8.50/tCO_2-eq	1.5-2.7 $GtCO_2$-eq/yr	12-20 b/yr	

Source	Activity	Unit cost (/tCO_2-eq)[1]	Emission reductions ($GtCO_2$-eq/yr)	Funding requirement (billion /yr)	Method/Comment
Strassburg, et al (2008)	Deforestation (95% abatement in top 20 forested developed countries)	4.00/tCO_2-eq	5,3 $GtCO_2$-eq/yr	21 b/yr	

Deforestation, conservation

Kindermann, et al. (2008) made the latest collective exercise involving the 3 main global land use models that were already used in IPCC WGIII AR4 and subsequently in other reviews including UNFCCC (2007). We therefore adopt their results as consensual within the community of experts on opportunity costs of avoiding deforestation. As an order of magnitude, a 50% abatement of deforestation would then cost around 15 billion per year and yield 2 $GtCO_2$/yr of emission reductions, equivalent to 11% of total base year emissions of Parties indicated in Annex B of Kyoto Protocol. If financing is based on credit issuance, with moderate connection to other global Kyoto carbon markets, 2 $GtCO_2$/yr of emission reductions with a market price 15/tCO_2 would amount to 30 billion per year market value.

In terms of timing, a decade would probably be required to ramp up REDD+ ground operations to the tune of 2 $GtCO_2$/yr. Therefore, only half of that estimate might be realistically achievable over the second commitment period, i.e. **1 $GtCO_2$/yr or 5.5% of Annex B Parties base year emissions**.

Grieg-Gran, IIED (2006) made a commendable attempt at assessing transaction costs of payment for environment services schemes (PES) and finds limited costs based on experiences from Mexico and Costa Rica. As large scale achievements are sought however, one will have to deal with less advanced tenure and farming systems and incur additional readiness, management and administration expenses. Results from Obersteiner et al. (2006) also highlight extra costs related to asymmetry of information. At the time when concrete national REDD plans are in the making, it remains challenging to quantify these overhead costs. We will set them globally at one third of the opportunity cost estimated above, bringing the total price tag to **10 billion per year over the second commitment period**.

These values are derived while assuming the scenario that PES implementation will generally be adopted as REDD+ policy; it is important to note that many countries may opt for different REDD+ strategies. Pending on specific opportunities and threats to the forest, actual action plans may include diverse activities such as land tenure reforms to promote private/municipal ownership, enhanced means of forest law enforcement, communication, training and subsidies for efficiency gains in traditional agriculture and the biomass energy supply chain, etc. Such strategies have different cost structures although it is not entirely clear whether the overall financial requirements would be higher or lower than with the PES compensation strategy. We therefore retain the above figures as our best possible estimate.

Degradation, restoration, SFM

Values for SFM are rather difficult to interpret in absence of clear differentiation between the short term and long term gains (avoided losses) in carbon stocks. Blaser & Robledo (2007) clarify that "*Through sustainable forest management, additional carbon sequestration can be reached, first through planned silvicultural management, based on optimization of yield and increase of faster growing, light demanding species. Forest restoration is another very important carbon sequestration strategy that could be addressed through forest management, but also through REDD. In addition forest management can reduce GHG emissions through reduced impact logging and other measures, including improvements in transport.*" As MRV tools for are under development, reducing emissions from forest degradation increasing removals with restoration are likely to yield a smaller order of magnitude of GHG emission reductions than avoided deforestation in the short/medium term. While important for forests and climate change

mitigation, it is fair to assume that the financial implications of positive incentives for these activities are well within the range of uncertainty on the cost of deforestation avoidance in the coming decade.

Forestation

A close look at values on forestation activities from Sathaye et al. (2007), IPCC AR4 WGIII (2007) and UNFCCC (2007) show that they are at best difficult to interpret because of the long time lag between forestation expenses and climate benefits. It is also unclear how forestation activities would be suitably incentivised under a reference and crediting scheme with periodic revisions of the agreed reference level: changes in the forest age class structures due to significant forestation actions would soon be captured into updated forward looking baselines while the bulk of the climate benefits from these activities would not have been reaped yet. Considering a positive incentive scheme in the form of an enhanced programmatic CDM in the second commitment period and referring back to the background note on the scale of CDM A/R produced by the EU LULUCF expert group in April 2001, we could expect the supply of credits from forestation activities in non-Annex 1 countries to reach 220-480 $MtCO_2$/yr over the second commitment period. The mid-range estimate is **350 $MtCO_2$/yr, or 2% of Annex B Parties base year emissions**.

As for REDD and SFM, funding requirements to achieve this depend on what sort of mechanism is put in place. If activities are financed on an incremental costs basis, as the GEF usually operates, experience from proposed forestation activities under the CDM suggest that the all-inclusive price tag could be about 10/tCO2, or 3.5 billion in total,. But it is unclear whether stakeholders would mobilise for prompt large scale action in absence of further incentives. Full market fungibility would likely multiply that price by a factor of 2 to 5 depending on where the GHG emission allowances price lands. Moderate market connection and positive incentives could bring the price up to **15/tCO_2 (5 billion in total)** while ensuring that sufficient incentives are in place to stimulate prompt action. Whether that is sufficient also depends very much on the evolution of timber and biomass markets.

Conclusion on funding requirements: REDD+ may yield 1.35 GtCO2-eq/yr over the second commitment period (equivalent to 7.5% of Annex B base year emissions) and cost 15 billion.

Funding sources

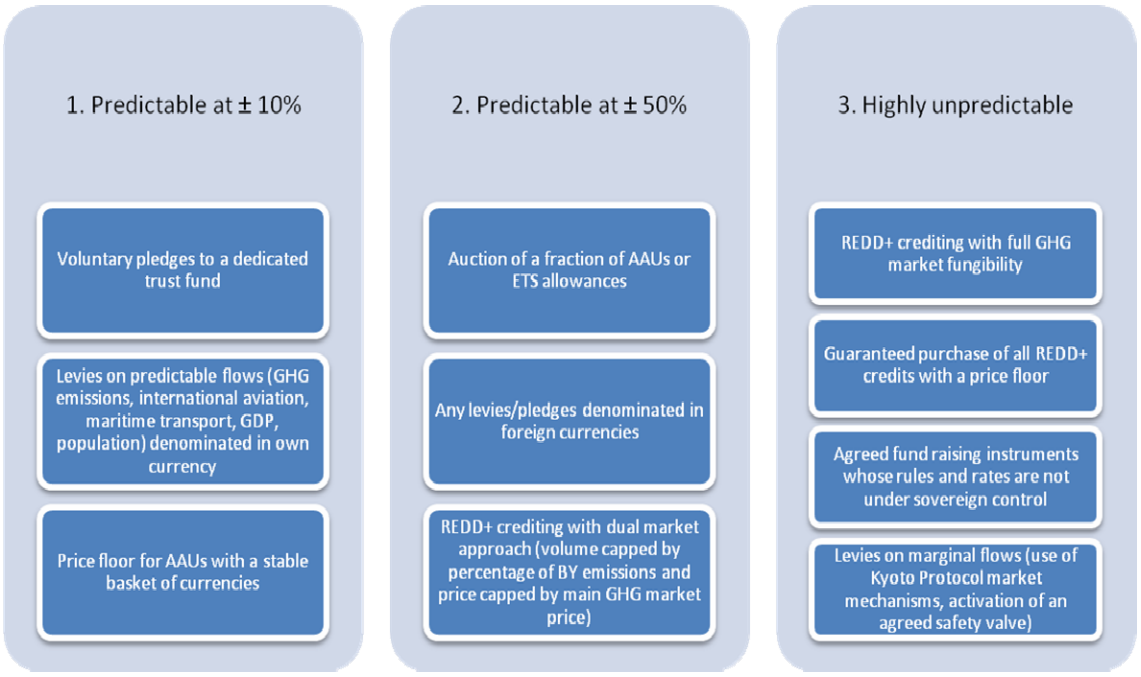
It is generally expected that the adopted funding scheme should raise the right amount of funds over extended periods in a predictable manner. Predictability of in-coming transfers is very important to participant countries that engage into domestic REDD+ strategies. The market offers no guarantee of appropriate financing because the market prices are in essence free to change in response to numerous factors. Uncertainties around the results of policies on deforestation as measured on the ground, and against baselines, are also part of the story. But to depend on the democratic processes in donor countries is also risky as few guarantees exist that funding will be renewed in future periods as explained above.

As was discussed above however, the requirements are themselves next to impossible to predict at present. Any adopted market-based scheme to reward performance would require funds that depend both on volumes and price of REDD+ credits. Whatever the merits of REDD+ endeavours in participant countries, Finance Ministries of donor countries are not going to underwrite them if it creates liabilities of unpredictable scale on taxpayers' money. The certainty of financial implications for donor nations must therefore also be addressed when designing finance mechanisms.

As some Parties noted in the cross-cutting UNFCCC negotiation on finance, public funding capacities pale in front of the scale of funds required for climate-related activities such as REDD+. A number of innovative fund raising mechanisms have been studied (UNFCCC, 2007). It should be noted that UN bodies do not have the authority raise taxes in UN member countries; therefore

any agreed levy on goods and services outside of UNFCCC-controlled transactions would practically take the form of pledges by donor countries to raise the tax by themselves and forward the proceeds to a dedicated trust fund. While the executive branch of governments may express goals of sustaining certain levels of funding over the long run, the democratic processes in these countries usually imply that such pledges cannot bind them over periods of time extending beyond a few years.

Table 2 : Categories of mechanisms based on the predictability of treasury or economic implications for donors[2]



In order to finance readiness and sustainable development policies and measures, it is recommended to adopt category 1-types of funding sources in order to generate sufficient predictability for both donors and REDD+ actors. Funding may evolve towards category 2 in consideration of better visibility on costs and volumes involved, i.e. after readiness activities have progressed in a number of REDD+ acting countries. That could mean REDD+ crediting with a dual market approach, as for CDM A/R under Kyoto Protocol 1st commitment period.

Conclusion on funding sources: Any REDD+ mechanism adopted in Copenhagen will have to provide some certainty to donor countries on financial liability incurred. This may involve funding pledges for predictable amounts and limited REDD+ crediting.

Funding mechanisms

There is a broad range of conceivable ways to finance REDD+ activities and a number of commentators have discussed their respective advantages (UNFCCC, 2007, OECD, 2007, MAF NZ, 2008). It is first useful to distinguish upfront funding requirements for readiness and sustainable development policies and measures on one side (input-based), and the purchase of credits for verifiable quantitative achievements over agreed ambitious reference levels on the other side (output based). A combination of these two approaches may also be envisaged for different sets of countries and different time periods (CRfN, 2008).

[2] Some category 3 schemes (broadening market fungibility and safety valve) would in fact tend to increase the predictability of the total cost of compliance but they reduce the predictability of positive incentives in other sectors.

Whether positive incentives are input-based or output-based, in both cases we can then distinguish bilateral, multilateral and private sources of funding. The following table provides some insight into all sorts of combinations that may be envisaged.

Table 3 : Envisaged approaches for financing REDD+ actions

	Bilateral	Multilateral	Non-governmental
Input-based: Support readiness and PAMs	Bilateral ODA as concessional loans, technical assistance, grants or debt swaps	Existing multilateral ODA agencies or new REDD+ dedicated funding institution under the authority of UNFCCC COP/MOP	Project-based grants from conservation NGOs, private foundations, corporate sponsorship, etc.
Output-based: Procurement of REDD+ credits	Acquisition of REDD+ credits by Nations of UNFCCC Annex I to help meet deeper QELROs	Reverse auctions by a dedicated trust fund under UNFCCC; Shared procurement services by e.g. the World Bank for donor countries; Procurement by international industry trade groups on behalf on members companies.	Purchase of REDD+ credits by business organisations and individuals on a voluntary basis (often via brokers); or by industrial companies to help meet their obligations under domestic emission trading schemes

All approaches have their own potential and limitations from the angle of poverty alleviation and ecological co-benefits, environmental and market integrity and cost/efficiency for consumers and tax payers at the end of the transaction chain. Many observers reckon that market-based instruments, whether that means private over public money or output over input-based funding, presents better prospects of sustaining the proper scale of funding over the long run. On the other hand Ian Fry's presentation on behalf of Tuvalu at the REDD+ workshop during Accra talks on climate change had an articulate 10 points argument on why market linkage should be avoided (CCPL, 2008). On balance, it seems that these approaches need to be somehow combined in order to meet the range of expectations of candidate countries for action on REDD+. Still, the Copenhagen COP/MOP will need to make painful decisions that will certainly leave no Party entirely satisfied.

Among the possible commitments in relation to REDD+ with implications on Annex I Parties Treasury, most decisions may be processed through ordinary ODA decision-making channels. Those that need be addressed specifically in the UNFCCC framework are: (*i*) any voluntary contributions to a new REDD+ dedicated instrument under UNFCCC, (*ii*) any share of proceeds on UNFCCC-related transactions and (*iii*) any mechanism to enable the use REDD+ credits to help meet extended Annex I parties QELROs.

Conclusion on funding mechanism: To make REDD+ work, bilateral, multilateral and non-governmental actors will all have to perform their duty in a complementary manner. Input-based and output-based funding have their own advantages and weaknesses and could be combined to suit different times and places.

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