

# Climate Change Mitigation through Land Use Measures in the Agriculture and Forestry Sectors

Background Paper

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## Abbreviations and Acronyms

A/R	Afforestation and Reforestation
AFOLU	Agriculture, Forestry and Other Land Uses
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BAP	Bali Action Plan
CDM	clean development mechanism
CER	Certified Emission Reduction
CIFOR	Center for International Forestry Research
CO <sub>2</sub>	carbon dioxide
COP	Conference of the Parties
EU-ETS	European Union Emission Trading Scheme
EU	European Union
FAO	Food and Agriculture Organization
GCP	Global Canopy Programme
GHG	greenhouse gas
Gt	gigatonne (billions of tonnes)
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
ICERs	Long-term Certified Emission Reductions
LUCF	land-use change and forestry
LULUCF	land use, land-use change and forestry
MMSD	market mechanism for sustainable development
Mt	megatonne (millions of tonnes)
NFF	National Farmers' Association
NRCan	Natural Resources Canada
OSQP	Offset System Quantification Protocol
PES	payment for environmental services
REDD	reducing emissions from deforestation and forest degradation
SBSTA	Subsidiary Body for Scientific and Technological Advice
tCERs	Temporary Certified Emission Reductions
U.S.	United States of America
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change

VCS  
WCI

Voluntary Carbon Standard  
Western Climate Initiative

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## 1.0 Introduction

In the context of climate change, mitigation refers to human actions to:

- reduce the sources of greenhouse gases (GHGs), such as substituting renewable sources of energy for fossil fuels and avoiding deforestation; and
- enhance sinks to remove carbon dioxide (CO<sub>2</sub>) from the atmosphere—such as increasing carbon storage through afforestation, improving soil, and crop and grazing land management.

This paper is concerned with mitigation by reducing GHG sources and enhancing sinks through land use, specifically looking at the agriculture and forestry sectors.

The Food and Agriculture Organization (FAO, 2008c) reports that agriculture and land-use change, such as deforestation, account for about 13 and 17 per cent, respectively of total GHG emissions from human activities.<sup>1</sup> Changes in land use such as deforestation and soil degradation—two devastating effects of unsustainable farming practices—emit large amounts of carbon into the atmosphere, contributing to global warming.<sup>2</sup> The reduction of emissions and the enhancement of sinks in the forestry and agriculture sectors are cost effective options that could take effect very quickly. Given that the required transformation in energy systems and infrastructure will take time to put in place, actions in the agriculture and forestry sectors could have a significant role to play in meeting short-to medium-term GHG emission reduction commitments.

These land-use sectors—agriculture and forestry—can potentially play a large role in the global efforts to address climate change under the United Nations Framework Convention on Climate Change (UNFCCC), but these sectors are largely excluded from in the current international policy framework. The international negotiations on a post-2012 agreement offer an opportunity to include these emissions in a new agreement. In December 2009, the 15<sup>th</sup> session of the Conference of the Parties (COP 15) will be held in Copenhagen, Denmark, where countries hope to ensure that a post-2012 climate regime will be put in place.

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<sup>1</sup> The term agricultural emissions can refer to methane and nitrous oxide emissions from fertilizers, livestock, rice cultivation, manure management and burning of agricultural residues. Agricultural emissions can also refer to GHG emissions from land use change, for example, conversion of forest to farm land and subsequent plowing. This paper deals with emissions in the latter group, which are part of the land use, land-use change and forestry (LULUCF) sector in the parlance of the international climate change negotiations.

<sup>2</sup> A NASA article notes that the single largest cause of tropical deforestation is conversion to cropland and pasture. Other causes are wood extraction (logging or wood harvest for domestic fuel) and infrastructure expansion such as road building and urbanization. Most often, multiple processes work simultaneously or sequentially to cause deforestation (Lindsay, 2007).

This paper reviews the status of the post-2012 negotiations on climate change mitigation through land-use measures in the agriculture and forestry sectors. Section 2 examines why these sectors are important, examining mitigation potential and the sectors' importance in developing countries. Section 3 looks at how these issues are addressed in the current negotiations, and Section 4 explores some of the major issues and considerations when considering their inclusion in a new climate agreement. Section 5 sets out implications for Canada, and Section 6 sets out six questions that will need to be addressed over 2009 as the world moves closer toward elaborating a post-2012 regime for international action on climate change.

## 2.0 Climate Change and the Agricultural and Forestry Sectors

The Intergovernmental Panel on Climate Change (IPCC) reported that land-use change contributes to approximately 20 per cent of global CO<sub>2</sub> emissions in each year, of which tropical deforestation is the largest part (Nabuurs *et al.*, 2007). The growth of emissions from agriculture and deforestation activities occurred mainly in developing countries where most of the world's agricultural production takes place (Smith *et al.*, 2007 and Nabuurs *et al.*, 2007). Table 1 shows that the share of emissions in the land-use change and forestry sector exceeds 100 per cent in developing countries. This is because developed countries have demonstrated emissions reductions in these sectors.

**Table 1: Comparison of the Contribution of LUCF Emissions in Developed Countries and Developing Countries to the World Total LUCF Emissions and to the Total GHG Emissions from all Sectors in their Group**

Land Use Change and Forestry Sector (LUCF)				
Year	1990		2005	
Group of Countries	Developed	Developing	Developed	Developing
% of world total LUCF emissions (CO <sub>2</sub> )	-3.27	103.01	-3.60	103.52
% of total GHG emissions from all sectors	-1.5 of Annex I total GHG emissions	42.7 of non-Annex I total GHG emissions	-1.6 of Annex I total GHG emissions	35.4 of non-Annex I total GHG emissions
MtCO <sub>2</sub> e of LUCF emissions	-258.8	8,156.0	-274.0	7,887.0
tCO <sub>2</sub> per person of LUCF emissions	- 0.2	2.0	- 0.2	1.7

Source: based on data found in Climate Analysis Indicators Tool (CAIT) Version 6.0. World Resources Institute, 2009.

The FAO (2008a) reports that agricultural emissions growth is and will continue to be driven by greater demand for food as a result of increasing human population [global population is projected to increase from 6.1 billion in 2000 to 9.2 billion in 2050 (UN, 2007)]. Per capita calorie intake is also projected to rise with an increased demand for a more diverse diet that includes more animal protein such as meat and milk products. For example, meat consumption in China has more than doubled in the last 20 years and is projected to double again by 2030 (Centre for World Food Studies, 2005). An increasing share of animal products in the human diet will contribute to rising agricultural GHG emissions, especially in developing nations. Meat-based protein requires more land for production and greater numbers of livestock result in increased methane emissions.



Expected mitigation potential in the agriculture, land use, land-use change and forestry (LULUCF) sectors in developing countries is significant. The National Farmers Association (NFF) of Australia reports that globally, approximately half of all soil carbon in farmed land has been lost to the atmosphere during the past two centuries. This loss, however, creates an opportunity for carbon storage, with global additional potential in agricultural soils estimated to be in the order of 10 per cent of atmospheric carbon (NFF, 2008). Smith *et al.*, (2008) note that soil carbon sequestration (including cropland and grazing land management and restoration of organic soils) is a prominent option for mitigation in the agricultural sector with a mitigation potential of up to 5.34 gigatonnes of CO<sub>2</sub> equivalent per year.<sup>3</sup> Carbon sequestration occurs with farming systems that increase plant material being returned to the soil, reduction of carbon loss through minimum or non-tillage conservation agriculture, and the introduction of carbon from external sources such as industrial and urban waste streams.

The Global Canopy Programme (GCP) (Parker *et al.*, 2008) reports that tropical forests cover about 15 per cent of the world's land surface and contain about 25 per cent of carbon in the terrestrial biosphere. These forests are being rapidly degraded and deforested resulting in the release of CO<sub>2</sub> to the atmosphere. Approximately 13 million hectares—an area the size of Peru—are converted to other land uses each year. This accounts for 20 per cent of global carbon emissions, making land-cover change the second largest contributor to climate change.

Mitigation efforts in the land-use sector can be cost effective. The FAO (2008b) estimated that mitigation efforts in developing countries through agriculture and forestry projects may cost about one-fourth to one-third of total mitigation in all sectors and regions, while generating one-half to two-thirds of all estimated emission reductions. The potential cost effectiveness of reducing emissions in deforestation and degradation in developing countries (REDD) is very high. Efforts in this sector can have positive economic and environmental effects on rural livelihoods, such as improved water quality and improved soil quality.

With growing agriculture and forestry emissions and the largest and most cost-effective mitigation opportunities in these sectors, developing countries are likely to play a prominent role in efforts to reduce GHG emissions through land-use measures. However, these countries also have the greatest barriers to overcome. At the national level, agriculture and forestry may be eclipsed by other priorities in many developing countries, such as poverty alleviation. A lack of capacity and political will to encourage mitigation are also contributing factors, where efforts in the agricultural sector are mainly focused on securing food for a growing population.<sup>4</sup> Agricultural policy is viewed by many

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<sup>3</sup> GHG emissions are often expressed in equivalent units of CO<sub>2</sub> in terms of their global warming potential in 100 years. Nitrous oxide has 296 times and methane has 23 times the warming potential of CO<sub>2</sub>.

<sup>4</sup> Lack of political will is also a barrier in developed countries. Little of agriculture's mitigation potential is projected to be realized by 2010 in the European Union due to lack of incentives to encourage mitigation practices (Smith *et al.*, 2005).

countries as a sovereign right that is linked to food security, meaning that they are reluctant to open up this sector to any perceived control by an international body. Barriers are often country or region related, and understanding the situation in different countries is crucial to realizing the mitigation potential in the agricultural and forestry sectors.

Mitigation through land-use measures in the agriculture and forestry sectors can be a meaningful way for many developing countries to contribute to the goal of the UNFCCC and participate in a future regime. Yet, despite this significant potential, minimal progress has been made to capitalize on opportunities in this sector, particularly for developing countries.

### 3.0 Forestry and Agriculture in the UNFCCC Discussions

The UNFCCC (Article 4) obliges countries to “mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases.” Despite this, land use has been approached in a fragmented manner, which is reflected in the current climate change negotiations on a post-2012 agreement, where issues related to land use are discussed under the Convention, the Kyoto Protocol, and both the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) and the Ad Hoc Working Group on further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP).

At the United Nations Climate Change Convention in Poznan, Poland in 2008, agriculture and forestry were mentioned under several agenda items in different forums. In the climate change framework, agriculture and forestry have been treated as a cross-cutting issue, considered within the LULUCF sector and the CDM regime under the AWG-KP, as well as in discussions on REDD and mitigation under the AWG-LCA. A technical paper on the challenges and opportunities for mitigation in the agricultural sector was written under the auspices of the AWG-LCA (UNFCCC, 2008) in November, 2008 and a workshop on the same topic will be held in Bonn in March, 2009.

#### 3.1 Reporting on Land Use for Annex 1/B Parties under the UNFCCC and Kyoto Protocol <sup>5</sup>

Under the UNFCCC, emissions and removals from the land-use sector are considered under LULUCF (mainly CO<sub>2</sub> from land, land-use change and forestry activities, including cropland and grasslands). Accounting for emissions and removals of these and other GHGs are a core element of national inventories of GHG emissions that are submitted to the UNFCCC. These inventories include two figures, one with LULUCF and one without. Supplementary reporting under the Kyoto Protocol restricts mandatory accounting in this sector to emissions and removal from human-induced afforestation/reforestation/deforestation activities since 1990. Reporting under the Kyoto Protocol is the basis for assessing compliance in meeting emissions targets and is essential for participation in the Kyoto mechanisms [international emissions trading, joint implementation and the clean development mechanisms {CDM)].

In addition, under Article 3.4 of the Kyoto Protocol, countries may elect to include emissions and removals from any of the following human-induced activities since 1990 including forest

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<sup>5</sup> Developing countries (non-Annex I Parties) are not required to submit an annual GHG inventory. They report their GHG data in national communications, which are submitted at different points in time. The definition format of data for emissions/removals from the forestry sector is different for Annex I and non-Annex I Parties. For Annex I Parties, the sector is called Land Use, Land-use Change and Forestry (LULUCF) while for non-Annex I Parties, it is called Land-use Change and Forestry (LUCF). These two definitions are close but not equivalent. Many developing countries, especially the least developed, still face reporting challenges.

management, cropland management, grazing-land management and revegetation. In 2006, Annex I Parties decided which activities of Article 3.4 would count toward their mitigation commitments. Because accounting of Article 3.4 activities is optional, countries are unlikely to select activities that constitute a net source of GHGs. Of the 38 developed countries that have ratified the Kyoto Protocol, 22 have opted to report on forest management, four on cropland management, two on grazing-land management and three on revegetation (see Table 2).

Making reporting mandatory under Article 3.4 (relevant for only Annex B Parties listed in the Kyoto Protocol) is an issue under discussion in the post-2012 negotiations. Mandatory reporting would mean that developed countries would have a better incentive to take action in the land-use sectors of agriculture and forestry, as reductions in emissions in these sectors would be counted toward overall reductions. Not all countries are in favour of this because these sectors would be a source of emissions for some countries.

**Table 2: Developed Countries Electing to Report on Land Use Activities under Article 3.4 of the Kyoto Protocol**

Forest Management	Cropland Management	Grazing Land Management	Revegetation
22 – Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Latvia, Lithuania, Norway, Poland, Portugal, Romania, Russian Federation, Slovenia, Spain, Sweden, Switzerland, Ukraine and United Kingdom	4 – Canada, Denmark, Portugal and Spain	2 – Denmark and Portugal	3 – Iceland, Japan and Romania

Source: UNFCCC, 2009. Annual compilation and accounting report for Annex B Parties under the Kyoto Protocol. CC/2009/1, January 12.

Another issue under discussion in the negotiations is the development of GHG inventories in a new agriculture, forestry and other land use (AFOLU) sector, unifying the now separate agriculture and land-use change and forestry sectors. This new approach developed by the IPCC in its 2006 Guidelines for National Greenhouse Gas Inventories (IPCC, 2006) includes the full GHG balance in these sectors and allows for a comprehensive approach. The new guidelines have not been agreed to nor adopted by any countries.

LULUCF was a very controversial subject during the Kyoto Protocol negotiations, and Parties did not reach agreement on all technical and methodological considerations in 1997, when the Kyoto Protocol was adopted for use.<sup>6</sup> The LULUCF regime and its accounting rules were agreed to in the Marrakech Accords, a set of agreements reached in 2001 on the rules for meeting targets set out in

<sup>6</sup> The Kyoto Protocol was adopted for use in 1997 and entered into force on February 16, 2005. The Protocol entered into force (became law) when at least 55 countries accounting for at least 55 per cent of the CO<sub>2</sub> emissions from developed countries ratified the Protocol. Notably, the U.S. has not ratified the Kyoto Protocol.

the Protocol. Some feel that this process led to a diminished role for LULUCF activities, including agriculture, in mitigating emissions (Trines *et al.*, 2006; Benndorf *et al.*, 2007). It is important to note that Parties have agreed to a “main idea” in an international agreement, consenting to work out the details in later negotiating sessions. While negotiators may not have all the answers to land-use questions in Copenhagen in December, the precedent exists to have agriculture and REDD recognized with the details developed in later negotiating sessions.

### 3.2 CDM – Clean Development Mechanism

Under the first commitment period of the Kyoto Protocol, which ends in 2012, CDM LULUCF activities are limited to afforestation and reforestation (A/R). These projects have not been widely taken up under the CDM. As of February 1, 2009, there was only one registered small-scale CDM project in the A/R sector (with 34 projects in the CDM pipeline). The slow uptake of A/R projects may hold lessons for including market-based mechanisms for broader land-use projects in a post-2012 agreement, including agricultural soil and avoided deforestation projects.

Initially, there were difficulties in developing A/R baseline and monitoring methodologies—although that is being overcome with nine large-scale methodologies and five small-scale methodologies available to project developers as of February, 2009. Some project developers still encounter data collection problems, and the preparation costs of A/R projects remain high as international expertise is often required (Robledo and Blaser, 2008). Under the Marrakesh Accords, the total number of credits that a developed country may claim from A/R project activities under the CDM has been limited to 1 per cent of the country’s total emissions in 1990 multiplied by five (UNFCCC, 2006b). The European Union Emission Trading Scheme (EU-ETS) currently excludes forestry CDM credits.

Perhaps the largest concern is the temporary nature of credits from A/R projects, whereby the credits expire after a predefined period. The issue of non-permanence of the carbon sequestered through A/R projects has been addressed through temporary CERs (tCERs) and long-term CERs (lCERs). The tCERs expire at the end of the commitment period following the one during which they were issued, while lCERs expire at the end of the project’s crediting period, which can be 20 years (renewable up to two times or 30 years without a renewal option). Once these tCERs and lCERs expire, the holder of the credit must replace them with new ones or achieve an equivalent amount of emission reductions elsewhere. The expiring nature of these credits means that A/R projects are regarded as a less attractive investment option than other types of CDM projects. The temporary nature of credits under forestry CDM projects is a major barrier preventing funds and companies from purchasing these CERs (EcoSecurities, 2006).

Many activities with the greatest value to rural communities in poorer developing countries were excluded from the CDM in the first commitment period with sinks activities restricted to A/R.

REDD is being discussed as a separate mechanism/activity for the post-2012 period (see section 3.3 below), and there are strong arguments for expanding the CDM, and countries have proposed that sustainable forest management, agricultural soils and other sustainable land-management practices be included under the CDM. There is also consideration of a cap for newly eligible LULUCF activities similar to the current cap on A/R project activities under the CDM (as noted, A/R CDM activities are limited to 1 per cent of a country's total emissions in 1990 multiplied by five).

There is room for discussion of moving beyond a credit-based mechanism to a broader market mechanism for sustainable development (MMSD) that allows for such projects as soil carbon sequestration through improved agricultural practices such as reduced tillage. A broader allocation-based MMSD for agriculture would first include an "allocation" for expected reductions for soil carbon sequestration (essentially a no-lose target). Any reductions beyond this allocation, measured in tonnes of carbon, would be eligible for sale through the carbon market. The intent of a broader MMSD is to move away from credits for project-based GHG emissions and the need to demonstrate additionality—an issue that has proven controversial over the life of the CDM and introduces difficulties not only for soil sequestration projects, but for virtually any other mitigation activity.<sup>7</sup>

### **3.3 REDD – Reducing Emissions from Deforestation and Degradation in Developing Countries**

REDD was introduced to the UNFCCC in COP 11 in Montreal in December 2005, and after two years of discussion, countries decided to encourage action on REDD including supporting capacity building and technology transfer, exploring demonstration activities and mobilizing resources to support the aforementioned efforts. In 2008, the Subsidiary Body for Scientific and Technological Advice (SBSTA) started a work program on methodological issues related to REDD. At COP 14 in Poznan in 2009, REDD discussions under the SBSTA focused mainly on these methodological issues, and consensus was reached on a 2009 work program on methodological issues that are crucial for underpinning a future REDD regime. Countries agreed on a decision text that encourages robust national forest monitoring systems, capacity building and use of IPCC Guidelines and Good Practice Guidance. An expert meeting on REDD will be held in 2009, and a technical paper will be prepared on the cost of implementing methodologies and monitoring systems.

REDD is considered in the Bali Action Plan (BAP) (UNFCCC, 2008a), which states that enhanced action on mitigation of climate change is to include consideration of, "Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of

<sup>7</sup> To avoid giving credits to projects that would have happened anyway (free riders), CDM projects must be additional. For example, the project must reduce GHG emissions more than would have occurred in the absence of the project. If projects would happen anyway, regardless of CDM benefits, then their offsets would not represent any reduction in emissions. The demonstration of additionality has been a challenging and controversial aspect of the CDM.

forests and enhancement of forest carbon stocks in developing countries.” A contentious issue in the Poznan discussions included the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; some countries wanted to include this in a future REDD mechanism. Another divisive issue was the language on indigenous peoples. Some countries wanted to include reference to the rights of indigenous peoples while other countries suggested this issue should be dealt with by the AWG-LCA. Countries have been invited to submit their views on these issues. Table 3 outlines the issues under the discussion in the REDD negotiations.

Linking REDD and agriculture is also an important topic because most deforestation is due to agricultural expansion and success on REDD could mean increased efficiency of food production on existing farmland. While there is recognition of potential benefits from one common sector, there is little support for linking REDD and sustainable land management or agriculture in a post-2012 agreement. There is no political momentum at this time for a broader discussion, and it will be difficult to expand REDD to include sustainable land management in the short term (in time for Copenhagen). Many feel that linking REDD and sustainable land management is unrealistic and could jeopardize momentum on REDD. A credible REDD mechanism can be agreed to in 2009, but that mechanism may be lost if other issues, such as agriculture, are forced upon it.

Financing of REDD actions will also be a topic of considerable discussion in the post-2012 negotiations. Some countries support the use of the carbon market, whereby REDD credits would be sold by developing countries and purchased by developed countries to help meet their domestic emission reduction targets. Other countries favour a fund-based approach, whereby grant funds from developed nations would be used to support REDD activities in developing nations.

**Table 3: REDD Issues under Current Discussion in the Negotiations**

Issues	Discussion
Activities to be considered	Some parties would like to concentrate on deforestation and forest degradation as they consider that other potential activities bring many uncertainties to the discussion. Others also want to consider conservation, sustainable forest management and/or enhancements of sinks.
Definitions	The definition of forest has a great impact on REDD as well as on the potential for all other mitigation options in forestry. It is imperative to clarify which definition should be used. Some countries highlight the need for having a definition that addresses different national circumstances and different ecosystems types within a country.  The definition of other terms such as degradation, sustainable forest management and conservation also needs to be clarified in the context of mitigating climate change.
National and sub-national approaches	Some Parties favour national approaches, while other Parties highlight the need to include also sub-national approaches with a certain level of flexibility. Issues for argumentation are treatment of emissions displacement, monitoring requirements, accuracy and treatment of uncertainties.
Reference scenario or baseline	The reference scenario seems to be linked to historical data while the baseline seems to also include future trends. For those countries with a high deforestation rate in the past, the reference scenario appears to be a more adequate option while for those countries with potential increments in deforestation rates in the future the possibility to build up a baseline considering these future trends looks more adequate.
Measurable, Reportable and Verifiable (MRV) requirements	This issue is discussed under the monitoring requirements. The discussion in the submissions is the adequacy of satellite imagery in terms of the technology and installed capacities in developing countries) and/or how other monitoring tools and existing information can be used (for example, inventories and ground check, among others).
Funding mechanism	This concerns the possibility of having a market mechanism or of creating a fund for REDD compensation. In both cases, it is assumed that some kind of payment needs to be considered as a key incentive for REDD.
Effectiveness of support given by developed countries	In the submissions, Parties refer to the need to have clarity about the criteria for support, the amount of resources invested and a way to assess its effectiveness.

Source: Robledo and Blaser, 2008, p. 33.

The risk of flooding the market is a consideration in the discussion of allowing the sale of credits



from REDD and agricultural soil carbon sequestration projects on the carbon market. One of the key benefits of expanding market mechanisms under a new post-2012 agreement is a larger quantity of GHG reductions, but a question is whether the resulting flow of credits from developing countries would find buyers or to what extent the price of credits would reach disastrous lows. A clear implication for a post-2012 regime that includes credits for deforestation and carbon sequestration in agricultural soils is the need for ambitious targets for developed countries that will fuel demand for these additional CERs.

As well, there needs to be consideration of who will buy the credits. As noted, the EU-ETS currently excludes forestry CDM credits. Australia intends to take a decision on including forestry, agriculture and land management in its emissions trading scheme in 2013, and the proposed Canadian regulatory framework, *Turning the Corner*, refused to accept forest sink projects from the CDM for compliance with Canadian regulations. Encouraging mitigation in the land-use sectors in developing countries through market mechanisms means that developed countries will need to be willing to purchase these credits. Agreeing to a market mechanism for agricultural soils or REDD will create expectations in developing countries, and developed countries must be sure they are willing to fulfill those expectations.

### **3.4 Agriculture in the UNFCCC Discussions**

Despite considerable potential for mitigating GHG emissions, agriculture has been approached in a fragmented manner in UNFCCC discussions. Under the AWG-KP, it is considered within the LULUCF sector, and discussions on improvements to the project-based mechanisms, including the CDM, involve discussion of other sustainable land-management activities (although agricultural soil project are not specifically mentioned). The AWG-LCA is holding an in-session workshop on opportunities and challenges for mitigation in the agricultural sector in March, 2009.

There are varying perspectives on the role of agriculture in a post-2012 agreement. Developed countries are discussing if agricultural soil carbon sequestration should be included in overall accounting of emissions and removals, and how to provide incentives in the area of agriculture for developing countries. Many developing countries are concerned about access to the carbon market and having a market mechanism that includes carbon sequestration in agricultural soils. For example, the African Bio-Carbon Initiative calls for a post-2012 agreement that encourages sustainable agriculture in Africa, including crediting and financial mechanisms that reward improved agriculture and forest-management practices that will also help the poor adapt to climate change (Common Market for Eastern and Southern Africa, 2008). Intensity targets in the agricultural sector are also an issue, recognizing the fact that food production will need to increase to keep pace with rising populations and improvements in standards of living.

The negotiations on a post-2012 agreement provide an opportunity to incorporate agriculture as an

integral part of the regime, and encourage greater participation on the part of developing countries in reducing emissions in this sector. There is a sense that any agreement in Copenhagen will be a broad text where the main ideas are fixed with negotiation on the details continuing over the two to three years. It is critical to have a flag or marker for agriculture in a new post-2012 agreement. This could mean that the broad negotiating text include such wording as “agricultural soil sequestration will be included in a market mechanism,” with the details and modalities to be elaborated in later negotiating sessions. Missing this opportunity to provide incentives for sustainable agriculture will mean that several poor countries will, once again, be denied access to a stream of carbon financing.

## 4.0 Barriers to Including Agriculture and Forestry in a Future Climate Change Agreement

Barriers to expanding the role of mitigation through land-use measures in the agriculture and forestry sectors in a post-2012 agreement are mainly technical and related to disagreements over uncertainties and accounting methodologies. Other obstacles include lack of permanence of emission reductions and credits associated with land-use projects, leakage and financial barriers. Increases in demand for food and changing diets (more animal protein) also will work against mitigation of GHG emissions in the land-use sectors.

While there are methodological issues that can act as barriers to including agriculture and forestry in a post-2012 climate change regime, these obstacles can be overcome—and indeed need to be overcome—to create opportunities for developing countries to be partners in mitigation efforts and to benefit from the carbon market. Methodological and reporting guidance and procedures to review emissions and sinks from agriculture and forestry have already been implemented successfully in the context of the UNFCCC process in many national GHG inventories and CDM projects (UNFCCC, 2007).

### 4.1 Uncertainty and Accounting

Uncertainty associated with changes in LULUCF emissions and emission reductions can be large, particularly in comparison with the uncertainty around fossil fuel emission reduction commitments. While the terrestrial carbon pool is three orders of magnitude greater than annual fossil fuel emissions, this carbon pool can result in very large emission releases or reductions because of natural occurrences that are beyond human control—although emission releases due to natural disturbances are not as problematic with agricultural soil emissions as compared to forestry (Benndorf *et al*, 2007). Human activities can also cause large emissions releases. For example, if soil management practices change, the carbon can quickly be released.

Current Kyoto accounting rules do not allow a distinction to be made between anthropogenic and non-anthropogenic soil carbon losses. As noted, soil carbon losses may occur due to natural circumstances, irrespective of land-use practices and this cannot be taken into account with current accounting rules. Alternatives to the current accounting rules have been proposed by some countries, such as the Forward-Looking Baseline suggested by Canada (see Section 5.1 for more information).

Some countries claim that there are too many uncertainties to ensure long-term emission reductions, especially concerning Article 3.4 activities (forest management, cropland management, grazing-land

management and revegetation). As an example, the EU notes that voluntary election of Article 3.4 allows countries to leave out activities where there are methodological problems. As a consequence, the uncertainties related to emissions or removals are high or where the risk of emissions (for example, due to natural disturbances) is perceived to be high (EU, 2008). New Zealand (2008) states that there is significant scientific uncertainty over what is really happening in some activities, such as those of Article 3.4.

While developed countries are well positioned to account for emissions and removals in the agricultural sector, many developing countries lack data and monitoring experience. The UNFCCC technical paper on mitigation potentials in the agricultural sector notes difficulties in some countries in establishing a baseline for agricultural mitigation activities because of the lack of information, a high level of uncertainty in emission estimates and a lack of information for assessments. Canada has had a credible carbon accounting system for soils and forests for some time and is a leader in this area.

## 4.2 Permanence

Permanence relates to the period of time that carbon remains in the biosphere. The lack of permanence creates uncertainty; there is the possibility that carbon in sinks can be emitted at any time, making emission reductions non-permanent. Due to different risks, including fires and pests, carbon can be released into the atmosphere, thereby reducing the climate change mitigation effect of a project. The treatment of permanence is especially relevant if Parties agree on a market mechanism for land-use sectors.

The permanence issue is a barrier to a broader role for agricultural soil carbon sequestration and to the inclusion of more forestry activities as mitigation options.<sup>8</sup> It can be difficult to meet current permanence criteria for agricultural soil sequestration projects as soil carbon fluxes can be rapid, moving in and out of soil on a daily basis. But there are robust methodologies for baselines and monitoring that are working and used in Canadian systems, such as Alberta's tillage protocol, under which soil carbon credits are permanent with an assurance factor that includes a built-in discount factor to account for future losses and risk sharing between farmers and government. The Voluntary Carbon Standard (VCS) has introduced robust rules that allow AFOLU activities to generate permanent carbon credits in four categories:

- afforestation, reforestation and revegetation;
- agricultural land management;
- improved forest management; and

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<sup>8</sup> The Kyoto permanence principle requires that credits created through avoided emissions and sequestration to offset emissions be permanent. This is to guarantee the validity of the carbon credit and preserve the integrity of the carbon market. The current solution to the permanence issue in CDM A/R projects has been the issuing of temporary credits.

- reducing emissions from deforestation.

The *Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination* includes a project risk assessment to determine the number of non-tradable buffer credits to be held in reserve to cover unforeseen losses in carbon (VCS, 2008).

### 4.3 Leakage

A CIFOR report (Wunder, 2008, p. 66) uses a hypothetical to describe the leakage problem:

“...a farm-level payment for environmental services (PES) programme may reward the landowner for not deforesting the PES-enrolled forest plot A during five years. However, if the owner shifted all planned deforestation from plot A to another, non PES-enrolled plot B, mitigation would be entirely offset by leakage or ‘displacement of emissions,’ as the phenomenon is called in the Bali Action Plan (Thirteenth Session of the Conference of the Parties-COP 13). If the landowner further used all PES funds to buy chainsaws to enable additional clearing and cattle to graze on the land, medium-run leakage may well exceed 100 per cent of mitigation – implying leakage also has a time dimension, depending on how quickly economic and biophysical processes work. Conversely, if the landowner invested the money in ecotourism or agroforestry and stopped all clearing, leakage would be reversed, crowding in off-site mitigation gains beyond target plot A.”

While developed countries that have signed the Kyoto Protocol have agreed to reduce their emissions, increasing imports from developing countries may cause emission “leaks.” Leakage can occur within a region, a country or at the international level. For some activities, the risk for international leakages due to REDD activities can be so high that emissions reduced in a country could be replaced by emissions in another (Robledo and Blaser, 2008).

Leakage can be addressed through broadened global participation in a climate regime, effective monitoring and banking of reserve credits. Balancing activity-reducing REDD conservation with activity expanding A/R, sustainable forest management or agricultural intensification may also help to address leakage.

### 4.4 Financial and Other Barriers

High transaction costs, costs of measurement and monitoring and lack of investment capital are barriers to including forestry and agriculture mitigation activities in a post-2012 climate regime (UNFCCC, 2008b; and Robledo and Blaser, 2008). There are millions of small farmers and there needs to be consideration of how to develop a crediting mechanism that can bring these participants into the carbon market at a reasonable cost. Other obstacles include competitiveness, slow progress in technological development and the need to be consistent with or break from traditional practices.

## 5.0 Mitigation through Land Use Measures in Canada

While taking domestic action to mitigate GHG emissions in its agricultural and forestry sectors, Canada also actively participates in international climate change negotiations. At the domestic level, Canada has gained significant policy and technical expertise in GHG emission mitigation practices and measurement in the agricultural and forestry sectors.

According to Environment Canada's 2008 GHG inventory, in 2006, the LULUCF sector was a net source of 31.3 megatonnes of emissions. Trends in the sector are mainly driven by changes occurring in the forests, and these trends suggest that the LULUCF sector can turn from a sink to a source. Carbon sequestration in arable soils was greater than emissions from lands converted to cropland, and there was a net reduction of 1.4 Mt in the cropland subcategory. The continued adoption of no-till and reduced-tillage practices and the reduction of summer fallow have resulted in a steadily increasing ability of cultivated soils to behave like a sink. Forest land converted to cropland, wetlands and settlements amounted to additional emissions of about 19 Mt in 2006 (Environment Canada, 2008a).

Land use, land-use change and forestry activities are a key consideration for Canada in the post-2012 discussions. Natural Resources Canada (NRCan, 2007) indicates that Canada's forest cover is 310 million ha (of which 236 million is managed forest), and estimates that between 1990 and 2005, Canada's forest was an overall sink—except for five years when it was an overall source mainly due to natural forest fires and decay associated with the mountain pine beetle. Analysis suggests that between 2008 and 2012, there is a 90 per cent chance that Canada's forests will be a net carbon source. Thus, "Including the managed forest would very likely have made the Kyoto target even more difficult to achieve. This high risk of a source led to the government's decision to not include forest management in Canada's Kyoto accounting" (NRCan, 2007). Application of current LULUCF rules, for example, would place Canada 54.8 per cent above its 1990 emission levels, rather than 22.9 per cent above without LULUCF activities included (UNFCCC, 2008b). Changed rules for forest carbon accounting that provide positive incentives for forest management activities, but do not punish or reward countries for emissions or removals that are beyond their control, would be beneficial to Canada.

As sinks, such as trees or soils, continue to age and recover from past disturbances, there is a risk that carbon storage in those sinks may reach saturation. Soil has a natural limit to the amount of carbon it can store—as carbon accumulates in the soil, the total soil carbon level approaches a new equilibrium and eventually the soil is saturated. The risk of saturation has been identified for Canadian forests and soils and gross-net accounting, such as used for forest management in the first

commitment period, is disadvantageous for countries such as Canada where carbon sinks are projected to decline over time because of saturation.

## 5.1 Canadian Submissions to the UNFCCC on LULUCF

A Canadian submission to the Subsidiary Body for Implementation (SBI) puts forward that the LULUCF sector has become too restrictive and there is considerable mitigation potential from a range of activities in the AFOLU sector that is not currently recognized under the Kyoto Protocol. Accounting for emissions and removals from agricultural land management should not be considered separately from other agricultural activities, and Canada supports the use of the 2006 IPCC GHG Inventory Guideline (Canada, 2008e).

The Government of Canada has submitted that consideration of further commitments for post-2012 will be facilitated by a broader understanding of LULUCF rules (Canada, 2008e). LULUCF can make an important contribution to the mitigation potential in developed countries, and the rules around LULUCF will in part determine the mitigation potential of Parties and have implications for the structure and magnitude of further commitments or actions the Parties are able to undertake (Canada, 2008d). Canada has also noted that it is critical that rules for the treatment of LULUCF be agreed to before targets or commitments are established to allow Parties to make commitments with full understanding of the potential of their LULUCF sector (Canada, 2008c).

Canada is in favour of enhancing the effectiveness of the LULUCF sector to achieve mitigation objectives. As such, Canada is calling for a review of the existing rules governing LULUCF under the Kyoto Protocol and a revision of the framework for the treatment of LULUCF so that it will enhance the sector's contribution to meeting the objectives of the Convention in a post-2012 agreement (Canada, 2008d). Canada has indicated that a new set of rules needs to be consistent and should allow for the use of current measuring and monitoring systems. LULUCF rules need to provide proper incentives for sustainable land-use management and must be appropriate to differing national circumstances. Revised LULUCF rules should be broadly applicable across developed and developing countries, "taking into account the substantial differences that exist in terms of the characteristics of their land, how it is used and managed, and the institutional and policy settings" (Canada, 2008b).

A forward-looking baseline is discussed by Canada as an approach for forest management, and Canada notes that this baseline can be used for agriculture and other land-use activities. The forward-looking baseline approach is a net-net approach that accounts for anthropogenic emissions and removals and ensures that accounting provides an improved incentive structure for sustainable land management. Through this approach, estimated emissions and removals in the commitment period are compared to a projected baseline, which would better reflect forest dynamics and business-as-usual forest management practices in the commitment period. Given the importance of

the baseline in a net-net accounting system, a set of guidelines or rules will be required to ensure that each country's forest management baseline meets a common methodological standard (Canada, 2008a). Current forest management accounting rules do not distinguish between emissions and removals due to direct human activity or those that occur due to natural or indirect human causes such as wildfires and the consequences of a changing climate. In Canada's managed forests, the impacts of natural disturbances forest carbon can far outweigh the impacts of forest management. Thus Canada's managed forests have fluctuated between being a large source and a large sink from year to year depending on the amount of wildfire that occurs. Canadian forests have been acting as a source due mainly to a mountain pine beetle infestation since 1999 (Canada, 2008c).

The temporary nature of credits of CDM A/R projects under the CDM has been a barrier to project development and progress, and uptake in this sector has been slow. Revision of LULUCF CDM rules for the second commitment period needs to consider if and how to create permanent credits for the LULUCF sector. Canada notes that expanding the scope of CDM-eligible LULUCF activities beyond A/R could also have a significant impact on the regional distribution of CDM projects and help to increase the number of projects in least-developed countries (Canada, 2008e).

## 5.2 Emissions Trading System in Canada

Canada's 2008 regulatory framework, *Turning the Corner*, puts in place a regulatory regime to meet Canada's target of reducing GHG emissions by 20 per cent from 2006 by 2020, includes a cap-and-trade system (Environment Canada, 2008c). Under this scheme, two of the compliance mechanisms (offsets and the CDM) could impact on emissions from the agriculture and forestry sectors..

The draft regulations indicate that Canadian firms can use certain CDM credits, but access to these credits for compliance purposes would be limited to 10 per cent of each firm's total target. Credits for forest sink projects are not accepted for compliance with Canadian regulations, although all other CDM project credits are allowed. The temporary nature of forest sink credits is considered to add complexity to the domestic system without significantly reducing compliance costs for regulated industry. If a market-based mechanism for REDD or carbon sequestration in agricultural soils is established, Canada's refusal to recognize CDM forestry-based credits could become an even more critical issue.

Canadian firms may also gain or buy domestic offset credits. Those offset credits are emission reductions verified according to an Offset System Quantification Protocol (OSQP), which is approved by Environment Canada. OSQPs are currently developed either under a standard protocol development process or under a fast-track process. The fast-track process is used for protocols that are already approved by other offset programs and that rely on a level of rigour that is comparable to Canada's system. In February 2009, the fast-track process included three protocols in the land-use sector with two of these developed for use in the Alberta Offset System (see table 3). Although



there is no guarantee that any of these protocols will be used as part of or become an OSQP, it is likely that offset credits from forestry and agricultural soil projects will be eligible under the Canadian offset system (Environment Canada, 2008b).

**Table 4: Land-use Protocols on Canada's GHG Offset System's Fast-Track Process Protocol Eligibility List, February, 2009**

Source	Protocol Name	Project Type Description
Alberta	Quantification Protocol for Afforestation Projects	The quantification of GHG emission removals from an increase in carbon stocks above and/or below ground and possibly soil carbon on the project site resulting from tree growth.
California Climate Action Registry	Forest Project Protocol Version 2.1 (Forest Management)	GHG emission reductions/removals resulting from carbon in long-lived wood products, forest management practices and forest conservation.
Alberta	Quantification Protocol for Tillage System Management (November 2007 ver. 1.2)	The quantification of GHG emission reductions associated with change in tilling practices from conventional or full tillage to reduced till or no-till in Canadian agricultural soils.

Source: Environment Canada, 2008b, Annex J.

Alberta has been a leader in the development of offset protocols. This is in response to legislation requiring an intensity-based reduction of 12 per cent beginning July 1, 2007 by firms emitting more than 100,000 tonnes of GHG per year. One compliance option for firms is offsetting, by purchasing verified credits created by other Alberta projects. In addition to the two land-use protocols in Table 2, Alberta is developing land-use protocols for wetland management, reducing summer fallow, conversion to perennial forages and rangeland/grassland management (Haugen-Kozyra, 2008).

The Western Climate Initiative (WCI) also intends to allow offsets in the agricultural and forestry sectors. The WCI, launched in 2007, is a coalition of four Canadian provinces—British Columbia, Manitoba, Ontario and Quebec—and seven U.S. states that has set a regional GHG emission reduction goal of 15 per cent below 2005 levels by 2020. The WCI is designing a regional cap-and-trade program that will include offsets to help reach the target (in addition to regulations, incentive programs, fees and tax programs, and voluntary programs in the region). The 2009 work plan of the WCI Offset committee includes protocol development in, *inter alia*, the priority areas of agricultural soil sequestration and forestry.

## 6.0 Conclusion

Land-use mitigation measures are complex but highly important issues that will play a critical role in any post-2012 climate regime. The current system of including agriculture and forestry activities as climate change mitigation options under the UNFCCC and Kyoto Protocol is not perfect. Our improved understanding of the issues associated with the accounting, compliance procedures and implementation mean that it should be possible to develop an improved framework under a post-2012 climate agreement.

There is a general sense that any agreement in Copenhagen will be a broad text where the main ideas are fixed with negotiation on the details continuing over two to three years. While negotiators may not have all the answers to the agriculture and forestry question in Copenhagen in December, the precedent exists to have agriculture and forestry recognized with the details and modalities developed in later sessions. It is necessary to give agriculture an appropriate place in the current negotiations, as REDD has, such that the maximum mitigation potential can be realized in this sector.

Several questions need to be answered over the coming year as the world comes closer to elaborating a post-2012 regime for international action on climate change:

1. What is the ideal mix of approaches to encourage meaningful and effective action in the agriculture and forestry sectors?
2. What is the best mix of incentives to capture the large mitigation potential in the agriculture and forestry sectors in developing countries?
3. What is the best way to address the permanence issue in crediting mechanisms, such as the CDM, that allow for developing country participation in the carbon market?
4. What are the best options to account for emissions and removals in the LULUCF sector?
5. What are the barriers to effectively including agriculture and forestry in a post-2012 regime? What are the best approaches to overcome these barriers?
6. How do we more effectively engage industry and the private sector in efforts in the agriculture and forestry sectors?
7. What are the priority needs of the agriculture and forestry sectors as we prepare for post-

2012 negotiations? What are the best ways to address these needs in a post-2012 climate change regime, utilizing existing structures, new structures or mechanisms outside the formal UNFCCC process?

## 7.0 Glossary

**AWG-KP** – Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol

This group, agreed to at COP 11 in Montreal in 2005, is discussing future commitments for industrialized countries under the Kyoto Protocol. Membership includes all countries that have ratified or approved the Kyoto Protocol. Most notably, the U.S. is not a member of this group.

**AWG-LCA** – Ad Hoc Working Group on Long-term Cooperative Action under the Convention

This group, formed under the BAP, is undertaking a dialogue to analyze approaches for long-term cooperative action to address climate change, including mitigation, adaptation, technology, and financing and investment. Membership includes all nations that have signed the UNFCCC.

**Afforestation**

The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

**Carbon Sinks**

Ecosystems, such as the oceans, forests and soils, which remove and store carbon from the atmosphere.

**CER** – Certified Emissions Reduction

A credit for reductions of GHG emissions achieved by a CDM project. The credit is registered and can be used by developed countries to count toward their emission reduction commitments.

**CDM** – Clean Development Mechanism

A market-based mechanism under the Kyoto Protocol, where a project or program of activities to mitigate climate change in a developing country can generate CERs that can be used by an Annex I Party to help meet its GHG emission reduction commitment. Activities in the land-use sector currently are limited to afforestation and reforestation.

**Cropland Management**

The system of land practices used to produce agricultural crops and land that is set aside or temporarily not used for crop production.

**Deforestation**

The direct human-induced conversion of forested land to non-forested land.

#### Forest Management

A system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

#### Grazing Land Management

The system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

#### IPCC – Intergovernmental Panel on Climate Change

A body made up of the world's leading climate experts, established in 1988 by the United Nations Environment Programme and the World Meteorological Organization to assess the scientific research on climate change and its environmental and economic impacts. Most notably, the IPCC publishes (at regular intervals) Assessment Reports on the state of knowledge on climate change.

#### LULUCF – Land Use, land-use Change and Forestry

A GHG sector that covers emissions and removals of GHGs resulting from land use, land-use change and forestry activities that result from human activities. Examples of activities in the land-use sector include increasing the removal and storage of carbon from the atmosphere by planting trees or introducing low-tillage agricultural practices or reducing emissions by curbing deforestation.

#### lCER – Long-term CER

A CER that is issued for an afforestation or reforestation project activity under the CDM and expires at the end of the crediting period for which it was issued. These credits are considered to be non-permanent or temporary and must be replaced by permanent emission reductions sometime in the future.

#### Reforestation

The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources on land that was forested but that has been converted to non-forested land.

#### Revegetation

A direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 ha and does not meet definitions of afforestation and reforestation.

#### tCER – Temporary CER

A CER issued for an afforestation or reforestation project activity under the CDM which expires at the end of the commitment period following the one during which it was issued. Like ICERs, these credits are considered to be non-permanent or temporary and must be replaced by permanent emission reductions sometime in the future.

#### UNFCCC – United Nations Framework Convention on Climate Change

The agreement signed by 192 countries at the Earth Summit in Rio in June, 1992 under which climate change is monitored and addressed globally.

## 8.0 Where to Find More Information

Below are a several key online documents that contain additional information on the issues discussed in this paper:

The UNFCCC has information on the state of the negotiations, background information on various issues, national reports, among others. There is a recent technical paper on mitigation in the agricultural sector.

- <http://www.unfccc.int>
- *Challenges and opportunities for mitigation in the agricultural sector*  
<http://www.unfccc.int/resource/docs/2008/tp/08.pdf>

The Government of Canada has information on Canada's regulatory framework and Canada's forestry sector.

- *Turning the Corner: Regulatory Framework for Industrial Greenhouse Gas Emissions*  
[http://www.ec.gc.ca/doc/virage-corner/2008-03/541\\_eng.htm](http://www.ec.gc.ca/doc/virage-corner/2008-03/541_eng.htm)
- *Guide for Project Developers*” Draft for Consultation  
<http://www.ec.gc.ca/creditscompensatoires-offsets/default.asp?lang=En&n=7CAD67C6-1>
- *Is Canada's Forest a Carbon Sink or Source?*  
<http://www.cfs.nrcan.gc.ca/news/544>

The IPCC has published the Fourth Assessment Report with chapters on forestry and agriculture, and a special report on LULUCF.

- “Forestry” in *Climate Change 2007: Mitigation*.  
<http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter9.pdf>
- “Agriculture” in *Climate Change 2007: Mitigation*.  
<http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter8.pdf>
- “Land Use, Land-Use Change, and Forestry”  
<http://www.ipcc.ch/ipccreports/special-reports.htm>

The FAO has a climate change page with information about forestry and agriculture.

- <http://www.fao.org/climatechange/home/en/>

The Stern Review on the economics of climate change includes a chapter on reducing emissions

from land-use change.

- [http://www.hm-treasury.gov.uk/stern\\_review\\_report.htm](http://www.hm-treasury.gov.uk/stern_review_report.htm)



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