A ROLE FOR LULUCF IN FLEXIBLE MECHANISMS FOR MEETING FUTURE EMISSIONS REDUCTIONS TARGETS BY ANNEX I COUNTRIES

A Submission to the Ad Hoc Working Group on Further Commitments of Annex I Parties under the Kyoto Protocol

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Introduction

[1] Achieving the goals of the Convention will require reducing emissions well below the levels currently mandated in the Kyoto Protocol. Countries have two options for meeting emissions reductions targets: reducing domestic emissions or using the Flexible Mechanisms. Flexible Mechanisms provide for acquiring part of a country's reductions commitments in other countries. There are currently three Flexible Mechanisms available to Annex B Parties for meeting commitments between 2008 and 2012: the CDM, JI and International Emissions Trading. Most Annex B countries are using these mechanisms to meet the modest targets of the first commitment period. Emissions trading systems are operational in the countries of the European Union. Voluntary trading systems are functioning in Australia and the United States.

[2] In order to make greater reductions more palatable to Annex B countries, it is desirable to maintain and even expand these mechanisms to allow for greater flexibility so that maximum reductions can be achieved at the lowest costs. Flexibility over how emission reductions are to be achieved, with a wide choice of sectors, technologies, sinks options and inclusion of non-CO_2 emissions is necessary to achieve greenhouse gas (GHG) abatement at lower costs. As Parties make commitments to greater emissions reductions, the importance of flexible mechanisms will likely grow.

[3] One of the most contentious areas within the Flexible Mechanisms has been the possible role of Land-Use, Land-Use Change and Forestry (LULUCF). The IPCC report issued on 2000 on LULUCF showed significant sequestration potential from these activities, particularly in grassland and forest management and agroforestry (Figure 1). Cropland management offers moderate sequestration potential. Other land-use options such as rehabilitation of degraded land and wetland restoration have relatively low potentials, globally, to contribute to mitigation, although locally their potential may be significant. These low values are the combined result of low area availability and slow carbon accumulation rates.

[4] The potential of LULUCF options has not been realized within the context of the CDM. Even the approved approaches, namely afforestation and reforestation (A/R), are not contributing in a meaningful way to climate change mitigation in the CDM because they are excessively regulated. With current regulations, a high level of expertise is required to develop and register a project, and this expertise is beyond the reach of communities and organizations in most developing countries. Even the simplified modalities for small scale A/R, which were developed specifically to allow communities to participate in the CDM, are beyond the capacities of these poor communities.

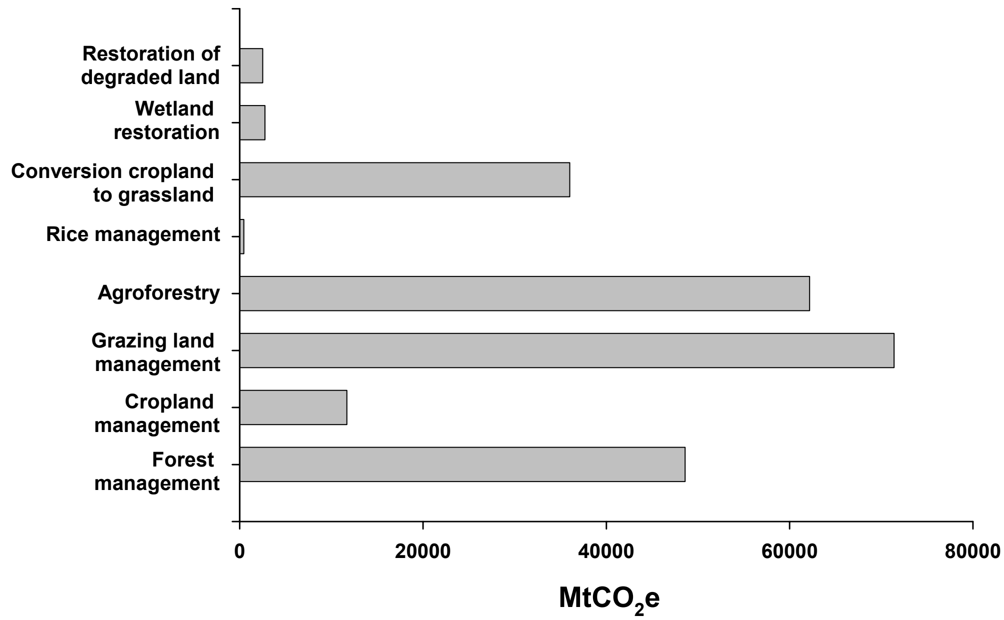

Figure 1: Technical potential for carbon sequestration of different land use and management options over a 30 year period (Verchot et al., 2007)

[5] The recent UNFCCC report on Investments and Financial Flows to Address Climate Change (UNFCCC, 2007) suggested that for reasons of efficiency, between one-half and two-thirds of abatement spending between 2000 and 2050 must occur in developing countries if the world is going to make significant cuts in GHG emissions. The high growth of emissions in these countries and the opportunities for reducing emissions in forestry make for more efficient investment opportunities (Enkvist et al., 2007).

[6] The Energy Modeling Forum (EMF) conducted a study on controlling carbon emissions and used a series of models to assess costs and policy options for significant reductions of carbon emissions. A number of plausible scenarios were considered in the analysis. The study concluded that carbon trading could reduce the cost of climate change mitigation by one-third or more by equalizing the marginal cost of control across all nations (Weyant 1993). The study also pointed to the need for all major emitters to participate in reductions and Flexible Mechanisms offer opportunities for developing country participation. A more recent modeling exercise carried out by the 21st EMF showed that cost reductions between 30 and 40% could be achieved by pursuing a multi-gas strategy that included sinks (van Vuuren et al., 2006).

[7] A rigorous analysis of costs and mitigation potential of LULUCF options does not exist in the literature nor have appropriate regional or global abatement curves been developed. Current estimates of the costs and mitigation potential of LULUCF options are based on rough approximations and generalizations from global models (Sathaye et al., 2007) and site-specific estimates of the tradeoffs associated with different land uses (Chomitz et al.,

2006). Here wee will present two examples calculations on the costs of sequestration in agroforestry and reduced emissions from deforestation and forest degradation (REDD)

Case study 1: Agroforestry

[8] The IPCC (2000) Special Report on LULUCF presented an illustration of the potential of carbon sequestration to contribute to climate change mitigation. The IPCC scenario suggested that it would be possible, with considerable international effort, that 20 percent of the available land could be under this land management practice by 2010 and 40 percent by 2040. These suggested targets have not been achieved and we are at almost the same state of land availability as we were in 2000, when the report was written, so we will use these values in this exercise.

[9] For this analysis, consider an example of a moderately intensive agroforestry system, which has been modelled using the ENCOFOR decision support Carbon Model (www.joanneum.at/encofor; Figure 2). The system is a timber producing system, with food or cash crops grown in the understorey. Examples of this system might be the rotational woodlots of Tanzania, the pine-coffee-banana systems of central Java, Eucalyptus and Poplar based agroforestry systems of the Indo-Gangetic Plain (Bekele-Tesemma, 2007).

[10] In this system, the trees are harvested after 12 years, and regenerated. The ENCOFOR model suggests that the average annual accumulation in this example over 30 years is 1.26 tonnes C per ha and over 60 years, this average figure drops to 0.52 tonnes per ha per year. The IPCC Special Report suggested an average C accumulation rate in an agroforestry system was about 3.1 tonnes per ha for a 30 to 50 year time horizon. These values are appropriate for a multi-strata system that is kept in place over a long period of time, such as the home garden systems of Africa or the jungle rubber agroforestry systems of Indonesia.

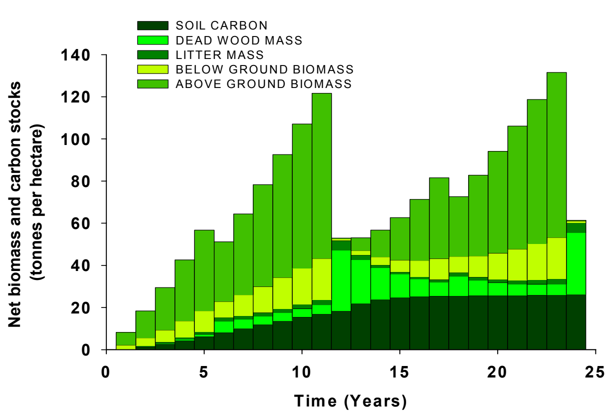

Figure 2: Projection of carbon accumulation in a multi-strata agroforestry system.

[11] These two examples are used because they provide useful bounds to our calculations. In one case we have a system which is regularly harvested and therefore has lower annual accumulation rates because the aboveground biomass is regularly brought back to zero. In the other case, we have a permanent tree-based farming system.

[12] Carbon sequestration potential can be calculated by taking the time frame proposed in the IPCC Special Report, taking the projections of area of land adopting the improved practices, and using both the IPCC and ENCOFOR projections for carbon accumulation rates (Table 1) If we take the sum of the annual accumulation rates over the next 30 years, the results suggest that the total potential sequestration is on the order of 18.9 billion tonnes of C or 69.3 billion tonnes of CO_2e. This does not account for the carbon sequestered in harvested wood products from the agroforestry plantations.

Table 1: Estimates of C sequestration in agricultural lands for agroforestry over 30 years. Two scenarios are presented: one based on the IPCC (2000) LULUCF report; and one based on the projections of the ENCOFOR Carbon Model.

			Permanent agroforestry (IPCC)		Rotational Agroforestry (ENCOFOR)	
Time (years)	Land area available (M ha)	Conversion of area (%)	Rate of C gain (tC ha^{-1} y^{-1})	Carbon (Mt y^{-1})	Rate of C gain (tC ha^{-1} y^{-1})	Carbon (Mt y^{-1})
Agroforestry						
10	630	20	3.1	391	1.26	159
20		27		521		212
30		33		651		265

[13] To calculate these costs, the ENCOFOR financial analysis tool was used. Values are in 2005$. The total cost in this scenario is $1470 per ha, and the costs of establishment and maintenance of these plantations globally comes to $308.7 billion (See Verchot 2007 for more details of this calculation). This is equivalent to US$36.75 per tonne of C, or $10.02 per tonne of CO_2e.

[14] However, not all of these costs need to be borne by the international community or by outside investors. Agroforestry systems are profitable in their own right. The example given here has a 22% internal rate of return. Agroforestry systems vary considerably across regions and have varying income generation potential. This means that the costs of expanding the adoption of agroforestry do not have to be fully borne by external investors. Costs can be shared with rural farmers who will benefit from these profitable systems. In most cases agroforestry systems are more profitable than subsistence agriculture.

[15] The idea of additionality in financing carbon sequestration is already embodied in the UNFCCC and its Kyoto Protocol. Additionality is the criteria for carbon offset projects to determine offsets that occur in addition to business as usual. Additionality is determined by analyzing barriers. Many barriers to adoption of these systems exist, and prevent them from contributing more fully to rural development, including: delayed returns on investments, lack of knowledge, labour shortages, etc.

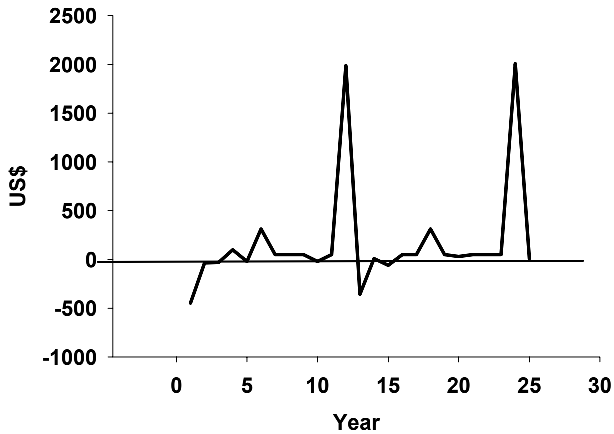

Figure 3: Cash flow over two rotations of a moderately intensive agroforestry plantation in the tropics. Values are in 2005$.

[16] Investments to facilitate wider adoption of higher carbon and higher profit production systems need to target removing these or other barriers that exist in rural areas. In the example above, one of the most important barriers for resource poor farmers to engage in this type of project is financial. Figure 3 shows that the cash flow for this type of plantation is negative for the first three years of the project. This is fairly common in agroforestry projects. In most cases it takes 3 to 5 years to recoup initial investments in agroforestry systems. This is prohibitively long for smallholder, subsistence farmers. Alternative and shorter-term income sources are required to bridge the gap between planting and income generation.

[17] A second barrier is lack of knowledge about agroforestry systems. Thus, despite the favourable internal rate of return resource poor farmers cannot undertake this type of production system because of the financial barrier early in the conversion phase to a new production system and because of the knowledge barrier.

[18] If additional investments were to be made to overcome these barriers, wider adoption of agroforestry could occur. In this case, investments of $640 per ha would be required and the cost of sequestering the carbon would be only $16.00 per tonne of carbon or 4.36 per tCO_2e. Finally, to put this in a global perspective, the technical potential C sequestration of this scenario is 30.8 $BtCO_2e$ for a total cost of $134.4 billion. The actual potential suggested by the IPCC scenario is given in Table 2.

Table 2: Calculations of actual sequestration and costs for agroforestry using the IPCC scenario for adoption/conversion. Costs are calculated using total costs per tonne C and the values suggested for investments aimed at removing barriers only.

		Permanent agroforestry (IPCC)			Rotational agroforestry (ENCOFOR)		
Time (years)	Adoption/ conversion of area	Carbon ($MtCO_2e\ y^{-1}$)	Total Cost	Barriers only ($M)	Carbon ($MtCO_2e\ y^{-1}$)	Total Cost ($M)	Barriers only ($M)
10	20	1434	14,369	6,256	583	5,843	2,544
20	27	1910	19,147	8,336	777	7,791	3,392
30	33	2387	23,924	10,416	972	9,739	4,240

[19] Greater consideration of these land-use mitigation options is warranted, as these types of activities can offer multiple benefits. If well designed, agroforestry, grassland management, land rehabilitation, and wetland rehabilitation projects can contribute to biodiversity conservation, watershed protection, reduction of desertification, and poverty reduction in addition to carbon sequestration.

Case study 2: Reduced emissions from deforestation

[20] The ASB Partnership for the Tropical Forest Margins has conducted biophysical, socioeconomic and institutional research on the tradeoffs associated with alternative land uses in the humid tropics of Southeast Asia, the Amazon basin, and the Congo basin. Building on previous research at the ASB benchmark sites, Swallow et al. (2007) present a spatially-explicit analyses of the tradeoffs between carbon and economic returns in three sites in Indonesia, and one site in each of Peru and Cameroon. Located in the humid forest zones of these countries, these sites represent a range of the conditions that shape tree and forest management across the humid tropics. Indonesia is particularly distinguished by having the world's highest levels of land-based emissions of greenhouse gases and largest CO_2 emissions from conversion of peat lands. The Indonesia and Peru analyses are conducted for provinces, each of which has area roughly equivalent to the size of European countries. Because the Cameroon analysis was conducted for much smaller areas, the results are not reviewed here.

[21] The approach is retrospective, answering the question: what would have been the opportunity cost to land users of keeping land in uses with high carbon values compared to switching that land into land uses with lower carbon values? Two time periods are considered: 1990 to 2000 and 2000 to 2005. Opportunity cost estimates are standardized into 2005 values per CO_2-equivalent of carbon loss. In Indonesia, the analysis was conducted for two different levels of market access (high and low) and two types of soils (mineral and peat). The Indonesia analysis was conducted for Jambi, Lampung and East Kalimantan provinces. The Peru analysis was conducted for the Ucalayi province in the eastern Amazon basin.

[22] Key inputs into the analysis are a detailed land use characterization, calibrated land-use change analysis, updated calculations of the net present value of each of the land uses over a 25-year time horizon, and estimates of the time-averaged carbon stock associated with each land use. The results show the prevalence and geographic distribution of land use transition and the tradeoffs associated with those land use changes.

[23] Results indicate similarities and differences across the sites. The patterns of land use transition over the last 10-20 years vary considerably, with some sites experiencing general trends of carbon-emitting land use changes, while others experiencing a balance of carbon-

emitting and carbon-sequestering land use changes. In general, however, the carbon losses due to carbon-emitting forest conversion vastly exceeded the carbon gains due to carbon-sequestering land use changes. This is exemplified by the Indonesian province of East Kalimantan. Although it has experienced more sequestering land use changes than emitting land use changes, the province has lost huge amounts of carbon overall since 1990. This is because the carbon-emitting land use changes have resulted in average losses of 230 tonnes per hectare per in the year that they occur, while shifts from lower to higher carbon-sequestering land uses have resulted in just 4 tonnes of sequestration per hectare per year.

[24] Further results from across the 3 provinces of Indonesia indicate that there is, even without specific support programs, substantial activity to restore carbon to landscapes that have been previously degraded. In East Kalimantan, the bulk of the carbon-sequestering land use changes are natural regrowth on cleared land, while in Jambi the transition to carbon-sequestering land uses mostly represent transitions from cropland to rubber agroforestry systems. Win-win solutions are possible: transitions from cropland to rubber agroforestry in Jambi and from coffee to complex damar agroforestry in Lampung increase returns to farmers and time-averaged carbon stocks. In Cameroon, shifts from crop-fallow systems agriculture into shaded cocoa systems can also be such a win-win solution.

[25] The analysis of the economic returns associated with the land use transitions (measured in terms of discounted net present value) shows that there is clear economic rationale for almost all of the land use transitions occurring in the 5 sites. That is, almost every land use transition has been economically rational from the perspective of private land users responding to: market incentives to harvest and sell timber; market opportunities for new cash crops; the lack of incentives they have to maintain the value of standing carbon, and high interest rates in local financial markets.

[26] Expressed in terms of tonnes of emissions of carbon dioxide equivalents (CO_2e), however, the economic gains associated with deforestation are very low. In the three provinces of Indonesia included in the study, between 6 and 20% of the area where emissions increased have generated returns less than 1$ per tonne of CO_2e and between 64 and 92% of the emission generating changes have resulted in returns less than 5$ per tonne of CO_2e. In the benchmark site in Ucayali Province in Peru, over 90% of emissions from land use change have generated returns less than 5$ per tonne of CO_2e. If carbon stock of standing forests were valued and sellable during the last 20 years, a large percentage of greenhouse emissions from deforestation in the Indonesia and Peru sites might have been avoided. Current market and incentive conditions in the humid tropics continue to inadequately provide incentives for cost-effective reduction of CO_2 emissions.

[27] The analysis also reveals heterogeneity in carbon stocks in humid tropical forests. Results from the Indonesian province of Jambi show that peat forests, as well as other peat

lands, should be given special attention in negotiations and programmes for reduced emissions from deforestation and forest degradation. The customary slash-and-burn system known as "sonor" is particularly damaging to the atmosphere, releasing large amounts of carbon from the rich peat soils, while providing very little return in terms of income to the local farming populations. The return per tonne of CO_2 emitted is as low as US$0.10-0.20 in those landscapes.

Multiple benefits through LULUCF

[28] LULUCF activities have the potential to do great harm if improperly implemented. Forests and other ecosystems provide goods and services to families and communities and are sources of livelihoods. Both A/R and REDD projects have the potential to dispossess communities from essential resources by restricting access to land and its associated resources, by depleting non-timber forest products involuntarily, by consuming water or by forcing resettlement of populations (Smith and Scherr, 2002). People could be displaced from their land and essential resources and poverty could be increased.

[29] Some activities could simply displace emissions. The current biofuel debate is essentially based on the linkage between fossil fuel emission reduction in Annex B countries and their LULUCF countries that are outside of the accounting system. This is now widely seen as a 'perverse' policy, because the net emissions may well increase through biofuel use, depending on the type and origin of the biofuel. Attaching a 'carbon footprint' to the biofuels, as such, will lead to further debate on the attribution for C losses prior to plantation development. A comprehensive LULUCF accounting in all UNFCCC countries with consequences for the C markets may be the only principled solution.

[30] At the same time, there are a number of good examples community based LULUCF projects that generate biodiversity and/or livelihood benefits. Agroforestry and community forestry projects can generate benefits for subsistence (food, fuel, etc.), for asset building through the sale of tree products and for sustainable land management, including degraded land rehabilitation (Smith and Scherr, 2002). In addition, these types of projects run lower risks of leakage as they enhance livelihoods rather than displace economic activities.

[31] Besides providing appropriate monetary or in-kind compensation for avoided land-use change, REDD schemes should address both the need for alternative sources of livelihood for the affected populations, as well as the need to produce alternative sources of wood products for local uses. Both agroforestry systems and community forestry can produce such win-win solutions.

[32] It is necessary to build safeguards into the rules of Flexible Mechanisms to ensure that multiple benefits are created and that poor communities and individuals are not harmed.

Gender and social equity issues must be addressed explicitly in the rules. Several measures could be built into the future of Flexible Mechanisms to improve the ability of a country to assess full costs and benefits, such as requiring a social impact assessment and setting minimum standards for stakeholder consultations. Several other international conventions have established social principles and these could serve as guidelines for future Flexible Mechanisms.

[33] Safeguards must be built into the program in such a way as they do not impinge on national sovereignty and the right of a country to determine whether a project meets sustainable development criteria. However, proactive measures are desirable when market imperfections, such as lack of adequate information, do not allow a country to properly assess the full costs and benefits of a project (Smith et al., 2002). Possible increased transactions costs of these measures must be weighed against the benefits of promoting better projects.

[34] At the national level, forestry LULUCF projects are limited by excessive regulation of forest market activity. For example, the dependence of A/R and REDD on the term 'forest', may create unnecessary delineation issues, e.g. where agroforestry systems do not meet the 'forest' definition, or where peat soil emissions fall outside of the REDD domain. A more comprehensive approach to LULUCF accounting (following IPCC AFOLU guidelines) is both possible and desirable, ensuring that 'nothing falls through the cracks' of the accounting system.

[35] Policy reforms will be required to reduce the regulatory burden on producers and open the door for participation in the market. At the same time, the desire by many countries to participate in LULUCF activities might provide the incentive for the needed policy reform.

[36] Finally, implementation of LULUCF projects is complex under current rules. Simplified rules will go a long way to creating a more enabling environment for these types of projects. However, it is unlikely that even with simpler and more straightforward rules, that these types of multiple benefits projects will be developed on a wide scale without significant international investment in capacity building, particularly in Least Developed Countries. ODA and other philanthropic investments in capacity building and support for project development should be encouraged.

The way forward

[37] No other area has generated such a heated and sustained debate in the climate change negotiations and in civil society fora as the potential role of LULUCF in Flexible Mechanisms. Despite all the efforts over the years by Parties and by development NGO's,

LULUCF still contributes negligibly to climate change mitigation efforts. The main reason for this is that LULUCF activities are highly over regulated. Transactions costs are prohibitively high for LULUCF projects and this has led to few of these types of projects being proposed.

[38] There are two principal reasons for the high level of regulation of LULUCF projects by the COP/MOP. One is political, where a number of Parties are concerned that inexpensive LULUCF credits might flood the market, lower the value of carbon credits, and shift the emphasis of investment away from other sectors. The second reason is technical, where there is legitimate concern that LULUCF sequestration is temporary, reversible, difficult to verify and subject to leakage.

[39] It is clear from the preceding case studies, that some LULUCF options offer low-cost opportunities for emissions reductions and emissions offsets. These options could lower the total cost of achieving the objectives of the Convention, and, as we have argued above, generate additional benefits that contribute toward meeting the adaptation objectives as well.

[40] With respect to the second reason for the high level of regulation, we suggest that the current approach of limiting the options available to Parties is counterproductive. For example, there is no defensible logic behind the decision to allow reforestation and disallow other types of revegetation. A more constructive approach would be for the COP/MOP to set standards for these projects with respect to the uncertainties cited above and ensure rigorous enforcement of the standards. The Executive Board of the CDM would be charged with ensuring that approaches meet the standards. This would foster wider experimentation than we have seen to this point, which would lead to creative solutions to these problems.

[41] Thus, as consideration of the mechanisms for Annex B countries to meet future commitments progresses, it would be useful for the Parties to reconsider the approach that led to the decisions in the Marrakech Accords that limit LULUCF to afforestation and reforestation. Rather than regulating the types of activities allowed, the AWG should recommend a policy framework that promotes innovation. The IPCC Special Report on LULUCF (IPCC, 2000) offers considerable guidance on such a framework. The AWG might consider an expert consultation process to update the pertinent areas of this report and formulate an enabling policy approach to increasing the flexibility of the Flexible Mechanisms in the LULUCF area.

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