Climate-Friendly Agriculture and the Clean Development Mechanism: An assessment of future prospects for agriculture and land use change in Latin America

By: Hannah Wittman

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Hannah Wittman
University of British Columbia
Faculty of Land and Food Systems
Institute for Resources, Environment and Sustainability (IRES)
2205 East Mall
Vancouver, BC V6T 1Z4
hannah.wittman@ubc.ca

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Abstract:

With the failure of the UNFCCC negotiating process to produce a post-2012 binding treaty to reduce global carbon emissions, market solutions based on the trade of carbon offset credits remain the dominant frame of reference for international negotiations to address climate change. Agriculture and forest and land based mitigation measures are proposed for increased integration in to offset market frameworks, including REDD+. This paper undertakes a preliminary assessment of the potential of such projects by evaluating Clean Development Mechanism (CDM) projects related to agriculture and land use change in Latin America. Results suggest that potential benefits of carbon markets in the agriculture and forestry sectors are often overstated, with failures in the areas of additionality, project accountability, and sustainable development. The data also indicates that industrial agriculture, already a major driver of climate change, stands to benefit from carbon markets to a much greater extent than smallholder agriculture, raising concerns related to climate justice and sustainable development. An increased reliance in carbon trading for climate mitigation may further displace small-scale agro-ecological farms in favor of an expansion of agrofuels cultivation.

1. Introduction

In an era of linked food, financial and climate crises, policy negotiators are increasingly turning towards "climate-smart" agriculture and land use change mitigation initiatives including REDD+ to address the dual demands of food and climate security. With the failure of both Cancun (2010) and Durban (2011) to produce a follow-up to Kyoto that included binding agreements to reduce global carbon emissions, market solutions based on the trade of carbon emissions credits remain the dominant frame of reference for international negotiations to address the drivers of climate change. Discussions around the role of agriculture in mitigation

and adaption are increasing, with 15 developing countries submitting agricultural mitigation strategies to UNFCCC Secretariat as part of their post-Copenhagen commitments (FAO 2010). A work program on agricultural adaptation and mitigation was designated for the FCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA) and climate-friendly agriculture was at the forefront of civil society discussions at COP-17 in Durban. For the first time, agriculture was included as a formal topic of discussion in the Ad Hoc Working Group on Long-term Cooperative Action (LCA), which plans to propose language around agriculture for discussion at COP18 in Qatar (Beddington et al. 2012).

Although no agricultural agreement was reached at Cancun or Durban, these negotiations showed "stronger recognition of the linkages between the agriculture, forestry and food security agendas" of climate change negotiations (GDPRD 2010), with the formalization of the REDD program and the creation of new market mechanisms around it having wide-reaching implications for land-use governance in the global south in order to reduce pressure on forests. An analysis of agriculture and land-use related projects registered in the Clean Development Mechanism offers an opportunity to evaluate the potential of further integration of agriculture into climate markets, in terms of their ability to meet food security and climate mitigation needs. Up to one-third of offset projects currently registered in the CDM take place in the agriculture and forestry sectors, including renewable energy projects in agro-industry (Tubiello et al. 2009). These include methane capture from livestock and manure/waste management, renewable energy from agricultural wastes including bagasse, rice husks, and food processing wastes, energy from woody-biomass, mainly from tree plantations, and afforestation and reforestation projects. In Latin America, 43% of the 604 projects registered in the CDM between 2005 and 2012 fall into these sectors. These projects represent a total potential carbon mitigation contribution of 109.4 million tons of CO2e, about 15% of expected offsets by 2020. Hydropower projects, which in Latin America constitute an additional 23% of CDM project registrations (152 projects), also have significant implications for agricultural and land–use change.

After reviewing recent developments in public and private carbon-offset negotiation frameworks, this paper discusses the current negotiations to increase the integration of agriculture and land-use change approaches and methodologies in climate mitigation policies. Subsequently, results are reported of the analysis of the Project Design Documents of Latin American agriculture-related projects registered between 2005-2012 under the UN's Clean Development Mechanism (CDM) program.

The experience with agriculture in the CDM to date suggests that within the Latin American context, the environmental and social development benefits of agriculture and land-use offset projects are often overstated, with failures in the areas of additionality[1], monitoring and evaluation, and project accountability, while social and ecological costs are often hidden from view. This evaluation correlates with widespread concern about the abilities of the CDM to effectively reduce emissions reductions while supporting sustainable development objectives in host countries (Olsen 2007; Paulsson 2009; Sirohi 2007; Sutter and Parreno 2007; UNFCCC 2012b). The current analysis of project design documents of projects registered between 2005 and 2012 found additional evidence regarding the "marginal incentive" of CDM offset funding for fostering land acquisitions and land use shifting towards agrofuels activities, in particular, which have serious implications for global food security and human rights in host country environments.

[1] i.e. a reduction in emissions or increase in sequestration that would not otherwise have occurred without a subsidy via financing from an international partner seeking to offset emissions.

The paper suggests that despite the intent of the CDM to foster more equitable and environmentally sustainable forms of development in newly industrializing countries, industrial agriculture, already a major driver of climate change, stands to benefit from carbon markets to a much greater extent than smallholder agriculture in Latin America. This analysis suggests that an increase in carbon trading will further displace diversified, family-based, and agro-ecological production in favor of an expansion of biofuel monocultures and industrial tree plantations, and suggests renewed attention to strengthening agricultural investment in small-scale, climate-friendly, agriculture and food security initiatives.

2. Carbon Trading in the Post-Kyoto Environment

Ecological services include the ability of the global carbon cycle to fix carbon from the atmosphere through photosynthesis and return carbon to the atmosphere through burning or decomposition of plant matter. The increasing rate of carbon emissions, via fossil fuel use, land degradation, deforestation, and industrial processes has now exceed the ability of natural sinks-e.g. forests which have also been damaged by human processes, to absorb and return this carbon to the earth, in what Clark and York (2005) have identified as a "biospheric rift" leading to climate change. A carbon offset is a practice or activity that involves avoiding (or reducing) the global warming impact of a carbon emission in one location by implementing an emissions reduction project in another location. Emissions reduction projects can include reducing emissions through the application of technology beyond what would have occurred in the absence of the project (e.g. capturing and burning methane emitted by a confined animal feeding operation) or by implementing an activity that removes (e.g. sequesters) carbon from the atmosphere (afforestation, agroforestry, and some soil carbon/tillage projects). The carbon offset is the net reduction in emissions of a variety of greenhouse gases, usually measured as the equivalence of one tonne of CO_2.

The carbon offset commodification process follows the standard pattern of translation experienced by many other commodification processes, including other ecological services: narrowing an ecological function (carbon sequestration or global warming potential) to separate it from its surrounding ecosystem, assigning an exchange value to the service linked to a fluctuating market price, and linking providers and consumers of the service in market exchanges (Kosoy and Corbera 2010, 1229; Lohmann 2010b). Property rights to carbon offsets are regulated in the current market trading environment by a complex arrangement between international institutions including the UNFCC, the CDM Executive Board, project developers, designated operational entities (DOEs) which are accredited to validate and certify emissions offsets, and community or private organizations charged with implementing the emissions offsets (Paulsson 2009).

The Clean Development Mechanism was introduced to the Kyoto Protocol in 2001 and came into effect in 2005 as a way to introduce institutional flexibility and allow the private sector to become involved in the commitments of protocol signatories to reduce emission reductions. CDM projects are intended to assist developing countries with their sustainable development goals, through the transfer of green technology and support for alternative land use practices including increased agricultural productivity, while allowing industrial carbon producers to more efficiently offset greenhouse gas emissions.

Projects that are registered, implemented by project participants, and then validated and verified by the CDM Executive Board are issued CERS, which are tradable on the open market. By July 2012, over 5600 projects have been submitted to the CDM board, and 4321 have been

registered and approved, involving the issuance of over 2.15 billion CERS through 2012 (UNFCCC 2012a) (Table 1). The CDM was superseded as the largest trading initiative by the European Emissions Trading Scheme (EU-ETS), responsible for 68% of carbon trading in 2008. The EU-ETS is the main driver of demand for CDM-sourced CERS; for example, at least 80 million tonnes of CDM credits were purchased within the EU-ETS by 2009, more than the level of the "cap" that was placed on regional emissions (Reyes 2009).[2]

Table 1: Registered CDM Projects by Sectoral Scope, 2012

Sectoral Scope*	Registered Projects	Percent
(01) Energy industries (renewable - / non-renewable sources)	3501	69.91
(02) Energy distribution	0	0.00
(03) Energy demand	47	0.94
(04) Manufacturing industries	247	4.93
(05) Chemical industries	79	1.58
(06) Construction	0	0
(07) Transport	15	0.30
(08) Mining/mineral production	59	1.18
(09) Metal production	9	0.18
(10) Fugitive emissions from fuels (solid, oil and gas)	181	3.61
(11) Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	29	0.58
(12) Solvent use	0	0
(13) Waste handling and disposal	650	12.98
(14) Afforestation and reforestation	39	0.760
(15) Agriculture	152	3.04

(UNFCCC 2012a)

In addition to the CDM and EU-ETS, growth in the trade of Voluntary Carbon Offset (VCOs) has exploded. Eighty carbon investment funds were set up by 2008 to finance offset projects or buy carbon credits (Lohmann 2009). Carbon offset aggregators began to emerge to consolidate credits from small projects in order to offer offsets for purchase to large carbon emitters. This has facilitated a growth industry in project developers that assist organizations, communities, and individual businesses or companies in navigating the institutional landscape of offsets, including contracts, marketing, and verification of emissions. Between 2005 and 2009, over $300 billion was exchanged in carbon transactions, at an annual growth rate of 89%

[2] This means that the EU-ETS has not actually reduced overall emission, while windfall profits are being realized through the sale of un-needed credits.

(Environmental Leader 2010).[3] In 2008 alone, 4.9 billion tonnes of carbon dioxide equivalent emissions reductions (CERS) were traded on global carbon markets (Environmental Leader 2009).

The CDM is at a crossroads – the CDM Policy Dialogue launched at COP-17 in Durban resulted in a September 2012 report by the High-Level Panel assessing the impact of the CDM to date, its governance and operations, and recommendations for a future context. This report argued that "global carbon markets…are collapsing with potential devastating consequences". In response, the panel suggests reforming governance and addressing social equity and land tenure concerns, particularly in agricultural and forest management contexts. The CDM Dialogue report builds on the assessment of the 2012 Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, which recognize that climate change is resulting in stresses to tenure systems (FAO 2012: v). Thus, the proposed inclusion of additional agriculture and land-use/land cover change (LULCC) projects within the CDM and REDD+ has been the subject of much contention, as discussed in the next section.

3. Climate-Friendly Agriculture and Land Use – offsetting the future?

> "Agricultural land is able to store and sequester carbon. Farmers that live off the land, particularly in poor countries, should therefore be involved in carbon sequestration to mitigate the impact of climate change".
>
> Alexander Mueller, FAO-Assistant Director General, 2 April, 2009

Agriculture and agriculture-related LULCC change (e.g. land-clearing, deforestation) have been estimated to be responsible for between 18 and 32 percent of total global greenhouse gas emissions, and are indicated as the largest contributor of non CO_2 emissions (59% in 1990 and an estimated 57% in 2020) (EPA 2006). Agriculture is responsible for about 60% of global emissions of N20 and about 50% of CH4 (IPCC 2007). Direct agricultural emissions include methane emissions from livestock, large confined-animal feeding operations (CAFOs) and wetland rice, denitrification and resulting N_2O emissions from the application of nitrogen-based fertilizer, soil carbon losses, and carbon dioxide, methane and nitrous oxide (N_2O) emissions from deforestation or other land-clearing activities. Indirect agricultural greenhouse gas emissions also result from manufacturing fertilizer and equipment, food processing and transport, fossil fuel use in agriculture and runoff and subsequent denitrification of nitrogen fertilizer (see Table 2).

Table 2 GHG Emissions by Sector, 2005 (CO_2, CH_4, N_20, PFCs, HFCs, SF_6)

Sector	Million Tonnes CO_2e	Percent
Energy	28,435.9	65.8
Electricity and heat	*12,335.8*	*28.6*
Manufacturing & Construction	*5,230.1*	*12.1*
Transportation	*5,369.0*	*12.4*
Other Fuel Combustion	*3,753.6*	*8.7*
Fugitive Emissions	*1,747.4*	*4.0*
Industrial Processes	1,883.9	4.4
Agriculture	6,075.2	14.1
Land-use Change and Forestry	5,376.2	12.4

[3] For perspective, in 2008 total US wheat exports were $115 billion.

Waste	1,418.7	3.3
Total	**43,189.9**	

Source: adapted from www.cait.wri.org

Emissions from agricultural soils in Latin America are expected to increase more than 46% by 2020, with similar increases in other categories driven by export-oriented growth (Stern 2007). The FAO has argued that almost 90% of agriculture's climate change mitigation potential could be realized through soil carbon sequestration, and that "carbon markets that provide strong incentives for public and private carbon funds in developed countries to buy agriculture-related emissions reductions from developing countries could provide important investments to spur rural development and sustainable agriculture in developing countries" (FAO 2009). These potential agricultural climate change mitigation strategies include "improved crop and grazing land management (e.g., improved agronomic practices, nutrient use, tillage and residue management), restoration of organic soils that are drained for crop production, and restoration of degraded lands" (UNFCCC n.d.).

However, little consensus exists on the most accurate methodologies to measure the highly variable conditions of soil carbon sequestration, or the effects of tillage on soil respiration in relation to N_2O emissions (Baker et al. 2007; Yang et al. 2008). Uncertainties also remain regarding the "permanence" or reversibility of offsets due to human activities, natural disturbances such as forest fires and disease, and ecological changes, including climate change. Despite these concerns, soil carbon and other agricultural offset and mitigation strategies including no-till agriculture, biochar, biotech crops and trees, agrofuels, and agricultural intensification are included in many private and voluntary offset schemes (including the CCX, regional initiatives, and voluntary offset agreements).

While soil carbon sequestration is still not an allowable offset category under the CDM methodological guidelines[4], agricultural related projects can be found not only the Agriculture sector (164 projects, constituting 3.04 % of all registered projects in December 2012), but also in the afforestation and reforestation sector, waste handling and disposal, manufacturing industries, and energy industries. Offset projects are divided into "large-scale" and "small scale" categories, with small scale projects defined as those for which the yearly emissions reductions do not exceed 60,000 tonnes CO_2e (UNFCCC 2010b). Small-scale projects are also allowed to use simplified methodologies, monitoring and verification procedures. Approved large-scale and small-scale methodologies related to agriculture under the CDM include (UNFCCC 2010a):

- Biofuels: generating energy from biomass, including agricultural wastes (e.g. rice-husks, palm oil lagoon-effluent, bagasse), tree plantations
- Livestock waste management: anaerobic digestion, methane capture
- Afforestation and reforestation
- Biological nitrogen fixation leading to reduced synthetic nitrogen fertilizer use

4. Agriculture and the CDM in Latin America.

As a region, Latin America and the Caribbean host 604 CDM projects, or about 14 percent of all CDM projects registered in July 2012. Brazil (204 projects, 4.72 percent of world-wide CDM projects) and Mexico (141 projects, 3.26 percent of total) are the largest Latin

[4] Soil carbon projects comprise an increasingly large percentage of credits traded under the Voluntary Carbon market, and soil carbon methodologies are included in the Voluntary Carbon Standard.

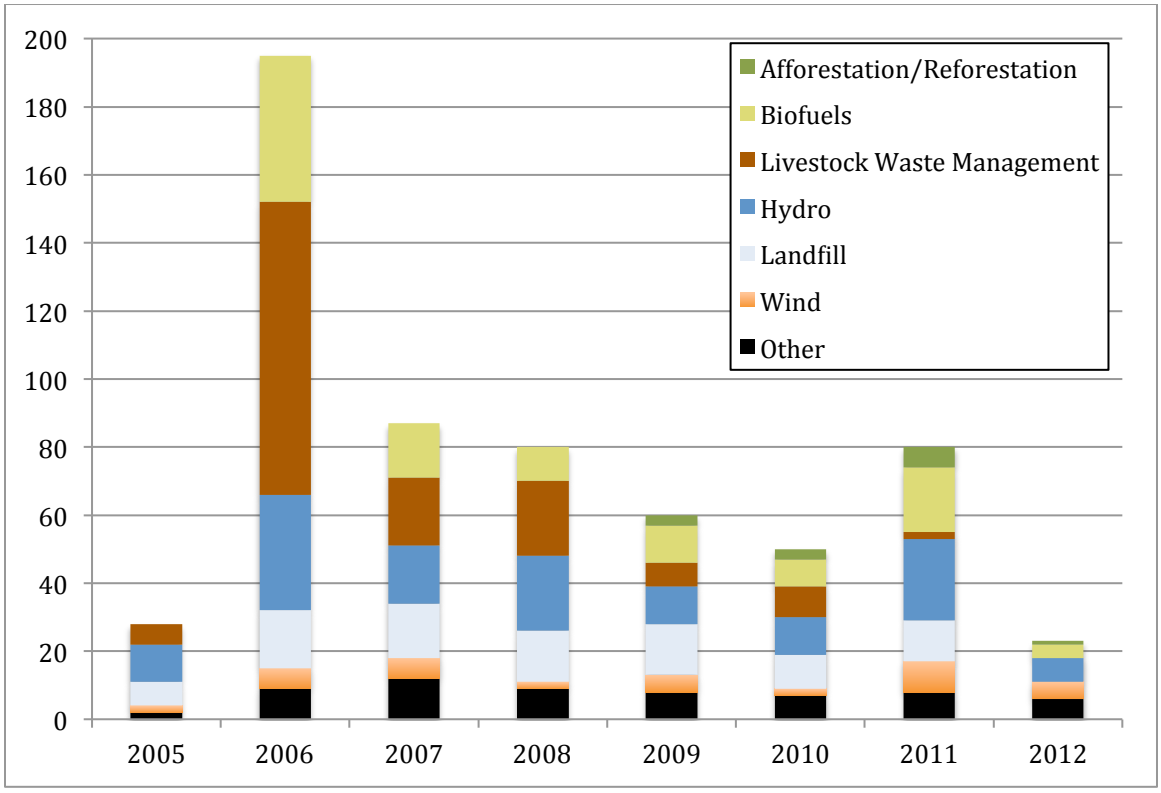
American hosts of CDM projects, and 56 percent of projects in the Agriculture Sector are hosted in Latin America (44 percent in Brazil and Mexico alone) (UNFCCC 2010c).[5] This paper analyzes the Project Design Documents (PDD) for all 604 projects currently registered in the CDM by host countries in Latin America to assess implications of CDM funding on agriculture and land-use change. Project categorization within the CDM was variable - for example, similarly designed renewable energy projects and fuel-switching projects using fuel stock from tree plantations and agricultural wastes were found in the Energy, Manufacturing, and Agriculture categories. This analysis categorized projects for analysis in 3 main categories – afforestation and reforestation projects, biofuels, and livestock waste management, each further analyzed below. Considering all projects with agricultural/land use implications (excluding hydro projects), the rapidly growing number of "agricultural" CDM projects in Latin America comprise a larger portion of total CDM projects (46 percent in July 2012) in comparison to other world regions (see Table 3 and Table 4), and thus offer a substantial framework for evaluation in terms of the ability of offset agriculture to meet combined goals of emissions reductions, food and climate security, and sustainable development.

Table 3: CDM Projects in Latin America

	no. of projects	*CERS Expected (1000 tons CO2e) to 2020*	*Projects with CERS Issuance*	*CERS Target (%)*	*Avg Months Delay*
Agriculture Related Projects					
Afforestation/Reforestation	13	9132	0	0	21
Biofuels					
Bagasse	37	14869	26	102	18.1
Tree plantations	27	35717	13	121	24.79
Other agricultural wastes	47	29521	17	91	25.2
Livestock Waste Management	152	59902	70	49	41.1
total agriculture	*276*	*149141*	*126*	*90.75*	*26*
Non-Agriculture Related					
Hydro (new + retrofits+ Run of River)	137	108413	64	119	23.7
Landfill (flaring/power)	92	224480	48	54	
Wind	37	54390	11	76	
Other (industrial, chemical, transportation)	62	212695	29	82	21.6
Totals	***604***	***749119***	***278***		

[5] In contrast, in July 2012 China contained 2122 projects, or 49 percent of the total CDM projects with 64% of expected CERS, and India 854 projects. Africa hosted just 90 projects, 2 percent of total registered projects.

Table 4: Yearly distribution of agriculture-related CDM project registrations, Latin America, 2005-2012ß



Source: author analysis of 604 CDM Project Design Documents (PDD), UNFCC CDM Project Registry, and UNEP CDM Pipeline Registry, July 2012.

4.1 Afforestation/Reforestation

Sequestration of carbon in forested environments has been the longest tested offset strategy, since its first use in Guatemala in the late 1980s (Wittman and Caron 2009). Forestry projects are among the top three most popular project types in the voluntary market in 2009, because they are "emotive and conceptually easier for business and consumer customers to grasp"[6]; voluntary forestry projects are also now certified under the Voluntary Carbon Standard, which offers a methodology for certifying and monitoring voluntary offset credits so that they can be traded.

Yet, only 14 afforestation and reforestation projects have been registered in the CDM in Latin America, over a combined area of 56,311 hectares. Afforestation and reforestation projects got off to a slow start in CDM project registrations, in part due to uncertainties over how to measure baseline and additionality concerns (Griscom et al. 2009). Registered projects include large-scale projects involving timber harvesting for pencils (Faber-Castell) and furniture

[6] Sascha Lafeld, co-chair of International Carbon Reduction and Offset Alliance (ICROA), an international aggregator. http://www.reuters.com/article/idUSTRE68R3IR20100928

(Precious Woods), where international investors purchased grazing land areas for conversion to timber-plantations specifically based on the "marginal incentive" of access to sales of carbon offsets (PDD 3970, Nicaragua) and as strategy against "possible future obligations" in post-2012 climate treaties (PDD 3845, Uruguay, land purchased by Posco Korea). Several projects in this category have been criticized for the displacement of small-scale farmers and indigenous peoples, including PDD 3233, reforestation of teak, on land seized by paramilitaries during Colombia's civil war.

Small-scale projects involving reforestation with native species on grazing lands with extensive community involvement include CDM Project 2694 in Paraguay, approved in 2009 and developed by Japan International Research Center for Agricultural Sciences (JIRCAS) that will implement plantations of exotic eucalyptus and gravillea species to sequester 1523 tons CO_2e per year. According to the project document, "Local farmers will provide the parcels of land and labor…JIRCAS and INFONA (the Paraguayan Ministry of Forests) will have the right to the income from CER resulting from the project activity and the farmers will have the right to the net income from forest products." Other projects include small-scale afforestation projects in Chile and Bolivia and larger forestry scale projects in Colombia and Peru.

Evaluations of carbon forestry offset programs have raised concerns about not only the accuracy and permanence of carbon offset calculations, but also concerns around ownership and benefit-sharing, environmental externalities and loss of biodiversity caused by landscape carbon management (Dauvergne and Neville 2010; Kosoy and Corbera 2010; McAfee and Shapiro 2010; Niesten et al. 2002). Equity and community consultation concerns have also been highlighted in development of payments for ecosystem services projects involving forest and rural communities. In small scale agro-forestry and reforestation projects, as in the Paraguayan case above and others examined in the literature, small-holder farmers are typically not directly compensated for the carbon credits derived by their activities, and other economic benefits may be distributed unequally (cf. Corbera and Brown 2010; Tschakert et al. 2007; Wittman and Caron 2009). In addition, afforestation projects often involve the encouragement of plantation forestry (Sasaki and Putz 2009), which can lead to losses of biodiversity, changes in the hydrological cycle, and a shift in local food production systems.

4.2 Biofuels: Tree Plantations, Bagasse, and Agricultural Wastes

Offset forestry has had greater success in CDM project registrations when classified under manufacturing or fuel-switching categories, with 27 projects registered in Latin America between 2005 and 2012 involving more than 1.4 million hectares of large-scale plantations of pine and eucalyptus. These projects are also highly concentrated in the Southern Cone, with 15 projects in Brazil and 8 in Chile, and the remainder in Argentina and Uruguay. This category includes Brazil's Plantar project in Brazil (PDD 1051 and 2569), which received CDM registration in 2007 and 2010 for the sale of offsets from 11,700 hectares of eucalyptus planted in the year 2000 for conversion to charcoal as an energy source in pig-iron production, one of the first projects funded under the World Bank's Prototype Carbon Fund. The Plantar Project involves more than 69,000 hectares of eucalyptus plantations, which have been used since the mid-1960s to make charcoal used in pig iron production in Minas Gerais, Brazil. The CDM project funds improvements in the charcoal production process to reduce methane emissions. The CDM project design document for the Plantar Project indicates that it contributes to sustainable development objectives by reducing GHG emissions, provides skilled

employment, and improves the health and safety of workers. The project document also states that the CO_2 emissions from the establishment, management and harvesting of its eucalyptus plantations are "not relevant" because they are "renewable" (PDD 1051, 10).

Evaluations of the Plantar project have identified serious concerns both about its additionality and its role in fostering sustainable development (La Vía Campesina-RS 2006; Lohmann 2006):

> the company's activities in the area of the project have illegally dispossessed many people of their land, destroyed jobs and livelihoods, dried up and polluted local water supplies, depleted soils and the biodiversity of the native cerrado savannah biome, threatened the health of local people, and exploited labour under appalling conditions (Gilbertson and Reyes 2009, 80).

The 25 bagasse (sugar-cane residue) co-generation projects in Brazil support an industry that has been charged with widespread violations of labor rights and with competing directly with small-scale producers for food production (Dauvergne and Neville 2010; McMichael 2010). For example, the Itamarati sugar and ethanol mill in Mato Grosso, Brazil processes 6.5 million tons of sugarcane/year into sugar and ethanol fuel. It generates electricity by burning the sugar cane residues, and sells extra energy back to the state-owned electricity grid. In 2001, the Itamarati plant upgraded equipment to allow more efficient energy production and allow the sale of larger quantities of electricity to the grid. In 2006, based on a provision of the CDM guidelines that allow projects to "bank" CERS starting in the year 2000, project developers successfully argued that the Itamarati upgrade was "additional" and thus eligible for CDM project registration because in 2001, the plant had taken into account the potential of CERS sales when designing the upgrade.[7] The Project Development Document estimated the project will reduce emissions by 7990 metric tonnes of CO_2e/year over a period of 7 years, and the CDM has since issued a total of 82115 CERS to Itamarati between 2006 and 2008, purchased by a Japanese power plant and a Brazilian carbon development fund.

4.3 Livestock Waste Management

More than half of agriculture-related projects – and 25% of all CDM projects - located in Latin America involve livestock waste management projects. These are unequally distributed, with 50 projects located in Brazil and 92 projects in Mexico, and rapidly increasing in number– registered projects in this sector almost doubled between 2010-2012. These are mostly large scale projects involving multi-national corporations oriented towards agricultural production for the export market. In some cases, large projects were broken into "small scale" components to take advantage of less stringent monitoring and validation requirements. For example, Granjas Carroll Mexico, a large-scale pork exporter and subsidiary of the US-owned Smithfield Farms, submitted a suite of 29 small-scale anaerobic digestor/biogass energy generation projects to the CDM in 2006.[8] Project partners included Cargill (with CDM offset credits accruing to Switzerland through the EU-ETS) and EcoSecurities, an offset project developer. In the project design documents, rationale for inclusion in the CDM included: improvements in air quality,

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[7] http://cdm.unfccc.int/filestorage/3X5BY4FQEIIO8HS11CJD8S5OJVMRPJ/Itamarati_PDD%20Ingles%20A.pdf?t=dld8MTI5MTkxNTc3NC44Ng==|qOql0kYpcKAkz83Do41ZNLcGzMM=

[8] 21 of the 29 projects were validated and registered in the CDM. Projects were not considered as "debundled" because CGM's individual "farm", each with its own manure lagoon, were at least 1km apart.

odor, and worker safety, and an explicit consideration of the project's importance in subsidizing a growth in pork exports:

> By improving the waste management system at the farm, the project will support the continued production of pork, which should reach 107 million tons in 2010 (17% increase from current production) in order to meet the consumption needs of the growing global population (PDD 608).

CDM validation and verification documents indicate that only 6 of the 21 sites were visited for verification; yet over 200,000 tonnes CO_2e have been estimated to have been offset.

Similarly, in Chile, Agrosuper (the world's 8th largest pork producer) has cooperated with energy companies in Canada and Japan to implement methane capture and combustion activities on feeding operations containing over 100,000 pigs. Estimated to produce over 400,000 CERSs to year, it involved one of the largest single sales of carbon credits in 2004. In an analysis of the project, Alarcon (2009) argues that the project financed the expansion of the export pork industry, not climate change mitigation, suggesting that "as the export of pork increases, more methane is produced and more carbon credits can be generated" (77). The project also involved other environmental externalities, included illegal water extraction leading to nine separate fines from the Chilean environmental ministry (COREMA) between 2005 and 2007.

5.0 Winners and Losers in Agricultural Carbon Trading

Global discussions around climate change have centered upon offset trading as an efficient and equitable way to reduce emissions while protecting economic growth. Given the role of agricultural activities in contributing to climate change, and as well as the potential of agriculture to mitigate the effects of global warming, negotiations are increasingly focused on how to create policy that will help agriculture to "feed the world and cool the planet". This is the slogan of La Via Campesina, an international coalition of peasant movements in 69 countries that advocates a food sovereignty framework to allow local populations to control their own food systems, ecologies and agricultural policies. Agroecological intensification within the small-scale farming sector, comprising 500 million farms and employing approximately 2 billion people, has been shown to produce food and maintain ecological services more efficiently than conventional monocropping systems (Badgley et al. 2007; De Schutter 2011; Godfray et al. 2010; IAASTD 2009). La Via Campesina and other small-scale farming organizations argue that the existing implementation of the agricultural carbon market, and the proposed expansion of land use and land cover change offsets, especially through the REDD+ program, not only does not reduce global greenhouse gas emissions but also threatens the survival of alternative and diversified forms of agriculture in developing countries. It also contributes to the maintenance of a global system of "climate injustice" that forces poorer countries to continue to export low-priced products for consumptions in rich countries, and to pay the local and global ecological costs of this production (Roberts and Parks 2009).

Property rights to carbon offsets are also abstracted and layered, with the rights to land and forest usage perhaps belonging to communities or individual landowners or companies, but the rights to the carbon offset separated and owned by a foreign investor or project developer (Bumpus and Liverman 2008). The continued expansion of the "pollution rights market" also contributes to what one indigenous peoples' network calls "potentially the biggest land grab in history" (Lohmann 2010a) as offset markets place new claims on forested and agricultural territories. Within a world system context, a geographic analysis of CDM projects has shown

that counter to the proposition of the CDM for sustainable development, natural resource exporting countries have lower CDM credit flows (Huang and Barker 2009). In addition, activities of relevance to the rural poor – e.g. agriculture, landuse change, biomass/biofuels, and forestry, only comprise about 10 percent of the CDM market (Tubiello et al. 2009, 9). In Latin America, those benefiting most from the development and sale of carbon offset projects have to date been large-scale corporations who invest in industrial carbon projects such as large tree plantations, sugarcane, and large-scale, export oriented livestock management, in what Bumpus and Liverman (2008) have called a process of "accumulation by decarbonization". This latest stage in the commodification of agriculture represents another phase of the world-historical process of unequal ecological exchange. As in earlier phases of exchange, the accumulation of carbon capital displaces smallholder farmers both physically, as well as relatively, creating a class of "conservation refugees" who are not able to access the carbon offset subsidy.

Lack of accountability and additionality

As one analyst concludes, "offsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened" (cited in Reyes and Gilbertson 2009). As in the Itamarati case, some estimates suggest that up to three-quarters of CDM projects were completed before being registered and ratified in the CDM (Davies 2007). Verification and monitoring of agricultural and land use/land cover change offsets also face numerous difficulties. The primary forces driving processes of unequal ecological exchange include rising consumption levels, particularly of meat, which are driving the expansion of agricultural industrialization (Golub et al, 2012). This expansion provides a context not only for raising emissions, but for creating a parallel market for trade in those emissions. Financing and project proliferation also create a role for project developers, carbon aggregators, and other middlemen. The logic of climate change mitigation is thus translated from one of resource use and conservation, based on multiple non-monetary values, to a single unit of exchange, which can be "counter-productive for conservation" ad good (the sequestration potential of a soil or forested area) occurs at the point of offset sale.

While it is clear that the global drivers of climate change and the equity benefits of mitigation measures are geographically differentiated, climate change also poses differential risks for Latin America (Roberts and Parks 2007; 2010). A recent meta-analysis of regional climate change impact projections indicated that between 1961 and 2000, low, middle and high-income groups were responsible for 13, 45 and 42 percent of global GHG emissions, respectively. However, it was estimated that the lowest income group will shoulder 29 percent of total impacts (Srinivasan et al. 2008; Srinivasan 2010). The IPCC Third Assessment Report also indicated that global warming is likely to reduce crop yields in the tropics, affect the adaptation of animal herds, and disturb normal forest regeneration. Greater agricultural vulnerability is likely to increase food prices, and thus affect food security – the total costs of livelihood protection for the rural poor in developing countries, under climate change, was estimated by the FAO to be between $83-127 billion per year, with $55-65 billion needed to address impacts in the agriculture, land use, land use change and forestry sectors (Tubiello et al. 2009).

Trade in agricultural carbon will likely increase resource consumption and economic development in industrialized countries. At the same time, it has the potential to also drain local ecologies in extractive economies, undermine local social organization and infrastructure, and increase emissions in poorer countries. As the latest form of wealth transfer from South to North, the current trend to focus mitigation and sequestration programs in developing regions has been

challenged as a form of environmental colonialism or global environmental injustice (Agarwal 2000; Martínez-Alier 2002), as those regions are faced with new constraints on their own emissions while also bearing increased responsibility for operating as carbon sinks for industrialized nations.

Proponents of a 'climate justice' model, including members of La Via Campesina, argue that if carbon markets are to proceed, better measures of accountability, additionality, and compensation need to be developed, particularly in the areas of land tenure protection and access to rights over carbon offset funds to adequately protect the interests of indigenous peoples and diversified small-scale and family oriented farming population in the global south. Rather than continuing to subsidize large-scale agriculture, which is responsible for a substantial portion of emissions, a CDM-like model should be developed based on the principle of 'climate democracy" rather than continued 'climate colonialism' (Bachram 2004).

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