



C-CIARN Agriculture

State-of-Play Report

2006-2007

C-CIARN Agriculture State-of-Play Report

*The Status of Climate Change Impacts and Adaptation
from the Perspective of C-CIARN Agriculture*

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Preface

In the last year of C-CIARN's mandate (July 2006-June 2007), each C-CIARN office was asked to write a report summarizing their perspectives on the state of climate change impacts and adaptation within their region or sector.

The resulting State-of-Play reports identify, from the point-of-view of C-CIARN, the key climate change impacts, as well as the key stakeholders and adaptation decision-makers (including how these stakeholders/decision-makers were most successfully engaged) of each representative region and sector of Canada. The reports also include a description of the important research questions which, from the perspective of C-CIARN, need to be answered, as well as the steps that need to be taken to both increase the level of engagement on the issue and to facilitate the decision-making that is needed to reduce vulnerability, across Canada, to the impacts of climate change.

It is anticipated that the State-of-Play reports will serve as a valuable point of reference for climate change impacts and adaptation initiatives carried out across Canada, post-C-CIARN.

1. Introduction

C-CIARN Agriculture (2001-2006) operated with these goals and objectives:

- to build a network of representatives from agri-food, research, and policy communities to promote and facilitate research on climate impacts, vulnerabilities, risks, and adaptation for agriculture;
- to facilitate training in the field of climate impacts, vulnerabilities, risks, and adaptation for agriculture and its applications;
- to synthesize and disseminate research results;
- to provide continuity in the effort to develop a shared understanding of present-day and future risks related to climate change and agriculture;
- to identify research gaps and priorities for climate impacts, vulnerabilities, risks, and adaptation for agriculture; and
- to make those research gaps and priorities known to funding agencies, research programs, and government ministries.

Highlights from C-CIARN Agriculture's activity during the 2001-2006 period include:

- ✓ 12 written reports and documents, including one edited book submitted to UBC Press;
- ✓ 38 media interviews and reports reflecting C-CIARN Agriculture issues;
- ✓ 60 presentations on impacts and adaptation research;

- ✓ 15 workshops/meetings sponsored (some as partners)
- ✓ 33 venues where C-CIARN Agriculture material was disseminated;
- ✓ 46 updates sent to membership and now archived on C-CIARN Agriculture web site;
- ✓ 550 people in the C-CIARN Agriculture (started with 160 in 2001-02);
- ✓ 650 entries in our bibliographic database; and
- ✓ 100's of copies of C-CIARN Agriculture reports and related material disseminated.

In addition to these achievements, C-CIARN Agriculture offered a website featuring upcoming events, funding announcements, a database of recent news media items on climate change and agriculture, and numerous documents and reports, among other resources.

C-CIARN Agriculture members made excellent contributions to the 2002-2003 hearings with the Standing Senate Committee on Agriculture and Forestry, to the 2005 Adaptation conference in Montreal (May), and to the CoP11 parallel event, *Living with Climate Change: Sharing Adaptation Experiences* (December, 2005). As well, the Scientific Director and Manager/Coordinator for C-CIARN Agriculture have worked on the Canadian National Assessment on Climate Change Impacts and Adaptation (2007) and the IPCC Fourth Assessment Report.

2. Key Climate Change Impacts on Canada's Agriculture Sector

Agriculture is an inherently risky business where weather and climate conditions strongly influence plant and animal performance, input use, management practices, yields and therefore economic returns.

In the past five years, agricultural producers across Canada have been adversely affected by drought, extreme weather, and increasing variability (C-CIARN-Agriculture 2003; 2004; SSCAF, 2003; Wheaton et al, 2005).

The agri-food sector experiences these impacts concurrently with increasing pressure from a number of additional factors including food safety challenges, environmental regulation, international trade negotiations, low commodity prices, high input prices, consumer demand, and dollar value. Business risk, uncertainty and change provide an unstable basis for dealing with additional impacts from climate and weather conditions. No thorough assessment of these impacts or of the adaptation strategies linked to them can ignore the broader political economy that forms the context for perception and action. (refer to Box 1).

When asked what triggers new management practices most participants said economic drivers. Economics send a stronger signal [than climate] to farmers although some had a hard time separating economics, the environment, and climate. Farmers said they would not implement changes [i.e adaptation] unless there is a bottom line and an economic payoff. (Stroh Consulting, 2005:10)

While agriculture has a strong tradition of adaptation and resilience to weather and climate, the collective evidence suggests that these challenges will become even greater with climate change; there may also be increasing opportunities associated with altered climate

and weather conditions. Impacts can be direct (e.g. drought reducing yield and therefore income) and indirect (e.g. increased temperatures and moisture creating suitable environment for new plant diseases affecting yields and therefore income).

Box 1:

Mad cow, high loonie and drought push Canadian farm income to record lows

**February 06, 2004
Canadian Press**

REGINA (CP) - The mad cow crisis, a sky-rocketing Canadian dollar and the effects of a lingering drought will combine to push farm income levels to record lows in 2003, says the latest federal forecast released Friday.

Final figures aren't yet available, but so far farmers look to be \$13.4 million in the hole across the country once all expenditures, depreciation charges and income-in-kind are taken into account.

It's the first time realized net income has been in the red since Statistics Canada began collecting the figures in the 1920s.

Box 2:

Statistics Canada News Release, July 31, 2006

Prairie farmers report that crop production will decline from last year's record levels, the result of persistent dry conditions. Data from the annual July Farm Survey of 17,600 farmers, conducted from July 28th to August 6th, indicated that there is a concern about the effects of recent drought-like growing conditions in the Prairie provinces. After an optimistic spring that allowed timely seeding with average rainfall in most areas, continuous hot and dry weather in July stressed crops and accelerated development.

<http://www.statcan.ca/Daily/English/060825/d060825a.htm>

DROUGHT



Impacts from drought conditions across Canada in 2001 and 2002 caused agricultural production to drop an estimated \$3.6 billion CDN.

In addition, the drought was responsible for net farm income being negative or zero for several provinces for the first time in 25 years (Wheaton *et al.*, 2005). Drought conditions persist in the Prairie region where groundwater levels in many regions continue to decline.

Drought impacts on the Canadian agricultural sector since the 2001-02 have not been formally documented. However, a collection of news excerpts indicates challenges from drought persist in the industry. Examples are offered in Boxes 2, 3, and 4.

Box 3: CANOLA FARMERS HAVE BAD YEAR THANKS TO HOT SUMMER

October 21, 2005
Enterprise-Bulletin
Brad Holden

GEORGIAN TRIANGLE—Nearly 70 per cent of this year's Ontario canola crop has become worthless. Without a buyer in sight, many in the industry are blaming the situation on a perceived monopoly.

But Brian Wiley, a Meaford farmer who heads up the Ontario Canola Grower's Association, says the problem stems instead from this year's hot, dry summer.

BOX 4: DROUGHT HURTS YIELDS: CORN AND SOYBEAN HARVEST WILL BE DOWN

October 6, 2005
The Chatham Daily News
Bob Boughner

Southwestern Ontario farmers will harvest smaller-than-expected corn and soybean crops this fall. But dry bean production will reach a record 169,200 tonnes, a 51-per-cent increase from the 112,000 tonnes achieved in 2004.

David Burroughs, of Statistics Canada, said Wednesday the information was obtained in a recent survey of 6,414 Ontario farmers. He said the survey, conducted during a seven-day period, began Aug. 29. "Drought conditions in many parts of Ontario were a big factor in crop production," he said.

EXTREME WEATHER EVENTS



According to producers' anecdotal observations, extreme weather events (such as intense storms, hail, flooding, and abnormally high temperatures) appear to be occurring with greater frequency in all Canadian agricultural regions.

"...many farmers, including myself, see hail as a big problem for us [in the Okanagan]. Twenty or 30 years ago, hail events occurred maybe once every eight or ten years. My farm has been hailed seven times in the last 10 years. That is fairly typical. It is quite substantial... All I see is that weather events are more intense, and the frequency of these weather events is increasing. This is coming at a time, unfortunately... where our crop insurance premiums have just doubled. We have a big problem with this because with increased weather events that affect our crops and our ability to grow good quality crops, we want affordable crop insurance..." (Patton, 2003).

Studies indicate higher temperatures have reduced yields for certain horticultural crops produced in southern Ontario (McKeown et al, 2005). The authors note: "that increasing

occurrences of hot weather played a significant role in the reduced yields of cabbage, cauliflower and rutabaga seen in the past 15 yr. Further, we found that both hot weather and timing of precipitation can influence the yields of other horticultural crops. These results indicate that predicting the yield response for crops in this agricultural sector under a changing climate is potentially more difficult than for other sectors, especially as very few growth models exist for horticultural crops. These crops show greater sensitivity to weather and climate than do the more studied field crops whose yields tend to correlate with growing season means. This sensitivity is twofold since, unlike field crops grown for feed, quality as well as yield affects the economic viability of production.

In particular, an increase in hot days during the growing season negatively impacts the marketable yield of cabbage and cauliflower, which explains, in part, the unusual historical yield pattern these two crops exhibited in southern Ontario. The data presented here suggest that an increasing number of hot days will have a negative impact on horticultural production. There is also evidence that high temperatures can affect the human nutritional value of some vegetables." (McKeown et. al, 2005: 437).

Media reports (Boxes 5 and 6) also indicate substantial impacts from extreme weather and climate events on the agri-food sector across Canada in recent years.

Box 5:

N.B. POTATO FARMERS FACE LOSSES OF MILLIONS DUE TO POOR WEATHER

October 21, 2004

The Evening News (New Glasgow)

About a dozen New Brunswick potato farmers are facing millions of dollars in losses due to last summer's wet weather and a warm autumn. Potatoes New Brunswick executive director Patton MacDonald said pink rot, which has affected 10 to 15 farms this year, might lead some farmers to leave the business. "For a producer that has it, it can be devastating," MacDonald said Wednesday. "It's a very disheartening situation... I've been on farms where the entire crop is lost. We may lose farmers as a result." Dr. Khalil Al-Mughrabi, New Brunswick's potato pathologist, said the problem follows frequent and excessive rain, along with high humidity levels during the growing season and an abnormally warm harvest that makes it difficult for growers to cool and dry their storage.



BOX 6:

AREA PROCESSORS COPING WITH CROP LOSSES DUE TO HEAVY RAIN

August 6, 2005

Portage La Prairie

Teresa Falk

Area agricultural processors are feeling the wrath of Mother Nature. Oats, flax and potato crops in the region have been affected by excess moisture and this will impact processors, such as Can-Oat Milling, Prairie Flax Products, Simplot Canada Ltd. and McCain Foods Ltd. Can-Oat Milling in Portage la Prairie will dip into resources in the west if need be, said Dennis Galbraith, manager of grain procurement. To some extent, the losses in Manitoba can be made up by other provinces, he noted. Galbraith said Red River valley producers have experienced massive devastation to their oats crops. "The local production, particularly as you go east from Portage, has certainly been pretty badly damaged by excess rain and some was never seeded in the first place," he said, noting the production is better further west.

VARIABILITY

Variable climate and weather conditions are considered a major challenge for agricultural production as they increase uncertainty and make management decisions more difficult. Agricultural practices tend to be developed for average weather and climate conditions so even relatively small but persistent changes in the climate disrupt efforts to optimize yields and achieve stable and sustainable agricultural production (USDA, 2006).

Variability includes substantive differences in climate and weather conditions within and between seasons.

According to a southwestern Ontario cash crop producer:

Weather is getting to be more sporadic and unpredictable each year. In the last three years with any luck, you probably get the best crops your farm has ever seen and if you are the other people your crops have been disastrous. Weather has been extreme and it seems to be tough to get that gentle rain that you need. Lots of areas are getting almost nothing and other areas are getting what we call hundred year storms. Something is wrong when you get three, hundred year storms in five years. (Oke, 2006)

Additional examples from News media reports are offered in Boxes 7, 8 and 9.

Box 7:
SUB-ZERO TEMPERATURES ON THE PRAIRIES PUT CROPS IN DANGER: RESIDENTS WAKE TO FROST ON GRASS
August 21, 2004

The Vancouver Sun
Michelle MacAfee

Summertime, and the weather is -- freezing. Residents of Manitoba and Saskatchewan woke to frost on their grass and ice on car windshields Friday, along with temperatures more suitable for fleecy jackets than bathing suits. One of the earliest widespread frosts in about 50 years settled over most of Saskatchewan Thursday night, with temperatures dropping as low as -3 C.

Box 8:
FARMERS DEAL WITH EXCESS MOISTURE
June 24, 2005

The Saskatoon StarPhoenix
Angela Hall

REGINA -- Farmers who endured one of the worst Prairie droughts on record three years ago are now awash in wet conditions -- so much so that the Canadian Wheat Board is forecasting a two-million-tonne drop in western Canadian wheat production. "This year is really the year of excess moisture," said Bruce Burnett, director of weather and crop surveillance for the board, which sells Prairie wheat and barley. The Canadian Wheat Board's internal crop forecasts, released this week, project a wheat and durum crop of 22 million tonnes for the 2005-06 crop year, down two million tonnes from the year before. The barley crop is projected to be 11.7 million tonnes, down from the 12.3 million produced in 2004-05. Burnett said about two million acres in Manitoba and Saskatchewan will be out of production because farmers haven't been able to plant. Seeded crops drowned out by standing water in localized areas in all three Prairie provinces will also cut down on production.

Box 9:

HARVEST PROSPECTS GRIM FOR MANY FARMERS
October 18, 2005
CBC News

Grain farmers in the Prairies are facing another tough year, and some experts warn that they could be up against their worst financial crisis in recent history. In parts of Saskatchewan and Manitoba, crops were good and harvest went well. But elsewhere -- and in much of Alberta -- rain and frost have delayed harvest and possibly damaged the crops. Trevor Douglas, who farms near McTaggart in Saskatchewan, said crops were looking much better this year than last, when an early frost killed a promising harvest.

3. Key Stakeholders

Key Stakeholders in climate change adaptation for agriculture include:

- **Producers** are the “front lines for adaptation” (Weber, 2005) and implement climate adaptive changes as part of their risk management strategy.
- Producers’ **agricultural organizations** (commodity based and issue based) constitute a producer-based vehicle for delivering government adaptation programs. Their organizational resources for additional support/advice and their ability to lend legitimacy to the climate change adaptation topic are important assets.
- **Agencies** involved in crop insurance vary across Canada but are all directly affected by climate and weather impacts on commodity production.
- **Agri-business** concerns supplying farm inputs provide some technological adaptations to climate change (eg improvements in irrigation systems, better systems for soil and water resource management, and new crop varieties)
- **Food manufacturers and retailers** have strong interests in farm product quality and quantity.
- Federal and provincial agriculture **policy makers** and **policy analysts** need to be well informed.

- **Researchers** mandated to produce results that have a practical/applied dimension need to have close links with producers, agribusinesses and government representatives.

4. Strategies for Stakeholder Engagement

Engagement tactics vary with stakeholder type. In all cases, it is preferable to include people as soon as possible so you know what kind of information is needed and how to present it.

For producers and their representative organizations:

- demonstrate that their businesses will benefit from taking climate change adaptation seriously;
- acknowledge their expertise and give ample opportunity for them to describe their experiences;
- use direct face-to-face meetings that are part of existing conferences/workshops;
- compensate them financially for their time; and
- ensure there is a practical outcome for them after they have contributed time/information.

For crop insurance, Agri-business concerns, food manufacturers and retailers:

- demonstrate that their businesses will benefit economically from encouraging climate change adaptation at the farm level; and
- provide factual information that points out if/how they may be directly affected by climate change and therefore need to take action (eg. effectiveness of chemical agents; existence of new plant diseases and pests; increased need for/reliance on private insurance)

For policy/program makers/analysts:

- be well informed about what programs and policies are relevant for climate change adaptation including those not “labelled” climate change;
- point out ways that existing successful policies/programs could be modified to include an adaptation angle; and
- provide opportunities for policy analysts to learn from producers directly.

For researchers:

- provide as much information (e.g. industry contacts, funding sources, current research) as possible; and
- provide opportunities for presenting and publishing research results.

Given a diversity of interests, it is challenging to determine the role communication tools (web sites, workshops, presentations, newsletters, face-to-face, media interviews) play in engaging researchers and stakeholders. Generally speaking producers seem more comfortable with factual and practical presentations/meetings. Researchers and policy analysts have commented on the value of the C-CIARN Agriculture website and regular updates. They also have appreciated the opportunity to engage directly with producers and hear first hand about their experiences in adapting to climate/weather conditions.

5. Engaged Stakeholders

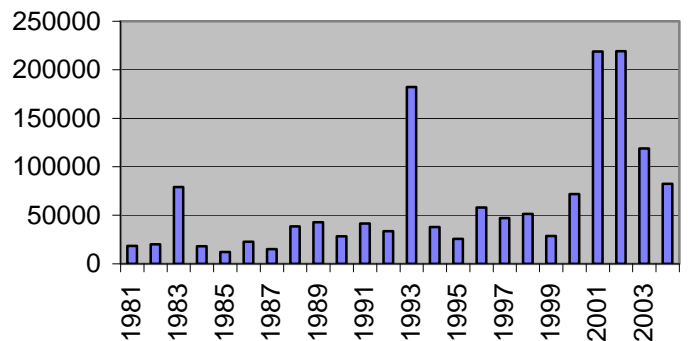
Producers have always been engaged in the process of managing business risk management for their agricultural operations. The history of agriculture in Canada is essentially one of continued adaptation to changing environmental, economic and social conditions.

A summary on how producers are currently adapting to changing climate and weather conditions across Canada include points

listed in Table 1. As the information in this table indicates, many environmentally “sustainable” practices are useful for helping producers deal with negative impacts from climate and weather conditions.

Financial management is a key element for dealing with climate and weather risks; crop insurance and other income stabilization programs play a major role (Figure 2 from Wall et al, forthcoming).

Figure 2 Ontario Crop Insurance Payments, 1981-2004
(Amounts in \$ '000, Source: Statistics Canada)



As Figure 2 demonstrates, payments have increased dramatically since the 2001 drought season in Ontario. It is understood that similar patterns exist in all provinces: crop insurance institutions are experiencing increasingly heavy use.

For apple producers in the Okanagan, Bellveau et al (2006:45) note:

“Crop insurance was generally seen as fundamental to farming and a necessity for managing weather risks in particular. The majority of the producers (90%) had at least basic crop coverage, which was mainly for insurance in the case of a hail event. Two major shortcomings of the crop insurance program that were identified were, for one, that it is not sufficient if the producer experiences two or more years of crop loss

in a row. A small grower remarked: “Even with crop insurance, the more loss you have, the less you can access the program later. Your premium goes up or your proceeds decline.” One producer explained that he was going into the season without crop insurance because the previous year he had suffered major losses, and his premiums doubled so he could no longer afford the insurance. The second drawback to the program is that it deterred producers from diversifying locations. If a producer had two orchards in separate locations in order to self-insure against hail damage, both plots

would have to be covered under one policy. If one orchard loses its crop from hail damage and the other doesn’t, then it would be considered a 50% loss and producers would not be able to make a claim. The only way producers can insure each orchard separately is if they pay a 20% premium on their insurance.”

Income stabilization is a major topic of concern for most producers. Recent and proposed changes to CAIS (Canadian Agricultural Income Stabilization) need to be thought through with climate change in mind.

Table 1: Summary of how producers use sustainable agriculture practices to manage climate and weather risks (from Wall and Smit, 2005:120 and C-CIARN Agriculture, 2003:6)

Diversify Crops

- More perennial crops (e.g. forages) are grown, thus improving drought tolerance by enhancing soil quality and moisture retention
- Where possible, some producers are re-introducing native grasses for pasturing. These grasses are drought resistant when rotational grazing is practiced on them.
- Many prairie producers are moving away from solid wheat production and growing a wide variety of new crops (e.g. pulses) that are more drought resistant.
- A diversity of crop types and varieties are grown in rotation and in different areas of farm properties. This spreads the risk of losing an entire year’s production since conditions can vary across fairly small areas and different crops vary in how they respond to those conditions.
- When possible, some producers also stagger their seeding and therefore harvesting dates by choosing a variety of crops that require a range of growing conditions so that crops are at different stages (and therefore more or less vulnerable) if and when climate/weather conditions start having a negative impact.

Diversify enterprises within one farming operation

- Many producers are including more livestock in their operations to make use of increased forage production and to add value on the farm.

Land Resource Management

- Conservation tillage practices were cited by all producers as having several positive outcomes for reducing risks from drought. These include: reducing soil erosion; enhancing moisture retention; and minimizing soil compaction.
- Conservation tillage is also credited with limiting damage from run off and wash outs during flooding.
- Some producers are enhancing established shelterbelts and/or adding new ones. This can reduce negative impacts from drought by maintaining water tables, increasing biomass in soil, and ensuring surface moisture is kept on the land. Shelterbelts also provide protection from heat and wind for livestock, and can increase the heat units in adjacent fields.
- Some producers cut stubble at different heights to trap snow on field surfaces thereby enhancing spring moisture levels in the soil.

Water Resource Management

- The increase in drought conditions is leading to more interest in irrigation. Some producers are adopting newer, more efficient systems and timing for applications to avoid waste.
- Sloughs and ponds are managed to ensure water is captured and protected as much as possible.

Livestock management

- Some producers who were affected by drought arranged to move some cattle out for winter feeding.
- In some cases, intensive grazing leads to doubling the number of cattle on same acreage, increasing economic returns.

Belliveau *et al* (2006) note the following regarding current adaptation practices.

“Cash crop operations get a maximum yield by dividing their acreage so that they have a combination of high, average and low heat unit corn, thereby optimizing yield in ideal growing conditions while being protected in a normal or cooler year.

We believe there is a longer growing season available to us. We have 500 acres. Instead of growing 2700 heat unit corn, we grow 100 acres of 2900, really high heat unit corn, and another 100 acres of 2850 h.u. We take 15-20% of our acreage and push it, if the weather is a little extreme, a lot of heat and enough rain, then those crops will give just a huge amount. If it is just a normal year we won't get the extra benefit, but they have the potential.”
(Belliveau *et al.*, 2006:63)

Manitoba farmers reported different tactics depending on whether they were experiencing “good” or “bad” years. For instance, the former allowed them to employ more strategic, financial management practices, such as:

- pay off debt;
 - put money away for retirement;
 - buy new equipment and/or upgrade machinery;
 - buy extra inputs;
 - buy additional land; and/or
 - buy additional cattle.
- (Belliveau *et al.*, 2006: 68)

Drought has become so normal to some Manitoba producers that they automatically adjust their management to accommodate it. One mixed farmer stated:

Generally where we are, every decision we make is based on drought. You assume you're going to have a drought so you bank for a dry year, and you make your decision based on that. If it rains it's a bonus. If it stays wet you'll have to make different decisions, but I'm going to be making drought decisions for a while yet.

Adopting the “drought as normal” attitude makes sense according to Botteril (2006), who notes how Australia fundamentally changed their drought policy in 1989:

“In policy terms drought is no longer considered a disaster,” ...We (Australia) really don't have a 'normal' climate... Therefore it's absurd to treat every drought as an emergency...It should be managed as any other risk. Farmers need to factor in that they are not always going to get needed rainfall.”

Agriculture Canada has adopted a similar outlook with the **Drought Watch** initiative overseen by PFRA (Prairie Farm Rehabilitation Administration). This web-based tool is currently being developed and uses the Australian and United States initiatives as models (Hill, 2006). The web site provides information on current moisture conditions and practices to reduce vulnerability to drought impacts across Canadian regions.
(http://www.agr.gc.ca/pfra/drought/index_e.htm).

Additional examples of producers' actions and decisions regarding climate and weather risk management have been documented and are presented in Boxes 10 and 11 from Belliveau *et al.*, 2006: 20 and 24).

Box 10:**Anticipatory Adaptation: One Winery's Self-Insurance Policy**

When one interviewee from a medium-sized winery was asked to identify a good year in the last 10 years, he said that there were none that were better or worse than others; there were "no peaks, no valleys." He explained that his strategy is to avoid being put in a high risk environment, through knowledge, and good vineyard husbandry, thereby creating his own insurance policy. Knowing he was going to get into the wine industry, he took his time to "do his homework," and to minimize risk from the beginning. He studied enology and viticulture in Germany for 6 years, and then worked on a local vineyard for 5 years before opening up his own business.

*During this time he conducted a 7 year microclimate study of the valley to determine the best location to plant his vineyard, by avoiding areas prone to spring and fall frost and hail. The site chosen is located on the west side of the valley so that the vineyard is shaded in the evening, slowing down the development of grapes, and allowing them to achieve a better balance of sugar, acid, and pH and more complex flavours. He also minimizes risk through the selection of grape varieties, choosing ones that are more winter tolerant and are on grafted rootstock which are resistant to the pest *Phylloxera vastatrix*. The development of his business occurred slowly and gradually, to avoid getting into debt. While he does acknowledge that despite his efforts he is still highly vulnerable to a severe winter, so is the entire valley. If a disaster were to occur, he would not be alone, and presumably the government would aid the industry until it is able to get back on its feet.*

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Box 11:**Adapting to Fire: Perspectives from a Small and Large Winery**

The fire that swept through the Okanagan Mountain Park and into the periphery of the city of Kelowna in the summer of 2003 had considerable impacts to local residents and business. Vineyards in the vicinity of the fire were filled with smoke, which tainted the flavour of the grapes and wine. As a small winery respondent described: "If you think about how fish is smoked, it doesn't take 24 hours and the fish is desiccated and has fully absorbed the smoke flavour. Well, our flavours weren't as nice as apple or mesquite, they were more like vinyl siding, carpet, trestle, and pine. All these can be picked off the aromas of some of our grapes from last year."

The other major impact that the fire had was in reducing tourism. The fire occurred in late August, people were evacuated from their homes, and there was a general travel warning for people outside the region, which deterred the majority of tourists for the remainder of the season. September, however, is typically the month with the greatest sales, as it is the more serious wine buyers who come through the valley at that time. Knowing that the grapes would produce a tainted wine, the small winery opted to write off the crop through crop insurance. The insurance covered 60% of the value of the crop (which is significantly less than the value of wine), less the charges to pick the grapes, which is approximately \$20-25,000. To save this expense, the winery instead decided to leave the fruit on the vine and let the birds, normally considered a major pest, eat the spoiled crop. The winery cut costs further by temporarily laying off the winemaker. Efforts were also made to encourage people to buy wines from the previous vintage.

The larger winery, on the other hand, had a greater range of options to deal with the event. In the first place, it was less affected by the fires because it was further away than the smaller winery, and the vineyard that was affected represents only a portion of the acreage of vineyard owned by the winery; it owns acreage all along the length of the valley. Nor was the winery affected greatly by a reduction in tourism, as it distributes the majority of its product within and outside of Canada. With its greater resources, however, the large winery was able to salvage a portion of the crop. A high pressure washer was rigged up and the entire vineyard was sprayed with water to get rid of the film of ash and some of the smoke taint. Then the grapes were hand picked to ensure that the skin of the grapes did not break, letting the smoke taint into the juice. Finally, the winery was able to purchase a Reverse Osmosis machine, which in short filters out the smoke particles while still retaining the wine

This discussion on “Engaged stakeholders” (producers) indicates that they manage climate and weather risks to ensure the best economic return for their farm operation. They have been successful in general because of their ingenuity and past experience, government support through crop insurance and other programs, and commitment to making their businesses work. More specifically, it appears that personal outlook and resources, regional conditions, and type of commodity produced also play important roles in how adaptation is viewed and undertaken.

5.1 Outstanding Needs of Engaged Stakeholders

In 2004, C-CIARN Agriculture held a workshop in Gatineau Quebec with the explicit aim of identifying what producers need to continue managing climate and weather risks successfully. Their responses are summarized below:

- first and foremost aim for stability-resist urge to change programs that are working
 - ensure crop insurance is flexible, affordable, and offers wide coverage
 - beware of systems where no one can lose (eg “disaster subsidies”) –management should impact the farm business
 - avoid creating the perception that agriculture is a sector always needing a hand-out
 - Climate change considerations need to be coordinated with production research, as they are directly linked. For example, changes in temperature and the frequency of extreme weather can create different pest pressures, warrant the selection of a new apple cultivar or provoke changes to growing practices, water management etc.
 - Long term predictive models would enable producers make better crop selection choices.
 - Technology and adaptation implementation support would help make adaptation a feasible option for growers.
- Increase communication between policy makers (among ministries and between different levels) and commodity groups.
 - Improve research and technology transfer initiatives.
 - solid science to determine (among other things) how climate change will affect growing seasons
 - technological advances, eg. web-based irrigation systems; genetic modification- could a cold tolerant gene eliminate frost damage and minimize climate related risks?
 - publicly funded research for “reliable” “unbiased” findings the public will accept
 - adopting a whole farm analysis approach so policies and programs are not at cross-purposes
 - viable support systems beyond crop insurance for production that is high risk (eg. fruit)
 - building on existing strengths-what does the sector do well now and how can it be furthered?
 - building on programs/partnerships that have worked in the past-need to learn from “success” stories (eg. VQA)
 - bolster safety nets and crop insurance
 - provide substantial support for best management practices in terms of developing programs and providing incentives
 - support adaptation research, particularly practical demonstration sites
 - build awareness and demonstrate cost/benefits of options

Despite the diversity in regional conditions and production focus, there are similarities in agricultural producers’ needs and expectations regarding federal and provincial climate change adaptation policy. These are summarized in Table 2 where seven challenges and their implications for policy and program development are noted.

All presenters pointed out that uncertainty and variability in all aspects of agricultural production present major risks that must be managed concurrently. Some want more government involvement, others want less. All

want stability - whether it is the stability of an insurance program, or the stability of a not-rapidly-changing policy environment. At the same time flexibility in policies and programs is crucial to ensure diverse needs are met from conditions in various types of commodity production, farming systems, biophysical environments, and personal circumstances.

Examples of potential problems for producers managing climate risk include uncertainty in the value of climate data; apprehension about the public acceptance of recommended technology, and potential conflicts among programs and policies. Research support, effective technology transfer and more collaboration among different government departments and ministries (as well as across federal, provincial and, in some cases local, lines) will go a long way in generating effective climate adaptation policies and programs.

Table 2 Summary of risk management policy challenges, solutions, and recommendations relevant for climate change as identified by producers (C-CIARN Agricultures 2004)

Challenge	Specifics	Solution	Recommendation for Policy
Economic Variability	Variation in: <ul style="list-style-type: none"> •income •interest rates •energy costs •dollar value 	Income stabilization	<ul style="list-style-type: none"> •Main goal for agricultural policy should be agri-food sector stability •AAFC and provincial Ministries of Agriculture should ensure the outcomes for the agri-food sector are considered when other ministries develop policy and programs that affect it. •Income stabilization programs must be adequate for future climate and weather risks.
Sector Variability	Variation in conditions and requirements: <ul style="list-style-type: none"> •across commodities •across regions •across types of farming systems 	A “one size fits all” solution is not possible. Flexible policies/programs that lead to equitable results.	<ul style="list-style-type: none"> •Ensure the diversity of conditions, needs and expectations for all sectors/regions are taken into account in policy and program development.
Mainstreaming	Adaptation to climate risks must be considered in light of other business risk strategies. Farming systems management is highly integrated.	Identify opportunities for integration into existing strategies. Identify potential barriers to integration and uptake. Become aware of real farm experiences.	<ul style="list-style-type: none"> •Substantial support for research is needed; it must feature a producer perspective and “whole farm context”. •Research must include assessments of barriers to adaptation including policy/program environment. •Include climate change adaptation in the APF; belongs directly in Business Risk Management but also relevant for other “pillars” (Environment, Food Safety, Innovation, and Renewal).
Barriers to adaptation	Some adaptation options for climate risk pose challenges for farming community: <ul style="list-style-type: none"> •additional costs to producers •GE solutions compromise marketing products conflicts with existing policy	Research needed to identify: <ul style="list-style-type: none"> •adaptation costs/benefits •implications of GE technology •potential conflicts and ways to make them complementary 	Support research that will: <ul style="list-style-type: none"> •provide long term and in-depth assessments •assess costs and benefits of climate risk adaptation options •Develop policy and programs based on research findings.

Adequate support	<p>Some options require improved resources:</p> <ul style="list-style-type: none"> •technology is lagging (e.g. weather forecasting needs to be more reliable) •knowledge transfer and financial support (incentives) needed to encourage effective risk management 	<p>Improved product development for “technological” adaptation options (e.g. weather and climate forecasting).</p> <p>View farm management practices in light of climate adaptation options.</p>	<ul style="list-style-type: none"> •Re-establish research and extension services that work directly with producers •Establish climate change adaptation on “on-farm” demonstration sites.
Communication	<p>Information about climate change risks is not always consistent or reliable.</p> <p>Insights from producers are not always recognized.</p>	<p>Improved resources for generating information.</p> <p>Enhanced “extension” services.</p> <p>Place more value on producers’ knowledge.</p>	<ul style="list-style-type: none"> •Ensure information from government is well supported through research and presented in useful formats. •Require producer representation on research and policy development teams.
Enhancing capacity	<p>Farming community needs more capacity to manage risks.</p> <p>Public image of agri-food sector can be one of “neediness”.</p>	<p>Look at past examples that worked (e.g. need for new grape varieties resulted in successful collaboration between industry and government)</p> <p>Initiatives that reward sound management.</p>	<ul style="list-style-type: none"> •Work collaboratively with producers to ensure relevance of potential solutions. •Aim for policy environment that provides assistance while promoting producers’ independence.

6. Unengaged Stakeholders

See Appendix A for a commentary on engaging Farmers in research/surveys

Based on our experience with C-CIARN-Agriculture’s researchers and stakeholders since 2001, four main points stand out when trying to engage producers in climate change impacts and adaptation strategies:

1. Economic consequences are the most important factor; demonstrate the economic advantage to improving climate/weather risk management and they will be interested.
2. Be aware of all existing programs and policies where climate change adaptation can be integrated and use all possible opportunities to “mainstream” the related options.

3. Because producers tend not use the term “adaptation” when discussing climate and weather risk management (Wall and Smit, 2006) it makes sense to find terminology and approaches that reflect their perspective.
4. Respect their time and knowledge.

7. Research Questions that Remain Unanswered

Following the “vulnerability” approach for climate change adaptation research (Lemmen and Warren, 2004), the pertinent themes and objectives are summarized in Table 2 . These have yet to be addressed comprehensively for the Canadian Agri-food sector (from Wall et al, 2004:34)

Table 3 Research Issues and Objectives for Vulnerability Assessments

Theme	Research Objective
Current Conditions	Identify conditions that are beneficial and/or problematic to the system under investigation.
Current Capacity	Assess how successful management strategies are for adapting to stress and/or opportunities. Determine effectiveness of policy and programs in assisting producers with their adaptation measures.
Future Conditions	Assess the likelihood that there will be changes in the trends and magnitude of beneficial and/or problematic conditions.
Future Capacity	Assess adaptive capacity to meet future risks and opportunities. Assess the suitability and viability of current policy and programs to meet future requirements.

Exploring each of the points in Table 2 leads to a multitude of more specific questions that require understanding influences from regional and commodity-based factors as well as farming system type, historic trends and producers' individual capacity.

In a more standard fashion, C-CIARN Agriculture documented the research gaps as identified by workshop participants in 2002. They are available through the following Web sites. The second source is from the National Advisory committee in 2002.

http://www.c-ciarn.uoquelp.ca/research/research_2002.htm
http://www.c-ciarn.uoquelp.ca/research/research_NAC_2002.html

Barriers to Advancing Climate Change Impacts and Adaptation Issues

The following comments from producers during C-CIARN agriculture 2005 workshop in Edmonton, Alberta provide a general response to what the barriers are to advancing climate change impacts and adaptation issues.

Nigel Weber (Mixed Farmer, National Farmers Union)

If, because of climate change, we don't know what the relative economics of grain production versus livestock production will be in a given area of the country, does it make sense to replace adaptable, mixed-production, family farms with corporate specialized producers? To put it differently, if we transfer hog production to corporate mega-barns and if climate change makes that industrial hog production impossible in the future—either through restrictions on water use or feed shortages—will those corporate producers adapt and begin growing crops or raising dairy cows? Most probably, those corporations will simply leave. As variability and

uncertainty grows, the existence of adaptable, family farm agriculture becomes increasingly important.

Don McCabe (Cash Crop Producer, Grain Council of Canada)

Don't expect anybody in Corntassle Ontario or Backslash Newfoundland to worry about it tomorrow if you are going to tell them the climate is changing. In order to be ready for where we are going to be tomorrow-- to pick up the grasshoppers that a farmer is going to have in Alberta or the bugs that I am going to have coming in from Louisville Kentucky to southern Ontario—we need to maintain capacity for wheat breeding, canola breeding and all the rest of it.

Canadian agriculture is the “deer in the headlights”; the farmer is the endangered species. We need to take this focus on adaptation one step further: as producers, we must change policy, with current conditions there is no longer any incentive for anyone to enter farming. Please note that increased yields do not mean more money in the farmers' pocket.

Bruce Beattie (Dairy farmer, Alberta Environmentally Sustainable Agriculture Program)

In terms of climate change, larger farms have some advantage for big tech solutions. For investing in some technological aspects (e.g. new equipment for conservation tillage), they can get access to financial capital and afford the operating cost more easily than a smaller mixed faming operation. Big is not always bad.

However for some adaptive responses (such as the tendency to think you can rely on irrigation) well that is mistaken—we are pretty well maxed out in terms of water resources in southern Alberta.

(Adaptive) Capacity is interesting topic --lots of heat but not much light.

8. Advancing the Impacts and Adaptation Issue

During its five year mandate, C-CIARN Agriculture has involved more than 500 people in its efforts to promote and facilitate research into climate change risks and adaptation for the Canadian agri-food sector. Insights from this experience are contained throughout this report and are offered here in summary fashion as a list of recommendations for policy makers developing future climate change adaptation initiatives in the Canadian agri-food sector.

1. View climate/weather conditions as one of many factors underlying economic risk and uncertainty; existing strategies for managing risk need to incorporate a changing climate.
2. Ask producers directly what risk management strategies work best; expect a wide variety of detailed, contingent responses; use the information they pass on.
3. Accommodate regional differences in farming systems and their soil/water resource base.
4. Recognize that the needs/capacity of large corporate producers differ from those of small to medium sized operations.
5. Involve provincial ministries of agriculture (and regional/local governments where applicable) and agricultural organizations at the start of program development and dissemination.
6. Go with what has worked in the past; mainstream “new” initiatives into plans and programs that producers currently use (CAIS, Crop Insurance, Environmental farm plans)
7. Assess implications of adaptation options (eg. Relying on GMO technology for new varieties when export markets are sensitive).
8. Adopt a climate change “lens” for all production research; determine if findings hold under altered climate/weather conditions.
9. Demonstrate costs/benefits of adaptation options; provide assistance while promoting producers’ independence.
10. Ensure information is consistent and reliable.

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Appendix A

Kevin Hursh Special to The Leader-Post
Surveys must be more farmer friendly

Wednesday, August 30, 2006

Farmers get surveyed to death and are growing increasingly suspicious and resistant to the whole process.

A lot of the surveys are from agri-business trying to get a handle on farmer attitudes and how to position their products and services in the marketplace. Farmers are able to participate or tell the person on the phone to take a flying leap.

However, there are also calls from Statistics Canada. Stats Can makes it sound like a farmer is compelled to answer, similar to the requirement for filling out the census. Lots of farmers still refuse. Others blatantly lie and then brag about it afterwards.

For the Stats Can survey on crop production released on Aug. 25, an amazing 17,600 farmers from across the country were surveyed. In Saskatchewan alone, there were 6,490. Considering how many refuse and how many would just not answer the phone, there were obviously a lot of calls to farm households.

When something is perceived as being in the public interest, citizens tend to participate. The Statistics Canada surveys result in regular reports on seeded acreage, grain in storage and harvest production. Rather

than being a service to farmers, many blame this release of information for depressing already dismal grain prices.

Statistics Canada needs a major public relations campaign to tell farmers why their surveys are important. They also need better education of the frontline people making the contact with producers.

Usually, the call is from someone who doesn't know canola from barley and who could care less about learning. And there's no inkling at all of how a farmer's schedule might work. They can't understand that during busy times, a producer may not be back in the house until late in the evening and may be gone again early the following morning.

The survey people also assume that farmers are an encyclopedia of numbers -- that they'll remember exactly how many acres of each crop they have seeded and know how this compares to last year without pulling out their records.

The survey itself also has problems. The timing between when the surveys are done and the results released is problematic. In the case of this recent survey, the information was gathered between July 28 and Aug. 6.

In that lag of several weeks, heat and drought took a toll on many crops. While the survey is extensive with a large number of participants, the time lag means the information is dated. With the communications and computing power available these days, there's no excuse for such delays.

Many, and perhaps most, producers would be happy if Statistics Canada never called them again and never released the results of another crop production survey. This points out the need for a public relations effort.

Practically every developed country collects these sorts of statistics. In the United States, the USDA (Department of Agriculture) releases acreage and production reports that regularly affect world markets. Only in countries like China are statistics questionable and hard to obtain.

If a government agency wasn't doing surveys, you can bet that various agri-business companies would increase their efforts to get reliable information. How else would companies know how much inoculant, herbicides and pesticides to have available? How else could grain handlers and marketers make appropriate decisions?

When Statistics Canada does a survey, the results are made public to everyone at the same time, farmers included.

If an agri-business does a survey or makes an estimate, you can bet those results are retained internally. If knowledge is power, farmers are better off with a strong public system of surveys.

At this point though, a majority of producers need a lot of convincing. Statistics Canada can't just rely on a sense of civic duty. It better start making its surveys more farmer friendly and it better do some explaining as to why the surveys are a benefit to the entire agricultural industry, farmers included.

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