

Climate Change, Greenhouse Gases and Agriculture

Number 2

December 2004

Greenhouse Gases - Things You Need To Know

What is Climate Change?

Although the Earth's climate is constantly changing and global climate change occurs naturally, the rate of future climate change may be more rapid than at any time in the last 10,000 years. The majority of the world's scientists who study this topic conclude that this expected climate change would differ from previous climate change because of human activities.

The atmosphere has an effect like a greenhouse on the Earth's atmosphere. The energy from the sun reaching the Earth is balanced by the energy that the Earth emits back to space. Greenhouse gases (GHGs) trap some of this energy that the Earth releases to space. These GHGs in the atmosphere act as a thermostat controlling the Earth's climate. Without this natural greenhouse effect, the average temperature on Earth would be -18°C instead of the current $+15^{\circ}\text{C}$. Therefore, life as we know it would be impossible.

Energy levels of GHGs in the atmosphere have increased in the past 100 years. The scientific evidence for this is very solid. In a 1995 scientific assessment, the Intergovernmental Panel on Climate Change (IPCC) concluded, "the balance of evidence suggests a discernible human influence on climate change."

Global climate change will mean substantial impacts on the environment, including water resources, fisheries, forests, wildlife, and ecosystems. Scientists also predict that the enhanced greenhouse effect could amplify climate variability. For the agriculture industry, changes in temperature and/or precipitation could significantly affect production on Canadian farms.

What are the Greenhouse Gases?

The major GHGs in our atmosphere are water vapour, carbon dioxide (CO_2), methane (CH_4), halocarbons, and nitrous oxide (N_2O). Modern industry and lifestyles have led to elevated levels on existing GHGs such as carbon dioxide, methane, and nitrous oxide and in some cases, completely new GHGs such as halocarbons (Figure 1).

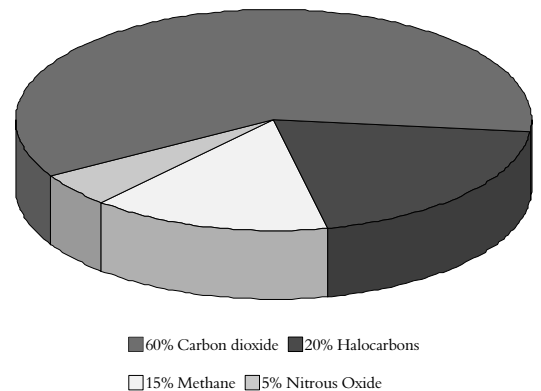


Figure 1. Greenhouse gases approximate contribution to enhanced heat trapping

Greenhouse gases differ in their ability to absorb the radiation leaving the Earth. The ability of a gas to trap heat depends on its capacity to absorb and re-emit radiation and on how long the gas remains in the atmosphere. In order to compare emissions from different sources, the global warming potential of each gas is equated to the global warming potential of carbon dioxide. For example, the global warming potential of one tonne of methane is 21 times more potent than one tonne of carbon dioxide over a 100 year period (Table 1).



Alberta Environmentally Sustainable Agriculture Council

Appointed by the Minister of Agriculture, Food and Rural Development.

Mandated to (1) identify and evaluate environmental challenges and opportunities facing the agriculture and food processing industry; and (2) encourage the industry to proactively address environmental issues.



Greenhouse Gases - Things You Need To Know

Table 1: Global Warming Potentials

Gas	Relative Global Warming Potential (CO ₂ equivalent)
Carbon dioxide	1
Methane	21
Nitrous oxide	310

Source: IPCC, 1996

How do People Affect GHGs?

Since the industrial revolution, concentrations of GHGs have been increasing steadily as a result of industrialization and deforestation. Since 1750, the atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased by 31%, 151%, and 17%, respectively. Current rates of increase per year are 0.5% for carbon dioxide, 0.6% for methane, and 0.3% for nitrous oxide. Without a concerted effort by all Canadians, our GHG emissions are expected to be 20 to 25% higher in 2010 than in 1990. If these current rates of increases continue, many scientists expect a significant impact on the world's climate.

Human activities increase the GHG levels by introducing new sources or removing natural sinks, such as forests. Sources are processes or activities that release greenhouse gases; sinks are processes, activities or mechanisms that remove greenhouse gases. A balance between sources and sinks determines the levels of greenhouse gases in the atmosphere.

How Could Canadian Agriculture be Affected by Climate Change?

As a northern country, scientists expect climate change in Canada to be greater than in most other countries. Scientists also predict increased variability in weather patterns across Canada to accompany the rise in temperatures.

The predicted change in climate will directly affect both crop and livestock management in terms of decisions regarding seeding dates, crop variety choices, pests and diseases, water,

and other important factors. This combined with the fact that GHG emissions change with the type of farming operations and within individual farms, adds another challenge to managing the rapidly changing agricultural industry in a sustainable manner.

Why Should We Be Paying Attention?

Canada and some 160 industrialized nations around the world signed an international agreement known as the Kyoto Protocol on climate change aimed at reducing GHG emissions. Canada ratified this agreement in 2002 and has therefore committed to reduce its GHG emissions to 6% below 1990 levels by 2008 to 2012. This agreement will come into legal effect in February 2005. In other words, GHG emissions must be reduced below those of fourteen years ago.

The agriculture industry already has some tools that reduce GHG emissions, such as direct seeding. The industry's efforts to develop strategies to reduce its GHG emissions will be guided by cost-effective, practical solutions that maintain or improve Alberta's competitive position in the international marketplace.

Sources:

Agriculture and Agri-Food Canada. 1998. *The Health of Our Air: Toward sustainable agriculture in Canada*. Research Branch, Agriculture and Agri-Food Canada.

Australian Greenhouse Office. 1999. *National Emissions Trading: Establishing the boundaries*. Discussion Paper No. 1. Commonwealth of Australia.

"Climate Change 1995: The Science of Climate Change". J.T. Houghton, L.G. Meira Filho, B.A. Callender, N. Harris, A. Kattenberg and K. Maskell (Eds). Cambridge University Press. 572 pp.

Environment Canada. 2004. *Climate change overview*. www.ec.gc.ca/climate/overview-e.html. Date last viewed Nov. 17, 2004.

Government of Canada. 1999. *Our Climate is Changing*. www.climatechange.gc.ca/info. Date last viewed Nov. 25, 2004.

IPCC. 1996. *1995 Summary for Policy Makers- A Report of Working Group 1 of the Intergovernmental Panel on Climate Change*.

Matin A., P. Collas, D. Blain, C. Ha, C. Liang, L. MacDonald, S. McKibbin, C. Palmer, and K. Rhoades. 2004. *Canada's Greenhouse Gas Inventory, 1990-2002*. Environment Canada.



Alberta Environmentally Sustainable Agriculture Council

Appointed by the Minister of Agriculture, Food and Rural Development.

Mandated to (1) identify and evaluate environmental challenges and opportunities facing the agriculture and food processing industry; and (2) encourage the industry to proactively address environmental issues.

