Climate Change Mitigation Finance for Smallholder Agriculture

A guide book to harvesting soil carbon sequestration benefits

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Leslie Lipper, Bernardete Neves,
Andreas Wilkes, Timm Tennigkeit,
Pierre Gerber, Ben Henderson,
Giacomo Branca and Wendy Mann

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Acronyms and abbreviations

AFOLU	Agriculture, forestry and other land use
ALM	Agricultural land management
APD	Avoiding planned deforestation
AR4	Fourth Assessment Report (of the IPCC)
ARR	Afforestation, reforestation and revegetation
AUFDD	Avoiding unplanned frontier deforestation and degradation
AUMDD	Avoiding unplanned mosaic deforestation and degradation
AWG-LCA	Ad-Hoc Working Group on Long-term Cooperative Action under the Convention (see UNFCCC below)
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
BioCF	BioCarbon Fund (World Bank)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (Brazilian Development Bank)
C	Carbon
CAR	California Climate Action Reserve
CCBA	Climate, Community & Biodiversity Alliance
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
CERs	Certified emissions reductions (under CDM)
CF	Carbon Fund
CGLC	Cropland and grassland land-use conversions
CH_4	Methane
CO_2	Carbon Dioxide
COP	Conference of the Parties (under UNFCCC)
DFID	Department for International Development (United Kingdom)
DNA	Designated national authority
DNDC	DeNitrification-DeComposition
ECCM	Edinburgh Centre for Carbon Management
ECOSUR	El Colegio de la Frontera Sur (Mexico)
ENCOFOR	ENvironment and COmmunity based framework for designing afFORestation, reforestation and revegetation projects in the CDM: methodology development and case studies (EU funded)
ERs	Emissions reductions
ERA	Extended rotation age/cutting cycle
ERPA	Emissions reduction purchase agreement
EU-ETS	European Union Emissions Trading System
EX-ACT	Ex-Ante Appraisal Carbon-balance Tool
FAO	Food and Agriculture Organization of the United Nations
FAS	Fundação Amazonas Sustentável (Brazil)
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gas

GtC	Gigatons of carbon
ICM	Improved cropland management
ICRAF	World Agroforestry Centre
IFC	International Finance Corporation
IFI	International financial institution
IFM	Improved forest management
IGM	Improved grassland management
IPCC	Intergovernmental Panel on Climate Change (UN)
LDCs	Least-developed countries
LULUCF	Land use, land-use change and forestry (precursor to AFOLU)
LtHP	Low- to high-productive forest
LtPF	Logged to protected forest
Mha	Millions of hectare meters
MRV	Measurement, reporting and verification
NAMA	Nationally appropriate mitigation action
NAP	National allocation plan
NAPAs	National adaptation programmes of action
N_2O	Nitrous oxide
NGO	Non-governmental organization
NRM	Natural resources management
NSW GGAS	New-South Wales Greenhouse Gas Reduction Scheme
PDD	Project design document
PES	Payment for environmental services
PIN	Project idea note
PoA	Programme of activities
PS	Panda Standard
REDD	Reducing emissions from deforestation and forest degradation (UN)
REDD+	Includes the role of conservation, sustainable management of forests, enhancement of forest carbon stocks and support to local communities dependent on forests
RGGI	Regional Greenhouse Gas Initiative (Northeastern and mid-Atlantic US states)
RIL	Reduced impact logging
SALM	Sustainable agricultural and land management
SBSTA	Subsidiary Body for Scientific and Technological Advice (under the UNFCCC)
SD-PAMs	Sustainable development policies and measures
SGM	Sustainable grassland management
SOC	Soil organic carbon
tCO_2e	Tonnes of CO_2 equivalent
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America
VCS	Verified carbon standard
VERs	Verified emissions reductions (voluntary market)
WCI	Western Climate initiative (covers 11 US states and Canadian provinces)

Context and overview

Globally, the agricultural sector is an important source of greenhouse gas (GHG) emissions, and projections indicate that these emissions will increase if agricultural growth and development proceeds under a 'business-as-usual' model of technology and resource use. For example, agricultural nitrous oxide (N_2O) emissions are projected to grow by 35-60% up to 2030 due to increases in both nitrogen fertilizer use and animal manure production (FAO 2003 cited in IPCC 2007). The Fourth Assessment Report (AR4) of the United Nations Intergovernmental Panel on Climate Change (IPCC) notes that food demand and dietary shift projections indicate that annual emissions of GHGs from agriculture may escalate further (IPCC 2007). At the same time, agricultural growth is a key component of economic development and food security strategies for developing countries, where the agricultural sector is often the largest sector in terms of gross domestic product (GDP) and employment. In the next 20 years, major transitions in developing country agriculture will inevitably occur in response to growing populations, and changes in national and global economies, markets and climate. These transitions will necessitate innovations in agricultural technologies and practices as well as institutions, and there exists a range of options that could be pursued to meet these challenges.

At present, there is increasing interest in 'climate smart agriculture' (CSA) options, particularly in developing countries that incorporate necessary adaptation into agricultural growth strategies for food security and poverty reduction, and that also capture potential mitigation co-benefits (FAO 2010). Low-emission agricultural growth strategies will entail different levels and types of investment, as well as operating and opportunity costs. Assessing GHG emissions associated with various trajectories of smallholder agricultural development and related public and private costs of reducing them is thus an important requirement for achieving CSA. This presents an opportunity to identify solutions that generate both private (food security, returns to agriculture) and public (mitigation) benefits. Financing for mitigation services generated by the sector could provide a potentially significant additional funding source to support investments to assist developing countries in adopting low emissions pathways to agricultural development and poverty reduction.

The AR4 identifies soil carbon sequestration as the highest potential source of mitigation from the agricultural sector – from both technical and economic perspectives (Smith et al 2007). Two main features of soil carbon sequestration drive this conclusion: the tremendous area and thus aggregate levels of sequestration that could be achieved by increasing carbon in soils, and the low costs associated with this form of emissions reduction, since the changes in farming practices required to increase carbon in agricultural soils often generate benefits to agricultural production in the long run, as well as mitigation benefits. Although this potential synergy between mitigation and agricultural development has generated much interest (FAO 2009), concerns about the lack of ability to achieve a system for the MRV of emissions reductions (ERs) from this source have hampered progress in tapping this potential means of mitigation.

To date, there is still relatively little field experience with crediting mitigation from soil carbon sequestration in agricultural systems in a project setting. There are also very few methodologies and approaches for crediting such benefits from smallholder agricultural systems, but there is a small and growing body of experience being built. So far, the contribution from agricultural soil carbon sequestration to climate change mitigation efforts has been mostly limited to two experimental programmes in developed countries, namely, the Chicago Climate Exchange (CCX) in the United States (US), and the Alberta Carbon Exchange in Canada. In developing countries there has been some progress with costly project-based approaches to generating offsets for the voluntary market, in anticipation of their eventual acceptance into compliance markets. The low prices, however, for agriculture, forestry and other land use (AFOLU) offsets results in relatively few opportunities to capture agricultural mitigation benefits in developing countries in this manner. While information on the biophysical potential for GHG abatement strategies is growing, the implementation potential in general, and in particular the involvement of smallholders, continues to face substantial challenges.

Thus, at this stage, it becomes important to take stock of the opportunities and obstacles of the project-based approach for the agriculture sector, and distil lessons to inform the development of broader mechanisms that can combine mitigation objectives with development goals.

Building on FAO policy advice and incorporating lessons from ongoing agricultural carbon finance projects of FAO and other organizations, this document aims to provide an overview of potential mitigation finance opportunities for soil carbon sequestration. The first part provides an overview of the opportunities for climate change mitigation from agricultural soil carbon sequestration, the emerging policy options and consequent institutional mechanisms for financing such mitigation, and the opportunities for smallholders to participate in them. The second part is aimed primarily at carbon project developers and decision makers at national level concerned with environmental and agriculture policies and incentives, and non-governmental organizations (NGOs) and farmers' associations working towards rural development and poverty alleviation. It provides step-by-step practical support to project development.

This FAO publication focuses on climate change mitigation financing for smallholders. The Organization, however, fully recognizes that adaptation may be the imperative and priority over the short and medium term for many smallholders in circumstances where climate change may adversely impact their efforts to overcome poverty and food insecurity. In many cases, most countries will need to deal with both adaptation and mitigation. FAO is supporting national efforts on CSA which seek to enhance the capacity of the agricultural sector to sustainably support food security, livelihoods and growth under climate change, incorporating the need for adaptation and the potential for mitigation into development strategies. Climate change mitigation financing can play a role, along with other sources of financing, in enabling climate smart agriculture.

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PART I

Climate change mitigation finance for smallholder agriculture in the context of agricultural development and poverty reduction

The role of mitigation finance* in meeting challenges facing developing country agriculture

1

Food insecurity and climate change challenges are increasingly seen as being interdependent – shaped by a confluence of different pressures that converge within the agriculture sector – population size and commensurate food demand are increasing; competition for food, land, water, energy and carbon storage is intensifying; degradation of natural resources is expanding; and solutions for climate change are becoming more urgent. Different agricultural practice and policy options may result in trade-offs and synergies across the two challenges. Mitigation finance is progressively being looked at as a new opportunity to support farmers in improving agricultural production and land management to enhance productivity as well as the capacity of the sector to adapt to and mitigate climate change.

The agricultural sector in developing countries is called upon to deliver multiple benefits – food, income, employment and environmental services – under increasing demand from rising populations, particularly in areas of greatest food insecurity. These increasing demands are occurring in the wake of decades of declining investments in the sector. Bruinsma (2008) projects that a 70% increase in agricultural production will be needed to meet food demands by 2050, and most of that increase will need to come from agricultural intensification. At the same time, analyses of near-term effects of climate change indicate that developing country agriculture, particularly in sub-Saharan Africa, is likely to experience increased variability and incidence of severe climate shocks, thus reducing productivity and livelihoods (Lobell et al 2008; Fischer 2009). These projections indicate the pressing need for widespread transitions in smallholder agricultural systems in developing countries—to improve productivity, resilience in the face of variability and, ultimately, the benefits farmers can realize from their systems.

According to IPCC 2007, agriculture is currently responsible for about one third of the World's GHG emissions[1] and this share is projected to grow, especially in developing countries. At the same time, the sector also has high mitigation potential, particularly through improvements in land-use management: 89% of IPCC-identified technical potential lies in enhancing soil carbon sinks. Initial studies indicate that the long-term social costs of adopting such measures decrease as agricultural productivity, stability and ultimately profitability increase (FAO 2010; McKinsey 2009; FAO 2009). There are, however, substantial costs and barriers to overcome in the short run to realize the level of change required to achieve significant mitigation benefits (McCarthy et al 2011; Thornton and Herrero 2010).

*Mitigation finance can be inclusive of a broad range of: (i) financing sources, i.e. public, private, innovative, and possibly combinations of these; and (ii) financing mechanisms, including compliance cap-and-trade systems such as the Clean Development Mechanism (CDM), voluntary markets which have a higher portion of land-based credits, and public funds such as that of the Global Environment Facility (GEF) and other climate finance instruments used by the World Bank, as well as Fast Start Climate Finance and the Green Climate Fund (GCF).

1 This includes impact of agricultural expansion on land use change and emissions.

Thus, enhancing carbon in smallholder agricultural systems, particularly in soil carbon stocks, has the potential to generate synergies between food security, adaptation and mitigation (FAO 2009). Financing is a key means of capturing these synergies, which explains the interest in the concept of linking mitigation finance to carbon-rich[2] transitions in smallholder agricultural systems. The carbon finance model is one type of Payment for Environmental Services (PES).[3] This guide has been developed to provide an overview of the potential and requirements for linking mitigation finance to changes in land management in smallholder agriculture, as well as more practical guidance on how to proceed in field-based situations.

As we will argue in this report, however, mitigation financing modalities based on project-based offsets are unlikely to become a significant channel of financing to smallholder agriculture in developing countries in the short run. This is due to three main factors: the relatively low demand for such credits, the high transactions costs relative to potential value generated, as well as the potential conflicts between mitigation and development objectives that can arise in the context of achieving additionality and permanence.[4] Today, carbon finance transactions for the Agriculture, Forestry and Other Land Use (AFOLU) sector remain limited in regulated cap and trade emissions reduction markets such as the Clean Development Mechanism (CDM). They play a larger role, however, in the voluntary carbon market. The potential for new dedicated public funds possibly combined with private sector funding for nationally appropriate mitigation actions (NAMAs) in developing countries, currently under discussion in the United Nations Framework Convention on Climate Change (UNFCCC) negotiation process, increases the importance of looking carefully at the potential opportunities and barriers to linking carbon finance to the AFOLU sector at this time.

1.1 Agriculture, food security and climate change in post-Copenhagen UNFCCC processes [5]

Article 2 of the UNFCCC[6] acknowledges that, in establishing a timeframe for achieving stabilization of greenhouse gases (GHGs) in the atmosphere, economic development, ecosystem resilience and food production (all of which relate to agriculture in a large number of developing countries) would need to be taken into account.

Heightened awareness of the potential of agricultural mitigation has generated broader interest by a growing number of parties in having agriculture included in ongoing international work on climate change, as was reflected during international negotiations under the UNFCCC. That being said, in both

2 In contrast to usual references to "low-carbon" transitions or pathways, we use the term "carbon-rich smallholder transition" to indicate the importance of increasing carbon stocks in agricultural development.

3 Payment for Environmental Services (PES): A concept linking the provision of an environmental service, e.g. adoption of improved land management resulting in less soil erosion, with the generation of revenues for the provider of such services, so that the provider is compensated for potential income reductions resulting from the adoption of the improved practices. The buyer, through investment in improved practices, profits from the enhanced environmental conditions and services rendered, e.g. from reduced silting downstream. Thus, all parties benefit from the investment in sustainable land management practices. Smallholders are offered an option to change their practices without income loss and to improve their livelihoods, and are made equal partners in a win-win deal.

4 See section 4.8 for definitions of permanence and additionality.

5 Text from FAO info note: http://foris.fao.org/static/data/nrc/InfoNote_PostCOP15_FAO.pdf

6 "*...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system... should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.*"

Copenhagen 2009 (COP15) as well as in Cancun 2010 (COP16), text on agriculture – including the proposal for a work programme on agricultural mitigation under the Subsidiary Body for Scientific and Technological Advice (SBSTA) – was excluded from the outputs of the Conference of the Parties (COP).

Agriculture, however, has already figured prominently in national adaptation programmes of action (NAPAs) formulated by least-developed countries (LDCs). NAPAs are now to inform new national adaptation plans which – in accordance with the Cancun Agreements – are to be prepared by developing countries.[7] Also, following COP15, a number of developing countries indicated their intention to undertake NAMAs related to agriculture.

The Cancun Agreements outlined in a very general way a number of steps that are to enhance adaptation and mitigation. How countries might move from an international agreement to national implementation with regard to agriculture is still not clear in the absence of explicit guidelines, policies and frameworks for early action. At the same time, the design of international enabling mechanisms, including financing mechanisms such as the Green Climate Fund (GCF), will need to be informed by realities on the ground and the specificities of agriculture in the context of climate change.

Under the Cancun Agreements related to mitigation, developing countries will: (i) undertake NAMAs in the context of sustainable development; (ii) report action seeking international support to the Secretariat to be recorded in a registry; (iii) establish the MRV of agricultural mitigation activities of internationally supported actions;[8] and (iv) be encouraged to develop low-carbon development strategies or plans. The Cancun meeting also resulted in progress on reducing emissions from deforestation and forest degradation (REDD) and REDD+ (which includes reducing emissions from conservation, sustainable management of forests and enhancement of forest carbon stocks), proposing that the Subsidiary Body for Scientific and Technological Advice (SBSTA) under the UNFCCC conduct work on the evidence base on drivers of deforestation. This includes identifying and analyzing agricultural mitigation options which also increase productivity, and which could potentially help to curb the expansion of agricultural lands into forested areas.

The commitment to mobilizing fast-start financing in the Copenhagen Accord was confirmed in the Cancun Agreements. Regarding longer-term financing, a decision was taken to establish a GCF which would manage resources committed to support adaptation and mitigation efforts in developing countries. The Cancun meeting also formally recognized NAMAs—a vehicle for developing countries to receive financing, technology and capacity building to support emissions reduction relative to a business-as-usual emissions scenario for 2020 (World Bank 2011). Thus far, 20 developing countries have submitted NAMAs which include mitigation from agriculture (Meridian Institute 2011). These are likely to form the basis of programmes and projects for Fast Start Climate Financing. The details of longer-term financing under the GCF are still to be developed, but there are expectations that a portion of the targeted amount of US$100 billion per year by 2020 would come from private sources mobilized through carbon markets (World Bank 2011).

7 FCCC/CP/2010/7/Add.11/CP.16, para 16

8 See chapter 4.

There is increasing interest in developing CSA strategies for developing countries that include adaptation, as well as potential mitigation co-benefits in the design of agricultural investments for food security, growth and poverty reduction (see Box 1 below). Identifying measures and strategies that enable countries to address adaptation, food security and mitigation in an integrated fashion is thus important for allowing countries to achieve commitments made, and to access new streams of climate finance. Given the importance of aligning mitigation activities with sustainable development objectives, it is likely that MRV approaches of emissions from agriculture – and particularly soil carbon sequestration – will become an increasingly important issue, albeit for a range of crediting options (not just for offsets). This guidebook is intended then to contribute to the identification of important design features needed to link mitigation finance to agricultural mitigation, focusing on agricultural soil carbon sequestration using lessons learned from emerging pilot projects.

Box 1:
Transitioning to climate smart agriculture to improve resilience

Climate smart agriculture (CSA) seeks to increase productivity and food security sustainably, strengthen farmers' resilience to climate variability and change, and reduce and remove GHG emissions. One of the main features of CSA is increasing resilience in agricultural production systems to climate shocks such as drought and flooding. FAO 2010c highlights several different examples of how this can be accomplished in diverse situations. Improving soil quality is one of the fundamental activities of CSA, as higher quality soils are better able to retain moisture and reduce runoff—two important features in responding to drought and flooding.

Source: FAO 2009 cited in FAO 2010

Agriculture greenhouse gas (GHG) emissions and mitigation potential

2

2.1 Agriculture's carbon footprint

According to IPCC 2007, the agricultural sector contributes about 14% of total global GHG emissions. If we include the additional 17% resulting from deforestation in tropical areas, which is mainly led by conversion of forestland into crop and pasture land, the sector is responsible for about 31% of total GHG, with energy and industrial-related emissions representing the rest.

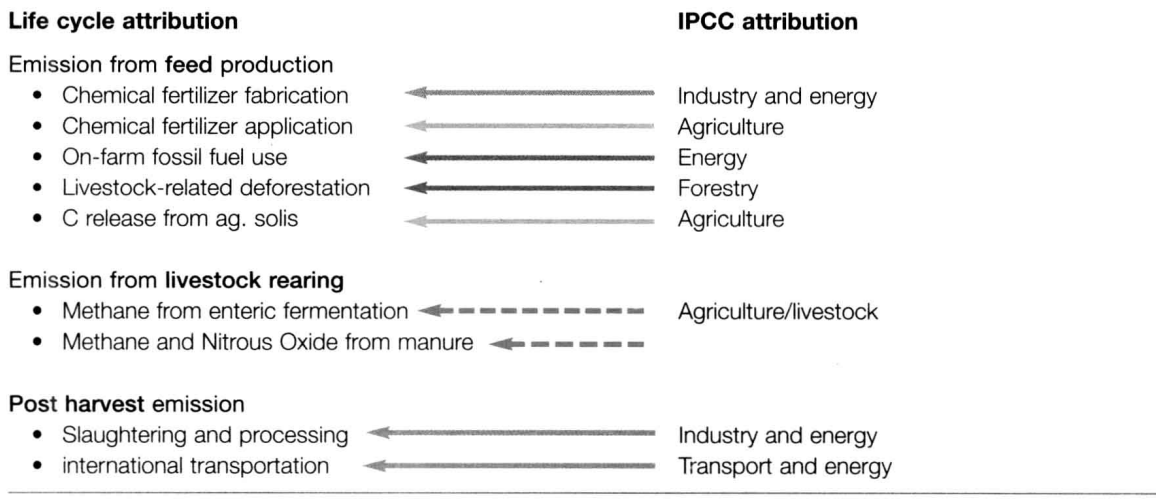
If we take an integrated view of the entire food chain for agricultural products, however, overall emissions would be even higher because some of its major emissions sources are reported under transport and other industries. For example, Steinfeld et al (2006) use this approach to calculate emissions from the livestock sector (see Figure 1).

While in the Forestry sector most emissions are from the release of carbon dioxide, agriculture (crop and livestock) is the source of more potent GHGs[9] such as N_2O from fertilized soils and CH_4 from organic waste and livestock (Figure 2). Agriculture is responsible for almost half of all anthropogenic CH_4 and N_2O emissions, and both of these are projected to increase considerably in the future, particularly in developing countries. N_2O is projected to increase by 35-60% and CH_4 by 60% up to 2030 (IPCC 2007a).

Figures 1 and 2 below give an indication of the GHG emissions associated with agriculture's entire food chain (Figure 1) and the relative share of GHG from the sector, compared with other major sources (Figure 2).

IPCC attribution of GHG emissions from agriculture along the entire value chain

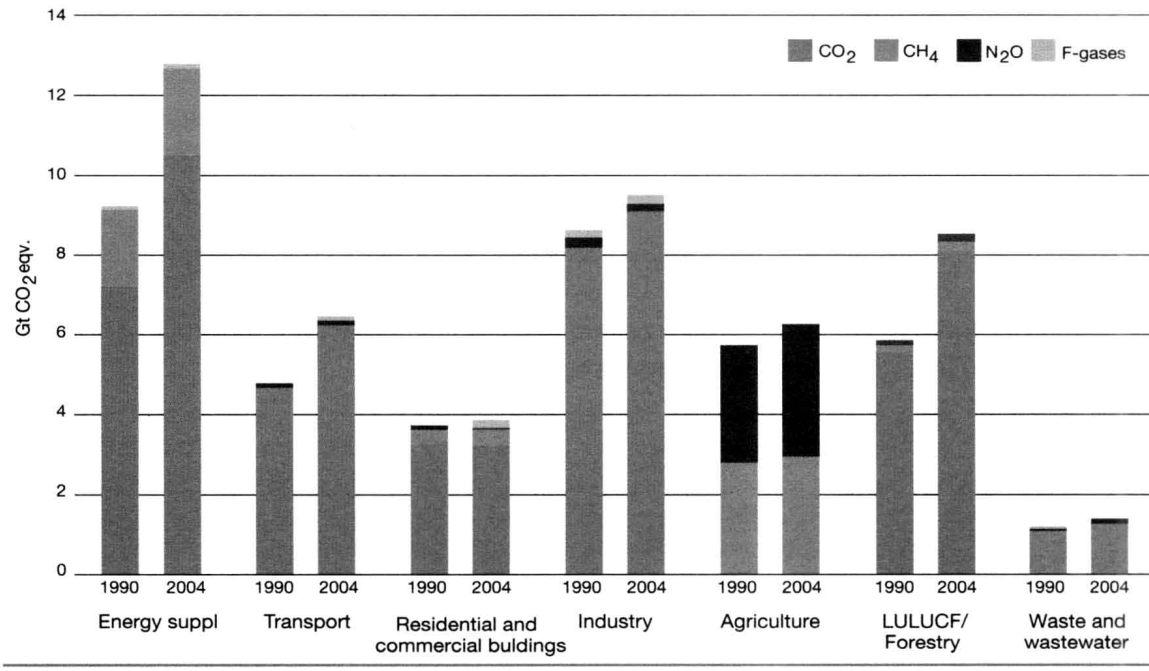
Figure 1: A life-cycle look into the livestock agriculture sub-sector



Source: Gerber, P. 2010. *Livestock and the Environment-Addressing the Consequences of Livestock Sector's Growth*. In: J. Estany, C. Nogareda and M. Rothschilde (editors), *Proceedings of the "Adapting Animal Production to Changes for a Growing Human Population: International Conference"* Lleida, May 2010 Unversitat de Lleida.

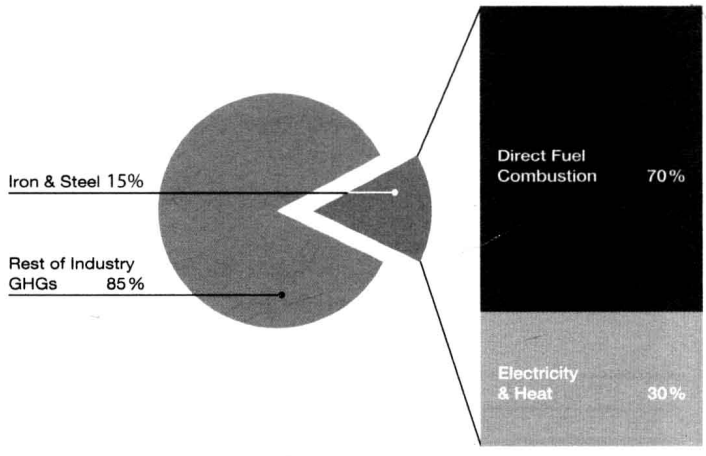
9 The global warming potentials of CH_4 and N_2O are 21 and 310 times, respectvely, that of CO_2 over a 100-year time horizon (IPCC 2007b).

Figure 2: Contribution of agriculture, land-use change and forestry to GHG emissions



Source: IPCC 2007c, TS2a

CO_2 from Iron and Steel



Source: Baumert et al. 2005, fig 15.1. IEA, 2004a,b. See Appendix 2.A for sources and Appendix 2.B for subsector definition. Absolute emissions in this subsector, estimated here for 2000, are 1,319 MtCO

2.2 Agricultural mitigation potential

In this section we summarize information provided by the AR4 about the mitigation potential from changes in land management in the agricultural sector that generate soil carbon sequestration, supplemented with some external references. There are several other forms of mitigation – aside from soil carbon sequestration – that the sector can provide, including reductions in methane (CH_4) emissions from livestock and rice production through improved management, or reductions in N_2O emissions from fertilizer use through the practice of integrated nutrient management. These are not discussed here, as mitigation from soil carbon sequestration is the focus of this report.

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