



# Climate Change IMPACTS and ADAPTATION Program

## Agriculture

The overarching goal of the Climate Change Impacts and Adaptation Program is to reduce Canada's vulnerability to climate change. Through a competitive proposal process, the research program supports cost shared research to address gaps in our knowledge of Canada's vulnerability to climate change and to provide information for adaptation decision-making. Additional emphasis is placed on research that examines processes, barriers, and drivers for adaptation.



The program also supports the Canadian Climate Impacts and Adaptation Research Network (C-CIARN). This network facilitates linkages between stakeholders and researchers, promotes new research techniques and methodologies, disseminates information, and provides a voice for an emerging impacts and adaptation research community.

Between 1998 and 2001, the Impacts and Adaptation component of the Government of Canada's Climate Change Action Fund (CCAF) supported over 75 projects to examine the impacts of climate change on Canadians and the processes by which we adapt. Ten of these projects related to agriculture and ranged from addressing questions of future changes in crop production to the role of different adaptation options. In addition, the CCAF funded Prairie Adaptation Research Collaborative (PARC), supported six projects focussing on agriculture topics of concern in the Prairie Provinces.



[adaptation.nrcan.gc.ca](http://adaptation.nrcan.gc.ca)

Here are some brief highlights of the projects funded.

## CROPS AND LIVESTOCK

### 1. Agricultural Adaptation in Atlantic Canada

Researchers applied projections from climate scenarios to investigate the impacts of climate change on agricultural yields in eastern Canada. Models suggest that warmer and longer growing seasons would increase yields of grain corn and soybean. Agricultural production would be expected to shift to crops that are better adapted to warmer climates, although non-climatic factors would continue to influence crop decision-making.

Principal Investigator: Andy Bootsma  
Agriculture and Agri-Food Canada

bootsmaa@em.agr.ca

### 2. Impact of Climate Change on the Risk of Winter Damage to Agriculture Perennial Crops

This study examined the impacts of climate change on winter damage of perennial forage crops and fruit trees in eastern Canada. Researchers found that warmer winters would harm perennial forage crops by reducing the amount of protective snow cover and increasing the occurrence of above-freezing temperatures, while higher fall temperatures would decrease the cold hardiness of the plants. Although deciduous fruit trees would also suffer from loss of cold hardiness due to above-freezing temperatures, they may benefit from a decrease in both cold stress and late spring frosts.

Principal Investigator: Gilles Bélanger  
Agriculture and Agri-Food Canada

belangergf@agr.gc.ca

### 3. Assessment of Climate Change and Impacts on Soil Moisture and Drought on the Prairies

Using temperature and precipitation projections from a range of climate change scenarios, the researchers found that future soil moisture levels would be the same or higher than present day values across the Prairie Provinces. Seeding dates for spring wheat would be advanced, and the growing season would be accelerated. There exists the possibility for increased production in this region.

Principal Investigator: Sean M. McGinn  
Agriculture and Agri-Food Canada

mcginn@em.agr.ca

### 4. Impact of Climate Change in the Okanagan Valley - Agriculture (irrigated crops)

Using crop water demand models and Geographical Information Systems (GIS), researchers investigating the impact of climate change on crop water requirements and crop suitability in the southern Okanagan Valley, found that crop water demand could potentially increase by more than 35% between the present and 2070-2099 (using scenarios derived from climate model output). As a result, some agricultural operations could experience water shortages. Water conservation measures, both traditional methods and new approaches, were suggested as potential adaptation options.

Principal Investigator: Denise Neilsen  
Agriculture and Agri-Food Canada

NeilsenD@em.agr.ca

### 5. Evaluation of the Effect of Climate Change on Forage and Livestock Production and Assessment of Adaptation Strategies on the Canadian Prairies

This study investigated the impact of climate change on livestock production, and the applicability of potential adaptation strategies at three sites in Saskatchewan. Adaptation options considered included an early turnout date, intensive early season grazing and an extended grazing season. Both the impacts of climate change, and the applicability of adaptation options were found to vary regionally. In some regions, productivity of beef cattle could be enhanced with climate change.

Principal Investigator: R.D.H. Cohen  
University of Saskatchewan

roger.cohen@usask.ca

### 6. The Potential Impact of Climate Change on the Development and Growth of Commercial and Horticultural Crops and on Pests Associated with these Crops

This project evaluated the use of bioclimatic models in projecting the impact of climate change on crop development, growth, and pests. The researchers concluded that although excellent models exist, there is a need for them to be updated and further validated. Appropriate models would make it easier for farmers to manage climatic information in their routine operations.

Principal Investigator: Gaétan Bourgeois  
Agriculture and Agri-Food Canada

bourgeoisg@em.agr.ca

## 7. Yield Variability under Climate Change and Adaptive Crop Management Scenarios

Using a simulation model that integrates major biophysical processes and soil and crop management practices, the researchers examined the impacts of climate change on crop yields across Canada. Results indicate that under a 2xCO<sub>2</sub> climate change scenario, yields of soybean, potato and winter wheat would generally increase, while yields of corn would tend to decrease. The role of adaptations in reducing losses and increasing gains was also demonstrated.

**Principal Investigator:** Dr Reinder De-Jong  
Agriculture and Agri-Food Canada

dejongr@em.agr.ca

## 8. The Effects of Elevated CO<sub>2</sub> and Temperature on Herbicide Efficacy and Weed/Crop Competition

This project evaluated the impact of elevated CO<sub>2</sub> levels and temperature on the efficacy of herbicides and crop/weed competition. The researchers found that herbicide efficacy would decrease in response to the combined influence of elevated CO<sub>2</sub> concentrations and increased temperatures. Economically, the losses resulting from decreased herbicide efficacy may be fully or partially offset by increases in crop yields resulting from CO<sub>2</sub> fertilization effects.

**Principal Investigator:** Daniel J. Archambault  
Alberta Research Council

archambault@arc.ab.ca

## MANAGEMENT ISSUES

### 9. Afforestation of Marginal Agricultural Land

This study determined the location, extent and forest potential of soils that are currently marginal for farming, and assessed the socioeconomic impacts of converting those areas to forest production. Researchers applied geographic information systems (GIS), ground-truthing, and socio-economic data to complete the analysis.

**Principal Investigator:** Ted Huffman  
Agriculture and Agri-Food Canada

huffmant@em.agr.ca

### 10. Adaptation Options in Agriculture

This project developed an inventory of adaptation measures for Canadian agriculture and a model to evaluate how successful an adaptation option is likely to be. Researchers identified a wide array of adaptations, including technological, managerial and financial. They concluded that instead of evaluating adaptation options individually, it is more useful to consider how climate change risks fit into the more general decision-making processes in agriculture.

**Principal Investigator:** Barry Smit  
University of Guelph

bsmit@uoguelph.ca

### 11. Indicators of Agriculture Adaptation to Climate Change, to Support Environmentally Sustainable Resource Management Strategies

Existing literature on indicators of agriculture adaptation was analyzed and a process for identifying effective indicators was outlined. The research illustrated the difficulties involved in isolating the impact of climate-driven changes from market and policy changes, at the farm level.

**Principal Investigator:** Leon Marciak  
Alberta Agriculture, Food and Rural Development

leon.marciak@shaw.ca

### 12. Investment Strategies of Agricultural Producers in the Montréal Region

Using focus groups and interviews, researchers assessed how agricultural producers in the southwest Montreal region consider climate change in their investment strategies. They found that adaptability is multi-dimensional, and highly variable between farms and farm types. The study also revealed that although producers generally do not view climate change as an important issue, climate variability is intrinsically integrated into their decision-making process.

**Principal Investigator:** Pierre André  
Université de Montréal

pierre.andre@umontreal.ca

### 13. Assessment of Climate Change on the Agricultural Resources of the Canadian Prairies

Researchers used climate models to project the impacts of climate change on land suitability for agriculture on the Prairies. They found that by 2040-2069, warmer and drier conditions would lead to significantly higher moisture limitations over much of the Prairies' agricultural regions. If appropriate adaptation measures are not undertaken, the sustainability of spring-seeded small grain crops would be threatened.

**Principal Investigator:** Bill Harron  
Prairie Farm Rehabilitation Administration,  
Agriculture and Agri-Food Canada  
harronb@em.agr.ca

### CROSS-CUTTING

### 14. An Evaluation of Impact Assessment Procedures

This study examined whether the choice of models and modelling methods affects the results of agricultural impact assessments. Using statistical tests, the researchers concluded that the choice of downscaling, land suitability, and crop yield models does not unduly influence the results of impact assessments.

**Principal Investigator:** Michael Brklacich  
Carleton University  
Michael\_Brklacich@carleton.ca

### 15. Agriculture Energy Use of Adaptation Options to Climate Change

A crop energy model was used to examine how farm energy use would be impacted by climate change and policy changes due to greenhouse gas reduction strategies. Researchers project that changes in crop production (e.g., increase in pulse and oilseed crops) would affect greenhouse gas emissions through associated changes in fertilizer and pesticide usage, rotation lengths, and summerfallow.

**Principal Investigator:** Andre Hucq  
University of Saskatchewan  
hucq@duke.usask.ca

### 16. Application of Long Range Seasonal Climate Forecasts to Improve Adaptation to Climate Variability and Change in Agriculture and Water Sectors of the Canadian Prairies

This project used a stakeholder workshop to discuss using long range (seasonal) forecasts to help build adaptive capacity in the agriculture and water resource sectors. The workshop revealed that if long range forecasts were more reliable, offered better spatial resolution and were tailored for agricultural time frames, they would be useful for production planning. Continued cooperation between stakeholders and forecasters to improve the suitability of long range forecasts was recommended.

**Principal Investigator:** Ted O'Brien  
Prairie Farm Rehabilitation Administration,  
Agriculture and Agri-Food Canada  
obrient@em.agr.ca

Further information on the  
program and funding  
opportunities can be found  
on the web site:

[adaptation.nrcan.gc.ca](http://adaptation.nrcan.gc.ca)

or contact the  
Climate Change Impacts &  
Adaptation Directorate,  
Natural Resources Canada  
E-mail: [adaptation@nrcan.gc.ca](mailto:adaptation@nrcan.gc.ca)