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Carbon financial mechanisms for agriculture and rural development: challenges and opportunities along the Bali roadmap

An editorial essay

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Three-fourths of the world's 1.2 billion poor live and work in rural areas; they directly depend on land, water and genetic resources, and the vagaries of climate, for their livelihoods. Their vulnerability and food security situation is expected to worsen under climate change. For instance, it has been suggested that increased climate variability and more frequent extreme events such as droughts and floods could significantly increase risk of production failures in poor regions as early as the coming decades, i.e., by 2020–2030. Particularly at risk are sub-Saharan Africa and South East Asia. The final declaration of the 2008 High Level Conference On World Food Security[1] stated: It is essential to address the fundamental question of how to increase the resilience of present food production systems to challenges posed by climate change." To this end, the projected costs of adaptation and mitigation measures necessary to safeguard food security and improve livelihoods for the rural poor under climate change are significant, about $100 billion annually in 2030. They exceed several-fold the current and projected private and public investment and financial flows in rural development over the coming decades.

[1]FAO, Rome 3–5 June 2008.

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Where will the money come from? We suggest that there are large opportunities linked to regulatory and voluntary financial carbon mechanisms for climate change that could be used by developing countries to reduce vulnerability of their rural poor in coming decades, by exploiting the well-recognized synergies that exist in the land sector between adaptation and mitigation potential. In fact, land-based activities in agriculture, forestry, and ecosystem services—including reduced deforestation and degradation, agro-forestry for food and/or energy, landscape restoration, recovery of biogas and waste, and in general a wide set of strategies for soil and water resource management and conservation—while essential components of sound adaptation planning, are the key to make carbon markets accessible for the rural poor, resulting in enhanced food security and sustainable cultural, social and economic development.

The Nairobi Framework and the Bali Roadmap of the United Nations Framework Convention for Climate Change recognize the need for enhanced financial mechanisms and reduced bottlenecks to better help the rural poor adapt to climate change, reduce their environmental and economic vulnerability, increase resilience of their production systems, while at the same time contributing to climate mitigation. After reviewing existing and evolving carbon market mechanisms, we propose that post-2012 regulatory markets should increasingly focus on scaling up offset activities from site to regional level, as well as consider promoting "premium" carbon financing for projects that produce joint mitigation and adaptation benefits.

1 Background

Climate change will have a disproportionate impact on poor developing countries—compared to the expected net effects in developed regions—due to a combination of more severe climatic effects in areas that are already vulnerable today, coupled to poor overall capacity to adapt to the projected threats.

Agricultural and other related activities, fundamental to safeguarding food security and for providing livelihoods to the majority of the world's rural poor—including smallholder and subsistence farmers, forest dwellers, pastoralists and fisher folks—are particularly at risk. Responding to climate change is, in this respect, also an issue of equity. This is because the majority of the greenhouse gas emissions have so far been generated in developed countries, while the resources necessary to both adapt to and mitigate the associated climate change are in general not available to those most at risk.

Within the framework of international climate policy and its associated mechanisms, it is therefore imperative to identify how rural poor in developing countries could more effectively access the growing carbon market, in order to mobilize the financial resources and capacity necessary for reducing their vulnerability in coming decades.

This implies a renewed focus on project activities in developing countries that not only contribute to global mitigation efforts, but also insure that appropriate levels of adaptation and sustainable development of rural livelihoods are achieved, in agreement with the ongoing climate policy objectives set within the UNFCCC Bali Roadmap and the Nairobi Framework.

To this end, this essay argues that there is large potential in the agriculture, land use, land use change and forestry sectors of developing countries, capable of generating emission reductions and associated financial flows from the carbon market that are of great relevance to adaptation under climate change, providing better livelihoods and sustainable cultural, social and economic development of the rural poor.

1.1 Greenhouse gas emissions, adaptation and mitigation

A third of anthropogenic emissions of greenhouse gases come from agriculture, land use, land use change and forestry (LULUCF). Virtually all of the emissions from deforestation, including associated land disturbance, and three-quarters of those from agriculture—methane from rice cultivation and livestock production; and N_2O from fertilizer use and animal waste management—are generated in developing countries.[2]

In order to avoid "dangerous anthropogenic interference" with the climate system in coming decades—i.e., in order to limit expected warming to levels that do not endanger ecosystem processes and human development—stabilization of atmospheric GHG concentrations must be achieved, requiring significant cuts in anthropogenic emissions.

A certain amount of climate change is however unavoidable, due to the slowness with which the climate system will respond to emission reductions. For instance, stabilizing carbon dioxide concentrations at 450–550 ppm CO_2[3] is expected to be associated with warming of between 2–4°C by the end of this century. Therefore, adaptation actions to reduce climatic vulnerability of ecosystems, people, and the economy are needed regardless of current and future agreements on emission reductions. In this context, it is imperative to protect livelihoods and safeguard food security of the rural poor in many developing countries, which as discussed are minor contributors to global GHG emissions, but are expected to be the most vulnerable under climate change.

Emission reductions are nonetheless necessary and urgent. The degree of mitigation to be undertaken depends on scientific information about potential impacts, as well as on the expectation that implementation costs to be paid now will be less than the benefits achieved in future decades. To this end, a realistic yet very challenging scenario, identified by UNFCCC and consistent with IPCC estimates, would be to allow emissions to rise by a reduced rate up to 2030, and implement significant cuts in following decades. In particular, this would require cutting GHG emissions in 2030 back to current levels, corresponding to annual cuts of 15–25 billion tCO_2e, or roughly 20–30% of the emissions expected in 2030 without any action. This paper quantifies costs and opportunities for the rural poor in relation to this mitigation scenario.

[2] Yet significant fractions of the associated food, fiber and wood products are consumed in developed countries.

[3] Current atmospheric concentrations are 380 ppm (parts per million), and growing about 0.5% annually.

1.2 Adaptation and mitigation costs relevant to rural livelihoods

Adaptation and mitigation actions require investment and financial flows that are additional to the "business as usual" economy. These translate directly as societal costs of climate change—though of course specific investment strategies and adaptation techniques will also have benefits that need to be assessed—recognizing that these are both financial and non-financial in nature, the latter including ecosystem services, human cultural and social dimensions.

The global annual costs in 2030 associated with the UNFCCC mitigation scenario—i.e., additional investment and financial flows compared to a baseline without climate change—are estimated at US$ 250–380 billion (Table 1). About half of these would be needed in developing countries. More specifically, about half of the expected mitigation costs and almost all of the adaptation costs in developing countries are expected in economic sectors relevant to the rural poor.

Thus, the total bill necessary in 2030 to protect livelihoods of the rural poor in developing countries under climate change can be estimated to be in the order of US$ 83–127 billion per year, or about one-third of global costs. Specifically, US$ 55–65 billion are needed to mitigate in the agriculture, land use, land use change and forestry sectors. They include costs for achieving emission reductions from avoided deforestation, forest management and afforestation/reforestation (A/R); as well as from enhanced agro-forestry, improved methane and N_2O management. Adaptation costs needed for the rural poor are US$ 28–67 billion per year. They are likely to be underestimates, since they include only a limited set of possible response actions,

Table 1 Annual investment and financial flows needed for mitigation and adaptation in developing countries in 2030, with attention on sectors relevant to the rural poor

	Mitigation	Adaptation	Total	2030 reductions
	US$ billion[a]			G t CO_2e
Global costs	200–210	50–170	250–380	15–25
Developing countries	90–100	30–70	120–170	
Rural livelihoods share				
Agriculture	28	4	32	1.0–1.5
Methane, N_2O	(13)			(0.5)
Agro-forestry	(15)			(0.5)
Soils	–	(3)		(0.5)
Food production and processing		(1)		
Water supply and infrastruct.		9	9	
Malnutrition and health		5	5	
Coastal zones		5	5	
Infrastructure		2–41	2–41	
Forests	21	2	23	10–12
Deforestation	(12)			(5–6)
Forest management	(8)			(5–6)
A/R	(.5)			
R&D	5–10	1	6–11	
TOTAL rural costs	55–60	28–67	83–127	11–13.5

[a]2005 US$. Source: UNFCCC (2007); IPCC AR4 WGIII

such as adapting some production and processing activities, including R&D; improving water supply; fighting diarrhoeal disease, malnutrition and malaria; safeguarding low-lying coastal areas; and upgrading infrastructure.

It is important to note that the expected mitigation potential in the LULUCF and agriculture sectors in developing countries is significant—making this sector nearly carbon-neutral—and cost-effective. Mitigation actions relevant to rural livelihoods via agriculture and forestry projects in developing countries may cost about one-fourth to one-third of total mitigation in all sectors and regions, but they generate one-half to two-thirds of all estimated emission reductions. In particular, the potential cost-effectiveness of projects that focus on avoided deforestation and degradation (REDD) is very high. Therefore enhanced climate policies relevant to the rural poor should focus not only on their adaptation needs, but also on their significant potential to contribute to, and tap into, the global carbon markets.

1.3 Financial mechanisms and the rural poor

The expected costs for adaptation and mitigation in sectors relevant to the rural poor in developing countries, roughly US$ 100 billion per year in 2030, represent in a sense the "climate change" bill that society needs to pay in order to reduce vulnerability and thus safeguard livelihoods in developing countries. *Where will the additional investment and financial flows necessary to cover such a substantial bill come from?*

Although US$ 100 billion is only a relatively small share (3–5%) of the projected agricultural gross domestic product (GDP) in 2030, they would represent a 15% increase in investment and financial flows that would be directed towards the agriculture and forestry sectors in developing countries in a scenario without climate change (Table 2). Importantly, these climate change additional costs would exceed foreign debt by a factor of three, and would be about 15 times the projected total investment and financial flows directed towards the agriculture and forestry sectors in developing countries that result from FDI, ODA, bi-lateral and multilateral aid combined.

Financial incentives are therefore needed in order to bridge the gap created by these additional costs of climate change. In particular, enhanced carbon markets could be created to encourage farmers and rural communities in developing countries to adopt GHG reduction strategies that, while sequestering carbon, also strengthen system resilience and ecosystem services. The analysis of the previous section

Table 2 Comparison of expected climate change annual costs in 2030 and business-as usual monetary flows

	2005	2030
	US$ billion	
World GDP	30,000	60,000
Agriculture GDP	1,200	3,000
Agricultural investment	175	750
International debt	(9)	(35)[a]
FDI, ODA, other	(2)	(7)[a]
	–	
Climate costs for rural livelihoods		83–127

Currency is 2005 US $.
Sources: UNFCCC (2007); Tubiello and Fischer (2007)
[a] Assuming same share in 2030 as in 2005

indicates that such activities include REDD projects, sustainable forest management and agro-forestry, improved management of agricultural practices that reduce non-CO_2 GHG such as improved livestock manure management systems, improved fertilizer and input management for crops, and in general a wide set of land and water conservation practices that lead to increased carbon sequestration in soils while enhancing system productivity and resilience to climatic shocks. Bio-energy production from either plant or animal waste products, biogas, or dedicated crops, also have potential for mitigation, by displacing equivalent amounts of fossil fuels, in addition to poverty reduction potential through increased demand of land-based products and diversified incomes.

Climate-related financial mechanisms currently available include UNFCCC flexible mechanisms, such as the Clean Development Mechanisms (CDM) and Joint Implementation (JI); and the GEF Trust Fund and associated Adaptation Fund(s). In addition, a number of Voluntary Market mechanisms have been established in recent years. Several public and private actors, including carbon funds, contribute to facilitate access to such funding, especially for developing countries participants, by targeting capacity building; technology transfer and support; and by helping lower entry costs such as transaction fees by supplying upfront payments for expected emission reductions. They are described in the following sections.

2 UNFCCC financial mechanisms

The Kyoto Protocol of the UNFCCC is the first international climate policy agreement aimed at reducing "dangerous anthropogenic interference" with the climate system. It establishes a set of emission reductions that developed countries (Annex 1 Parties) must meet in order to limit their overall GHG emissions during the period 2008–2012—the first Kyoto commitment period—to a level that is on average 5% lower than in 1990.

Compliance by Annex I countries under the Kyoto Protocol includes the possibility of using emission credits from flexible mechanisms, such as the Clean Development Mechanisms (CDM), which allows investments in climate change abatement projects in developing countries that are parties to the Kyoto Protocol, but without emission commitments—referred to as non-Annex I countries. Another similar mechanisms, the Joint Implementation (JI), allows Annex I countries to invest in project activities located in economies in transition countries. These two options allow access to low abatement costs in many developing countries, provided that the project activities proposed contribute to sustainable development of those regions. Another important UNFCCC mechanisms is linked to the funding available under the Global Environmental Facility (GEF) Trust Fund. This funding is available for both mitigation and adaptation projects. Over US$ 17 billion have been allocated since inception in 1991 for projects addressing climate change mitigation. Funds available for adaptation under the GEF Trust Fund include the Piloting and Operational Approach for Adaptation (SPA), the Special Climate Change Fund (SCCF), and the least Developed Countries Fund (LDCF). Finally, a special Adaptation Fund has been set up that receives funding directly from the sale of 2% of CDM carbon credits.

Investment and financial flows for developing countries linked to climate change mechanisms are currently dominated by the UNFCCC CDM market. Under the CDM (and JI) mechanisms, a project activity in a non-Annex I country that results in avoided GHG emissions with respect to a baseline scenario—in addition to those that would have happened in the absence of the project activity—is issued by the UNFCCC an equivalent number of certified emissions reductions (CERs), each representing one metric ton (t) of CO_2. These CER units can then be sold on the carbon market to compliance buyers that represent entities in Annex I countries with reduction needs.

Registered CDM projects already generate about 200 million tCO_2e annually, corresponding to financial flows of US$ 2 billion per year, at current carbon prices of US$ 10/tCO_2. Expected current and new future CDM projects should result in financial flows of US$ 10–15 billion per year during 2008–2012, assuming average carbon prices of $25/$tCO_2$ (Table 3). In addition, according to the UNFCCC, investments associated with current CDM projects total about US$ 25 billion, half of which from private domestic sources. Assuming a 10-year CDM project cycle, this translates into investment flows of US$ 2.5 billion per year. Because the UNFCCC does not estimate future investment flows related to the CDM, however, these additional flows will not be considered further in this analysis; the rough calculations above nonetheless indicate that the total monetary "benefits" from the CDM estimated herein would be increased by 15–25% by including investment flows.

Further analysis of currently registered CDM projects indicates that project activities of relevance to the rural poor—i.e., activities focused on the relevant agriculture and forestry sectors, including renewable energy generation from biomass—correspond to about 10% of the CDM market. As a result, CDM-related financial flows in agriculture and forestry in developing countries are currently US$ 200 million per year, and likely to reach US$ 1.0–1.5 billion per year during the first commitment period of 2008–2012.

Investment and financial flows related to the UNFCCC JI mechanisms are currently an order of magnitude lower than the CDM. The same applies to the GEF trust funds. Specifically, total contributions from GEF since 1991, including leveraged funding from the private sector, result in flows of about US$ 1 billion per year for all sectors; funding for the GEF Adaptation fund should add another US$ 200–300 million per year during the first commitment period.

Table 3 CDM financial flows, adaptation fund, and underlying emission reductions

	Current	2008–2012	2030 (low)	2030 (high)
	US$ billion per year			
All sectors CDM	2	10–15	10–15	100–150
GEF trust fund		1		
Agriculture and LULUCF	0.2	1.0–1.5	1.0–1.5	10–15
GEF adaptation fund	0.04	0.2–0.3	0.2–0.3	2–3
	Million tCO_2e per year			
All sectors	200	400–600	400–600	4,000–6,000
Agriculture and LULUCF	~20	40–60	40–60[a]	400–600[a]

Currency is 2005 US $. Source: UNFCCC (2007)

[a] Assumed share of agriculture & forestry projects is the same as in 2008–2012

Table 4 CCX offset credits issued as of Feb 2008

Offset type	Amount issued ($ktCO_2eq$)
Soil carbon	11,609
Methane—coal	7,321
Methane—landfill	2,856
Forestry	1,475
Renewable energy	1,140
Methane—livestock	795
Waste disposal—HFC destruction	728
Energy efficiency	2
Total	26,859

Source: Chicago Climate Exchange

How do the projected UNFCCC funds compare to climate change adaptation and mitigation needs of the rural poor in developing countries? Investment and financial flows in 2030 were projected by UNFCCC under two distinct scenarios (Table 4). The first is a "low" compliance scenario, which assumes that the 2030 demand for CERs remains at 2008–2012 levels. The second is a "high" compliance scenario, which assumes that demand for CERS in 2030 increases up to ten-fold compared to 2008–2012 levels, i.e., 4–6 billion CERs per year. The latter implies full commitment by all Annex-I parties—including Australia and the US—and none by non-Annex I parties, in particular China and India.

In 2030, CDM project activities of relevance to the rural poor in developing countries—including agriculture and the LULUCF sectors, plus energy from biomass waste, could therefore generate annual financial flows of about US$ 1.0–1.5 billion—and up to US$ 10–15 billion in case of full post-2012 Kyoto compliance. Such funding through the carbon market corresponds to 2%–25% of the total mitigation needs estimated previously for relevant sectors in agriculture and LULUCF. Annual investment flows in 2030 from the GEF Adaptation Fund could be US$ 200–300 million, and up to US$ 2–3 billion, corresponding to 3–10% of the total adaptation needs for the rural poor in developing countries.

There is therefore a significant gap between the level of funding needed for adaptation and mitigation to climate change in sectors relevant to rural livelihoods, and the carbon funding currently available under UNFCCC flexible mechanisms. This paper next analyzes in more details the current characteristics and potential problems associated with both the UNFCCC carbon market, particularly the CDM, and other public and private carbon funding. Potential solutions needed to both improve access of the rural poor to these mechanisms, as well as enhance the overall funding from carbon markets, are discussed.

3 The clean development mechanism and the rural poor

3.1 Project activities in agriculture, forestry and energy from renewable biomass

Project activities under the CDM range broadly across sectors and regions where carbon offsetting is possible. Projects of relevance to poor rural communities realized to date focus largely on the agriculture and forestry sector, including renewable energy from biomass waste or captured biogas from animal manure management

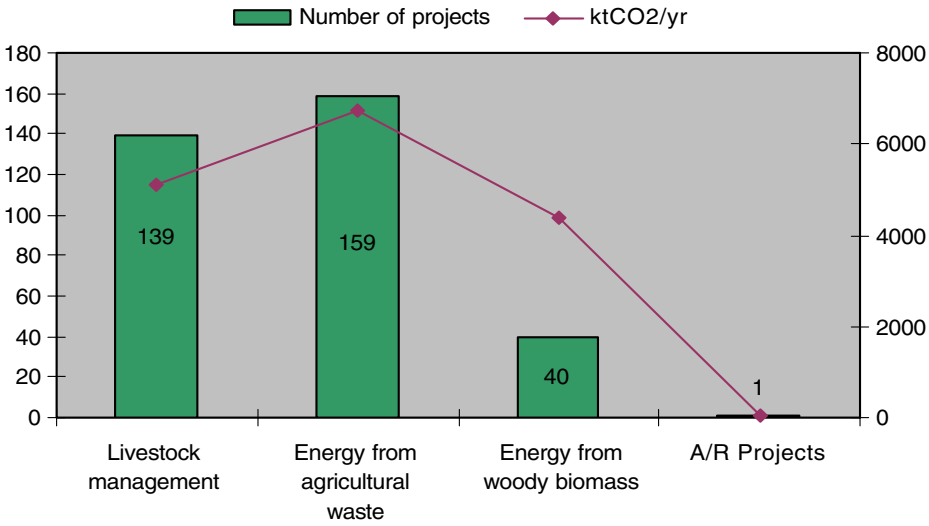

Fig. 1 Distribution of projects by type and by associated CERs in agriculture and forestry. UNFCCC data, March 2008

systems. The CDM and JI financial mechanisms have not been yet linked to climate change response activities in the areas of fisheries and coastal zone management.

Out of a total of over 1,000 projects currently registered by UNFCCC,[4] over a third of the total are either undertaken in agriculture and forestry sectors directly, or focus on renewable energy process in agro-industry. These projects are expected to generate, over the 2008–2012 period, over 15,000,000 CERs annually, about 8% of those generated by all CDM projects. Note that the emission potential per project would be much higher under LULUCF project activities, currently not allowed under the CDM.

Only some of the CDM activities surveyed herein—for instance new technology for recovery of farm-generated methane, or forest restoration in watersheds—are directly linked to on-farm or forestry activities relevant to the rural poor. Several of the other project activities considered—such as renewable energy projects utilizing residues from either agro-industry or farm production—have instead a more indirect link to rural livelihoods, with benefits depending on complex social and market impacts on rural communities.

Only 41 of the total "land" CDM projects analyzed, or about 12%, are related to the forestry sector. Of these, 40 projects are in renewable energy from woody biomass, and one in afforestation/reforestation (A/R) sector (see Fig. 1). The large majority of the "land-based" CDM projects considered herein are related to the agricultural sector with over 85% of the total, and generating about 75% of total CERs. They focus largely on two sets of activities, i.e., methane capture in improved animal manure management systems and bio-energy production from agricultural biomass waste.

[4]UNFCCC data updated to March 2008.

The geographic distribution of CDMs relevant to rural livelihoods is extremely skewed towards few regions and countries within those regions. Latin America and Asia combined host over 98% of the total, and account for 98% of total CERs generated. Three countries alone, i.e., Brazil, Mexico and India contribute more than three-quarter of the total, generating over 60% of total CERs. Adding China and Malaysia[5] to these three countries brings the total to well over 80% of total CERs generated in agriculture and forestry activities. By contrast, and of importance for assessing the relevance of current CDM activities for the rural poor, Africa and the Middle East are significantly underrepresented regions. For instance, of the roughly US$ 180 million that represent annual CDM income in developing countries form activities relevant to rural livelihoods, only about US$ 2.6 million reach sub-Saharan Africa.

3.2 Problems with project identification and implementation

A number of obstacles and problems currently reduce access of the CDM funding mechanisms to the rural poor, resulting in uneven distribution of projects across regions and sectors. With specific relevance to the agriculture, land use and forestry sectors considered herein, key issues can be divided into two broad categories: problems related to current bottlenecks, either administrative or technical—they include insufficient capacity to understand existing, and develop new, methodologies to cover relevant activities allowed under the CDM; insufficient capacity to utilize funds and markets for improved access in many developing countries—and problems related to insufficient sector coverage under the current CDM. As discussed, significant mitigation potential exists in several LULUCF, as well as in some agriculture sectors; were they to be brought into the CDM or similar compliance mechanisms, they could generate high levels of CERs, thus providing rural communities access to new significant financial flows.

- Few project types and approved methodologies for project development
  The scope of mitigation measures currently implemented under the CDM is quite narrow—it covers largely project activities in animal waste management and biomass residue use for renewable energy production. In addition, there are only a few approved methodologies for project activities in the agriculture and forestry sectors relevant to rural livelihoods and their range needs to be expanded to benefit agricultural activities that can be implemented at farm-level. In fact, there is a much broader range of activities with the potential to reduce GHG emissions in the agricultural sector under the CDM,[6] larger than activities currently implemented—for example reduced enteric fermentation, reduced agro-chemical inputs and machinery use, increased irrigation efficiency and

[5]These two countries have only a combined total of 24 projects in the agriculture and forestry sector. However their generated CERs per project are the highest, or about 135 kt CO_2eq/yr/project, compared to 54, 28 and 36 kt CO_2e/yr/project for Brazil, Mexico and India, respectively.

[6]Soil carbon sequestration in agricultural soils has significant potential, but it involves largely LULUCF activities that are not allowed—with the exception of A/R projects—under the first phase of the Kyoto Protocol.

improved agronomic management, including agro-forestry. Additional resources should be directed towards developing new methodologies and implementing project activities that reduce emissions of nitrous oxide from soils, and methane emissions from enteric fermentation and rice cultivation.

- Fragmented project counterparts
  Another major obstacle to project activities of importance to the rural poor is their typically small-scale and high fragmentation levels over large areas. Because transaction costs of CDM projects are high, aggregation of many players and regions is required to generate emission reductions that are large enough to ensure project viability and attractiveness to compliance buyers. The new "programmatic CDM" tool, discussed below, may at last facilitate such aggregation needs.
- Country risks and underdeveloped financial markets
  Most developing countries do not have a large and sophisticated financial market. In addition, many are considered high-risk by foreign private investors. In general, financial risks include political instability, low economic growth, unclear government policies and leadership, bureaucracy, corruption, opaque tax regimes and a lack of readiness to embrace changes. In particular, the following factors have been identified as having impact on the implementation of CDM project activities:
  - Lack of capacity by regulators to mainstream climate mitigation into their national agenda is a principle barrier to more CDM project activities. For instance, as prerequisites for participation in the CDM financial mechanism, non-Annex I countries must have a designated national authority (DNA) in place, and completed a national strategy study on their greenhouse gas emissions. Globally, 33 non-Annex I Parties have not yet established a national CDM authority. In the case of Africa, 47 of 53 countries have ratified the Protocol, yet only 35 have DNAs, and a mere seven have a registered project under the CDM. Finally, 68 developing countries still have no experience in the CDM.
  - Lack of capacity at stakeholder level is also a major obstacle. Accessing financing through the CDM is a complex process; it is difficult for a potential project owner to develop a project idea without external support. Financial quantifications of such limitations do not yet exist; the UNFCCC plans to launch a review of capacity building needs in 2008.
  - High transaction costs. Indeed, they may total up to US$ 100,000 per CDM project, so that large emission reductions are necessary to keep transaction costs per unit CER low. For developing countries, specific tax incentives may be needed to lower transaction costs and facilitate entry into the carbon market. On the other hand, developing efficient monitoring methodologies for projects aggregating many small activities creates additional challenges to project participants.

These factors have led to a pronounced geographic asymmetry among CDM host-countries, and a very high concentration of projects in a handful of host countries. As discussed, Latin America and Asia are the most active regions in the CDM. By contrast, no CDM project activity related to agriculture and LULUCF has been registered in an African country.

The growing realization that most developing countries, and the poor rural communities within them, face serious problems in identifying and implementing CDM projects has brought about a number of initiatives to promote and foster CDM capacity building. The core objective of these initiatives is to identify approaches that minimize transaction costs, remove CDM-related barriers, and facilitate efficient and equitable CDM distribution. Their core activities include: workshops and training sessions for DNA staff, potential project developers, national CDM experts and other stakeholders; preparation of analytical work such as guidebooks, market analysis & research; (promotion activities including organization/participation in carbon events; and facilitation of information management including web-based tools (Hinostroza 2008, Pers. Comm.).

The single most important initiative to catalyze CDM access is The Nairobi Framework,[7] initiated by the United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), World Bank Group, African Development Bank, and the UNFCCC with the specific target of helping developing countries, especially those in sub-Sahara Africa, to improve their level of participation in the CDM.

3.3 Carbon funds

Several funds focus on poverty alleviation in developing countries while providing financing for climate change adaptation and mitigation activities. Two are managed under the GEF Trust Fund: the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF), providing grants for urgent adaptation projects in developing countries. The World Bank administers two additional funds: the Community Development Carbon Fund (CDCF) and the BioCarbon Fund (BioCF), designed to direct financial resources to mitigation activities that also bring multiple environmental and social benefits to rural communities in developing countries. The capital of these funds amounts to US$ 470 million.

In addition to the BioCF and the CDCF, the World Bank administers funds that purchase CERs from mitigation projects in developing countries and countries with economies in transition. Some of the funds, such as the Umbrella Fund and the Carbon Fund for Europe, have multiple contributors, comprising governments as well as private entities. Other funds are designed to meet compliance needs of a particular country—e.g. the Netherlands CDM Facility and the Spanish Carbon Fund. These funds seek to contribute to sustainable development in developing countries, but they do not explicitly target poverty alleviation, nor do they require additional social or environmental benefits from purchased CDM projects.

The resources accumulated through the World Bank funds can be significant. For instance, the Umbrella Carbon Facility has a purchasing agreement with two projects for HFC23 destruction at manufacturing facilities in China totaling US$ 250 million. This level of funding and this project type, however, do not guarantee sustainable development per se—in fact, equivalent funding levels may have played a better role for poverty alleviation and development assistance, if allocated instead to diverse

[7] http://cdm.unfccc.int/Nairobi_Framework/index.html

projects within the BioCarbon Fund and the CDCF in poor regions of participating developing countries. These two funds currently support more than 40 projects with about $220 million.

4 Voluntary financial mechanisms

The voluntary carbon markets include all carbon offset that are not required by regulation. Voluntary market transactions include purchase of carbon credits by individuals or institutions at a retail level to offset emissions; by project developers for retirement or resale; and the donation to GHG reduction projects by corporations in exchange for credits. At the broadest level, the voluntary carbon markets can be divided into two main segments: voluntary but legally binding cap-and-trade systems, such as the Chicago Climate Exchange (CCX), and the broader non-binding, over the counter (OTC) offset market (Hamilton et al. 2007)

4.1 The Chicago climate exchange

The CCX is a voluntary, legally binding, rule-based greenhouse gas emission reduction and trading system based in North America. Members voluntarily join the CCX and sign up to annual emission reduction goals. These were set at 4% below baseline for 2006 and 6% below baseline by 2010, the baseline being 1998–2001 emissions of the CCX member. CCX emission credits are carbon offsets generated from qualifying emission reduction projects, including activities in agriculture and forestry. Importantly, the CCX market is not limited to offset projects in the U.S., but is open to credits generated worldwide.

Eligible CCX carbon offset activities with relevance to agriculture and rural livelihoods in developing countries are carbon sequestration in soils and methane capture and flaring—from animal waste management systems—for renewable energy. Specifically, credits from soil carbon sequestration projects issued since 2003 total 11 M tCO_2e, and represent the majority of all offset types under the CCX (Table 4). They comprise conservation tillage and pasture conservation projects. By contrast, methane recovery from livestock manure management systems accounted for 3% of all emission offsets. Allowed CCX Forest carbon offset categories of relevance to rural livelihoods in developing countries include Afforestation and Sustainable Forest Management. Almost 1.5 M tCO_2e in forestry offsets have been issued to date, representing 4% of all CCX credits.

Although CCX project activities can be located worldwide, credits issued so far from international projects are few. For instance, soil carbon and livestock methane projects offsets are all located in the United States and Canada. By contrast, three LULUCF projects were located in Central and South America—specifically in Brazil, Costa Rica and Uruguay.

4.2 Over-the counter voluntary markets

Almost all carbon offsets purchased outside of a cap-and-trade system originate from project-based transactions. Their trading typically operates outside of formal exchange mechanisms, and is often referred to as a voluntary over-the counter

market. Credits in this market, each corresponding to 1 tonne CO_2e, are referred to as Verified or Voluntary Emissions Reductions (VERs).

At least 13 million VERs were transacted in 2006 (Hamilton et al. 2007). The volume-weighted average price of carbon in these markets was about US$ 4/tCO_2e, corresponding to annual financial flows of US$ 52 million in 2006. Over 40% of the carbon credits that were transacted in 2006 originated from offset projects in North America. Asia and South America generated 22% and 20% of total VERs, respectively. Africa accounted for 6% of the VER market, about 500,000 tCO_2e.

Carbon offset forestry projects have generated to date a large share of VERs, accounting for about 36% of the market. These projects include avoided deforestation, establishment of plantations, afforestation/reforestation with mixed native tree species, and carbon sequestration activities in new forests.

By contrast, VERs originating from methane recovery at livestock farms are few, about 110,000 tCO_2e, or 1.1% of the total.

4.3 Financial flows from VERs relevant to rural livelihoods

Offset prices at the CCX range from around US$ 1.50 to US$ 6/tCO_2e, with recent trends showing rising prices in the expectation of a cap and trade system to be implemented in the U.S. in coming years. Annual carbon offset credits generated in agriculture and forestry in 2008–2012 are expected to be similar to those in 2006, i.e., generating financial flows of over US$ 50 million, representing 3–5% of the CDM flows for the same sectors (Table 5).

The Chicago Climate Exchange has constantly expanded since 2003 in terms of new members embracing voluntary commitments as well as in terms of trade intensity. If it continues to increase in size and adopt, as expected, new emission reduction goals after 2010, its potential for mitigation activities in both sectors can be substantial. Foreign projects can be expected to play a more important role as well, opening the door to a range of agriculture and LULUCF activities of relevance to the rural poor. In addition, because CDM CERs can be traded within the CCX, an expansion of this market may increase demand of CDM projects supplying offsets from land-based sectors.

Carbon credits for over-the-counter voluntary purposes are diverse and are not yet a standardized commodity. As a result the current market is fragmented and there is a lack of reliable data on total financial flows. A survey of Hamilton et al. (2007) identified a large price range of $0.5–45/t$CO_2e$. Prices vary according to the project type. For example, VERs from avoided deforestation are estimated to range from US$ 10–18/tCO_2e by retailers, whereas credits from afforestation/reforestation with mixed native tree species have been sold with much greater price ranges, from

Table 5 Annual financial flows in agriculture and forestry at CCX in 2006

Offset sector	Amount issued (ktCO_2eq)	Financial flows ($1,000)
Agriculture	12,404	45,896
Forestry	1,475	5,456
Total	13,879	51,352

Source: Capoor and Ambrosi (2007)

US$ 0.5–45 per unit VER. In agriculture VERs from livestock management were sold at around $6/tCO$_2$.

Importantly, prices paid by the end user do not reflect the prices paid to projects developers. In general, projects owners typically receive half of the retailer price (Neeff et al. 2007). The year 2006 saw record volumes for the voluntary carbon markets. The volume of VERs sold grew by almost 80% in 1 year—from about 7 million in 2005 to 13 million VERs in 2006. In 2006, these volumes corresponded to financial flows from forestry and agriculture offsets of USS 10–15 million.

The ICF (2007) estimates that the global annual offset demand in 2008–2012 will be 26–76 million tCO$_2$e annually. Assuming the same share for LULUCF projects as in 2006, and keeping conservatively VER prices at 2006 levels (US$ 4 on average), this volume corresponds to financial flows of about US$ 40–100 million, or 3–6% of the financial flows generated by the CDM in agriculture and forestry sectors during the same period.

4.4 LULUCF offsets in voluntary markets

Compared to the UNFCCC regulatory markets, VERs markets have a higher proportion of forestry based credits out of total market transactions than the CDM (36% vs. 1% for CDM), and a slightly higher proportion of credits sourced from Africa (6% vs. 3% for CDM). Importantly, they already provide carbon finance for avoided deforestation projects.

The voluntary markets are also more open than the CDM to smaller offset projects. A survey of LULUCF offset projects in 2006 indicates 19 micro size projects, i.e. generating less than 5,000 tCO$_2$e/year. Indeed, one third of offset credits were by projects generating less than 100,000 tCO$_2$e. This feature currently provides greater opportunities for voluntary markets—compared to the CDM—to contribute to sustainable development in small rural communities.

The large share of small-scale projects generating VERs is also likely related to the possibility to make up-front payments to project owners, helping them cover start up costs. This reduces the development burden on small producers, but also results in payments being made for reductions that have not yet occurred (Peskett et al. 2006). By contrast, CDM buyers typically purchase credits only after CERs have been generated and verified. Small projects in a VER market are also encouraged by the ability to use simpler methodologies and flexible mechanisms for monitoring and verification. This is also a limit to scale up such markets of course, compared to the CDM, since the absence of stringent oversight mechanisms may negatively affect the quality of the VERs produced. In order to reduce such concerns, several independent voluntary standards have been established in recent years, aiming at enhancing the credibility of offset projects.

5 Financing adaptation and mitigation in coming decades

The analyses presented in the previous sections summarize the many opportunities that the carbon market offers to project activities that focus on the rural poor in developing countries and their ability to contribute to global climate mitigation while enhancing their adaptation capacity. These opportunities comprise a wide range of

options, from international climate policy agreements such as UNFCCC mechanisms to voluntary frameworks.

Many problems and bottlenecks were discussed in relation to the ability of developing countries to access such funding opportunities, despite a variety of international, multinational and bilateral support actions. The following sections present recommendations for improving the current mechanisms, offering a strategy for enhancing the role of the rural poor in developing countries while contributing to their adaptation and development needs. Importantly, these strategies offer a view on how to include—within both post-2012 Kyoto flexible mechanisms and enhanced voluntary markets—project activities in sectors of importance to the rural poor, such as avoided deforestation and degradation (REDD) and a wide range of agro-forestry practices, including agricultural land conservation.

5.1 Expanding the base: enhanced voluntary markets and enlarged CDM

The analyses undertaken in previous sections indicate that there is scope for enhancing the ability of carbon markets to reach rural poor communities, by both strengthening the numbers of these project categories and widening their geographic distribution. Importantly, the economic potential for additional carbon sequestration potential of these activities—largely linked to REDD and sustainable forest management actions, but also including agro-forestry techniques, soil conservation in agriculture and renewable energy from biomass—is substantial, corresponding to 5–10 billion tCO_2e per year by 2030 at carbon market prices ranging from US$ 4–10/tCO_2e (IPCC AR4 WGIII 2007). Therefore annual financial flows from these offsets could be as high as US$ 20–100 billion in 2030, helping decisively to meet the expected costs of adaptation to climate change in developing countries.

Many of these activities are currently allowed under a number of voluntary schemes and pilot funds, but are excluded under the CDM, the largest of the existing carbon markets. In particular, allowing credits from REDD, as well as from a range of agricultural and forestry activities, has the potential to greatly increase carbon flows to rural poor people in developing countries. Significant efforts should therefore be directed towards implementing enhanced land-based mechanism for use within voluntary and post-2012 Kyoto carbon markets.

5.2 Mainstreaming offsets into national development themes, programmes of activities

As discussed, land-based project activities in rural areas face several barriers to entry the carbon market—high start-up costs; expensive entry fees; insufficient knowledge about project registration cycles; small project scale and fragmentation, etc. In order to provide "economies of scale", the individual emission reductions of many small project activities will need to be bundled together, so they can become cost-effective and thus attractive to carbon and compliance buyers. In fact, especially with regards to implementing large-scale forestry and agriculture projects, including bio-energy for rural communities, bundling of individual projects—a solution that after all is routinely performed today within the CDM—would be a necessary, yet not sufficient condition for success. Rather, success at large scales should be achieved

by "mainstreaming" a number of mitigation strategies into regional and national-development policy "themes."

The nascent CDM Program of Activities (PoA) provides exactly such a tool. This project category could be used both within UNFCCC funding mechanisms and voluntary schemes, providing a mean to linking large scale, land-based mitigation projects to sustainable development policies. Under the PoA, a policy or market entity—whether a local, regional, or national government, association, or corporation—would set a regional-wide theme that links development policy with mitigation. For instance, it may set forth a plan for regional adaptation activities, based on "good agricultural practices," aimed at strengthening food security in the face of climate variability and change. A PoA offset project could in this case allow certification of the carbon credits associated with such large-scale adaptation solutions, provided it can be demonstrated that the plan would not have been implemented without the additional income from its associated carbon credits.

5.3 Leveraging on development resources and targeting new funds

A portion of the financial leverage needed to create a new carbon market capable of generating US$ 20–100 billion per year in 2030 through large-scale land-based mitigation, could be realized by properly channeling investment and financial flows for rural development. As discussed, these flows—comprising international debt, FDI, and ODA—are small compared with the expected costs of adaptation and mitigation in agriculture and the LULUCF sectors. Yet, if specifically utilized in the context of climate change planning, for instance for development programs that also support entry into the carbon markets, they could have significantly larger positive impacts on safeguarding rural communities under climate change.

Two main areas that could be targeted in this way are capacity building and technology assistance. Capacity building would be needed to (1) Inform and educate with regards to adaptation techniques and options; (2) Inform and prepare entry into existing and future carbon mechanisms, with a focus on development of programs of activities; (3) Lower barriers to entry into the carbon market. Technology support could be expanded to adaptation pilot projects that focus on resilience and food security, and development of expertise and technology solutions related to activities linked to carbon sequestration in forestry, agro-forestry, and soil conservation.

Of relevance to facilitating the links between development and carbon financing, the World Bank elaborated a new package of strategic Climate Investment Funds, with the overall objective of providing support for policy reforms and investments that achieve development goals through a transition to a low carbon development path and climate-resilient economy. They include the Clean Technology Fund, the Forest Investment Fund, and the Adaptation Pilot Fund. Finally, the UNFCCC GEF Adaptation Fund is expected to be the major source for financing adaptation activities in developing countries.

Recent efforts aimed at reducing funding gaps for carbon credits related to rural development also include the Asian Pacific Carbon Fund, and the Future Carbon Fund of the Asian Development Bank. These funds can pay up to 50% of the estimated CERs upfront, i.e., at project registration, helping to reduce large financing uncertainty for project participants. Importantly, the Future Carbon Fund already purchases post-2012 carbon credits.

5.4 Premium carbon credits: linking adaptation and mitigation

Several adaptation activities leading to increased systems resilience and improved rural incomes may be attractive to carbon markets because of their associated mitigation value. No-regrets, win-win strategies that provide additional income to poor rural communities may for instance include forestry management and agro-forestry techniques, agricultural "good practices" that conserve soil and water resource; and properly scaled bio-energy projects for rural communities.

A possibility for enhancing the role of several of these land-based projects activities relevant to the rural poor is the development of "premium credits," i.e., carbon credits generated in projects that not only sequester carbon, but that specifically enhance adaptation capacity through improved ecosystem resilience. On top of likely demand from voluntary markets and carbon funds, a regulated market could be created in a post-2012 Kyoto, by requiring compliance buyers to purchase a minimum percentage of such credits into their portfolios. The resulting higher prices for "premium credits", compared to standard offsets, may significantly increase direct financial flows to project participant in rural communities. Premium carbon credits face additional monitoring and validation challenges however, as parties willing to adopt them would have to agree on a set of baseline and monitoring standards defining acceptable adaptation actions.

6 Recommendations and conclusions

The Bali roadmap to Copenhagen 2009 provides an important new focus on the synergies between adaptation and mitigation strategies within the carbon market, offering a unique window of opportunity for developing countries to identify, negotiate, and take advantage of enhanced and additional financial resources that could be used to help their rural poor reduce their vulnerability under climate change.

Under current financing mechanisms of the Kyoto Protocol—in particular the CDM and JI, as well as the GEF Adaptation Fund—significantly larger financial flows could already be directed to help developing countries, by focusing in particular on the agriculture, land use, land use change and forestry sectors so fundamental to support sustainable livelihoods and economic development of their rural poor.

At the same time, important contributions already exist under a variety of voluntary carbon markets, typically established by private–public partnership, some of which focus on the linkages between carbon sequestration and sustainable development of relevance to rural communities. These markets should be enhanced in the future, and some of their approaches to mainstreaming mitigation into sustainable development could be used to complement and possibly expand current UNFCCC mechanisms.

Significantly larger financial flows than are possible under the current carbon market could be created by adding a range of land-based activities within post-2012 climate mitigation and adaptation mechanisms—in particular reduced deforestation and degradation (REDD), agricultural land restoration and soil carbon sequestration, agro-forestry, and many land conservation practices. These project activities are of direct relevance to the Bali Roadmap, including issues of equity, as they

can play a fundamental role in enhancing sustainable social, economic and ecologic development of the rural poor.

Access to financial mechanisms for the rural poor is however currently difficult, due to a number of barriers related to governance, technical capacity, high transaction costs, lack of appropriate baseline and monitoring methodologies. These barriers also limit the interest of carbon investors, compared to project activities in other sectors. Reducing such barriers, including streamlining project development and application processes, is necessary in order to increase access to current and future financial mechanisms.

In particular, there may be significant scope to applying Programme of Activities, as well as develop access for Premium Carbon Credits that reward adaptation and mitigation synergies, under both the CDM and other voluntary markets, in order to increase financial support for regional and/or national scale climate adaptation and development plans that, by focusing on the land-based sectors identified above, are also synergistic with mitigation.

To this end, a strong mandate on behalf of the rural poor is necessary for identifying novel solutions—and develop a first set of pilot activities—necessary for simplified and unhindered access to current and future climate mechanisms and the carbon market, with a focus on key adaptation, development and sustainability issues of importance to the rural poor.

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