



Agriculture and  
Agri-Food Canada

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Agroalimentaire Canada

## Agriculture and Climate Change

Canada



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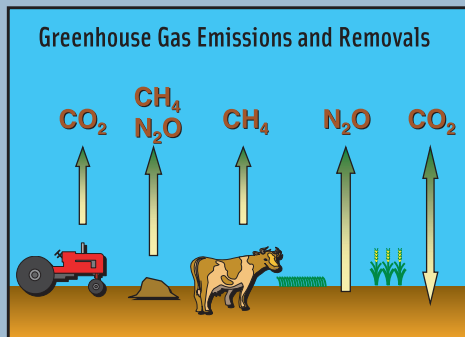
## Agriculture and Climate Change

Climate change is a global problem, affecting every nation and every living thing. Although greenhouse gases (GHGs) occur naturally, many human activities add GHGs to the atmosphere. Scientists say that if present trends continue, by 2100 the Earth's average temperature will be 1.5 to 6 degrees Celsius warmer than it is today, due in large part to a global increase in GHG emissions.

Canada is responsible for about two per cent of these emissions. Under the Kyoto Protocol, Canada has agreed to reduce its annual greenhouse gas emissions between 2008–2012 to a level six per cent below actual emissions in 1990. Our target is the most ambitious emission reduction target among all Kyoto signatories.

### Why climate change is important to agriculture

Primary agricultural activities account for about 10 per cent of Canada's GHG emissions. The major sources of GHG emissions in agriculture in Canada are manure (methane and nitrous oxide), enteric fermentation (methane), crops (carbon dioxide) and fertilizers (nitrous oxide).



### What is a carbon sink?

*A sink is defined as a process that removes CO<sub>2</sub> from the atmosphere and stores it elsewhere, such as in forests or agricultural soils. This process is also known as carbon sequestration. Sinks are an important component of Canada's overall approach to climate change. We are recognized for our contribution to increasing carbon sinks (see page 8).*

Farmers face a double challenge. First, they must find ways to enhance carbon sinks and reduce emissions produced by agriculture. Second, they need to adapt to the effects of climate change on agricultural production.

Agriculture is sensitive to climate. Some conditions, such as drought, can severely reduce crop production, while ideal climate conditions contribute to bumper crops. Variable climate conditions affecting major producing countries can have significant effects on world food supplies and markets.

## Agriculture and Agri-Food Canada and the 2005 Climate Change Plan for Canada

The agriculture industry can make a significant contribution towards helping Canada meet its GHG reductions target. In recognition of this, agriculture is one of the six key elements of the 2005 Climate Change Plan for Canada.

Agricultural “business-as-usual” practices are predicted to generate a carbon sink of 10 mega tonnes in the Kyoto commitment period of 2008-2012. An additional sink of 16 mega tonnes

### Positive impacts

- Increased productivity from warmer temperatures
- Possibility of growing new crops
- Longer growing seasons
- Increased productivity from enhanced CO<sub>2</sub>
- Accelerated maturation rates
- Decreased moisture stress

### Potential Climate Change Impacts On Agriculture

#### Projected Changes

- Warmer Temperatures
- Drier or wetter conditions
- Increased frequency of extreme climatic events
- Changing market conditions

The net impact on Canadian crops is uncertain, and depends largely on the adaptation measures undertaken

### Negative impacts

- Increased insect infestations
- Crop damage from extreme heat
- Planning problems due to less reliable forecasts
- Increased soil erosion
- Increased weed growth and disease outbreaks
- Decreased herbicide and pesticide efficacy
- Increased moisture stress and droughts

or more may be achieved through various soil and land management practices that increase the carbon stored in the soil. These include low-till and no-till soil management practices, reduced summer fallow, and/or increased use of forage. Incremental emission reductions could also result from activities such as improved beef feeding strategies and/or manure management.

The Government of Canada's Climate Fund is of particular interest to the agriculture industry. Part of the Climate Change Plan, the fund has been allocated \$1 billion over five years to encourage projects that reduce and/or remove greenhouse gas emissions from the atmosphere. As the agriculture sector is not a regulated sector under the Climate Change Plan, reducing GHG emissions and/or increasing sinks will be voluntary.

## **Agriculture and Agri-Food Canada's (AAFC) GHG mitigation programs and plans**

### **The Shelterbelt Enhancement Program**

The Shelterbelt Enhancement Program is a

## **What is a shelterbelt?**

*A shelterbelt is a hedge or fence of trees or shrubs that lessens the force of the wind and reduces soil erosion. Shelterbelts also act as carbon sinks.*



\$4-million, five-year initiative designed to reduce greenhouse gas emissions by planting more shelterbelts on agricultural lands across the Prairies.

Under the program, AAFC is partnering with farmers, livestock producers and rural organizations to reduce GHG emissions by planting 8,000 km of shelterbelts by 2006.

### **The Greenhouse Gas Mitigation Program**

The Greenhouse Gas Mitigation Program aims to reduce GHG emissions through improved soil, nutrient and livestock management techniques, increase carbon sinks, and help Canada meet its Kyoto commitments. To accomplish this, the program identifies beneficial management practices (BMPs) that reduce GHG emissions, raises awareness and encourages producers to adopt better management techniques. An example of a BMP is an improved fertilizer application practice, which allows producers to lower costs while reducing GHG emissions.

### **The Virtual Farm Program**

The goal of the Virtual Farm Program is to develop a method for quantifying net GHG

## **Beneficial Management Practices**

*Beneficial management practices (BMPs) describe a practice, or system of practices, designed to minimize the impact of agricultural activities on natural resources while maintaining economic viability of the agricultural industry.*

*Examples of BMPs include fertilizer formulation and application practices, livestock feeding strategies, manure handling practices (including manure storage, manure treatment technology and manure nitrogen management), and soil management practices including enhanced carbon sequestration practices such as low-till agriculture.*

emissions from whole farms, in order to estimate current emissions and evaluate mitigation practices. The program draws on findings from soil, nutrient, and livestock studies and evaluates net GHGs from combined elements of current and proposed farming systems. The initiative will also include an economic analysis to identify practices that most efficiently reduce net emissions from farming.

### **Energy Co-generation from Agricultural and Municipal Wastes (ECoAMu) National Program (2002-2006)**

This program is designed to mitigate net greenhouse gas emissions from agriculture through energy co-generation while improving production efficiency and resource conservation. The main objective of the program is to help establish, and conduct technical and economic assessments of, model demonstration plants. For instance, one project will demonstrate the full potential of Anaerobic Digestion Technology by processing manure into biologically stable, odourless and pathogen-free fertilizer, electricity and water. The program is being delivered through collaborative agreements between AAFC and industry.

### ***Benefits of adopting BMPs include:***

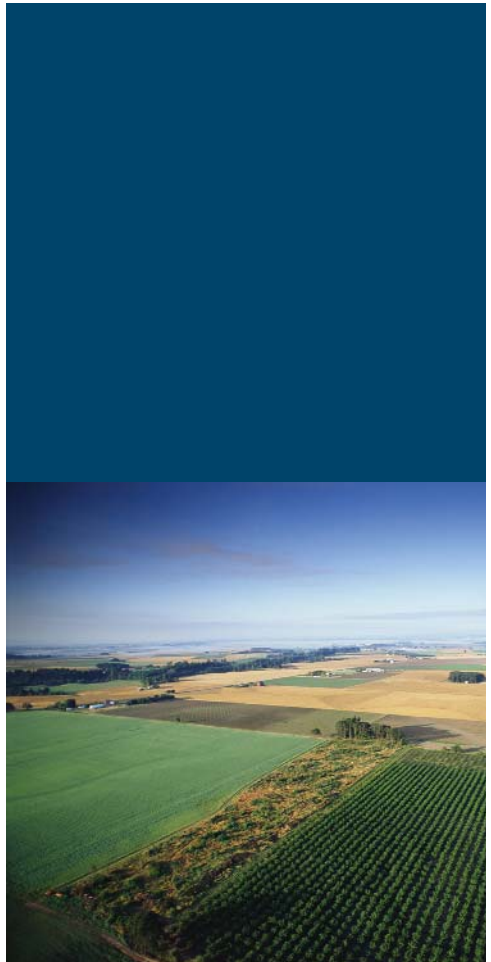
- improved nutrient-use efficiency (fertilizer, manure), leading to lower crop production costs;*
- improved soil quality (from increased soil organic matter and reduced erosion), leading to higher and more stable yields because of improved fertility and water holding capacity;*
- improved efficiency of feed conversion (meat, milk, eggs), leading to lower costs of production;*
- improved air quality around livestock operations (decreased odours);*
- increased value of manure (composting, nutrient content), making it more desirable as a source of plant nutrients; and*
- potential for eligibility for future carbon trading opportunities, leading to possible future financial rewards from selling carbon and GHG emission reductions credits to energy and manufacturing corporations (see page 8).*

## **Ethanol Expansion Program**

Increasing the production and use of bio-products and bio-fuels such as ethanol creates new markets for Canada's farmers. The Ethanol Expansion Program helps expand fuel ethanol production and use in Canada, and helps reduce transportation-related GHG emissions. It supports Canada's target of increasing the proportion of gasoline blended with ethanol to 35 per cent by 2010.

## **Domestic Offset System**

The Government of Canada is developing a Domestic Offset System. Under this system, sectors that voluntarily reduce and/or remove GHGs will be able to earn credits representing their reductions. In the agriculture sector for example, farmers who adopt certain on-farm beneficial management practices will be able to earn credits for removing and storing atmospheric carbon. These credits will be purchased by large final emitters (LFEs), including the oil, mining and gas industries, to meet their mandatory GHG reduction targets. The federal government's Climate Fund will also buy credits on behalf of the Government of



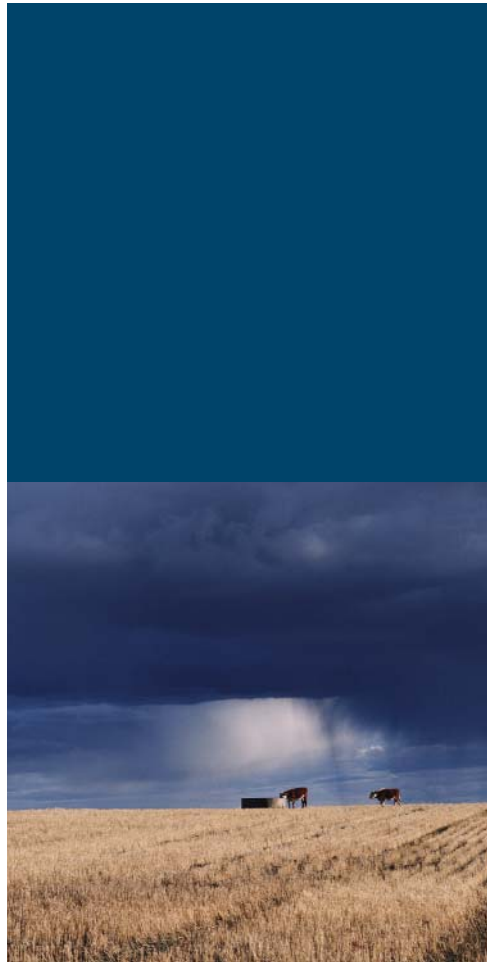


Canada through a competitive process and then use them to help meet Canada's emission targets under the Kyoto protocol.

### **The National Carbon and Greenhouse Gas Emission Accounting and Verification System (NCGAVS) for Agriculture**

NCGAVS is a scientific, transparent, and verifiable accounting system for reporting soil carbon stocks, carbon stock changes, and nitrous oxide emissions for Canadian agricultural land at the provincial, regional, and national level to meet international commitments under the Kyoto Protocol and in support of sustainable agriculture.

NCGAVS will help report the amount of agricultural carbon sinks and GHG emissions as required under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The accounting system will be linked to the national inventory of GHG emissions and may serve as a backbone for the inventory of carbon credits in domestic and international emission trading schemes.



## Climate Change Impacts and Adaptation

The agriculture sector is continuously evolving as new adaptation strategies are developed. Successful and sustainable adaptation is necessary to adapt to the effects of climate change.

While recognizing the need to reduce GHG emissions, the agriculture sector also needs to develop ways to adapt to climate change for three main reasons: the climate is changing and production techniques need to change with it; farmers need to maintain a livelihood and to continue producing food and other agricultural products; and, by adapting to climate change now, the agriculture sector will be able to capitalize on the benefits while minimizing the costs.

**Technological Developments:** Technological innovations, such as the development of new crop varieties and innovations in water management, will play an important role in adapting to a changing climate. By developing new crop varieties that are best suited for survival in extreme weather events, scientists are helping to prepare Canada for extreme climatic events that could result from climate change.

## What is adaptation?

*Adaptation refers to any adjustments undertaken to reduce the expected or actual adverse effects of climate change.*

## Atlantic Coast Adaptation

*Climate change is expected to result in the Atlantic region experiencing longer and warmer growing seasons. To capitalize on new conditions, producers in the region are expected to introduce new crop types, such as corn hybrids, that are compatible with warmer climates.*

**Farm Production Practices:** New and innovative farm production practices, including crop diversification and new irrigation techniques, will help Canadian farmers adapt to climate change.

## Conclusion

Canadian agriculture will be tremendously affected by climate change. The industry is unique because it must adapt to the effects of climate change, it is a source of GHG emissions, and it can reduce GHGs through carbon sinks. This uniqueness has been recognized by including the industry in the 2005 Climate Change Plan for Canada. In response, Agriculture and Agri-Food Canada has been working on a number of projects and policies with the industry to promote sustainable, economically viable and environmentally sound activities. Canada is committed to protecting and enhancing the environment, and AAFC will help Canada achieve that goal.

## Sharing Knowledge Internationally...

*Agriculture and Agri-Food Canada is collaborating with the Mexican government and the Global Environmental Facility/World Bank in a research and development project on agricultural sustainability and carbon sequestration in the State of Oaxaca, Mexico. In this area, the traditional "milpa" system of cultivation is often used, which involves clearing forested land and cropping it to beans and corn for a few seasons, then abandoning it for a fresh clearing. AAFC has helped introduce new cultivation systems which involve conservation production where corn and beans are produced together with "living terraces" of peach and coffee trees. This has increased the annual corn production from 600 kg/hectare annually to more than 4,500 kg/hectare. Research shows that these new production technologies prevent soil erosion, and that atmospheric carbon is being sequestered at a rate of 3 tonnes/hectare annually by the living tree fruit biomass. The associated sequestration of soil carbon in the conservation systems is being monitored. Complementary production of coffee and fruit in conservation terraces enhances the sustainability of agriculture by improving the environment and the economy of farmers and rural communities.*