

Expanding Agriculture's Role in the International Climate Change Regime: Capturing the opportunities

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With contributions from Caroline DeVit and Jean Nolet

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Abbreviations and acronyms

AAFC	Agriculture and Agri-Food Canada
AWG–LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
AWG–KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
CCCDF	Canada Climate Change Development Fund
CDM	clean development mechanism
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CO ₂	carbon dioxide
COP	Conference of the Parties
EFP	Environmental Farm Planning
ENGO	environmental non-governmental organization
EU	European Union
EU ETS	European Union Emission Trading System
FAO	UN Food and Agriculture Organization
GDP	gross domestic product
GHG	greenhouse gas
IDRC	International Development Research Centre
IPCC	Intergovernmental Panel on Climate Change
ISTP	International Science and Technology Partnerships
LDC	least developed country
LULUCF	land use, land-use change and forestry
MRV	measurement, reporting and verification
NAMA	nationally appropriate mitigation action
NRCan	Natural Resources Canada
ODA	official development assistance
R&D	research and development
REDD	reducing emissions from deforestation and forest degradation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	small island developing states
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture

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1.0 Introduction

Agriculture's profile in the international negotiations on climate change is increasing, with a broader role envisioned for agriculture and related land management practices and systems. Agriculture has the potential to play a critical role in reducing greenhouse gas (GHG) emissions, especially in the short term. The Intergovernmental Panel on Climate Change (IPCC) reports that the agricultural sector has the potential to contribute significantly to GHG emission reductions, with potential ranges from 5 to 20 per cent of total carbon dioxide (CO₂) emissions by 2030 and a global mitigation potential ranging from 5.5 to 6 gigatonnes of CO₂ equivalent per year by 2030 (Smith et al., 2007). Reductions in the agricultural sector in the short term can help to buy time to allow the required transformation in energy systems and infrastructure, because changes in agricultural practices can occur more quickly than shifts to zero-carbon energy technologies. Agriculture can play a critical mitigation role in the short term, in a manner that is complementary to reductions in the energy sector.

Agriculture is responsible for around 14 per cent of global GHG emissions and offers relatively cost-effective options for significant emission reductions in the short term.¹ The IPCC estimates that approximately 70 per cent of the mitigation potential is in developing countries, with much of the potential in the restoration of cultivated organic soils and degraded land (Smith et al., 2007). Actions to mitigate agricultural emissions can have important co-benefits, such as increased soil fertility and productivity, enhanced resistance to drought and extreme weather, and better capacity to adapt to climate change. Sustainable agricultural practices can also contribute to increased food production and have a positive impact on rural people's welfares and livelihoods. Seventy-five per cent of poor people in developing countries live in rural areas; most of these depend on agriculture for their livelihoods, directly or indirectly (World Bank, 2008).

Effective mitigation in the agricultural sector will require the participation of developing nations; developed countries, such as Canada, can play an important facilitative role through the provision of capacity building and technology transfer. Focused support for mitigation in the agricultural sector in developing countries could help Canada build its reputation as a helpful contributor to solutions surrounding agriculture and climate change and demonstrate leadership on the issue.

This paper examines the options for expanding the role of agriculture in the international climate change regime. Section 2.0 explains the importance of agriculture in the climate change regime and

¹ The Food and Agriculture Organization (FAO, 2008) estimates that mitigation efforts in developing countries, through agriculture and forestry projects, might 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.

Section 3.0 reviews the outcomes of the United Nations Climate Change Conference in Copenhagen in December 2009 and the United Nations Framework Convention on Climate Change (UNFCCC) meetings in June 2010. Section 4.0 assesses Canadian strengths in capacity building and technology transfer. The concluding section sets out recommendations for the meaningful and effective treatment of agriculture in the international climate change regime.

2.0 The importance of agriculture in the climate change regime

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.² The growth of emissions from agriculture and deforestation activities occurs mainly in developing countries, where most of the world's agricultural production takes place (Nabuurs et al., 2007; Smith et al., 2007). The 2008 *World Development Report* explains that agriculture is the principal source of overall economic growth in many developing countries, employing nearly one-half of the labour force in these countries, accounting for about 25 to 50 per cent of GDP and about 30 to 40 per cent of employment. A high share of rural communities—especially the rural poor—is directly or indirectly dependent on agriculture, and agricultural exports fuel economic development in many developing countries (World Bank, 2008).

Developing countries are likely to play prominent roles in efforts to reduce GHG emissions through agriculture and land-use measures because of growing agriculture and forestry emissions and the largest and most cost-effective mitigation opportunities in these sectors. For many developing countries, the greatest mitigation potential is in the agricultural sector.

It will be important to deal with agriculture in a manner that accounts for related land management practices and systems, i.e., using a sustainable land management approach. Agriculture is the most frequent cause of deforestation, and some countries require an approach that considers agriculture and forestry simultaneously.³ In Latin America and Asia, forest conversion for large-scale (>25 hectares) agriculture is the predominant pattern; in Africa, deforestation most often leads to small-scale agriculture (Bellassen et al., 2008, pp. 12–13). Given the anticipated population growth and expected changes in diets with more animal protein, agricultural systems will need to increase resource use efficiency and reduce pressure on forests. Production practices that emphasize integrated nutrient and water management—for example, no-till production, conservation tillage, or mixed cropping that combines food crops with cover crop legumes and/or tree and shrub species—can also sequester carbon. Mitigation in the agricultural sector can have sustainable land management and sustainable production benefits and have a positive effect on deforestation by reducing demand for more agricultural land. Agricultural policy must consider broader land management practices and systems, such as forest conservation.

² A National Aeronautics and Space Administration (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).

³ Bellassen et al. (2008, pp. 12–13) note that other causes include timber exploitation and fuel-wood collection, but agriculture is clearly the first driver of deforestation.

Mitigation through agriculture and related land management practices and systems 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. Agriculture has been somewhat marginal in the climate change negotiations and played a limited role in the Kyoto Protocol. The UN Food and Agriculture Organization (FAO, 2008) notes that agriculture is considered “difficult” because of the perceived lack of and expense associated with robust methodologies for measurement, reporting and verification (MRV) and because of the large number of farming systems, agroecosystems and farmers. An additional factor is the narrow scope of the current clean development mechanism (CDM) with regard to the land use, land-use change and forestry (LULUCF) sectors; the CDM excludes soil carbon sequestration from agriculture. This is largely due to the non-permanence of reductions from this sector.

Uncertainty regarding reporting, monitoring and protocols at the time of the negotiations for the Kyoto Protocol meant that agriculture was eventually excluded as a recognized mitigation activity under the CDM. Most experts consider that the science has caught up since then and CO₂ sequestration in soils can be monitored with much greater accuracy. The advances in the science and technology and the recognized need to provide support for emission reductions in poor developing nations reliant upon agriculture mean there is growing interest in, and momentum for, the inclusion of agriculture in a post-2012 climate change regime.

An effective international climate change regime will need to encourage global mitigation actions in the agricultural sector. Such actions can have important co-benefits, particularly in regard to sustainable development and food security, and this is especially so for poor developing countries. The list of co-benefits linked to soil carbon sequestration includes reduced soil erosion, improved soil fertility and structure, improved water quality, reduced levels of nitrogen and phosphorus pollution, buffering against drought, and improved agricultural performance. Improved crop yields can contribute to higher incomes for farmers and thus help to alleviate poverty. Increasing resilience to climate change is also important, indicative of the important linkages between adaptation and mitigation in the agricultural sector.

3.0 UNFCCC negotiations: Agriculture

While most countries agree that agriculture is an important element of emission reductions, the issue of how agriculture should be accounted for in any future regime continues to attract discussion and controversy. Agriculture, along with reducing emissions from deforestation and forest degradation in developing countries (REDD), is one of the areas that made greatest progress within the formal UNFCCC negotiations over 2009 and in early 2010. Much of this progress on agriculture was made in the mitigation contact group discussing cooperative sectoral approaches and sector-specific actions in agriculture under the Ad Hoc Working Group on Long-term Cooperative Action (AWG–LCA). Decisions regarding nationally appropriate mitigation actions (NAMAs), REDD and LULUCF also could have impacts on the agriculture negotiations because actions in one land-use sector, such as forestry, will have impacts on other land-use activities, such as agriculture.

3.1 Cooperative sectoral approaches and sector-specific actions in agriculture

The AWG–LCA discussions on cooperative sectoral approaches and sector-specific actions evolved over the course of the 2009 negotiations to focus specifically on agriculture. The draft text *Cooperative sectoral approaches and sector-specific actions in agriculture* (UNFCCC, 2010) was produced at the 15th Conference of the Parties (COP 15) in Copenhagen in December 2009. No decisions were taken on this negotiating text in Copenhagen, and the COP agreed to continue the work of this group. Discussions on agriculture progressed and countries continued negotiations at the Bonn Climate Change Talks in May and June of 2010, working with the AWG–LCA Chair’s text to facilitate negotiations. The Bonn discussions included informal consultations under the Subsidiary Body for Scientific and Technological Advice (SBSTA), facilitated by Japan and Malawi, which focused on defining the scope of a programme of work on mitigation in the agricultural sector.

In the AWG–LCA negotiations, “nothing is agreed until everything is agreed,” meaning that agreement on the agriculture text is subject to Parties agreeing on all sections of the AWG–LCA text and the creation of a legally binding agreement. As a result, the agriculture text remains on the negotiating table, and the first opportunity for a decision on this text will take place at COP 16 in Cancún, Mexico, in December 2010. Reaching a comprehensive agreement will be no easy task, given the lack of consensus in such areas as targets and market mechanisms, and expectations are low for such an outcome in Cancún. There is speculation that a critical group of substantive decisions in Cancún could be the framework for a broader legal agreement at COP 17 in South Africa in November and December 2011 and that the text on agriculture could be a deliverable in Cancún, after which Parties would be invited to make submissions on the scope of a programme of

work on agriculture. Such a programme of work under SBSTA could help to provide the scientific and technical groundwork for contentious methodological issues in a manner similar to earlier work on REDD.

Although all of the negotiating text on agriculture remains bracketed, or undecided and open to future negotiation, significant progress has been made. The main points of agreement in the negotiating text are:

- Recognition of the relationship between agriculture and food security and of the link between adaptation and mitigation;
- A decision that Parties promote and cooperate in research, development and transfer of technologies for the mitigation of agricultural GHG emissions; and
- A request for the SBSTA to establish a programme of work on agriculture (UNFCCC, 2010).

The critical sticking points in the AWG–LCA text are:

- Whether countries “should” or “shall” promote and cooperate in research, development and transfer of technologies for the mitigation of agricultural GHG emissions. The choice of terminology will carry a legal meaning and will need to be agreed upon by Parties.
- Language on trade included by Argentina that notes that actions in the agricultural sector should “not constitute a means of or unjustifiable discrimination or a disguised restriction on international trade.” Venezuela expressed concern about trade and livelihoods.

3.2 The Copenhagen Accord

The Copenhagen Accord, which was taken note of at COP 15, has been referred to as both a success and a failure, although almost everyone agrees that the resulting document was less satisfactory than most had hoped for.

The Accord does not impose binding emission targets or set a deadline for forming an internationally binding treaty; however, progress was made in many areas, with the main points of the Accord including:

- The objective of keeping maximum global temperature increase to below 2 degrees Celsius;
- A commitment to list developed country emission reduction targets and developing country NAMAs for 2020;

- A developed country commitment to a goal of jointly mobilizing US\$100 billion annually by 2020 from both public and private sources, and a collective commitment to provide “new and additional, predictable and adequate funding” amounting to US\$30 billion for the period 2010–12, with a balanced allocation between adaptation and mitigation;
- Explicit acknowledgement to act on REDD, including the immediate establishment of a REDD-plus mechanism;
- Action and cooperation on adaptation, particularly in least developed countries (LDCs), small island developing states (SIDS) and Africa; and
- Establishment of a technology mechanism to accelerate technology development and transfer (UNFCCC, 2009).

Thirty-seven non-Annex I countries submitted communications to the UNFCCC regarding being listed in the chapeau of the Copenhagen Accord in early 2010. Although the Accord did not mention agriculture, 18 of these developing countries included agriculture in their list of NAMAs. (See Appendix I for the list of countries and their NAMAs in the agricultural sector.) The NAMAs included sustainable agricultural practices, increased carbon sequestration in agricultural soils, restoration of pastures and grazing land, and promotion of plant species with improved nitrogen fixation. Not all countries included a detailed list of NAMAs, and no modalities or eligibility criteria have been determined for providing support to NAMAs.

3.3 LULUCF and REDD negotiations

The negotiations on LULUCF under the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG–KP) and on REDD-plus under the AWG–LCA could potentially influence discussions on agriculture.

The LULUCF negotiations include discussion of two SBSTA programmes of work that could have positive impacts on agriculture. The first is a request for SBSTA to consider modalities and procedures for possible additional LULUCF activities under the CDM, such as revegetation, forest management, cropland management, grazing land management, wetland management, soil carbon management in agriculture, and other sustainable land management activities. The second is a request for a programme of work that considers modalities and procedures for an alternative approach to addressing the risk of non-permanence under the CDM, such as how to take responsibility for reversals, insurance, buffer and credit reserves, and exceptions for low-risk activities. Calls for widening the CDM to include agriculture and other land-use activities could have positive implications for those whose livelihoods depend on agriculture, especially in Africa.

The negotiation of LULUCF rules could also affect agriculture discussions, particularly in regard to accounting methods. Outcomes of negotiations on LULUCF rules for developed countries could influence expectations for agriculture rules in developing countries. These rules could also influence the REDD-plus negotiations, and the outcomes of the REDD-plus negotiations will in turn influence discussions, because agriculture is a leading cause of deforestation. There is some discussion of a REDD-plus mechanism eventually including agriculture (after further research on accounting and methodologies), but this is not a consideration in the current negotiations.

3.4 Global Research Alliance on Agricultural Greenhouse Gases

A positive outcome of 2009 was the launching of the Global Research Alliance on Agricultural Greenhouse Gases in Copenhagen on 16 December 2009. This initiative is completely outside the UNFCCC, but will help to achieve objectives of the Convention (for example, GHG accounting and targets). The Alliance, consisting of 30 member countries in September 2010, aims to help reduce the emissions intensity of agricultural production and increase its potential for soil carbon sequestration, thereby contributing to overall mitigation efforts.⁴ It will also seek to increase international cooperation and investment in both public and private research activities. The Alliance will initially focus on information sharing and, over time, will undertake collaborative projects.

The Alliance was spearheaded by New Zealand, which will host the interim secretariat. The New Zealand government hosted a first meeting in April 2010 to establish objectives and develop work plans. At the meeting, it was determined that New Zealand and the Netherlands would coordinate research efforts on the livestock research group, Japan would lead efforts on rice paddy management, and the United States would lead research on crop management. Canada is leading research efforts on the cross-cutting issue of MRV.

Countries in the Alliance keep control over funds they commit to the Alliance and, in many cases, that will be used to fund domestic research. New Zealand has pledged NZ\$45 million (Fallow, 2010) and Agriculture and Agri-Food Canada (AAFC) will invest up to C\$27 million in the Alliance.⁵ The United States Department of Agriculture (USDA) plans to expand agricultural climate change mitigation research by US\$90 million over the next four years and contribute this research to the Alliance. In addition, the USDA plans to grant fellowships to Alliance members from developing countries to allow for collaborative research by scientists from multiple countries (USDA, 2009).

⁴ The alliance consists of Argentina, Australia, Canada, Chile, Columbia, Denmark, Finland, France, Germany, Ghana, India, Indonesia, Ireland, Japan, Malaysia, Mexico, the Netherlands, New Zealand, Norway, Pakistan, Peru, the Philippines, Russia, Spain, Sweden, Switzerland, United Kingdom, United States, Uruguay and Vietnam. Brazil, China and South Korea attended the first meeting in April 2010 as observers.

⁵ All subsequent dollar amounts in this paper are expressed in Canadian dollars, unless otherwise indicated.

3.5 Moving forward: Views and priorities

Most countries want agriculture included in the international climate change regime to enable research and the development of programs and activities—similar, in a manner, to the earlier development of REDD. But disagreements, challenges and roadblocks have negatively affected the negotiating sessions. Although some progress has been made on discussions surrounding critical issues such as agriculture and REDD, to date this process has been excruciatingly slow and leaves many concerned about the potential for an outcome at Cancún.

Negotiators will need to consider a number of critical issues as they move forward on agriculture and climate change, including:

- Defining an eventual role of agriculture in any international post-2012 climate change agreement.
- Ensuring that developing countries are prepared and ready to take on mitigation projects in the agricultural sector. This likely means extensive readiness programs for a number of poor developing nations.
- Building on the work of existing institutions and organizations. Considerable good work is taking place in research facilities around the world and their work is not necessarily aligned with climate change efforts or funding mechanisms. It will be important to make the required linkages to build synergies and avoid duplication.
- Linking with official development assistance (ODA) efforts. Much support for rural livelihoods and agriculture in developing nations is delivered through ODA budgets. Mitigation efforts in the agricultural sector in developing countries will need to build on these projects; ODA projects should be encouraged to mainstream climate change adaptation and mitigation.

The perspectives and proposed actions of various countries are discussed below.

Developed countries

The *United States* was an early committer to the Global Research Alliance, helping to give momentum to the initiative. The United States is interested in MRV because of unresolved issues and the need for standards, protocols and methodologies. There is some concern that the United States will move ahead with its own methodologies, but this is likely to be balanced by recognition of the need for international guidance. The United States has been active in the AWG–LCA agriculture discussions, including putting forward an SBSTA programme of work at the 2010 informal sessions in Bonn. The United States suggested that the work programme consider such areas as measurement and monitoring, livestock research, paddy rice, croplands, and carbon and nitrogen cycling in agricultural soils.

The USDA has become active on the climate change file under the Obama administration, promoting the need for research and seeing agriculture as an opportunity for mitigation. The USDA was visible at Copenhagen, with Secretary Tom Vilsack speaking at Agriculture and Development Days. The USDA promotes the carbon offset market as a means to create income-generating opportunities for U.S. farmers; in addition, the USDA anticipates considerable opportunity for the purchase of developing country offsets in the agricultural sector as a means for compliance. It should be noted that there is considerable opposition to cap-and-trade from the agricultural sector in the United States.

Canada is a founding member of the Global Research Alliance on Agricultural Greenhouse Gases and is an active participant in agriculture discussions under the AWG–LCA. Canada has gained considerable experience on agriculture protocols and methodologies, because the province of Alberta’s cap-and-trade scheme includes agricultural offsets, including credits for no-till practices. Canada’s proposed federal cap-and-trade system would not accept credits from CDM forestry projects because the temporary nature of the sinks credits is considered to add complexity to the domestic system, without significantly reducing compliance costs for regulated industry. This could change, as Canada has stated that it plans to “continentalize” its emission reduction plan and harmonize Canada’s actions with those of the United States (Prentice, 2010). Canada supports broadening the inclusion of carbon sinks in agricultural soils in an international agreement, recognizing the importance of agriculture in developing countries and the important co-benefits for sustainable development.

The **European Union** (EU) is supportive of a programme of work for a sectoral approach to agriculture, and some EU member countries have signed on to the Global Research Alliance. The issue of agriculture and climate change is gaining attention within the EU, and the European Parliament adopted a resolution on EU agriculture and climate change in May 2010. The resolution affirmed that EU farm policy could help slow climate change and that the future Common Agricultural Policy should be used to make the transition to sustainable farming by creating more synergy between EU agriculture and environmental policies.

Some countries, notably France, have been supportive of expanding the CDM to include agricultural soil carbon sequestration projects. The European Union Emission Trading System (EU –ETS) does not include land-based offsets and is not likely to include them in the short term. The EU has asked if expanded LULUCF options are best addressed under an expanded CDM or NAMA approach, reflecting that there remain many outstanding questions about the financing of NAMAs.

Australia sees the Copenhagen Accord as an important step forward and signed on to the Global Research Alliance. Australia is interested in better exploring the role that soil carbon could play in a

post-2012 outcome on LULUCF, and is considering including forestry, agriculture and land management in its proposed emission trading scheme at the earliest possible time. Australia's carbon pollution reduction scheme has been pushed back to at least 2013; it will only launch the scheme if the world's major emitters have similar measures in place by then. Australia supports a broader range of LULUCF opportunities under the CDM.

New Zealand is a leader on agriculture in the climate change negotiations, spearheading and promoting the Global Research Alliance and co-leading the drafting of text on agriculture.. New Zealand is interested in maintaining both focus and momentum on agricultural sector mitigation in the negotiations. The New Zealand domestic emission trading scheme initially counted only forests and was expanded on 1 July 2010 to include electricity generation, manufacturing industries and transport. The trading system is expected to include agriculture by 2015 (Ministry of Agriculture and Forestry, 2010). The country has indicated that it will progress slowly on its cap-and-trade plans until Australia moves (Reuters, 2010). New Zealand is a supporter of expanded LULUCF activities—including agricultural soil sequestration projects—in the CDM or other market mechanism.

Japan signed on to the Global Research Alliance. The country is particularly interested in manure management and emissions from rice cropping. Japan is introducing incentives for soil carbon sequestration and improved accounting and reporting methodologies, anticipating that soil carbon reporting will be mandatory in a post-2012 climate agreement. Japan hopes to introduce a cap-and-trade system in 2013, and has left room to adopt any form of carbon pricing. Japan has expressed support for including other LULUCF activities, including soil carbon sequestration, in the CDM, noting that an expanded CDM could help to create a more equitable geographic distribution of projects.

Developing countries

Brazil is supportive of including efforts to reduce agricultural emissions in a climate change agreement. Brazil has not yet signed on to the Global Research Alliance, largely because internal approval processes could not keep up with developments on the international stage, but it plans to become a member and is interested in arable cropping systems. President Lula da Silva is recognizing increasingly that action on climate change can support his social agenda and he has become a supporter of efforts to reduce emissions in the agricultural sector. Brazil submitted voluntary NAMAs in the agricultural sector to the UNFCCC, including restoration of grazing land, integrated crop–livestock systems, no-till farming, biological nitrogen fixation, and increased use of biofuels.

In regard to market mechanisms, Brazil supports a narrow forest approach in all land-use discussions and, as such, supports the current eligibility of LULUCF activities for CDM projects—

that is, only afforestation and reforestation. Brazil maintains that REDD activities should be financed only through grant funds, although there are indications that this stance is softening.

China has been quiet on the issue of agriculture in the negotiations, neither opposing nor supporting. In side discussions, representatives from China have noted that China does not want international interference in the agricultural sector because of its importance for food security and rural development and livelihoods. China does not mention agriculture in its submission on voluntary actions under the Copenhagen Accord, where it committed to endeavour to reduce CO₂ emissions per unit of GDP 40 to 45 per cent from 2005 levels, by 2020. It did note actions to increase forest coverage and forest stock volume.

With respect to market mechanisms, China has expressed a preference for the status quo (afforestation and reforestation) in regard to eligibility of LULUCF activities. China notes that issues of accounting, measurement and non-permanence need to be sorted out before including broader LULUCF activities such as soil carbon sequestration.

India has signed on to the Global Research Alliance and is particularly interested in rice cropping systems. India submitted its voluntary target under the Copenhagen Accord to reduce emissions intensity of GDP by 20 to 25 per cent from 2005 levels, by 2020. The agricultural sector is not included in its mitigation actions and will be excluded from the assessment of emissions intensity so as to ensure food security for India's large and growing population.

In regard to expanding market mechanisms in the land-use sector, India favours a fully fungible market mechanism for REDD. If developed countries wish to include soil carbon sequestration as developing country offsets, they need to develop methodologies and help deal with outstanding technical issues. If technical issues are sufficiently overcome, land-based agricultural projects could be included in market mechanisms.

South Africa is supportive of a research program on agricultural mitigation, but has generally been quiet on the topic. The government's primary response to climate change in the agricultural sector has been investment in biofuels. The country will undertake NAMAs to enable a 34 per cent deviation below the business-as-usual emission growth trajectory by 2020. In regard to market mechanisms, South Africa is supportive of a market mechanism for REDD and agriculture credits from developing countries.

Argentina, Chile and Uruguay are among South American nations that are supportive of actions related to the mitigation of GHG emissions in the agricultural sector; the three countries have signed on to the Global Research Alliance. Uruguay was a co-lead on the drafting of the agriculture negotiating text and has supported research and information exchange in reducing GHG emissions

from livestock and nitrogen from agricultural soils. Argentina has promoted the need for increased research and development (R&D) and the development of baseline and monitoring methodologies. These three countries, along with several other Latin American countries—Panama, El Salvador, Costa Rica, Mexico and Belize—are supportive of including additional LULUCF activities under the CDM, including soil carbon sequestration.

A group of Latin American countries that are members of the Bolivarian Alliance for the Americas (ALBA—a regional free trade bloc, founded in 2004, that includes Antigua and Barbuda, Bolivia, Cuba, Dominica, Ecuador, Nicaragua, St. Vincent and the Grenadines, and Venezuela) do not support the use of market mechanisms and have been somewhat obstructionist in the negotiations.

African countries are generally supportive of the inclusion of agriculture in a climate change agreement. The African Partnership Forum states that agriculture needs to be included in an international agreement, given that the forestry and agricultural sectors account for 75 per cent of emissions in the region. They note that further research and work is needed on mitigation in the agricultural sector. Ghana is the only African nation to sign on to the Global Research Alliance. Other African nations have indicated interest in the initiative, but lack resources to participate.

The African Group supports an expanded CDM that includes wetlands and soil carbon projects, with Senegal, Ethiopia and Malawi being vocal supporters in the negotiations. The Common Market for Eastern and Southern Africa and the African Progress Panel are also supportive of the inclusion of agriculture in an international climate change agreement, including expanding the CDM to include soil carbon sequestration projects.

Other constituencies: ENGOs

Many environmental non-governmental organizations (ENGOs) are likely to be opposed to an expanded CDM or other market mechanism that includes more land-based activities, such as soil carbon and wetlands. The issue has not yet attracted much of their attention because the agriculture discussion has focused largely on cooperative sectoral approaches, as opposed to market mechanisms. ENGO concerns would likely include that land-based projects with cheaper credits would divert political and financial resources away from the urgent task of reducing fossil fuel-related emissions, working against reducing industrial emissions in both developed and developing countries. They could also note issues of non-permanence, impacts on local communities and farmers, and concerns that large increases in carbon credits available on the market would reduce the price of carbon. This expected resistance needs to be considered when moving forward on mitigation in the agricultural sector.

4.0 Canadian strengths in capacity building and technology transfer

Several developing countries, particularly LDCs, will require capacity building and technology transfer to introduce farming practices that sequester carbon while improving the efficiency and productivity of agricultural systems in an environmentally sustainable manner. Canada is well positioned to respond to this need, having significant strengths in agricultural technology and know-how, and is considered a world leader in such areas as GHG accounting systems for LULUCF and agriculture, development of protocols for the agricultural offsets, and soil carbon sequestration. Such expertise could be shared with developing countries to help position them to act on the significant mitigation potential in the agricultural sector. As noted earlier and depicted in Figure 4.1, about 70 per cent of the mitigation potential is in developing countries. Of the total technical potential estimate by Smith et al. (2007), about 89 per cent is soil carbon sequestration, 9 per cent from mitigation of methane and 2 per cent from mitigation of soil nitrous oxide emissions.

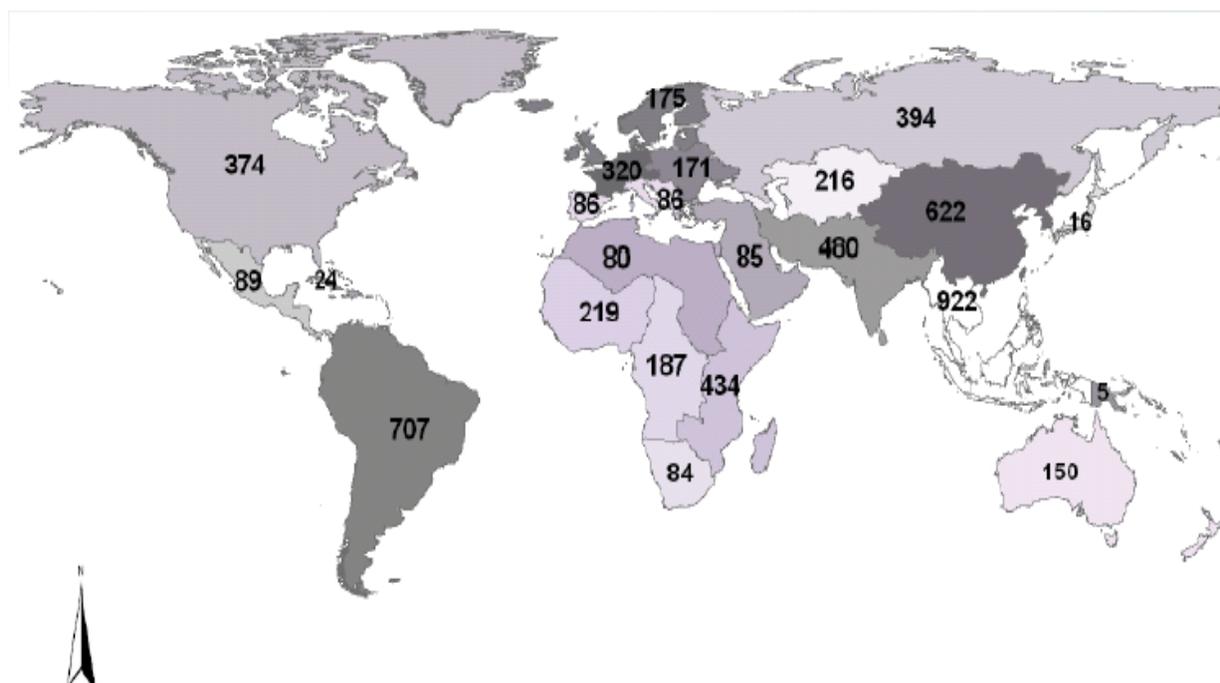


Figure 4.1: Potential for greenhouse gas reductions from agriculture, in gigatonnes.

Source: Smith et al. (2007).

This section includes an assessment of Canadian strengths in capacity building and technology transfer, considering options to help promote agriculture in developing countries consistent with a post-2012 agreement. The analysis in this section helps to identify where Canada may have a strategic advantage for fostering mitigation and adaptation actions in the agricultural sector in developing countries. Canadian strengths are assessed, potential partner countries are identified, and potential programming framework is explored. This analysis is based on a literature review and interviews with experts (listed in Appendix II).

4.1 Canadian strengths

Canada's experience in agricultural development and international assistance can serve as a building block for supporting and enabling mitigation and adaptation overseas. Canada's research and policy-making in the agricultural sector have helped to develop domestic expertise and capacity for managing agricultural emissions. Canadian strengths are examined in this section, which looks at programs and expertise in the federal government and briefly reviews expertise in provinces, universities, and the private and not-for-profit sectors.

Canadian capacities for monitoring, measurement and reporting of GHG emissions in the agricultural and land-use sector have been developed through the National Carbon and Greenhouse Gas Accounting and Verification System. This Agriculture and Agri-Food Canada (AAFC) research program forms the basis for reporting to the UNFCCC on emissions and removals of GHGs from agricultural lands. Canada has gained considerable experience in the measurement of cropland emissions, being only one of four countries opting to report on emissions from this sector under the Kyoto Protocol. Although the need for additional research, even in the Canadian context, has been expressed, Canada is perhaps the country with the most experience in this sector, being considered—as stated earlier—a world leader in the monitoring and reporting of agricultural and LULUCF emissions. In addition, Canada is well positioned to share this expertise with developing countries that will require such accounting systems to properly measure, report on and verify supported NAMAs.

Canada also has considerable experience in developing protocols that provide guidance for quantification, monitoring and verification of GHG reductions or removals for specific agricultural activities. Mitigation actions such as the Alberta Greenhouse Gas Reduction Program have created capacity with the implementation of mitigation policies involving agriculture. As well, Alberta has gained considerable experience in the development of offset protocols, a practical application of Canadian agricultural GHG science. This experience could be used to develop research and academic partnerships with agencies in developing countries to increase the capacity for protocol development.

Several Canadian agricultural programs and policies offer experiences that could inform capacity building efforts in developing countries. Experience with AAFC's National Farm Stewardship Program could be used to help create capacity in national governments in developing countries for promoting and tracking agricultural activities that sequester carbon. The national Environmental Farm Planning (EFP) Initiative, a federal–provincial partnership, has contributed to improvements in agri-environmental performance. Many of the practices funded by EFPs contribute to GHG mitigation. The EFPs can be used to track mitigation in Canada, and the initiative can be used as a model for other governments for tracking and reporting agricultural mitigation. Greencover Canada is another federal agri-environmental program that funds practices aimed at GHG mitigation and that can also be used as an example for other countries.

The AAFC Shelterbelt Centre promotes the environmental and economic benefits of integrating trees with agricultural systems through research, extension and provision of seedlings to Prairie farmers and other eligible clients. The Permanent Cover Program responded to the need for an understanding of carbon sequestered in agricultural soils by evaluating the carbon sequestration potentials of 522,000 hectares converted from annual cultivation to forages in selected Prairie sites.

Other federal research programs, although not specifically intended to address mitigation, may have applications for reducing agricultural emissions. The National Agri-Environmental Health Analysis and Reporting Program involves the development of a set of indicators for measuring agri-environmental impacts. A possible extension of this program could be the development of GHG management indicators for developing countries. The Biomass Inventory Mapping and Analysis Tool is another feature that can be used to develop capacity in developing countries for tracking carbon reserves.

Many of the agricultural practices that support carbon sequestration also provide other benefits, including adaptation benefits, and Canada has experience in this regard that could be transferred to developing nations. Identification of potential co-benefits—such as water quality, drought resilience, food security and climate change adaptation—is needed up front, and project design and delivery should aim to maximize these benefits. There is opportunity for research and support for programs and actions that identify and generate co-benefits at the community level. AAFC and Natural Resources Canada (NRCan) have undertaken a series of projects related to adaptation in the agricultural sector; these could generate findings that are of interest to developing countries. The programs include AAFC's research projects in environment and ecology (AAFC, 2009a) and NRCan's program on enhancing resilience in a changing climate (NRCan, 2009).

The Green Crop Network is a Canadian nationwide research network for sustainable GHG management in agricultural production systems. The network focuses on the development of high-performing crops ideally suited for the Canadian climate, crops that decrease emissions of nitrous oxide through reduced nitrogen requirements and altered root physiology, enhancing soil carbon stocks, optimizing yields and performance under conditions of increasing CO₂, and increasing production of plant oils suitable for biofuel production. The Green Crop Network includes 50 Canadian scientists, 14 universities across Canada and three industry partners (Syngenta Inc., Reductase Consortium, and Agribiotics Inc.). This network was formed in 2006 and has funding to 2011 from the private sector and government departments. This and other research networks could provide lessons (such as processes, structure, etc.) for a virtual research centre on agricultural mitigation technology.

Considerable expertise also resides with provincial governments, farmer and producer organizations, universities and colleges, and the private and not-for-profit sectors. The Soil Conservation Council of Canada and the Saskatchewan Soil Conservation Association carry out research and outreach in regard to agricultural soil carbon sequestration. Research networks include the Institut de recherche et de développement en agroenvironnement in Quebec, and the Canada–Saskatchewan and Canada–Manitoba Crop Diversification Centres. Considerable agricultural research takes place in Canadian colleges and universities. Food security research in Canada is carried out at public institutions such as Ryerson, Lakehead, McGill and the University of Saskatchewan. The research and expertise of these organizations could potentially be applied to international programs. Universities and colleges are well placed to host scientists from developing countries.

4.2 Potential Canadian partners in international programs

Canada has been successful in transferring agricultural mitigation technologies and know-how to developing nations. Many Canadian entities have established linkages and connections with developing country partners that can be built on to further mitigation and adaptation efforts in the agricultural sector.

Within the Canadian government, the Canadian International Development Agency (CIDA) is the main delivery agent of Canada's ODA budget. Food security is one of three development priorities (along with sustainable economic growth, and children and youth), as announced by the federal government in February 2009. CIDA has considerable experience in the delivery of projects in the agricultural sector and builds capacity not only in the developing countries, but also in the Canadian organizations that deliver the aid programs. Approximately 43 per cent of CIDA's agriculture project funding is delivered by Canadian institutions or entities (see Table 1).

Table 1: CIDA contracts and agreements in the agricultural sector, summer 2009.

Project	Organization	Country/Region	Amount (CAN\$)
Boosting agricultural production and food security	Oxfam Québec	Haiti	4,981,660
Support to livestock farmers	FAO	West Bank Gaza	2,500,000
Revitalization of agri-food sectors	Tecscult International Limitée & UPA Développement International	Burkina Faso	8,691,777
Farmer-responsive mechanisms on extension and research	CHF partners in rural development	Ghana	9,700,000
Proagri common fund	Ministerio da agricultura e desenvolvimento rural	Mozambique	19,000,000
Sustainable Livelihoods and Agriculture Project	Oxfam Canada	Mozambique	6,000,000
Agriculture policy support facility	International food policy research Institute	Nigeria	2,880,000
Improving agriculture	Inter-American Institute for Cooperation on agriculture	Jamaica	49,000,000
Farmer-based organizations' development fund	Bank of Ghana	Ghana	1,300,000
Nile Basin, trade and agriculture production	World Bank	Panafrica	9,700,000
Andean agriculture in Altiplano	International Potato Centre	South America Regional	10,000,000
Agriculture Marketing Project	Agriteam Canada	Cambodia	4,200,000
Agriculture in mine-affected areas	Geospatial/Salasan Consulting Inc	Cambodia	2,552,847
Sustainable Agriculture Development Phase II	Agriculture and Agri-Food Canada Corporate Services Branch	China	19,044,000
Integration of women producers into effective markets	Mennonite Economic Development Associates	Pakistan	6,720,000
Facilitating agricultural reform and marketing in Sughd	Centre d'études et de coopération internationale	Tajikistan and Central Asia	4,209,000
Food and agriculture products quality	Univesité de Montréal	Vietnam	16,000,000
Agriculture Market Information Systems	Agriteam Canada	Vietnam	4,451,370

Source: CIDA, 2009a.

In October 2009, CIDA released a Food Security Strategy (CIDA, 2009b). The strategy is based on three pillars: sustainable agricultural development, food assistance and nutrition, and research and innovation. Funding associated with the strategy more than doubles CIDA's investment in funding for food security and agriculture (including food aid), with an additional \$600 million in funding over three years (including 2009–10). The sustainable agricultural development pillar includes a doubling of support to \$75 million to promote small-holder farmers' access to technologies, knowledge, markets, land and water; and support for national and regional strategies. The food assistance and nutrition pillar's highlights include continued support to the United Nations World Food Programme, working with countries on continued improvements to the Food Aid Convention, supporting national and regional strategies to incorporate nutrition considerations into broader food security initiatives, and strengthening national and regional food reserves. The third pillar is the creation with the International Development Research Centre (IDRC) of a \$62 million, five-year food security research fund to support research partnerships between Canadian and developing country organizations. CIDA will provide an additional \$32.5 million over three years to the International Fund for Agricultural Development and contribute to two challenge programs of the Consultative Group on International Agricultural Research (CGIAR). Although details of the strategy and action plan have not been made public, discussions suggest that climate change is not a priority in CIDA's new strategy.

IDRC has built experience in climate change adaptation through the Climate Change Adaptation in Africa research and capacity development program, which was launched in 2006 and is jointly funded by IDRC and the United Kingdom's Department for International Development. A number of the projects are focused on building adaptive capacity on farms and increasing resilience in the agricultural sector. The projects are focused on support to African institutions, with all activities eventually devolving to these entities. During interviews, it was suggested that IDRC is well-placed to support capacity building for agricultural mitigation in sub-Saharan Africa.

In the future, it will be helpful to strongly consider both mitigation and adaptation when developing international programs. AAFC's National Water Quality and Availability Management project in Egypt and the Water Harvesting and Institutional Strengthening project in Ethiopia can serve as examples of initiatives intended to promote adaptation. The sustainable agriculture project in Inner Mongolia, China (included in Table 1) can be used as a template for projects that promote mitigation and adaptation. Other projects have been carried out in Russia, Ukraine, Sri Lanka and Indonesia. Such programs can be structured as international aid through CIDA, or funded by departments such as Environment Canada or AAFC if they are primarily intended as mitigation or adaptation projects.

AAFC (2009b) is also active through bilateral memoranda of understanding (MOU), including several with developing countries (China, India, Chile, Mexico) and international organizations

(CGIAR, International Institute for Cooperation in Agriculture). The MOU with China is the most active and has included the establishment of six China–Canada Science and Innovation Centres, including one on eco-agriculture and environment. Under the Canada–China MOU, cooperative research has been undertaken on sustainable agriculture, including conservation tillage. AAFC is also collaborating with the Mexican government and Global Environment Facility (GEF) on an R&D project on agricultural sustainability that aims to improve crop productivity, prevent soil erosion and increase carbon sequestration.

International Science and Technology Partnerships (ISTP), Canada Inc., implements the India, China and Brazil elements of the International Science and Technology Partnerships Program, a \$20 million program announced by the Government of Canada in 2005. Managed by Foreign Affairs and International Trade Canada, the program aims to promote collaborative R&D between Canadian and foreign scientists and technical experts. ISTP Canada aims to strengthen Canada’s science and technology, business-to-business relations and ultimately overall economic, trade and political relations. One technology partnership in China is related to agriculture and climate change. Researchers in Saskatchewan and China are developing and commercializing a grassland health monitoring and productivity prediction system that helps scientists better understand the impact of climate change on these plant communities. A comprehensive database and new software will be developed, based on experiments conducted in the Canadian Prairies and Tibetan grasslands.

A number of non-profit groups are active in the delivery of international cooperation projects, such as REAP Canada, Oxfam Canada, Canadian Hunger Foundation International and the Canadian Foodgrains Bank. The Agricultural Institute of Canada manages the International Twinning Partnership Project that provides opportunities for members to partner with organizations in developing countries. The Association of Universities and Colleges of Canada manages the CIDA-funded University Partnerships in Cooperation and Development that includes some projects in the agricultural sector, such as food crop production and conservation activities in the Democratic Republic of the Congo and sustainable rural agriculture development in Ethiopia. For-profit companies, such as Agriteam and Baastel, are also experienced in delivering agricultural projects in developing countries.

4.3 Engaging developing countries

Increased support for agricultural mitigation activities in developing countries could help Canada establish itself as a player and leader in this area, as well as help to enhance its reputation in the negotiations. Canada has expertise and know-how that is suited, or can be adapted, to developing-country circumstances. But Canada will be challenged to respond quickly for a number of reasons:

- CIDA has a limited agricultural program. The new funds attached to the new food security strategy amount to \$200 million a year for three years (including 2009–10), which is only 4 per cent of the \$4,080 million total aid distributed by CIDA in 2007 (Organisation for Economic Co-operation and Development–Development Assistance Committee [OECD–DAC], 2009). Although the amount allocated to agriculture has doubled, it still remains low, and climate change is not a focus of funding.
- Canada has not been actively engaged in climate change programs and projects in developing countries since the sunset of the Canada Climate Change Development Fund (CCCDF) in 2006.
- Twenty focus countries for aid were identified by the Canadian government in February 2009, reducing the number of African concentration countries from 14 to seven.
- There is a tendency to deliver climate change-related aid through multilateral institutions. In October 2008, the Government announced \$100 million in funding for international climate change adaptation to assist countries that are especially vulnerable to the adverse effects of climate change. This funding is channelled through the World Bank, leaving no opportunity for bilateral projects that emphasize Canadian expertise and technology.

The limited support for agriculture and climate change projects, and the channelling of funds through the World Bank, minimizes the visibility of Canada contributions and reduces opportunities for Canadian entities.

In the early years of the Kyoto process, Canada was perceived as an active participant in the UNFCCC negotiations and processes—for example, helpful analysis of options in the international discussions, useful interventions in the negotiations, ODA support for climate change projects in developing countries, and Canadian companies moving on opportunities under the CDM with government support. The CCCDF established Canada as an early leader on the development and climate change agenda, enhancing Canada’s reputation and UNFCCC negotiating positions (CIDA, 2004). Canada used this fund to gain profile with developing countries in the negotiations, being one of the first supporters of the LDC Fund (providing \$10 million) and making contributions to the UNFCCC–LDC Expert Group and the UNFCCC–LDC Group. Canada also contributed \$13.5 million to the UNFCCC Special Climate Change Fund (GEF, 2008).

Support to agriculture could be one way to re-establish this reputation, helping to build support for Canadian positions in the negotiations (or at least reduce the criticism of positions) and helping to improve Canada’s standing in the UNFCCC forum. Agricultural mitigation could be a strategic area for Canada to support. There are strong ties with adaptation, Canada has developed expertise in sustainable farming and soil carbon sequestration, and Canada could direct this support to LDCs or

SIDS—helping to rebuild Canada’s relationship and reputation with these nations in the climate change negotiations.

Canadian engagement with developing countries on agriculture and climate change

Increasing mitigation and adaptation efforts in the agricultural sector could require new approaches. This would require understanding the needs of developing countries, identifying potential countries and regions for focus, and considering new approaches that account for existing programs and available expertise.

Canada could develop a program to engage developing countries on mitigation in the agricultural sector. Canada has a long history of formulating effective agricultural policy and delivering programs to farmers; this experience could be used to help developing countries prepare for and implement mitigation and adaptation actions, be it through sectoral approaches, NAMAs, REDD or market mechanisms.

In developing a program, Canada might consider the following two regions to focus its efforts:

- **Sub-Saharan Africa**—Many Sub-Saharan African countries support including agriculture in a post-2012 agreement, calling for expanding the CDM to include agricultural land uses. Many of these countries view agriculture as a way to eventually become involved in the carbon market, and it is the sector of greatest mitigation potential. Agriculture is the most important economic sector in many of these countries, which will need support to adapt to climate change. The co-benefits of mitigation projects are important for such countries, many of which suffer from severe soil degradation. Most of these countries require substantial capacity building to measure and account for emissions, undertake R&D to develop CDM protocols and baseline information, develop extension programs for farmers, and address vulnerabilities in the sector.

Many of these countries are considered the most vulnerable to climate change, a group that the Government of Canada has put forward as a priority for public funding under the UNFCCC. Focusing on these countries would be consistent with this priority.

- **Central Asia** (Kyrgyzstan, Kazakhstan, Turkmenistan, Tajikistan, Uzbekistan)—Canadian technology is tailored to Canadian conditions, and will not necessarily be directly applicable throughout the world. Much Canadian technology and experience can best apply to Central Asian countries, which also have a higher capacity to adopt new technology. These countries tend to be overlooked in Canada’s development cooperation network and could be a niche partnership for Canada. This could also be a limiting factor in initially identifying partners,

but engaging these countries could open up important relationships for Canada and offer opportunities for new international partnerships.

Established and new methods of cooperation will be needed, and could include:

- **Triangular Cooperation** – Canada could work with larger influential developing nations, such as China and Mexico, through triangular cooperation. This involves two countries working in partnership to deliver technical assistance to a third country. As an example, Canada could provide funding to allow Canadian and Chinese partners to deliver technical assistance to nations in Sub-Saharan Africa. This would build on long-term relationships established between Canadian and Chinese institutions and allow these groups to continue working together while assisting a third nation. China and Canada could help to establish extension services to promote sustainable land use and mitigation practices, and work with African researchers to develop innovative land-management technologies.
- **Collaborative Research Program** – This research program could be a public–private partnership between the government and Canadian universities to support research, extension and capacity development in agricultural mitigation in developing countries. For example, a government department such as AAFC could provide financial and human resources, Canadian universities could provide financial and human resources and facilities, and developing country institutions could provide human resource and facilities. Collaborative research could be focused on agricultural mitigation and conducted in Canada (for example, visiting scholars) and host countries. The aim would be to build knowledge and capacity, and transfer technology through coordinated research programs that are collaboratively developed and cooperatively implemented, with shared responsibilities between Canadian and host country institutions and scientists. The research could be managed by a lead Canadian university that coordinates collaborative work among several institutions in Canada and select developing countries.
- **Expert Sharing Programs** – These projects could include the exchange of scientists and engineers, and training programs to promote best practices and technologies. Expert sharing programs could bring experts from developing countries to Canada to undertake research or complete studies, as well as send experts from one developing country to another. Strong linkages with developing country research institutions are needed to ensure the success of the latter programs. Expert sharing or visiting scholar programs could be undertaken as part of a collaborative research program.

- **Agricultural Mitigation Platforms** – This framework could foster private–public partnerships between the research community, industry, governments and NGOs. The platform would initially provide an opportunity for government and stakeholders to define R&D priorities, action plans, and demonstration and pilot projects. Encouraging acceptance of Canadian technologies and know-how in developing countries could best be accomplished by engaging businesses in both countries in the R&D process and supporting demonstration and pilot projects. Such platforms could help to overcome technology barriers and build acceptance of new technologies. The ISTP could be considered as a model.

5.0 Next steps to momentum on agriculture

Considerable momentum has been generated on the issue of agriculture and climate change, and Canada is well placed to be a leader on this issue. Focused support for developing countries could help Canada maintain its reputation as a helpful contributor on the agriculture and climate change issue and demonstrate leadership on the issue.

In June 2010, Canada announced \$400 million for its 2010 portion of the US\$30 billion in fast-track financing promised under the Copenhagen Accord. Canada could direct some of that funding toward agriculture and climate change and deliver some of the money bilaterally to ensure recognition of Canadian support. This would build on Canadian strengths in measurement, monitoring and reporting; offset protocols; conservation farming methods; and outreach programs.

Recommended next steps for Canada are discussed below.

Support an SBSTA programme of work on agriculture. Canada could support an SBSTA programme of work on agricultural emission reductions by funding workshops and research and by financing developing country participation for various initiatives under the work programme.

Convene a “blue ribbon” group of international experts (government, international organizations, private sector, NGOs) to encourage that modalities for agriculture in an international agreement (likely similar to the Marrakesh Accords) consider the sustainable development needs of developing nations. Experts would consider issues in the ongoing negotiations and take messages back to governments and negotiators.⁶

Support developing country participation in the Global Research Alliance on Agricultural Greenhouse Gases. Although AAFC put forward \$27 million to be spent domestically to support the Global Research Alliance, support for developing country participation is needed. The funding could support collaborative research programs with scientists from developing countries, expert sharing programs, or support for participation of developing country institutions. Developing countries have expressed interest in participating in a global research alliance, but lack the required resources. Efforts should be taken to ensure synergies and complementarities with initiatives under CIDA’s food security program.

⁶ The International Institute for Sustainable Development managed the “Development Dividend” task force for three years. This group met annually to discuss the CDM, with a focus on ensuring the CDM provided development benefits while providing the large number of credits needed by developed nations for compliance. The task force included members of the CDM Executive Board, negotiators, project developers, carbon traders, business and NGOs, with representation from developed and developing countries.

Establish an agriculture and climate change fund focused on adaptation and mitigation in the agricultural sector. This would support CIDA's priority of food security and allow a greater coherence between Canada's aid agenda and the climate change negotiations. To ensure that Canadians are able to benefit from such a fund, the majority of funding should be delivered bilaterally. While channelling climate change grant funding through international organizations may be an efficient means of programming funds, it leaves little for locally managed projects that positively affect sustainable livelihoods at the community level or for "signature" projects that are identified as Canadian initiatives.

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Appendix I: NAMAs in the land-use sector submitted to the UNFCCC⁷

Armenia

- Sustain and increase soil CO₂ content

Brazil

- Restore grazing land
- No-till farming
- Biological nitrogen fixation

Central African Republic

- Promote plant species that fix nitrogen
- Improve pasture land and forage
- Increase agricultural production through improved seeds

Republic of the Congo

- Promote and enhance non-timber forest products
- Raise awareness of adaptation actions in the agricultural sector
- Promote plant species that fix nitrogen

Cote d'Ivoire

- Develop and implement a national plan to combat land degradation
- Manage waste in an integrated and sustainable manner
- Develop sustainable farming

Eritrea

- Implement projects and programs that enhance soil carbon stocks in agricultural soils

Ethiopia

- Apply compost on 80,000 square kilometres of agricultural land of rural local communities for increased carbon retention in the soil

⁷ As of 5 June 2010. Party submissions can be accessed at <http://unfccc.int/home/items/5265.php>.

- Implement agroforestry practices and systems on 261,840 square kilometres of agricultural land for livelihood improvement and carbon sequestration

Gabon

- Community forestry and agroforestry

Ghana

- Develop and enforce land-use plans
- Promote spot and zero burning practices
- Promote minimum tillage
- Incentivize use of bio-fuels for mechanized agriculture
- Promote the use of organic fertilizer
- Promote integrated use of plant nutrients
- Promote the cultivation of high-yielding upland rice cultivation
- Promote the recycling of crop residues

Indonesia

- Development of carbon sequestration projects in forestry and agriculture

Jordan

- Rehabilitate and protect the green cover and grazing areas in the Badia region
- Grow perennial forages in the Badia region
- Implement best management practices in irrigated farming fertilization applications

Macedonia

- Enable favourable pre-conditions for GHG emission reductions in the agriculture and forestry sectors
- Introduce and develop GHG mitigation technologies in agriculture
- Strengthen local capacity for carbon financing
- Educate farmers and decision-makers on agricultural mitigation measures and technologies

Madagascar

- Improve pasture land and forage
- Increase agricultural production through improved seeds
- Increase use of compost and organic fertilizer in agricultural investment zones

Mongolia

- Improve forest management, with major mitigation options identified as natural regeneration, plantation forestry, agroforestry, shelter belts, and bioelectricity

Morocco

- Improve the yields of agricultural land

Papua New Guinea

- High-level policy objectives include forestry and agriculture as appropriate mitigation actions

Sierra Leone

- Introduce conservation farming and promote the use of other sustainable agricultural practices (e.g., agroforestry)
- Develop an Integrated Natural Resources and Environmental Management program, including sustainable land management programs, particularly in relation to ecosystems

Tunisia

- Increase the surface area reserved for organic farming to 500 thousand hectares by 2014
- Increase the amount of farmland using modern water-saving irrigation technologies that meet best international practices, from 120 thousand hectares in 2009 to 200 thousand hectares
- Consistent with the national water strategy, strengthen programs to desalinate brackish water and reuse treated wastewater, by using best energy and water conservation technologies to increase agricultural profits, fight desertification, and encourage afforestation and improved grazing lands

Appendix II: List of persons interviewed

- Daniel Bernier, Union des Producteurs Agricoles
- Carl Bérubé, Clubs Conseils en Agroenvironnement
- Stu Clark, Canadian Foodgrains Bank
- Don Flaten, University of Manitoba
- Nancy Lease, Quebec Ministry of Agriculture, Fisheries and Food
- Daniel Martino, Carbosur
- Don McCabe, Soil Conservation Council of Canada
- Brian McConkey, Agriculture and Agri-Food Canada
- Calvin Mulligan, Farm Credit Corporation
- Nathaniel Newlands, Agriculture and Agri-Food Canada
- Marco Rondon, International Development and Research Centre
- Esther Salvano, Manitoba Agriculture, Food and Rural Affairs
- John Stone, International Development and Research Centre
- Tony Szumigalski, Manitoba Agriculture, Food and Rural Affairs
- Laura Telford, Canadian Organic Growers
- Ian Wishart, Keystone Agricultural Producers
- André Vézina, Bio-Terre Systems Inc.