The Manitoba Agriculture Risk Management Task Force is funded by the Canada and Manitoba governments through Growing Forward 2, a federal-provincial-territorial initiative.

“Of the top ten costliest weather years, seven have occurred since 2000.”
- Global insurance company giant Aon Benfield, reporting in the 2014 Annual Global Climate and Catastrophe Report

“With each flood, we take the time to learn from our experience with the water. This year’s flood is the largest in our recorded history and our approach will be no different.”
- Premier Greg Selinger, July 4, 2011
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Task Force Members

The Agriculture Risk Management Review Task Force members are:

- Bill Uruski (Chair/Producer)
- Frieda Krpan (Chair, Manitoba Agricultural Services Corporation/Producer)
- Goldwyn Jones (Producer)
- John DeVos (Producer)
- Doug Chorney (Producer)
- Dr. Derek Brewin (Academic, University of Manitoba)
Foreword

Before members of this task force first met, we each knew the seriousness of the job in front of us. For the last several years, Manitoba has been profoundly affected by climate change. We have seen flooding and excess moisture that has devastated communities and caused incredible damage to agricultural production in some parts of the province.

There is no way to ignore climate change today and it is not a problem that can be easily solved. On the contrary, it presents a highly complex series of challenges for agricultural production in this province. Finding solutions means looking at a big picture that involves business risk management programs such as AgriInsurance and AgriStability, encouraging best practices on farms, doing a better job of managing surface water and conducting research into ways Manitoba farms can thrive in the future.

Over the past several months, this task force has heard from many people including producers, scientists, insurance actuaries and more. We have sifted through a large amount of information looking at how climate change is altering agricultural production here. We also heard how other jurisdictions in Canada and around the world are dealing with these same issues.

The members of this task force rose to the challenge, offering their time and thoughtful input throughout. I want to thank them for their time and effort. I also want to thank the many staff members from Manitoba Agriculture, Food and Rural Development who supported the task force. We are grateful for their help. Additionally, we owe thanks to the many individuals and organizations that made presentations to us or sent us their thoughts on the matter. We heard many great ideas, which show that the problem of climate change is being discussed in detail around a great many boardroom and kitchen tables.

It is evident that provincial and federal governments must take concerted action today in order to prepare for the expected effects of climate change on agriculture. Based on the information received and the final report recommendations, this will require a renewed discussion on federal-provincial cost sharing.

Finally, I want to thank Minister Ron Kostyshyn for creating this task force and entrusting it to come up with independent recommendations for the province. As we were finishing this report, the leaders of the world were in Paris discussing the urgent global need to address climate change. We hope that our report will help Manitoba and Canada do its part.

Bill Uruski, Task Force Chair
Executive Summary

Manitoba’s agricultural producers have faced serious challenges in recent years, brought on by the changing climate. There have been more frequent periods of excess moisture that have taken previously fertile land out of production, as well as flooding disasters, which brought an increased magnitude of disruption to agricultural production.

These weather-related incidents have caused massive hardship for thousands of people in our province, including many agricultural producers. They have also led to serious budget pressures as the province has had to deal with the financial consequences of large, co-ordinated responses to emergency flooding, as well as providing relief to hard struck producers. Unfortunately, the overwhelming majority of climate-related research is predicting that the challenges produced by a changing climate will grow more pronounced in the years to come.

Agriculture is a key driver of the provincial economy. Primary agriculture contributes an estimated 3.8 per cent of Manitoba’s gross domestic product. Sales of primary agricultural products generated almost $6 billion for Manitoba in 2014. These products support Manitoba’s food processing industry, which in turn did over $3.1 billion in business in 2014. According to the last Census (2011), agriculture directly employs approximately 24,000 workers on more than 15,000 farms in Manitoba.

FIGURE 1: Manitoba’s Agriculture and Food and Beverage Processing Industry

Source: CANSIM 002-001 (2014)  
Source: CANSIM 304-0015 (2014)
Executive Summary

Agriculture Risk Management in Manitoba |
| Task Force Report

Executive Summary

- Business risk management programs have paid Manitoba farmers over $3 billion since 2008
- The 2011 flood caused:
  - more than 7,100 people to evacuate their homes
  - damage to more than 650 provincial and municipal roads and nearly 600 bridges
  - costs associated with flood preparation, flood fighting, infrastructure repair and disaster payments to reach $1.2 billion
  - tens of thousands of cattle to be relocated
  - three million acres of farmland to go unseeded
- According to Environment Canada, the period from 2004 to 2014 was the wettest in southwestern Manitoba in more than half a century

Through its consultation process, the task force heard specific and immediate challenges posed with Lake Manitoba, the Shellmouth dam and the dike infrastructure along the Assiniboine River. In addition, the impacts of flooding in areas with no natural outlets were noted, such as Whitewater Lake and Shoal lakes.

Agriculture also represents a significant challenge in our collective fight against climate change, as our food and farming systems contribute approximately 30 per cent of global greenhouse gas emissions. Those emissions come from livestock manure and decomposing organic matter, as well as various inputs such as nitrogen fertilizer, which requires a large amount of energy to produce. On December 3, 2015 the Manitoba government announced in its Climate Change and Green Economy Action Plan that it would work with Keystone Agricultural Producers and other producer groups to research ways to promote sustainable agricultural practices, leading to greater resiliency to a changing climate, reduced emissions and a growing green economy.

For Manitoba, agriculture’s greenhouse gas emissions profile is proportionally large relative to other jurisdictions. This is due to the structure of the provincial economy, where most of our energy comes from clean, renewable hydro-electricity generation and a lower presence of large final emitters. This is a very unique situation, not found to date in other provincial or international jurisdictions, which challenges Manitoba policy and program discussions.

At the same time, agriculture and agricultural producers can play an important role in combatting greenhouse gas emissions through the creation and protection of wetlands, forests and shelterbelts. The future growth and prosperity of the agricultural industry does not have to be at odds with doing what’s best on the climate front. After many months of in depth study, during which this task force received thoughtful presentations and scholarly research, it is our position that agriculture can play a positive role in helping the province take important steps to mitigate the impact of climate change and adapt to the changes it will bring. In order to do that, the agricultural industry must adapt itself through the use of environmental farm plans, beneficial management practices, independent research and innovative approaches to land and water management, as well as to managing the risks associated with operating a successful farm.

Recognizing the importance of agriculture and the significant pressure the sector faces with climate change, in its December 2014 throne speech, the Manitoba government announced it would create the Agricultural Risk Management Review task force. This working group was to be comprised of industry stakeholders and was charged with ensuring that the province’s risk management tools are responsive to a changing climate.
Objective and outcomes

The objective of the task force was:

- to improve Manitoba farmers' capacity to recover from risks/impacts associated with the effects of changing climate events on agriculture
- to mitigate the risk exposure of the federal and provincial governments as it is related to business risk management tools as well as ad hoc programming requests

Expected outcomes of climate change on agriculture in Manitoba

The cost of doing nothing

In 2011, Manitoba faced a flooding disaster that cost the taxpayers at least $1.2 billion, with a record three million acres of cropland in the province unseeded and an additional 500,000 acres drowned out after seeding. That flood was followed immediately by two months without rain that wilted what crops remained. One producer told the Globe and Mail newspaper that he could be receiving flood and drought insurance payments at the same time.

This kind of “weather whiplash” is not going away. In fact, data collected by Manitoba Conservation and Water Stewardship shows that the incidence and severity of flooding and excess moisture in Manitoba has been increasing for much of the last 70 years. Governments have responded to the challenges of excess moisture and flooding in a number of ways. In 2000, for example, the Manitoba Agricultural Services Corporation established Excess Moisture Insurance (EMI). Between 2000 and 2015, the EMI program had collected a cumulative deficit of $236 million. The program is under continuous review to ensure it is meeting the needs of producers, is actuarially sound and is equal to the challenges presented by climate change and weather events.

FIGURE 2: Historic Palmer Drought Severity Index for Winnipeg Area (1895-2007)
While Manitobans may be forgiven for thinking that flooding alone is the major impact of climate change, the reality is that many more jurisdictions in western North America have been coping with drought conditions. As the chart above indicates, with Winnipeg as a proxy for the province, extended drought cycles were more common early last century, with more moisture events occurring into the new millennium. A 2012 report in the journal Nature Geoscience projected that the drought of 2000 to 2004 was possibly the most severe in the last 800 years. The same report projected that droughts would become longer and more severe in large areas of the continent in the 21st century.

That will not be news to farmers in Alberta who have had to cope with multiple devastating droughts over the last decade and a half. Those dry years have recently been punctuated in some parts of that province with excess moisture, highlighted by the catastrophic floods in and around Calgary in 2013 which caused over $5 billion in losses. Alberta’s experience also shows how climate conditions can vary greatly within a single province: in 2010, while the southern part of the province fought floodwaters, the Peace River region suffered an intense drought. Similarly, Saskatchewan has had to cope with serious flooding and droughts in recent years.

After reviewing hundreds of pages of research and submissions from producers, scientists and other stakeholders, the task force recognizes that inherently complex weather patterns are growing, more so as the climate changes. It is clear that long-term solutions to mitigate the impact on our agricultural sector will require cross border cooperation between municipalities, provinces and countries. We are all affected by climate change: Manitoba must work in concert with the federal government as well as its neighbours to the east, west and south that occupy the same Hudson Bay watershed. Water management is not something that can or should be dealt with by a single province in isolation. It has a serious long-lasting impact on our country’s (and continent’s) environmental and economic well-being.

**FIGURE 3: Global Land and Ocean Temperature Anomalies, January-December (Source: NOAA)**

**Increasing payouts**

Since 2008, business risk management programs have paid Manitoba farmers over $3 billion. AgriStability, AgriInsurance and AgriRecovery have provided assistance to producers to address income losses. However, AgriStability and AgriInsurance, by design, will provide decreasing assistance if applicants qualify for payments with any regularity. AgriRecovery is not designed to address recurring events or losses covered by other programs. If we continue down this path without changes, it’s possible that these programs could be asked to cover increasing, recurrent losses among agricultural producers. The federal and provincial governments need to consider how these programs can continue to be employed successfully, while considering changes or additional programs to help encourage better land and water management on the farm and across the province. Without careful consideration, it’s possible these programs could be
forced to scale back the assistance they offer, which could have serious long-term effects on agricultural production in this country.

**FIGURE 4: Manitoba Business Risk Management Payments**

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop Insurance Payments</th>
<th>AgriInvest</th>
<th>AgriStability</th>
<th>AgriRecovery and Ad Hoc</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>$200,000</td>
<td>$50,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>$250,000</td>
<td>$100,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>$300,000</td>
<td>$150,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>$350,000</td>
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<td>2012</td>
<td>$200,000</td>
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<td>2013</td>
<td>$150,000</td>
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<tr>
<td>2014</td>
<td>$100,000</td>
<td></td>
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</tr>
</tbody>
</table>

It’s not just Manitoba that is dealing with this kind of issue. Global insurance giant Aon Benfield reports that “weather disasters have caused USD3.5 trillion in economic damage on an inflation-adjusted basis since 1980 and annual average economic losses have increased with each decade: USD55 billion in the 1980s, USD103 billion in the 1990s, USD111 billion in the 2000s, and USD180 billion thus far in the 2010s. This data translates to an annual increase of 7.3 per cent in nominal dollars and 4.1 per cent above inflation on an economic basis. Of the top ten costliest weather years, seven have occurred since 2000.”

The problem of more severe weather related events is only expected to get worse. The National Climatic Data Center in the United States reports that 2014 was not only the warmest year ever recorded since official data began being kept in 1880, it was also the 38th consecutive year of above average global temperatures. Climate scientists predict that rising temperatures will lead to more volatile weather extremes for many parts of the world.

For Manitoba’s agricultural sector, rising temperatures may lead to some benefits such as longer growing seasons and the ability to grow new crops, but they also seem to be leading to increased incidences of excess moisture and flooding. At the same time, risk of drought remains. And, as we have seen in Alberta and California and other parts of the world, droughts can last for several years in a row, creating their own host of challenges.

**Methodology and guiding principles**

Manitoba Agriculture, Food and Rural Development Minister Ron Kostyshyn created the task force in January 2015, granting it a wide scope to look at how various programs and tools might be most effective in addressing the risks associated with climate change for the agricultural sector in Manitoba. The task force was also to consider the ability and role of business risk management programming to maintain a foundation for a profitable industry.

For example, the task force was asked to consider the impact of consecutive years of extreme moisture levels on production as well as multiple years of recovery from extremes (excess moisture, flooding and drought). Additionally, the task force was empowered to look at other initiatives and policy considerations that the Manitoba government may wish to consider in order to adapt to the effects of climate change.
With regard to program and policy scope, the task force was specifically guided with the following principles:

• The first line of defense is the producer’s ability to manage the losses by implementing the best management practices. The next line is the programs and other policy tools to assist mitigation or recovery when management is not enough.
• Insurance programs or insurance-like tools are the preferred means of recovery due to the ability to target, recognize management practices and be financially stable.
• Consider the ability of other programs (agriculture and non-agriculture) to directly respond or complement insurance tools and identify improvements within their intended purpose to address climate change or respond to serious climate related events, such as drought and flood.

Additionally, the task force was to be guided by the following principles to ensure emerging or changing policies and programs will:

a) not unduly influence the decisions of producers of agricultural products with respect to production or marketing, and should encourage adjustments with respect to production and/or marketing so as to improve the effectiveness of the responses of producers

b) maintain the integrity and sustainability of business risk management programming

c) continue to encourage the long-term social and economic sustainability of farm families and communities

d) be compatible with Canada’s international obligations, including trade

e) continue to encourage long-term environmental and economic sustainability

f) be fiscally prudent – avoid net increased costs to government budgets and result in positive net benefits for the sector

**Summary of recommendations**
Manitoba sits at the lowest point of the Hudson Bay watershed, the largest ocean watershed in Canada. Rivers converge on Manitoba from the Rocky Mountains to the west, the Canadian Shield to the east and from the headwaters of the Red River Valley to the south. The province’s geographic location means it can be greatly affected by climate events occurring in neighbouring jurisdictions, as well as by policy and program decisions made in those places. The task force also recognizes that climate change has significant impact on the agricultural sector in general. For Manitoba, where that sector plays a larger role in the economy compared to other Canadian provinces, that means taking action to mitigate the effects of climate change is even more important.

In the end, geography and macro-economic conditions mean that Manitoba’s agricultural producers are increasingly seen to be on the frontline fighting the effects of climate change. This is making the need for producers to adopt best agricultural practices even more pressing. The province and the country can’t let them stand alone; we need to immediately press for more actions that will ensure the sustainability of agriculture in Manitoba and across the country.
Additionally, policy makers need to understand that Manitoba is composed of several distinct regions that have unique climate and geographical characteristics. Those regions are affected by climate change and weather-related events in markedly different ways; our efforts to adapt to and mitigate climate change need to take that into account.

Until now, Manitoba and Canada have responded to weather related events and disasters in the agricultural sector through a number of programs: producers can access AgriInsurance for insurance, AgriStability for income stabilization, and AgriRecovery in times of disaster. At the same time, through the joint federal-provincial-territorial Growing Forward 1 and 2 initiatives, the Manitoba government has invested in new approaches for business risk management, water and land management projects, as well as efforts to promote best practices for farms of all types.

More needs to be done, because the need for action is growing.

The task force is recommending the provincial and federal governments take concerted action today in order to prepare for the expected effects of climate change, specifically extended periods of excess moisture and flooding, as well as the risk of extended periods of drought. The province has already begun many worthwhile initiatives related to land use and water management that should be continued or even sped up. That includes the protection of existing wetlands and creation of new wetlands, which have proven to have a beneficial impact on water management.

Because of the potential for massive catastrophic losses associated with weather events, and because climate change in general is expected to lead to significant changes in the way agriculture is practiced throughout Canada, no single province can be expected to deal with the costs or associated programming needs by itself. Growing Forward 1 and 2 have illustrated how the federal, provincial and territorial governments can cooperate to benefit the agricultural industry. We believe that climate change is making the need for a Growing Forward 3 agreement that takes into account our recommendations even more imperative.

Additionally, it’s important that the province and the agricultural industry at large do more to promote and embrace best management practices for all types of farming. That includes farms creating and following recommended environmental plans and participating in best management practices. The task force has also concluded that business risk management programs should be revised to incentivize producers to adopt best practices in farm and land use management. Doing so will help mitigate the impact of excess moisture or drought, while also minimizing the financial impact on producers as well as insurance programs.

After engaging in a public consultation process that heard from a large number of industry stakeholders and experts, including producer groups, scientists, crop insurance specialists, the task force is making 25 recommendations. These recommendations call on the Manitoba government to introduce or reform certain programs, engage in more research and invest in efforts to mitigate the impact of climate change. Most are based on a philosophy to incentivize beneficial behaviour, as we believe a carrot works better than a stick.

Manitoba can position itself at the forefront of a new agricultural revolution if it takes intelligent steps today that involve equal measures of producer action and government support. We must do what we can to ensure our farms and agricultural systems help resolve the climate change problems we face instead of just contributing to them.
Summary of Recommendations

Programs
1. Consider a new permanent cover program to compensate producers for taking marginal land out of production.
2. Encourage insurance programs to promote the use of novel crops and ensure programs respond more quickly to the impact of climate change.
3. Continue to promote policies that reward and incentivize best management practices, including reforms to insurance, extension activities and other government programming.
4. Continue to develop the Excess Moisture Insurance program so that premiums and coverage reflect the risk and improve the long term viability of the program.
5. Work with the federal government and other provinces to renew the AgriStability program in a way that deals with the expected effects of climate change.
6. Consider predictable compensation for producer’s losses in designated areas due to mitigation measures, and discuss shared funding options with the federal government.
7. Consider reforming AgriInvest so it can act as an incentive for best management practices among producers.

Research
8. Support the Aquanty HydroGeoSphere modelling project to provide data to better inform decisions on policy and programs.
9. Examine practices employed by irrigation districts in Alberta to see if Manitoba can learn from them to improve water management through its conservation districts.
10. Explore development of whole farm revenue insurance.
11. Research use of weather derivatives as a business risk management tool for producers.
12. Encourage ongoing and new research into perennial grain and winter cereals with a view to determine how different crop varieties handle wet and dry conditions.
13. Restore federal funding to public research, including research in the areas of climate change mitigation and adaptation for the agricultural sector.

Mitigation
14. Recognize that mitigation activity requires a federal funding arrangement and should be part of negotiations for Growing Forward 3 or an equivalent program.
15. Support the BASIC program as a pilot program that encourages infrastructure investment by creating a fund for mitigation works.
16. Continue to develop and promote best practices program (Environmental Farm Plan focus) to encourage best management practices (ex: tillage, crop rotation, tile draining, equipment).
17. Renew investment in conservation districts – outcome to improve drainage or storage of water in current problem areas.
18. Conduct a comprehensive assessment of the role catastrophe insurance could play in mitigating the financial impact of weather-related disasters on the province (ex: reinsurance for Manitoba and municipalities).
19. That the Manitoba government and its departments consider working with the International Institute of Sustainable Development to develop advanced climate and weather forecasting programs.
Summary of Recommendations

Other

20. Remove permanent Class 4 wetlands from municipal taxes through federal-provincial cost sharing.
21. Create a province-wide comprehensive approach to LiDAR to provide additional elevation and water management data to benefit agro-environment policy, program decisions and on-farm best practices and productivity.
22. Continue to encourage more constructive use of biomass (ex: cat tails).
23. Share best practices in municipal water management and infrastructure.
24. Ensure any subsequent negotiations with neighbouring jurisdictions such as the Prairie Provinces Water Board and the International Joint Commission include a focus on climate change.
25. Continue to invest in education and extension programming.
The Cost of the Status Quo

Human and social

For the agricultural sector in Manitoba, the extreme climate events experienced throughout the province have challenged individuals to rethink their production and investment decisions. The overall provincial costs in dealing with the resulting negative economic consequences are clearly shown within this report. The task force heard of the many different events across the province that has had a direct human and social cost, some of which can’t be easily measured.

Producers are now clearly challenged further in their thoughts, not only with seasonal production option norms, but the longer term identification of possible mitigation and adaptation investments to build the future resilience required on their operation. Conversations revealed not only recent concerns around extreme moisture events, but also future thought of drought cycles. Relative to normal weather events of the last half of the last century, management options are clearly challenged by the uncertainty of climate change events. The complexity in managing today’s farming operation for an individual producer has clearly reached new levels.

It was apparent that as different climate events occurred in Manitoba that location and landscape geography dictated the scale of impacts to production and infrastructure. As a result, it is fair to say that the operations in these areas experienced damage and setbacks, but these varied to some degree. The resulting challenge to the current risk management approaches is whether these varied impacts are covered in current policy and program design.

The rising personal stress in attempting to deal with these management decisions was evident during the consultation. At stake is the ability of a farm operation to recover economically from detrimental one time climate impacts and yet maintain its long term viability. It is also evident as each farm operation in a specific geographic region experiences a negative economic impact, that collectively the rural community suffers the economic and social consequences as well. And in time, what occurs in the rural countryside does affect the well-being of Manitoba’s urban centres and the province overall.

Production challenges due to the impact of changing climate

Through the course of the public consultations, presentations and submissions to the task force, changes in Manitoba’s physical agricultural landscape as a result of recent events were noted.

Extreme moisture occurrences in different regions of the province have affected production and related management decisions in varying ways. The unknown is the timeframe for the landscape to return to a productive norm, or in some cases, whether this is even possible. The task force heard about situations including high water tables and resulting salinity issues; land reverting to marsh vegetation such as bulrush and reed growth were productive crops were previously grown; and land areas flooded during the growing season that during previous seasons had not flooded before.

The overall impact was crop production levels in some areas of the province were decreased and/or the grades of a particular crop were downgraded as a result. For the livestock sector, forage supplies in areas became tighter and more difficult to obtain and lower pastures become less accessible due to the resulting
flooding and mud. Combined, it was noted that the management decision to retain basic cow herd numbers was challenged in these conditions.

As a result, changes in production management were also noted. In low lying areas where it made sense, forages were planted to deal with excess moisture and flooding issues. The use of minimum tillage in seeding operations, which supports less soil disturbance and retains soil moisture, continued to work for some operations. However, in wetter areas, the use of minimum tillage was being rethought on some cropland impacted in recent years.

There is a need to develop and expand alternate cropping options that could counteract adverse climatic conditions. It was noted that uptake has been painfully slow, but there are existing options and existing models for alternate production practices that can mitigate the impact of severe climatic shifts. Examples include inter-cropping, crop rotations that include nitrogen fixation plant species, perennial cereal varieties, and organic production. As these options become further advanced and available, business risk management (BRM) programming needs to evolve and support these options; certainly the BRM options must not discourage these new and different production modalities.

More drainage and subsurface drainage thinking by some individual producers was evident in current and longer term management decisions and actively being undertaken to restore and/or mitigate risk from future events. One submission from the Interlake had calculated the lost production in their area over recent years and its overall economic impact as local businesses closed and people moved on to look for new opportunities.

Investment decisions on machinery that could deal with these events were also being contemplated and undertaken by farm operators. Larger tractors with tracks, the latest minimum tillage technology, and faster balers and rakes are a few examples that were mentioned. This particular decision for an operation is difficult, given the resulting longer term financial obligation and impact on cash flow. Only future weather events determine whether this decision, in fact, will be rewarded.

For more information on expected climate change effects on agricultural production, please see the *Climate Change Vulnerabilities and Adaptation Needs* report from the International Institute for Sustainable Development in the appendix.
Task Force Review

The task force held a consultation process that invited input and presentations from producers, producer groups, researchers and other stakeholder groups beginning in February 2015. The task force held consultations in person at seven locations around the province in July. Those consultations were attended by 72 producers/organizations, 50 staff and four media representatives.

Additionally, the task force engaged the International Institute for Sustainable Development (IISD) to look at agricultural risk management programs across Canada and internationally, to examine how they respond to a changing climate. The IISD also conducted a study to look at climate change vulnerabilities and adaptation needs as identified through previous assessments in Manitoba and elsewhere. Additionally, IISD completed a rapid review of climate scenario simulations to inform the task force as to how future climate change scenarios may impact government policy.

As part of the consultation process, Manitoba Agriculture, Food and Rural Development (MAFRD) undertook an online survey that invited submissions from producers, organizations and other interested parties.

Presentations

- Aquanty
- Assiniboine River Basin Initiative (ARBI)
- Bifrost Agricultural Sustainability Initiative Committee (BASIC)
- CDEM – Conseil de Développement Économique des Municipalités du Manitoba
- Conservation and Water Stewardship (CWS) – Surface Water Management
- Conservation and Water Stewardship (CWS) – Surface Water Drainage in Manitoba
- Keystone Agricultural Producers
- Keystone Potato Producers
- MAFRD, Agri-Resource Branch – Climate Change Presentation
- MAFRD, Policy, Planning and Programs – Business Risk Management Programs
- Manitoba Canola Growers
- Manitoba Agricultural Services Corporation – Insurance
- Manitoba Beef Producers
- Manitoba Conservation Districts Association
- Manitoba Corn Growers Association
- Manitoba Forage and Grassland Association
- Manitoba Pork Council
- Manitoba Pulse and Soybean Growers
- National Farmers Union
- PBS Water Engineering Ltd.
- University of Manitoba, Faculty of Agriculture and Food Sciences, Agribusiness and Agricultural Economics – Conservation Easements
- University of Manitoba, Faculty of Agriculture and Food Sciences, Plant Science – Perennial Grain Breeding Program
- University of Manitoba, Watershed Systems Research Program
Review of Recommendations

Programs

1. Consider a new permanent cover program to compensate producers for taking marginal land out of production.

SUMMARY:
Significant excess moisture in recent years has resulted in higher than typical unseeded acres of farmland in Manitoba. Producers still remain responsible for this land. Removing marginal land from production can have several beneficial effects including creation of wetlands and natural habitat, enhanced biodiversity, reduced greenhouse gas emissions and protection of water quality. Lands under permanent cover absorb and have the ability to store more moisture.

INSIGHTS:
Between 2003 and 2008, Agriculture and Agri-Food Canada administered the Greencover Canada program, which paid producers to convert annual cropland to pasture land or native cover. The program administered 10-year land use agreements, paying producers $20 to $25 per acre. The program encouraged the seeding of long-lived perennial species such as forage, shrubs and trees, but other plant species were also permitted.

The $110 million program was deemed successful and the task force recommends this program be reintroduced.

In climate change discussions, the role of agriculture in assisting with the reduction of greenhouse gas (GHG) emissions in a carbon economy is a possibility. Manitoba, now or in the future, should consider agriculture carbon offset protocols that could be used for GHG reduction targets. If this is an opportunity, given the recent announcement of Manitoba’s Climate Change and Green Economy Action Plan, possible inclusion should be considered and explored.

RECOMMENDED ACTIONS:
The task force recommends the federal and provincial governments invest in a new permanent cover program. This should be part of federal-provincial-territorial negotiations for Growing Forward 3.

New permanent cover program may be modeled on Greencover Canada and have as its goals:
• land conversion – converting land that is environmentally sensitive to perennial cover
• critical areas – managing agricultural land near water
• technical assistance – helping producers adopt beneficial management practices
• watershed evaluation of beneficial management practices
• creation of shelterbelts
Encourage insurance programs to promote the use of novel crops and ensure programs respond more quickly to the impact of climate change.

SUMMARY:
While there are many negative repercussions from climate change, Manitoba does stand to benefit in some respects, including with longer growing seasons. Longer growing seasons make it possible to grow new varieties of crops. Insurance programs need to be able to accommodate these new varieties more quickly than they have in the past.

INSIGHTS:
A number of individuals and groups emphasized the need for policy makers to recognize the natural regions within Manitoba. The province is composed of different regions that have their own unique climate and geographic characteristics. As government and industry push forward to find new ways to adapt to and mitigate the effects of climate change, those regional differences need to be considered.

Innovative farmers currently take on significant personal risk when trying new crops that may end up benefiting many producers and the province as a whole over time. An example is how rapidly soybean production has grown in Manitoba in recent years. In 1996, the province had less than 800 acres of soybeans. In five years that had grown to 45,000 acres. By 2013, Manitoba had more than 1 million acres growing soybeans.

AgriInsurance (a federal-provincial cost-shared program) today is a vital part of running a farm. Producers use insurance as collateral for bank loans. That is especially true for younger producers who are just starting out. If a novel crop is not eligible for insurance, then producers are unlikely to put it in the ground, no matter its economic potential.

Research undertaken in British Columbia showed that crop insurance “will become more important with greater variability and extremes in weather as the climate changes.” It recommended incorporating new crops into insurance programs sooner than is currently the practice, though the research also recognized that premiums would likely need to be higher “to reflect the actuarial uncertainty associated with the lack of local production history.”

The same research explored the possibility that some producers will opt out of AgriInsurance in these circumstances, preferring to self-insure instead. This could reduce the base for loss sharing within the program and increase the actuarial risk. Crop insurance must become an incentive to the production of novel crops in Manitoba.

RECOMMENDED ACTIONS:
AgriInsurance needs to take into account the effects of a warmer and longer growing season in Manitoba by making certain novel crops are eligible for insurance. The task force believes AgriInsurance should promote innovation in the use of new crops.

Flexibility is key for provinces to deal with their own regional issues within the framework of a federal-provincial agreement on AgriInsurance.
3 Continue to promote policies that reward and incentivize best management practices, including reforms to insurance, extension activities and other government programming.

SUMMARY:
One of the most common themes heard by the task force throughout its consultations was the importance of having more producers embrace best practices. Diversified farms that engage in practices such as crop rotation and tile drainage, while investing in innovations such as precision agriculture, tend to be farms that withstand weather events while having the lowest level of claims to the major business risk management programs (AgriInsurance, AgriStability, and AgriRecovery).

INSIGHTS:
Insurance
The task force heard that computer modelling research conducted by Agriculture and Agri-Food Canada and by the OECD suggests that the demand for, and the public cost of, crop insurance across the Prairies is not expected to increase under future climate change. Using Monte Carlo simulations, the AAFC research revealed:

“… that the average annual deficit for the programme (extent to which payouts exceeded premiums paid by both producers and government) remained similar when the results for the historic period were compared to the future climate change scenarios. In fact, the deficit declined slightly with climate change, in part owing to lower average yields and therefore slightly lower exposure.”

Likewise, the OECD study showed that “demand for insurance is not expected to significantly increase under climate change given that the simulated scenarios imply reductions in variability rather than increases.” The OECD study went on to say that climate change could potentially increase insurance demand in some cases for high risk farms and under extreme event conditions. Since climate change will impact agriculture programs gradually over time, it is likely that business risk management programs can adjust to most changing conditions through normal annual program reviews and updates.

While it is generally good news to know that programs such as AgriInsurance are expected to be largely unaffected by climate change, that does not mean we should miss the opportunity to make improvements to them. With insurance playing such a vital role in farm finances today, business risk management programs could play a very positive role in providing financial incentives for producers to adopt better farm management practices.

Extension Activities
Producers and MAFRD staff largely agree there is a need for improved extension services to educate producers about best practices. Most agreed that more one-on-one, in person meetings would be helpful to encourage producers to adopt better on farm management practices. Keystone Agricultural Producers, for example, called for MAFRD to provide more proactive programming to educate farmers about concepts such as new crop options, diversification and better water management.
Other Government Programs
While the vast majority of agricultural industry stakeholders embrace the idea of best practices, there is near universal recognition that more could be done from a program perspective to encourage more producers to adopt better practices to reduce their risk and improve their operations. For example, many producers recognize the benefits of tile draining their land. Research along with the experience of U.S. producers indicates that subsurface drainage such as tile drains can increase yields, decrease soil compaction, improve harvesting conditions and promote less wear on farm equipment. Yet, regulations have been slow to keep up with the demand from producers to install tile drainage in Manitoba.

RECOMMENDED ACTIONS:
The task force recommends the federal and provincial governments make changes to business risk management programs that provide financial incentives for producers who engage in best farm management practices. For example, farmers who can demonstrate they have rotated their crops according to best practices should be given preferential insurance rates over their neighbours who continue to grow the same crops on the same land year after year and then see higher disease risk.

Work needs to be done by the federal and provincial governments to determine an approved list of practices that help farmers and the province deal with the effects of climate change (excess moisture, drought, pests, etc.) that could be rewarded with lower insurance rates. This recommendation is consistent with two of the task force’s guiding principles:
• The first line of defense is the producer’s ability to manage the losses by implementing the best management practices. The next line is the programs and other policy tools to assist mitigation or recovery when management is not enough.
• Insurance programs or insurance like tools are the preferred means of recovery due to their ability to target, recognize management practices and be financially stable.

Additionally, the task force recommends that Growing Forward 3 support the concept of enhanced extension services to educate Manitoba producers about best management practices and various ways to improve sustainability of their operations in the face of climate change.

The task force also recommends that the Manitoba government engage in a review of all current provincial (including Manitoba Conservation and Water Stewardship regulations) and municipal regulations that affect producers’ abilities to adopt beneficial practices such as installing tile drainage. Wherever possible, government regulations should be in sync with allowing producers and the agriculture industry to move quickly to adapt to changing conditions caused by climate change.

**4 Continue to develop the Excess Moisture Insurance program so that premiums and coverage reflect the risk and improve the long term viability of the program.**

SUMMARY:
When the Manitoba Agricultural Services Corporation (MASC) began selling Excess Moisture Insurance (EMI) in 2000, it collected just over $3 million in total premiums, including $444,000 charged to producers. In 2015, the total premium collected had risen to $25 million, including
$12 million charged to producers. Even with the rapid increase in premiums, the program has accumulated a $236 million deficit since its inception, due to multiple years of serious flooding and excess moisture in various parts of the province.\textsuperscript{xii}

**INSIGHTS:**
Some parts of the province have suffered from chronic excess moisture. Parts of the Interlake, for example, suffered 10 straight years (2005–2014) with more than 25 per cent of the land unseeded due to excess moisture. Large portions of the Interlake, the Parkland area and southwestern Manitoba have seen between 3 and 6 years with more than 25 per cent of the land unseeded.

Climate change is expected to continue to bring higher levels of excess moisture to Manitoba’s farms, making EMI an important program for Manitoba’s producers. At the same time, the program needs to be actuarially sound and viable over the long term.

The EMI program is currently facing a number of issues that could impact its long term viability. For example, low risk producers currently share in the cost of the program. Their premiums will likely need to rise in the future, which may lead some to opt out of the program. The program is not viable without universal participation. MASC must also take steps to ensure the program adheres to sound insurance principles, including that it cover accidental loss (protect against moral hazard), group similar risks together, adhere to a principle of indemnity (restore to position prior to the loss) and to maintain an affordable premium.

Additionally, a MASC review has determined that in some cases, losses are more related to management than to climate. This speaks to the need to tie program participation and premium rates to producers’ farm management practices. Producers also need to understand that EMI is insurance as opposed to compensation.

**RECOMMENDED ACTIONS:**
The task force recommends the federal and provincial governments recognize the importance of EMI and commit to it for the long term. This may require MASC to levy higher premiums on both government and on producers to ensure it remains viable and offers adequate coverage.

The task force believes EMI is a vital program for the province’s agricultural producers.

The federal-provincial agreement on crop insurance should reflect extraordinary circumstances affecting individual provinces, giving those jurisdictions flexibility to act while staying within the framework of the agreement.

5 Work with federal government and other provinces to renew the AgriStability program in a way that deals with expected effects of climate change.

**SUMMARY:**
AgriStability is “a margin-based program which allows producers to protect their farm operations against large declines in farm income.”\textsuperscript{xiii} The program triggers payments when a producers’ margin (allowable revenue less allowable expenses) drops below their average margin from previous years. AgriStability (alongside AgriInvest) replaced the former Canadian Agricultural...
Income Stabilization program in 2007. The program is meant to provide support for farmers when they experience a large decline in their operating margin.

Under *Growing Forward* 2, the program was changed in a way that reduced payments to producers. This has led some producers to opt out of the program as they perceive levels of support are insufficient.

**INSIGHTS:**

In addition to the lower participation rate under *Growing Forward* 2, producers told the task force that AgriStability rules make compliance very complex (often requiring farms to hire accountants to complete the applications). The program also takes a long time to provide payments to eligible producers, suggesting it is not responsive to the financial distress it is trying to resolve. Interim payment options cover some of the timing problem, but they add risk because payments are made before the final values are known.

The task force heard from some producers that the accounting and administrative fees are too high and the probability of a payout too low. Some stated they were withdrawing from the program as a result. Other producers stated that they were able to manage their accounting costs and, with administration costs, could expect a payout sometime in the future based on the current program triggers. The task force also heard that farmers who run highly diversified operations tend to have more stable incomes and therefore tend to have a lesser need to access business risk management (BRM) programming. It should also be pointed out that many well diversified farms, which incorporate best management practices such as crop rotation and incorporating legumes and livestock manure, have a beneficial impact on the environment. Some of these producers feel that the support eligible from BRM programs has been lowered because of their diversification efforts.

AgriStability is designed to respond and provide support on negative market or production event combinations. The task force heard that some producers were concerned they may be facing increased frequency of extreme climate events along with possible decreased support from AgriStability. The program helps cover income and expenses directly related to production of farm commodities, though only a few of these will be weather related (ex: cost of feed, seeds). Additionally, the program needs to be able to differentiate between single year weather events, which have multi-year impacts, from multi-year events.

Therefore, one of the key questions to answer is whether AgriStability supports the capacity of producers and other stakeholders to adapt to the effects of climate change. The task force consultation process brought forward a discussion on the risk management tools available for farm operations to mitigate or adapt to climate events. Management decisions, for example, that improved drainage or changed crop rotations could reduce risk, and therefore, lower the trigger point for the AgriStability program. The question to be further explored is what the current and future role of government is to support these longer term management decisions.

Climate change will certainly impact crop prices in the future in many ways and therefore must be considered when planning for future iterations of AgriStability. Localized weather related events will continue to cause urgent distress to Manitoba producers, but climate change may lead to issues elsewhere in the world too. Climate change may, for example, help cause a worldwide...
glut in a particular commodity one year, thereby lowering prices. The opposite could happen just as easily.

Based on preliminary research supplied to the task force, it is recommended that governments monitor the program closely to see if climate variability and extremes are affecting AgriStability’s ability to meet its stated objectives.

RECOMMENDED ACTIONS:
The task force recommends that governments monitor the program closely to see if climate variability and extremes are affecting AgriStability’s capacity to meet its stated objectives.

The task force recommends the Manitoba government engage the federal government in a comprehensive discussion regarding the future of the AgriStability program. Climate change must be considered in those discussions. So must the serious concerns expressed by producers that the program no longer addresses the financial needs of today’s farms.

Furthermore, the task force recommends the federal and provincial governments consider the potential for introducing alternative programs such as Whole Farm Revenue Insurance (see Recommendation #10) as a possible option to AgriStability.

6 Consider predictable compensation for producer’s losses in designated areas due to mitigation measures, and discuss shared funding options with the federal government.

SUMMARY:
The task force’s consultations reaffirmed the specific and immediate challenges for producers in the following areas: Lake Manitoba, the Shellmouth dam, and the dike infrastructure along the Assiniboine River. In addition, the impacts of flooding in areas with no natural outlets were noted, such as Whitewater Lake and Shoal lakes. This has had a serious negative impact on producer’s short and long term incomes.

INSIGHTS:
The economic impact for farms in affected varies greatly by location and the limited options to replace or recover lost resources. Although the landscape appears to be permanently altered, the difficult question is whether weather events may reverse their cycle and bring back its productive capacity at some point in the future. Given that the scale of these impacts is large, and to some extent complicated by extreme climate events outside Manitoba’s borders, the task force recommends that further discussions with the federal government be held concerning shared funding.

RECOMMENDED ACTIONS:
The task force recommends consideration of predictable compensation for producer’s losses in these designated areas due to mitigation measures and to discuss shared funding options with the federal government.
7 Consider reforming AgriInvest so it can act as an incentive for best management practices among producers.

**SUMMARY:**
AgriInvest is a tool that helps farms manage savings over time to help cover potential small margin declines. It can provide farmers with some liquidity in times of need. The program matches one per cent of allowable net sales up to a maximum of $15,000 (down from previous maximum of 1.5 per cent and $22,500).

Producers can withdraw funds at any time to alleviate risk or make other investments. Withdrawals must first come from government contributions, which are taxable upon withdrawal.

**INSIGHTS:**
The task force heard from producer groups that they wanted the government contributions to be increased and for the program to allow more flexibility on withdrawals.

**RECOMMENDED ACTIONS:**
The task force recommends investigating the option of providing some additional flexibility in how producers can access funds held in their AgriInvest accounts. Specifically, the task force recommends investigating the option of allowing producers to withdraw funds from the producer contributions first with no tax implications (producers have already paid tax on those funds prior to deposit) to be used for climate change mitigation on their own operations. And be able to access the government portion for climate change mitigation without tax implications provided the funds are replenished within a certain time frame.

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8 Support the Aquanty HydroGeoSphere modelling project to provide data to better inform decisions on policy and programs.

**SUMMARY:**
Aquanty Inc. was engaged to develop a HydroGeoSphere (HGS) modelling platform for the Assiniboine River Basin. The project is designed to help prepare the basin for flood, drought and excess moisture risks to agricultural production. It can also help prepare municipalities for flood risks. The model tests the hydrologic sensitivity of the basin to projected future climate conditions and scenarios.

The project is expected to deliver a web-based HydroGeoSphere platform for the Assiniboine River Basin and its three major sub-basins (Souris, Qu’Appelle and Birdtail). The platform will present key metrics and show how forages and grasslands influence the hydrologic characteristics of the area under various conditions including flood and drought.
FIGURE 5: A map of the Assiniboine River basin showing the Qu’Appelle, Birdtail, Souris and Assiniboine River watersheds.

**INSIGHTS:**
The projected 27-month Aquanty project is expected to evolve into a web-based predictive tool to help understand water-related risks to agriculture. It will also provide a way to quantify the impact of certain land management practices, such as maintaining forage and grassland areas. It could then help in the development of economic strategies to compensate producers for incorporating land management practices that provide a greater public good.

The project is supported by Agriculture and Agri-Food Canada, Manitoba Agriculture, Food and Rural Development and Manitoba Forage and Grasslands Association, as well as multiple producer groups and conservation districts.

**RECOMMENDED ACTIONS:**
The task force recommends the provincial and federal governments commit to long term support for the Aquanty project in Manitoba.
Examine practices employed by irrigation districts in Alberta to see if Manitoba can learn from them to improve water management through its conservation districts.

**SUMMARY:**
Alberta’s irrigation infrastructure started in the late 1800s when the early settlers in the southern area of the province experienced drought conditions. This set up in legislation the early principles of water rights and an inventory of the agriculture landscape that would benefit from irrigation. This effort was expanded over time so that, by the 1950s, over 182,000 hectares of farmland was irrigated.

**INSIGHTS:**
With the focus on climate events, the Alberta experience could be researched to explore possible policy or program options that might be of benefit to Manitoba. In the early 1990s, Manitoba had an Irrigation Strategy with program funding to support the expansion of irrigation infrastructure. Although this activity did have a particular focus in advancing the potato and related processing industry, this could be expanded further with a climate focus.

**RECOMMENDED ACTIONS:**
With future expectations of a severe drought cycle, the task force recommends a review of Manitoba’s past policy and programs supporting agriculture irrigation as a risk management tool. Also recommended is expanding research into what further updates might be needed to mitigate risk for producers, in conjunction with Manitoba’s current water strategy.

Explore development of whole farm revenue insurance.

**SUMMARY:**
Over the years, the federal and provincial governments have deployed a number of different business risk management programs to help the agricultural sector in Canada, but these are not the only ways to approach the issue. The U.S. government, for example, recently launched Whole Farm Revenue Protection for Federal Crop Insurance. This insurance product offers producers a risk management solution for all commodities on the farm under one policy. It’s designed for farms with up to $8.5 million (US) in insured revenue. Whole Farm Revenue Insurance provides protection against the loss of insured revenue due to an unavoidable natural loss.

**INSIGHTS:**
A number of stakeholder groups including the Keystone Agricultural Producers and the Manitoba Canola Growers urged the task force to look at Whole Farm Revenue Insurance as a potential risk management option for producers, especially as it relates to climatic and weather-related effects. The Canola Growers, for example, cited research it commissioned that said Whole Farm Revenue Insurance would be an optimal replacement for AgriStability. The group’s research said that Whole Farm Revenue Insurance had a number of clear advantages over AgriStability, including:
• It is financially stable as operated under sound insurance management principles (grouping similar risks, principle of indemnity, control of moral hazard, affordable premium, actuarially sound).
• It is far simpler than AgriStability.
• It offers effective risk protection to current market conditions that would be bankable. The Whole Farm Revenue Insurance model would insure farmers against crop and price failure, as well as a reduction in income. It would cover the whole farm, as opposed to individual commodities and would reflect the current market. Additionally, the wide variety of crops and types of production covered under the program would serve to lower overall cost, much like a group health insurance plan lowers costs for all employees of a company.

It is possible that Whole Farm Revenue Insurance could replace or augment AgriStability. In addition, research should also explore the trade compatibility of this program option.

**RECOMMENDED ACTIONS:**
The task force recommends the federal and provincial governments study the possible development of a Whole Farm Revenue Insurance product for Canadian producers. These efforts should include industry consultation as well as a comprehensive review of similar products on offer in other jurisdictions, including the U.S.

**SUMMARY:**
Weather derivatives are financial products which allow individuals or organizations exposed to adverse or unexpected weather conditions to mitigate those risks through weather-related indices. Weather conditions may include temperature, rainfall, frost or snowfall. The weather derivatives’ market has historically been dominated by the energy business. More recently, however, the market for weather derivatives has broadened to include sectors such as agriculture, construction, transportation and entertainment.

Hail insurance, which has been available to producers for decades, is an example of a financial risk management tool based in part on weather derivatives. Just as its possible to set a price on hail insurance, so is it possible to hedge a producer’s risk based on other weather events, such as the case of a warmer winter where extreme winds and light snow have left a lower than expected snow pack and moisture. In that case, a producer’s subsequent seeding and growing season may be significantly impacted. Had they purchased a derivative to protect against that eventuality, they would be able to manage some of the many weather related risks associated with that growing season.

**INSIGHTS:**
Recent research by University of Guelph professor Sylvain Charlebois (along with the University of Regina’s Saqib Khan and Morina Rennie) surveyed Saskatchewan producers on their use and knowledge of weather derivatives. The research found that just over nine per cent of respondents had used weather derivatives to help manage risk within their operations. More farmers appear to be looking to weather derivatives as a way to mitigate risk as they grow higher-value crops and
farm on a larger scale. Climate change and its predicted weather volatility is also helping to drive demand for these financial products.

A weather derivative treats temperature and precipitation as commodities. The derivative derives its value from an underlying value such as an asset or an index. Most weather derivatives are traded on exchanges such as the Chicago Mercantile Exchange. They can cover temperature, rain, snow, wind, humidity or other types of weather. They may be held for a short duration (a week) or for a period of years.

Unlike insurance, weather derivatives are triggered by the weather event rather than any loss caused by the weather. Additionally, weather derivatives cover low-risk but high probability events such as winters with lower than average snowfall or cooler than normal summers. Those events may not eradicate a crop, but they can certainly have an impact on a farm’s profitability.

Because they are comparatively new financial products, they are not well understood by the market. Producers may be uncertain about buying a weather derivative product because they aren’t sure about pricing.

It is possible for organizations such as MASC to package weather derivatives into a kind of index or pool for sale to producers. This could offer a number of advantages including:

- more certainty over pricing
- more credibility among producers which could promote uptake
- lower prices compared to purchasing as individuals
- opportunity for better extension and outreach to the agricultural community

With producers as the front line of defence against major weather events caused by climate change, weather derivatives seem to be a good tool to help mitigate against the impact of certain weather events. They could help hedge risk, provide less volatility in farm income over the long term, and promote better understanding of how weather impacts individual farms as well as agricultural regions.

**RECOMMENDED ACTIONS:**
The task force recommends the province ask MASC to research the development of weather derivative products for the Manitoba market.

**SUMMARY:**
Perennial crops have deep root systems. Annual plants have root systems near the top foot of soil, but perennials have roots an average of 6-12 feet deep. Deep roots build and maintain soil fertility and increase biodiversity. This helps maintain/create topsoil with crops that are more resistant to drought, excessive moisture, inclement weather and nitrogen loss. They also have a longer growing season which increases their capacity to remove carbon from the atmosphere (244 per cent to 320 per cent greater than annual crops).
Because of their hardy root system, they would have better survival rates in a warming climate, and could sequester more greenhouse gases from the atmosphere. Perennial crops are seeded once and then harvested for several years with the goal of plant breeding to maintain economic yields and minimize susceptibility to plant disease.

INSIGHTS:
The successful outcome of perennial grain breeding is to provide the producer and the agriculture sector with another option in crop production as a companion to the annual crop varieties currently grown. The University of Manitoba is the first public research institution in Canada to support a perennial grain breeding program. Research in perennial breeding is a worldwide effort that is located in China, Japan, Australia, United States and other countries, being primarily publicly funded. The private sector remains interested, but the time to commercialization currently limits research investment.

Manitoba hopes to proceed with enough seed for agronomic trials by 2016. At this stage, it is optimistically estimated that a viable crop may be 15 to 20 years down the road.

RECOMMENDED ACTIONS:
That the perennial grain breeding research and development program currently underway at the University of Manitoba continue with the support of federal and provincial funding.

SUMMARY:
With climate change becoming an increasing threat to the province’s agricultural sector, the need for more and better research into mitigation and adaptation is clear. Publicly funded research conducted for the benefit of the industry as a whole is required for the province to take intelligent action over time to cope with climate change.

INSIGHTS:
Programs such as the Prairie Farm Rehabilitation Administration (PFRA) were cut back in recent years, causing the PFRA’s shelterbelt and community pasture programs to be divested, for example. Founded during the Great Depression, the PFRA was created to help mitigate the effects of a lengthy drought. Among other projects, the PFRA was instrumental in building dams which can be used for flood mitigation and drought protection.

The message to the task force from a large number of producers and producer groups was loud and clear: there is a need for publicly-backed research on matters that broadly impact agricultural producers. While very valuable to the industry, private sector research is by its very nature geared to the profits of corporations. There is a need for research that can benefit agricultural producers and the public more generally. This is especially so for smaller commodity groups such as growers of sunflowers, forage and flax.

This kind of research could help to stimulate more diversified farms, which the task force heard tend to make less use of business risk management programs.
Public research into drought or water tolerant, or disease resistant crops would be beneficial to the agriculture industry as a whole, especially if that research were to remain in the public domain.

**RECOMMENDED ACTIONS:**

The task force recommends the federal and provincial governments invest more funding into public research to mitigate the effects of climate change and help the provinces to adapt to it.

The task force recommends public funds be directed towards scientific research that can have broad benefit to agricultural producers and a specific benefit for smaller commodity groups, especially with regard to developing drought or water tolerant, and disease resistant crops.

**Mitigation**

14 Recognize that mitigation activity requires a federal funding arrangement and should be part of negotiations for Growing Forward 3 or an equivalent program.

**SUMMARY:**

Although the province and its producers can take some action to mitigate climate change impacts, Manitoba cannot tackle these challenges as they relate to its agricultural sector on its own. Watersheds that flood land in Manitoba cross provincial and international borders. Many of the programs currently supported by the provincial and federal governments are not going to be sustainable, unless mitigating behaviour is encouraged.

**INSIGHTS:**

The challenges related to climate change are multi-jurisdictional. The weather doesn’t care about borders and boundaries. Governments need to recognize their joint responsibility to fund mitigation initiatives.

There are some multi-jurisdictional initiatives already in place. For example, the task force heard from the Assiniboine River Basin Initiative, which was launched in 2014 to bring together stakeholders who have an interest in working cooperatively to address water related issues across the Qu’Appelle, Souris, and Assiniboine River basins. It brings together municipalities and counties, conservation, water, agricultural and science based organizations as well as government departments from Manitoba, North Dakota, and Saskatchewan. The task force believes this sort of multi-jurisdictional approach is important to consider in the future.

**RECOMMENDED ACTIONS:**

The task force recommends the federal government assist with funding for climate change mitigation projects under Growing Forward 3.
Support the BASIC program as a pilot program that encourages infrastructure investment by creating a fund for mitigation works.

**SUMMARY:**
The Bifrost Agricultural Sustainability Initiative Committee (BASIC) was formed in 2008 to look for solutions to what was becoming a chronic problem of excess moisture for crop and livestock producers in the RM of Bifrost.

The project had three objectives:
- to develop a plan to rehabilitate 220 miles of drainage infrastructure
- leverage producer contributions to attract provincial and federal infrastructure funding to rehabilitate or expand provincial drains and highway ditches
- test innovative cropping methods to manage excess moisture such as raised beds and tile drainage

**INSIGHTS:**
Many of the participants of the BASIC program cite it as an example of how producers can work with municipalities and the provincial and the federal government to solve local water management issues. By improving mitigation efforts relating to excess moisture, the provincial and federal governments stand to benefit by increased production and lower payments to farmers through business risk management programs. Producers benefit through increased production and profitability of their farms.

**RECOMMENDED ACTIONS:**
The task force recommends other jurisdictions suffering from chronic excess moisture use the BASIC program as a model for promoting mitigation efforts.

Continue to develop and promote a best practices program (Environmental Farm Plan focus) to encourage best management practices (ex: tillage, crop rotation, tile draining, equipment).

**SUMMARY:**
To make their farms more sustainable, some farmers are adopting risk mitigation best management practices, such as diversifying their production and completing environmental farm plans. These farms also tend to be the farms with lowest total claims against AgriStability.

**INSIGHTS:**
Any initiative designed to improve the resiliency of Manitoba’s agricultural sector needs to consider how it can actively promote beneficial management processes on as many farms as possible. This is as much a program and policy issue as it is a challenge for extension and education.

Crop diversification and rotation alone is worth singling out. Just like with a financial portfolio, diversification helps to reduce risk on farms, which smooths out income and profitability over time. If one commodity is adversely affected by markets or weather, others may not be
and the farm operation can continue with minimal impact. However, we need to take in local conditions as we consider these practices. Researchers at the University of Manitoba found that conservation tillage, which creates better soil for drought resistance, was not being adopted in parts of the Red River Valley because it slowed drainage on wet lands.

There are some years when a non-diversified farm will be more profitable due to commodity prices. But on average, diversification tends to help farms maintain profitability and financial sustainability over time, as they are less impacted by years with serious crop failures or low commodity prices.

**RECOMMENDED ACTIONS:**
The task force recommends *Growing Forward 3* embrace renewed investment in the research, development and promotion of best practices on Manitoba farms, including environmental farm plans, tillage, crop rotation, tile drainage, equipment, etc.

**SUMMARY:**
Manitoba’s conservation districts have been growing in importance in recent years as the province has struggled to cope with excess moisture. Being constituted around watersheds means conservation districts have a unique role to play by bringing together resources of multiple municipalities, landowners, provincial government departments and other stakeholder groups (such as Ducks Unlimited).

**INSIGHTS:**
Planning and investment in surface water storage infrastructure at the watershed level is being embraced in other countries to help with the integrated management of floods and droughts.

The International Human Dimensions of Global Environmental Change Program made the following observation in its 2014 report on Land, Water and People:

“Integrated land and water management is absolutely essential in regions stressed by both floods and drought. Without integrated management, achieving development progress in these regions will be similar to walking up a downward moving escalator. In other words, the majority of public and private investment will be consumed by continual and costly repairs to existing infrastructure, leaving little to no fiscal resources for advancing human well-being and sustaining ecosystems for current and future generations.”

In Manitoba, conservation districts are perfectly suited to lead many watershed level water management initiatives including LiDAR mapping, wetlands mapping, the development of new wetlands and water storage, the creation of new wildlife habitats and the management of regional drainage.

Conservation districts can take on a larger, leading role in these efforts will require better co-ordination with rural municipalities, Manitoba Conservation and Water Stewardship, producer groups and landowners.
RECOMMENDED ACTIONS:
The task force recommends the province embrace policies that recognize the important role conservation districts can play in regional water management efforts and provide them with regulatory and financial support to help better co-ordinate those efforts.

Conduct a comprehensive assessment of the role catastrophe insurance could play in mitigating the financial impact of weather-related disasters on the province (ex: reinsurance for Manitoba and municipalities).

SUMMARY:
If there is one thing that Manitoba has learned in recent years, it’s that weather-related events can have serious and long lasting negative impacts on the provincial treasury. The 2011 flood alone cost Manitoba $1.2 billion.

Climate change experts predict that Manitoba is likely to suffer more periods of excess moisture and flooding in the future. Those researchers also say it is likely that the province (or areas within the province) could suffer extended drought conditions in the years to come.
All the science - as well as history - says the province needs to prepare for more catastrophes. We have come to expect governments to act as the insurer of last resort when it comes to catastrophes. After agricultural business risk management programs and private property insurance has paid out, the public turns to government to shoulder the rest of the load.

Just as this task force is calling on producers and governments to take steps to manage risk better with innovative and novel insurance options, it is also calling on governments to examine the potential role that catastrophe insurance can play in managing the long-term risks for government budgets. By taking out catastrophe insurance (as municipalities do in California to protect against catastrophic losses caused by earthquakes), governments can help mitigate the massive disruption that a major flood might create for the provincial or federal treasury.

INSIGHTS:
Over the past several decades, governments around the world have been experiencing higher and higher losses as a result of weather-related catastrophes. According to Aon Benfield, weather disasters have caused $3.6 trillion (USD) in economic damage on an inflation-adjusted basis since 1980. Those losses have increased with every decade, rising from $5.5 billion (USD) in the 1980s to $180 billion (USD) in the 2010s.

Of the top 10 costliest weather years, seven have occurred since 2000. This is partly attributable to the general rise in the value of assets due to economic growth. Other factors at play include the increasing value of insured assets as well as population migration to coastal and more urban concentrations around the world. Aon Benfield estimates that weather and climate related issues account for approximately 15 per cent of the increase in losses.

It’s important to distinguish between economic losses and insured losses. Economic losses are generally unrecoverable financial costs to individuals, businesses and governments. Insured losses represent a portion of the loss that is recoverable after the fact.
Aon Benfield reports that insured losses have been rising due to increased penetration of insurance products in affected areas. This includes an increase in the amount of catastrophe insurance that governments are carrying to offset costs to repair infrastructure for example.

Had the Manitoba government carried catastrophe insurance against flooding in 2011 and 2012, it is possible that the treasury could have coped with the aftermath of massive business risk management payouts, infrastructure rebuilding, flood proofing, emergency channel building and disaster financial assistance. It is doubtful that such catastrophe insurance would have covered all the economic losses suffered by the province, but insurance could have had a significant impact in reducing the damage caused to provincial finances.

As we prepare for more weather-related disasters in the future, we believe that governments (provincial and municipal) should consider investing in some sort of catastrophe insurance. This is already common practice in some parts of the world. While it is new for Canada, its time may well have come. Reinsurance could be a useful risk management tool as governments look for ways to reduce their potential financial exposure to weather disasters. Evaluated on an ongoing basis as to what’s most effective for the insured, reinsurance is a part of normal business practices for many organizations. MASC, for example, evaluates its need for reinsurance each and every year with the broker of the day before going to market. The Audit and Finance Committee of the MASC Board of Directors works closely with MASC staff to keep the board up to date on current needs for reinsurance.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Event</th>
<th>Location</th>
<th>Deaths</th>
<th>Economic Loss (USD)</th>
<th>Insured Loss (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year-long</td>
<td>Drought</td>
<td>Brazil</td>
<td>0</td>
<td>$4.3 billion</td>
<td>$450 million</td>
</tr>
<tr>
<td>September 10 to 17</td>
<td>Hurricane Odile</td>
<td>Mexico</td>
<td>5</td>
<td>$2.5 billion</td>
<td>$1.1 billion</td>
</tr>
<tr>
<td>June/July</td>
<td>Flooding</td>
<td>Canada (MB, SK)</td>
<td>0</td>
<td>$745 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>August 7 to 8</td>
<td>Severe Weather</td>
<td>Canada (AB)</td>
<td>0</td>
<td>$600 million</td>
<td>$410 million</td>
</tr>
<tr>
<td>October 13 to 17</td>
<td>Hurricane Gonzalo</td>
<td>Bermuda, Caribbean Islands</td>
<td>4</td>
<td>$150 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>All Other Events</td>
<td>~230</td>
<td>~1.6 billion</td>
<td>$0.5 billion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>~300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Aon 2014 Global Climate and Catastrophe Report

**RECOMMENDED ACTIONS:**

The task force recommends the Manitoba government conduct a thorough examination of how catastrophe insurance might be used to mitigate serious financial losses to the public treasury due to weather-related disasters. Municipalities should be included in the study to determine if individual RMs, towns and cities should also consider catastrophe insurance in the future.
19 That the Manitoba government and its departments consider working with the International Institute of Sustainable Development to develop advanced climate and weather forecasting programs.

SUMMARY:
Manitoba is home to the International Institute of Sustainable Development (IISD), one of the world’s leading resources for how human populations can mitigate their environmental impact on the earth. Working as a joint initiative between the University of Winnipeg, the IISD is set to launch the Prairie Climate Centre, which will feature an online digital map repository that will help create highly accurate climate models for the province.

INSIGHTS:
According to the International Institute for Sustainable Development (IISD)xv, Canada as a whole is warming at about 2 degrees C per century, approximately double the rate of the rest of the planet. Parts of Manitoba are warming even faster. Among other things, that allows us to make predictions as to how much less energy we’ll need to heat our homes in the winter, and how much more we’ll need to cool them in the summer. The Prairie Climate Centre will be able to offer government and the public highly accurate and responsive climate models. These models will provide detailed representations of how land and water systems interact.

That is crucial information because we will need to adapt to living in a much warmer environment. For example, for the agricultural sector, the Prairie Climate Centre will be able to characterize the expected frequency of excess moisture and drought throughout the province up to the year 2100 under various climate scenarios.

RECOMMENDED ACTION:
The task force recommends the Manitoba government and its departments and agencies start using IISD for climate forecasting.

Other

20 Remove permanent Class 4 wetlands from municipal taxes through federal-provincial cost sharing.

SUMMARY:
Manitoba’s agricultural producers are on the front line in the battle against serious weather-related events such as flooding, excess moisture and drought. Researchers now understand how important wetlands are to water management in the province. Wetlands help store and filter water, thereby mitigating the impact of excess moisture and flood events. Federal provincial cost sharing could act as an incentive for keeping wetlands and natural habits healthy and vibrant.

INSIGHTS:
As stewards of the land, producers are responsible to leave permanent wetlands (Class 4 and 5) alone. Wetlands are classified based on internationally agreed standards, accepted by Canada,
the U.S., western Europe and many other areas of the world. Many producers agree with and recognize the importance of wetlands for the environmental health of the province. At the same time, many of these wetlands constitute large areas of land within farms, and landowners are responsible for paying tax on those lands without deriving much economic benefit.

By maintaining wetlands for the common good, it’s the common good that should pay for it.

By insisting on taxing wetlands and similar natural habitats that are environmentally beneficial, producers are forced to bear the real economic costs for managing and maintaining resources that have demonstrated social and environmental benefits.

Furthermore, despite the widespread acceptance of the importance of wetlands, evidence suggests that some producers continue to drain them to add to their farms’ productive acres. This practice is in part due to the fact that Class 4 wetlands represent a financial burden to producers.

The task force was interested in the Alternative Land Use Services (ALUS) program, which recently received federal funding. Its purpose is to provide financial compensation to landowners for projects that benefit the environment such as restoring or conserving wetlands, fencing off riparian areas or converting cropland to grassland.

The task force noted that the Manitoba government announced its intention in November 2015 to introduce new legislation to protect rivers, lakes and wetlands. Among other things, the proposed bill would ensure there is no net loss of wetland benefits by making landowners compensate for such losses, as well as modernize the conservation districts program to strengthen integrated watershed management planning.

**RECOMMENDED ACTION:**
The task force recommends that federal and provincial governments develop a cost-sharing model through which property taxes on permanent wetlands can be removed from producers’ tax bills without affecting the tax base of the local municipality.

The task force recommends investigating the ALUS program as an option to encourage maintenance of wetlands.

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21 Create a province-wide comprehensive approach to LiDAR to provide additional elevation and water management data to benefit agro-environment policy, program decisions and on-farm best practices and productivity.

**SUMMARY:**
The Light Detection and Ranging Watershed Project Planning (LiDAR) tool uses lasers mounted on aircraft to create highly accurate elevation maps of terrain. Those maps show in detail how water drains off the land into waterways and then into the lake. Pioneered by the International Water Institute in Fargo, North Dakota, the system has already been used to create detailed maps of the Red River Valley in that state.
INSIGHTS:
The LiDAR tool creates detailed topographical terrain maps showing land elevations. It is ideal for planning water management practices because it provides highly specific details on how water drains off land into watercourses. This gives planners and landowners information they need to enhance water storage features such as wetlands and identify where excess nutrients are running off the land into waterways.

The system uses a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light. Using a laser mounted in an aircraft, data is fed into special software that creates highly accurate high-resolution maps of landscapes. It can even identify levels of phosphorous and nitrogen.

LiDAR has proven itself to be a highly useful tool for water management and flood mitigation, and would be highly beneficial for the province as it plans future climate change mitigation and adaptation efforts.

RECOMMENDED ACTIONS:
The task force recommends the Manitoba government support the creation of publicly accessible LiDAR mapping of all agricultural areas in Manitoba.

SUMMARY:
Biomass was long thought of as a near useless by-product of agriculture. Today, biomass in the form of flax straw, hemp straw or cat tails, for example, has been shown to have many beneficial environmental and economic uses.

INSIGHTS:
Crop residue is an important component of soil health and the burning of straw ultimately costs the producer money. There are several benefits from leaving standing stubble in the field, including trapping snow, minimizing water and wind erosion, and returning valuable nutrients to the soil. Trapping snow during the winter months has several advantages in terms of enhancing the supply of moisture in the spring for the crop and in improving the survival of winter wheat crops.

Crop residue can be a very effective tool in preventing soil erosion. During heavy rain events, exposed soil is much more likely to be eroded away than soil that is protected by crop residue. The straw absorbs the impact of the rain and allows the water to infiltrate the soil rather than simply running off, carrying valuable topsoil with it.

Wind erosion is also greatly reduced by leaving crop residue on the field. Standing straw helps to slow wind speeds at ground level, protecting the topsoil from being blown away and trapping blowing soil.

Leaving straw in the field also returns nutrients valuable to crop growth back to the soil. These nutrients include carbon, nitrogen, phosphorus, potassium, sulfur, calcium and magnesium. When
straw is burned, about 90% of these nutrients are lost (Heard et. al., 2001). As a result, the soil requires supplemental amounts of fertilizer to be productive, which costs the producer money.

Finally, by incorporating straw into the soil it is returning organic matter back into the soil. Organic matter from straw, stubble and chaff binds soil particles, improving soil structure. Well-structured soils drain faster and make better seedbeds. Most importantly, good soil structure improves the ability of the soil to deliver water and nutrients to crops.

While once considered an invasive species with little value, research today agrees that cat tails are particularly useful in a number of ways. Growing in abundance in wetlands, for example, they help store water during periods of excess moisture, which makes them excellent tools for water management. Additionally, cat tails absorb large quantities of phosphorous and help filter the water.

Successful pilot projects in Manitoba have already shown that cat tails can also be harvested and turned into fuel sources. Likewise biomass such as flax and hemp straw is now being converted into biomaterials for use in manufacturing everything from tractor hoods to ceiling tiles.

**RECOMMENDED ACTIONS:**
The task force recommends the provincial government continue to invest in and encourage the use of biomass as both a water and land management tool and as a natural resource for green industries. This will help the province reduce its environmental footprint, while also encouraging new economic growth.

**SUMMARY:**
Producers, the provincial and federal governments, and conservation districts and municipalities all have a role to play in mitigating and adapting to the effects of climate change. It’s imperative that all players engage in an integrated approach to these efforts. Municipalities often shoulder major responsibilities for water management, as they are responsible for miles and miles of drainage and other infrastructure.

**INSIGHTS:**
The task force heard from a number of officials representing municipalities who brought forth concerns about multi-jurisdictional approaches to surface water management. They were vocal about a lack of funding and a lack of co-ordination between municipalities (especially when they are not part of the same conservation district). They told the task force that the current environment made it difficult to fund long-term continued improvements to their local drainage systems.

The Ontario government has created a *Drainage Guide for Ontario*, which is a technical reference document for the regulations to the *Agricultural Tile Drainage Installation Act*, 1990. It is designed for contractors, engineers and others interested in the planning, design, inspection and construction of agricultural drainage systems.
RECOMMENDED ACTIONS:
The task force recommends the Manitoba government work with the Association of Manitoba Municipalities along with individual municipalities, conservation districts and other stakeholders, to encourage sharing of best practices and co-operation on shared water management issues.

The task force recommends the province create a drainage guide for Manitoba.

24 Ensure any subsequent negotiations with neighbouring jurisdictions, such as the Prairie Provinces Water Board and the International Joint Commission include a focus on climate change.

SUMMARY:
As climate change knows no borders and as Manitoba shares a watershed with multiple other jurisdictions with which it has standing agreements on water management, the province needs to consider the impact those agreements may have on its ability to mitigate and adapt to climate change.

INSIGHTS:
The Prairie Provinces Water Board (http://www.ppwb.ca/) was formed in 1948 to recommend the best use of interprovincial water and recommend water allocations between the provinces. In 1969, the three Prairie provinces signed the Master Agreement on Apportionment. The PPWB does not have any legislative powers, but provides a forum to promote interprovincial cooperation and discuss and resolve issues among jurisdictions.

The master agreement was drafted to provide equitable sharing of water supplies across the three Prairie provinces, however it was drafted long before climate change became a reality. The current agreement is written to deal with drought only, not with excess moisture. Under the current agreement, Alberta is entitled to keep 50 per cent of the natural flow of any river before it enters Saskatchewan. Likewise, Saskatchewan is entitled to keep 50 per cent of the natural flow of any river before it enters Manitoba.

The International Joint Commission (IJC) is an organization created by the Boundary Waters Treaty signed by Canada and the United States in 1909. It prevents and resolves disputes between the United States and Canada. It rules on applications for approval of projects affecting boundary or transboundary waters and may regulate the operation of these projects. It also assists both countries in the protection of the environment.

It is important that the Government of Canada, along with neighbouring jurisdictions, recognize the unique geographical place occupied by Manitoba. The province sits at the bottom of the very large Hudson Bay watershed that stretches from the Rocky Mountains in the west, northwestern Ontario to the east and the upper Midwest of the United States to the south. Because of its geographical location, Manitoba bears a disproportionate amount of risk for serious watershed-wide flooding.
RECOMMENDED ACTIONS:
The task force recommends that the Government of Manitoba consider the impact of climate change on the province and consider if the PPWB agreement should reflect up to date research and concerns in that regard, covering both excess moisture and drought.

The task force recommends the Government of Canada consider the impact of climate change with respect to international water treaties and urge the International Joint Commission to add mitigation of the impact of climate change to both Canada and the United States as one of its stated objectives.

25 Continue to invest in education and extension programming.

SUMMARY:
History has shown us that one of the best ways to change behaviours is through education. Perhaps more than most people in contemporary society, agricultural producers have a large number of things competing for their attention. Extension programming is required to bring best practices to farms today. Government has an important role to play in educating today’s producers about the many options at their disposal to mitigate and adapt to climate change.

INSIGHTS:
Aside from the very real challenges of running a successful farm today, many farm families are also required to seek off-farm income in order to make ends meet. It is difficult enough to keep up with the daily operations of a farm today, let alone stay current on complex issues such as climate change, novel crops, insurance, best management practices and things like weather derivatives.

Government can and should play an important role by providing education through extension services directly to producers. Government extension services are well suited to support producers by synthesizing and simplifying the volumes of data and information required to run a successful farm operation today. Areas that were identified as needing additional or new extension support including insurance, novel crops, livestock, diversification and crop rotation.

RECOMMENDED ACTIONS:
The task force recommends the federal and provincial governments include in Growing Forward 3, increased provision for education and extension services to the agricultural sector.
References


8. Aon Benfield, 2014 Annual Global Climate and Catastrophe Report


10. See Appendix A: Review of Agriculture Risk Management Programs for a Changing Climate in North America and Internationally, prepared by Darren Swanson, for the International Institute for Sustainable Development.


12. Manitoba Agricultural Services Corporation data.


14. Weather risk management by Saskatchewan agriculture producers, Saqib Khan and Morina Rennie of the University of Regina, and Sylvain Charlebois of the University of Guelph, www.emeraldinsight.com/0002-1466.htm

Appendix
Appendix A: Briefing Note

Review of Agriculture Risk Management Programs for a Changing Climate in North America and Internationally

December 4th 2015

Prepared by:
Darren Swanson, for the International Institute for Sustainable Development (IISD)

Submitted to:
Manitoba Agriculture, Food and Rural Development (MAFRD) Secretariat for the Agriculture Risk Management Review Task Force

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Summary

In January 2015 the Premier of Manitoba formed the Agriculture Risk Management Review Task Force with a mandate to work with industry to ensure that risk management tools are responsive to the changing needs of producers. The International Institute for Sustainable Development (IISD), through its ongoing technical support to the Manitoba government on sustainable development issues, undertook research for the task force secretariat to review agriculture risk management programs for a changing climate in North America and Internationally.

The review of insurance and non-insurance programs for agriculture risk management in North America and internationally produced the following key insights relevant to the Manitoba context.

<table>
<thead>
<tr>
<th>Insights from the Review</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Insight #1:</strong> Computer modelling studies conducted by Agriculture and Agri-Food Canada (AAFC) and the Organization for Economic Cooperation and Development (OECD) suggest that the demand for, and public cost of, crop insurance programming across the Prairie region of Canada is not expected to increase significantly under future climate change [with some caveats, see paper for details].</td>
</tr>
<tr>
<td><strong>Key Insight #2:</strong> Many countries appear to be moving toward the use of multi-peril crop insurance as a tool for helping producers adapt to a changing climate.</td>
</tr>
<tr>
<td><strong>Key Insight #3:</strong> The U.S. Government Accountability Office recommended in 2014 “that the Federal Emergency Management Agency (FEMA) and the Risk Management Agency (RMA) take additional steps to encourage flood and crop insurance policyholders to adopt building and agricultural practices that reduce long-term risk and federal exposure to losses.”</td>
</tr>
<tr>
<td><strong>Key Insight #4:</strong> In a review of agriculture risk management in Canada, the OECD recommended in 2011 to “improve the definition of boundaries between [Business Risk Management] programs and layers of risk.”</td>
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<tr>
<td><strong>Key Insight #5:</strong> To support innovation in the agriculture sector, and to help align farmer expectations of changing climate risk, some jurisdictions are investing in better information for producers on climate impacts, combined with support for innovative adaptation measures (i.e., the British Columbia Climate Action Initiative).</td>
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<tr>
<td><strong>Key Insight #6:</strong> Planning and investment in surface water storage infrastructure at the watershed level is being recommended in other countries for the integrated management of floods and drought risks under climate change.</td>
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<td><strong>Key Insight #7:</strong> Improved landscape modelling and assessment tools are needed for integrated flood and drought risk management</td>
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<td><strong>Key Insight #8:</strong> Aquifer recharge/storage schemes are being tested and proposed at the watershed level in other countries for integrated management of flood and drought risks.</td>
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<tr>
<td><strong>Key Insight #9:</strong> Surface water storage schemes are being tested and proposed at the farm level in other countries for integrated management of floods and drought risks.</td>
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<tr>
<td><strong>Key Insight #10:</strong> An array of farming practices are being suggested by non-governmental organizations and governments to increase resilience under climate change.</td>
</tr>
<tr>
<td><strong>Key Insight #11:</strong> The integration of flood and drought risk management will be essential in a changing climate and can be addressed through a combination of policy and landscape interventions.</td>
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</table>
Context: Weather Whiplash in Manitoba

In January 2015 the Premier of Manitoba formed the Agriculture Risk Management Review Task Force with a mandate to work with industry to ensure that risk management tools are responsive to the changing needs of producers. As the paragraphs below illustrate, the financial cost and social impact of recovering from recurrent flooding and drought are upsetting the development trajectories of rich and poor nations alike and illustrate the urgency and timeliness of the task force’s deliberations.

In recent years, producers in Manitoba have been challenged by a changing climate. For example, in what has been referred to as “weather whiplash”, the 2011 flood cost taxpayers $1 billion with a record one-third of cropland unable to go to seed (Winnipeg Free Press 2011). Yet the flood was immediately followed by two months without any rain, wilting what crops remained (Globe and Mail 2013). One producer described the events as “jarring”, noting that “I could be receiving flood and drought insurance payments at the same time. That’s crazy. You would never believe it to be possible” (Globe and Mail 2013).

This story is not unique to Manitoba. A report by the International Human Dimensions of Global Environmental Change Program cited the above Manitoba experience within the context of similar events in North America and elsewhere (UNU-IHDP 2014). In 2013 for instance, approximately 90 percent of the state of Colorado was in a drought condition. Unprecedented wildfires ravaged 140,000 acres with many ranchers needing to cull their herds due to a lack of feed. But during September a perfect storm converged over the Rocky Mountain state delivering flood damage estimated at $2 billion (Reuters 2013). This was the same year that inflicted Calgary with $6 billion in flood damage (Calgary Herald 2013), making it the most costly natural disaster in Canadian history (CBC 2013, cited in UNU-IHDP 2014).

Also in 2013, “much of Central Europe was affected by extreme flooding in many areas: causing damages to houses, infrastructure, and services (Europa 2013). Then in July, crops in Austria and Hungary were subjected to unusually high temperatures in excess of 40 degrees Celsius which shriveled the harvest (Deutsche Welle 2013, in UNU-IHDP 2014).” Furthermore, in China the same year saw record high temperatures in parts of the country and a drought that caused an estimated USD $2 billion and “affected 2 million hectares of farmland, with about 350,000 hectares unable to be harvested at all (Xinhuanet 2013).” At the same time and in the northern part of China, the Gansu Province received “double the normal annual precipitation and in Tianshui City, four successive rainfall events triggered floods, landslides, and mud-rock flows across seven townships and affecting 1.22 million people (Xinhuanet 2013).”
Purpose and Scope of this Report

The purpose of this report is to summarize the agricultural risk management approaches of other jurisdictions in North America and internationally in the context of a changing climate and to glean critical insights for improving risk management programming in Manitoba.

This report researches insurance and non-insurance programs that are being used in other jurisdictions to manage agricultural risk in a changing climate. Non-insurance programs include disaster recovery policies and mechanisms as well as landscape-level management initiatives that increase the coping and adaptive capacities of producers.

The geographic scope of this report includes other Canadian provinces, the United States, Australia, Europe, and other international jurisdictions across Asia and Latin America.

Risk Management Programs and Insights

Manitoba producers have access to a suite of business risk management tools under the federal government’s Growing Forward 2 Agriculture strategy, including AgriInsurance, AgriStability, AgriInvest and AgriRecovery (AAFC 2015). This section reviews analogous programs in other countries that have been created or modified in response to a changing climate.

Crop Insurance Programs

**Key Insight #1:** Computer modelling studies conducted by AAFC and the OECD suggest that the demand for, and public cost of, crop insurance programming across the Prairie region of Canada is not expected to increase significantly under future climate change [see details below for exceptions].

Two recent studies on the AgriInsurance program were conducted by Agriculture and Agri-Food Canada (AAFC) and the Organization for Economic Cooperation and Development (OECD). In 2012, AAFC studied the resiliency of the Canadian crop insurance program under climate change using an integrated modelling approach (AAFC 2012a and AAFC 2012b). Global circulation models (GCMs) were coupled with the Environmental Policy Integrated Climate (EPIC) crop growth model and the agency’s regional, partial equilibrium, optimization model (CRAM) to perform over 10,000 Monte Carlo simulations on the resiliency of the crop insurance system. The AAFC modelling effort revealed the following:

“…that the average annual deficit for the programme (extent to which payouts exceeded premiums paid by both producers and government) remained similar when the results for the historic period were compared to the future climate change scenarios. In fact the deficit declined slightly with climate change, in part owing to lower average yields and therefore slightly lower exposure (AAFC 2012a).”

Also in 2012, the OECD undertook a comparative assessment of agriculture risk management tools under climate change in Canada, Australia and Spain. Using a stochastic micro-simulation model calibrated
on different types of individual crop farms in the three countries, the OECD researchers studied “the demand and effectiveness of different risk management policy tools which are affected in different ways by climate change (OECD 2012).” The ‘hypothetical’ risk management tools simulated under a ‘marginal’ climate change scenario across the three countries included: (i) individual yield insurance triggered by observed yield shocks on the farm; (ii) area yield insurance triggered by a reduction in the average yield in a given location; (iii) weather index insurance triggered by a rainfall index built from the nearest meteorological station; and (iv) ex post payments triggered by a large systemic shock.

The OECD simulations for Canada were based on 457 crop farms in Saskatchewan producing wheat, barley and canola. The results of the modelling effort revealed the following:

“Demand for insurance is not expected to significantly increase under climate change given that the simulated scenarios imply reductions of variability rather than increases. In fact climate change hardly modifies the level of insurance demand. However, it increases insurance demand in some cases (high risk farms) and, in particular, in the extreme events scenarios that imply significant increases in the standard deviation of yields (OECD 2012, p. 70).”

The OECD study took the analysis further by discussing the budgetary implications of climate change on different types of insurance programs. Among their conclusions were the following (OECD 2012, p. 72):

• “Weather index insurance is the cheapest instrument for the government and its budgetary costs remain reasonable even under the scenarios of extreme event and misalignment.”
• “Individual yield insurance becomes the most expensive under the climate change scenarios, while budgetary outlays for area yield insurance are maintained at lower levels.”
• “As long as there is no misalignment in expectations about climate outcomes, the cost of instruments does not increase radically with climate change; however, governments need to be aware of the possibility of extremely high budgetary costs under misalignment, especially in the case of area-yield insurance.”

Lastly, a modelling study was commissioned by the U.S. Department of Agriculture in 2010 that integrated global climate models with the EPIC model, the Forest and Agricultural Sector Optimization Model (FOSOM), actuarial models and the Standard Re-insurance Agreement (SRA) model (RTI International 2010). The study assessed the future financial returns to the Federal Crop Insurance Corporation (FCIC) and the private approved insurance providers (AIP) under the Standard Re-insurance Agreement (SRA).

Among the results were the following (RTI International 2010, p. 5-6):

“In general, the crop insurance program may be impacted by changes in the expected losses that necessitate modification to the program to maintain actuarial soundness. However, to the extent that these changes occur very gradually over time, they may be largely handled through the normal annual updating process for insurance programs. The larger issue is the extent to which conditions in the near future can no longer be predicted reasonably well based on historical experience because conditions are changing too rapidly, certain crop/region combinations begin hitting temperature or water availability thresholds that have large non-linear negative yield effects, or there are changes in the probability of other catastrophic events that would increase requirements for the disaster reserve factor to adequately account for such events.”

1 Note that ‘high risk’ farms were 16% of farms simulated and that ‘Climate change’ is based on a ‘marginal scenario’ in which “production risk and the most reliable numbers gathered by the Inter-Governmental Panel on Climate Change (IPCC)” are used (OECD 2012, p. 11). The ‘extreme events scenarios’ includes a “likely higher frequency of extreme events. (OECD 2012, p. 11).”
2 “Misalignment” refers to a type of adaptation response by farmers, specifically: “no response due to ignoring climate change.”
Additionally, based on this modelling study the following was recommended with regard to the future development of the crop insurance program in the U.S. (RTI International 2010, p.5-6):

“...the need to develop rates, loss adjustment standards, underwriting standards, and other insurance program materials that are appropriate for new production regions or for changes in practices within existing regions. For instance, areas that have not relied heavily on water-saving practices or irrigation in the past may begin switching to those practices in the future if drying occurs in their region. Other regions may move in the opposite direction. Either would tend to make historical yield data less useful for predicting future yields. Certain crop varieties may also offer considerably better yields than others under hot, wet, or dry conditions. Generally, it is likely that there will need to be greater resources devoted to modelling the effects of the more rapidly changing conditions and practices that are expected under climate change and appropriately include them with insurance policy specifications, loss adjustment standards, and underwriting standards.”

**Key Insight #2:** Many countries appear to be moving toward the use of multi-peril crop insurance as a tool for helping producers adapt to a changing climate.

A review of agriculture risk management approaches internationally reveals that many countries are either expanding their crop insurance programs, or where they didn’t already exist, are exploring crop insurance as a means for adapting to a changing climate.

In Australia for example, where multi-peril crop insurance is not offered by the government due to the high public cost, commercial crop insurance programs are emerging to meet a growing demand from producers, despite the high premiums which approach $30,000 USD (ABC News 2015). And the Government of Australia in its recent White Paper on Agricultural Competitiveness is providing $30 million in funding for farm insurance advice and grants to help cover assessments required by commercial insurance programs (Australian Government 2015). A review of Australia’s agriculture risk management approaches by the OECD made special note of the country’s need “to refocus from mitigating financial impacts of short-term adverse climatic events to facilitating farmers’ adaptation to changing climate (OECD 2011b).” Among the report’s recommendations in this regard was to “explore the possibility to develop insurance markets for drought risk.”

Nnadi et al. (2013) report on insurance as a strategic tool for climate change adaptation in the agricultural sector in Africa, noting that “traditional adaptation practices alone cannot sustain the farmers in the face of changing climatic scenarios.” In India, insurance schemes including the National Agricultural Insurance Scheme, NAIS (area based crop yield insurance) and the pilot Weather Based Crop Insurance Scheme, WBCIS (area based rainfall insurance) are already in place and are being explored as an adaptation approach for climate change (Swain 2014). In the context of developing economies, weather-indexed insurance is increasingly being looked at as a climate risk management tool, due to its lower transaction costs and information requirements (Hellmuth et al. 2009).

In the United States under the 2014 Farm Act it is stated that “crop insurance is the major USDA program for helping farmers manage risks of crop losses (USDA 2015).” The size of the federal crop insurance program has grown from 90 million acres insured in 2000 to over 295 million acres in 2013. Additionally, “Under the current premium subsidy structure, about 62 percent of total premiums, or more than $11.5 billion in 2013, is paid by the Federal Government on behalf of insured producers.” The 2014 Farm Act also introduced two new insurance programs in the Supplemental Coverage Option (SCO) –
offering producers additional insurance coverage for losses that fall under the levels generally covered by standard crop insurance policies, and the Stacked Income Protection Plan (STAX) – providing revenue insurance policies to producers of upland cotton.

Agricultural policy in the European Union has evolved on a quite different track relative to the United States. A 2014 study by the European Parliament characterized the difference as follows (European Parliament 2014):

- **US**: 60% insurance, 40% safety nets, 0% income support with direct payments; and
- **EU**: 1% insurance, 39% safety nets, 60% income support with direct payments.

However, the European Common Agricultural Policy (CAP) has included for the first time a Risk Management Toolkit. The toolkit has three components, namely: (1) Crop, animal, and plant insurance (insurance premiums); (2) Mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents; (3) Income stabilisation tool (Costumt 2014). Insurance programs are available in several European countries and France for instance, has recently accelerated their shift from “limited crop insurance (hail, frost) to multiple peril crop insurance, including drought for grains (European Parliament 2014, p. 55).”

**Key Insight #3:** Studies undertaken by the U.S. Government Accountability Office (GAO) and the OECD warn of the downside of using crop insurance programs in the context of a changing climate in that they do not incent farm-level risk management practices. The U.S. GAO recommended in 2014 “that the Federal Emergency Management Agency (FEMA) and the Risk Management Agency (RMA) take additional steps to encourage flood and crop insurance policyholders to adopt building and agricultural practices that reduce long-term risk and federal exposure to losses.”

In 2014 the U.S. Government Accountability Office reported that “from 2000 to 2006, the federal crop insurance program’s exposure grew from $45.5 billion to $56.9 billion (25 percent) compared with 68 percent from 2007 to 2013, adjusted for inflation. Also, as a share of total federal exposure, in 2006, federal crop insurance comprised 5 percent of total federal exposure, compared to 9 percent in 2013.” This set the context for the U.S. GAO’s study on climate change and overall conclusion that “better management of exposure to potential future losses is needed for federal flood and crop insurance.” Among the key conclusions from the report are the following:

“while federal law prohibits crop insurance from covering losses due to a farmers’ failure to follow good farming practices, such as various irrigation methods, some of these practices maintain short-term production but may inadvertently increase the vulnerability of agriculture to climate change through increased erosion and inefficient water use. A recent executive order directed federal agencies to reform policies that may, perhaps unintentionally, increase the vulnerability of economic sectors or communities to climate change. Without encouraging NFIP and crop insurance policyholders to adopt building and agricultural practices that reduce long-term risk, FEMA and RMA may send policyholders signals that unintentionally encourage their vulnerability to climate change, counter to the direction of the executive order, which could exacerbate federal exposure to losses (US GAO 2014, p. 2).”

The U.S. GAO report acknowledged the efforts of the Federal Emergency Management Agency (FEMA) and the Risk Management Agency (RMA) in considering climate change in its planning, but encouraged additional action to reduce federal exposure to climate risk. In this regard the report concluded the following:
“FEMA and RMA have commissioned climate change studies, incorporated climate change adaptation into their planning, and taken other steps to address aspects of their federal flood and crop insurance programs that create fiscal exposures associated with climate change and extreme weather. However, the agencies continue to face fundamental challenges that send inaccurate price signals to policyholders about their potential risk of loss and increase federal fiscal exposure, and may unintentionally increase their policyholders’ vulnerability to climate change risks. We have previously concluded, among other things, that reducing subsidies and charging full-risk premiums to individual policyholders would decrease the federal government’s fiscal exposure under the flood and crop insurance programs (U.S. GAO 2014, p. 30).”

Similarly, a 2011a OECD report found that agriculture risk management in Canada is “overcrowded with policies and unable to signal risk layers in which farmers should take their own responsibility of management (OECD 2011a).” The report identifies that “the major policy challenge in Canada is to maintain farmers’ incentives to proactively develop risk management strategies and improve the targeting policies to income risk.” The report makes the general recommendation to “empower farmers to take ownership of their own business risk management” and that “reducing the role of the government in risk management is a first step in allowing proactive approaches to risk management to emerge”. The OECD proceeds to recommend three additional means for empowering the risk management abilities of farmers (OECD 2011a, p. 73):

a) “Help establish market instruments. Market mechanisms like options, futures and other hedging mechanisms are effective private risk-management tools. Government can play a role in establishing and supporting the trading of such instruments through addressing missing markets and providing information. Programs such as the Cattle Price Insurance Program in Alberta can help reduce barriers to entry by simplifying access to hedging instruments and reducing transaction costs while keeping farmers’ responsibility to pay the premium.

b) Support diversification strategies. The export-dependence of the sector is a particular problem for prairie agriculture, exposing farmers and ranchers to exchange rate and trade risks. Helping to develop and diversify export markets can help reduce exposure to these risks and contribute to the overall diversification at the farm level. Developing domestic market infrastructure and alternative marketing tools can help producers diversify their operations.

c) Support innovation in the sector. The ability of the Canadian farmer to produce a consistent crop in the face of difficult conditions has improved greatly in the past century, thanks to innovations in technologies and practices that reduce the impact of weather variability and the damaging effects of pests and disease. The government will always have a role to play in promoting innovations in the sector, and should redirect resources away from traditional business risk management programming towards this area.”

The above recommendations are again reflected by the OECD in their 2012 analysis of the impacts of climate change and crop insurance mechanisms in Canada (using Saskatchewan data). The OECD climate change analysis describes the implications of misalignment, which refers to the case in which there is no response by farmers due to ignoring climate change. The specific conclusion about crop insurance made in this regard was: “As long as there is no misalignment in expectations about climate outcomes, the cost of instruments does not increase radically with climate change; however, governments need to be aware of the possibility of extremely high budgetary costs under misalignment, especially in the case of area-yield insurance (OECD 2012, p. 72).”

As an additional note on the influence of subsidized insurance on behaviour, a 2006 paper by McLeman and Smit examining crop and flood insurance reported that in New Zealand when subsidies for crop
insurance were removed “production intensity, development of new/marginal lands, fertilizer use and cropping of high risk land all decreased when subsidies were eliminated (McLeman and Smit 2006, cited in Meyers 2008).” Although it was also noted that some of these improvements in practice were only short term (Bradshaw and Smit 1997, cited in Meyers 2008).

Non-insurance Programs

Reviewed in this section are studies that provide insights for the other three business risk management programs available to Manitoba producers, namely AgriInvest, AgriRecover, and AgriStability.

**Key Insight #4:** In a review of agriculture risk management in Canada the OECD recommended in 2011 to “Improve the definition of boundaries between [Business Risk Management] programs and layers of risk.”

In its 2011 study on agriculture risk management in Canada the OECD concluded that “The major policy challenge in Canada is to maintain farmers’ incentives to proactively develop risk management strategies and improve the targeting policies to income risk.” The report goes on to state that “In most cases, this means that the government should do less rather than more, and do it more simply. True targeting of income risk is difficult by the very nature of the problem, and Canada has taken policy design in this area as far as it can go. More information and detail lead to more delay, and more complexity leads to producer uncertainty about the benefits of the programme. These problems cannot be resolved by simply doing the current approach better (OECD 2011a, p. 73).”

FIGURE 1. Summary of risk management programs in Canada (from OECD 2011).

While this study did not deal with climate change specifically, it did make a number of cogent recommendations for the improvement of the full suite of business risk management programs in Canada, namely (OECD 2011a, p. 73):

a) “Keep AgriInvest and allow it to take over part of “Tier 2” coverage. This programme does not greatly interfere with farmer decision-making and can help farmers to develop risk management.

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3 See Figure 1 for description of tiers (i.e., layers).
Appendix A

strategies through its incentives to save for the future.

b) **Refocus AgriStability on the medium range of risks (non-catastrophic and nonnormal risk).** “Stabilization” tier 2 coverage of small “normal” risks was seen to be ineffective at reducing risk while at the same time causing the most interference with private risk management strategies. Additionally, AgriStability seems unable to provide a viable response to catastrophic events due to the delay between the income loss and the payment.

c) **Address the overlap between AgriStability and AgriInsurance by requiring farmers to choose between them.** AgriStability is partly covering the “market” layers of risk and competing with other market strategies including crop yield insurance. The system could be improved by allowing farmers to choose between two alternative programs, AgriStability and AgriInsurance, depending on the risk environment they are exposed to. Producers will reveal their risk preferences enabling better targeting of programme benefits and give valuable feedback for programme design. The participation fee in AgriStability could be increased appropriately to compete with crop insurance and converted to a premium that can be adapted to the risk of each farm so that the scope for moral hazard is reduced.

d) **Clarify the role and purpose of AgriRecovery.** Catastrophic assistance under AgriRecovery should be framed within more strict protocols and disciplines that should apply also to all ad hoc payments to farmers.”

With regard to non-insurance agriculture risk management programs in the United States under the 2014 Farm Bill, disaster assistance has been virtually eliminated as evidenced by the statement on the USDA website: “Given the current budget situation and the recent focus on revenue-based programs, the likelihood of future ad hoc disaster programs for crops is low. Significantly, there have been no ad hoc disaster payments following the severe droughts that have occurred over the last several years.” Additionally, the USDA notes that “subsidized crop insurance remains the primary form of assistance provided by the Federal Government against bad weather, plant diseases, and other natural hazards.” However, the 2014 Farm Act changed the mix of programs available to producers (USDA 2015). Among the programs that were repealed were Direct Payments, Countercyclical Payments, and the Average Crop Revenue Election (ACRE) program. The non-insurance programs introduced and retained in the 2014 Farm Act include:

- **The Price Loss Coverage (PLC) program** (new): Provides payments to producers of wheat, feed grains, rice, oilseeds, peanuts, and pulses on a commodity-by-commodity basis when market prices fall below a reference price.
- **The Agricultural Risk Coverage (ARC) program** (new): Provides payments for covered commodities on a commodity-by-commodity basis when county crop revenue drops below 86 percent of benchmark revenue.
- **Noninsured assistance program (NAP)** (expanded): Payments are made to producers of crops for which crop insurance is unavailable in that county.
- **The Livestock Forage Disaster Program, the Livestock Indemnity Program, the Emergency Assistance for Livestock, Honey Bees, and Farm Raised Fish, and the Tree Assistance Program** (retained): Provides payments to producers of eligible commodities for losses incurred as a result of diseases, adverse weather, or other environmental conditions.
- **Emergency loans** (retained): have been provided on various occasions to farmers as part of broad disaster assistance packages. Loans are generally repaid to the Government at reduced interest rates.
- **Emergency feed assistance programs** (retained): have helped livestock producers obtain feed when local pasture, hay, and forage supplies have been limited due to drought or other adverse conditions.
- **Marketing assistance loans** (retained): Allows farmers to obtain a loan for their commodity at the loan rate and repay it later at a lower loan repayment rate.
In Australia the government’s White Paper on Agricultural Competitiveness lists a number of non-insurance programs to strengthen the approach to drought and risk management. Among the programs designed to help farmers prepare for drought are (Australian Government 2015): improvements to climate forecasting; accelerated depreciation incentives for building on-farm fodder storage assets and water facilities; and making Farm Management Deposits (FMDs)4 more beneficial and attractive to support good business management. Among the programs designed to support farmers during drought are: Drought Concessional Loans; increase Farm Household Allowance case management for farmers to help them make informed decisions about their business’ future; Farmers in drought will be able to access their FMDs when needed in a drought; Increased financial counselling services and improved access to community mental health; support for local infrastructure projects to help communities suffering due to drought; and support to manage pest animals and weeds in drought-affected areas.

In the European Union the Common Agricultural Policy is advancing two specific non-insurance risk programs in the form of: (1) Mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents; and (2) an Income stabilisation tool (Coturni 2014).

**Key Insight #5:** To support innovation in the agriculture sector, and to help align farmer expectations of changing climate risk, some jurisdictions are investing in better information for producers on climate impacts combined with support for innovative adaptation measures.

Neither insurance nor income stabilization programs on their own will be effective in supporting adaptive measures by producers. For example, the OECD study described previously referred to the importance of “alignment of expectations” about climate change between farmers and insurance providers. As an example of a response to support innovation in the sector, and to help align farmer expectations of changing climate risk, some jurisdictions are investing in better information for producers on climate impacts combined with support for innovative adaptation measures.

The Climate Action Initiative (CAI), in the province of British Columbia, supports the assessment of climate impacts and tests agricultural adaptation measures in the province’s regionally diverse climate zones and agro-ecosystems. The CAI is designed as a limited-duration program to support diagnosis of emerging climate risks in the agriculture sector, and to test innovative production practices for climate risk management. It is probably the leading program of its type in the country. The CAI was established in 2008 as a joint initiative by the Ministry of Agriculture, the B.C. Agriculture Council, and the Investment Agriculture Foundation. CAI supports producers with a wide range of tools and resources on its website and through social media.5

Based on a sector-wide action plan (Climate Action Initiative, 2010), CAI produced six regional/commodity sector adaptation risk and opportunity assessment reports based on climate modeling and industry consultation in 2012. Since 2013, CAI has been funded by the Province and the federal government through the innovation component of Growing Forward 2, but it continues to be implemented by the B.C. Agriculture Research and Development Corporation and the Investment Agriculture Foundation.

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4 The FMD Scheme assists primary producers to deal more effectively with fluctuations in cash flows. It is designed to increase the self-reliance of Australian primary producers by helping them manage their financial risk and meet their business costs in low-income years by building up cash reserves. The scheme allows eligible primary producers to set aside pre-tax income from primary production in years of high income, which they can draw on in years of low income. Income deposited into an FMD account is tax deductible in the financial year the deposit is made. It becomes taxable income in the financial year in which it is withdrawn. [Source: Australian Government 2015b]

Its main activities have included:

- **Regional Agricultural Adaptation:** Comprehensive regional adaptation strategies have been developed in consultation with producers, producer associations, and other industry stakeholders, for the Cowichan, Peace, Delta, Cariboo, and Fraser Valley areas, and the Okanagan is underway. Once regional adaptation strategies are prepared, funding is available to implement regional adaptation projects to develop adaptation responses for the priorities identified by a local working group and the CAI; and

- **Farm Adaptation Innovator Program:** Provides funding for innovative farm-level adaptation, risk reduction practices and new production opportunities. The program also emphasizes communication of results and sharing of knowledge and resources through industry associations, networks and support organizations.

The CAI is the main vehicle through which the B.C. Ministry of Agriculture supports climate change adaptation in this sector. In addition to the GF2 funding provided, technical staff from Ministry programs and regional offices play key advisory roles in the regional and farm-level projects. Pilot projects and farm-level innovations are cost-shared, with collaborative roles played by local governments, industry partners and local producer groups. CAI products and results from on-farm and regional pilots are widely shared with Ministry staff and the public.

The CAI has over two dozen regional adaptation projects underway or completed, and is starting to develop its farm-level innovation projects (5 so far) with producers (B.C. Ministry of Agriculture, 2015). The program has already raised awareness by producers of climate risks in different regions of the province, and intends to accelerate farm-level innovation in responding to these risks. Studies of improved practices include farm-level and landscape-level improvements to drainage, water management, shelterbelts and forestry, as well as industry-specific measures.
Landscape Management Programs and Insights

This section provides a review of landscape management programs in jurisdictions outside of Manitoba which are used, at least in part, for purposes of climate change adaptation and agriculture risk management.

Watershed Level

**Key Insight #6:** Planning and investment in surface water storage infrastructure at the watershed level is being recommended in other countries for the integrated management of floods and drought risks under climate change.

In its 2014 report on Land, Water and People, the International Human Dimensions of Global Environmental Change Program (IHDP) made the following observation relevant for regions prone to floods and drought (UNU-IHDP 2014):

“In integrated land and water management is absolutely essential in regions stressed by both floods and droughts. Without integrated management, achieving development progress in these regions will be similar to walking up a downward moving escalator. In other words, the majority of public and private investment will be consumed by continual and costly repairs to existing infrastructure, leaving little to no fiscal resources for advancing human well-being and sustaining ecosystems for current and future generations.”

In relation to the integrated management of floods and droughts there are many instances where surface water storage programs are being proposed as a climate change risk management approach. For example, McCartney et al. (2013) in a report from the International Water Management Institute (IWMI) advocate for the use of agricultural water storage as a climate change adaptation approach in Africa. They noted that “In the past there has been considerable emphasis on large-scale infrastructure but other options need to be considered that incorporate the beneficial aspects of natural wetlands, soil moisture, groundwater aquifers, ponds, small tanks and reservoirs (Figure 2). The effectiveness of each option varies and none is likely to be a solution on its own. However, broadly speaking, the deeper and/or larger the storage, the more reliable the water supply it provides; and the more ‘natural’ it is, the less complex and less costly it is to develop and access.” It was concluded that “Agricultural water storage in its various different forms, if planned and managed correctly, can increase water security and make an important contribution to safeguarding livelihoods and reducing rural poverty (McCartney et al. 2013).”
The Australian Government, taking note that it is “the driest inhabited continent on Earth” and seeing evidence of per capita water storage declining in the country, announced a new $500 million National Water Infrastructure Development Fund in its White Paper on Agricultural Competitiveness to support the planning and construction of water infrastructure for securing Australia’s water supplies (Australian Government 2015c).

**Key Insight #7:** Improved landscape modelling and assessment tools are needed for integrated flood and drought risk management.

With regard to the implementation of infrastructure at the watershed level for the integrated management of flood and drought risks, the 2014 report of the International Human Dimensions of Global Environmental Change Program noted that “there is also a need for better assessment and forecasting tools for informing integrated land and water policies and programmes, including access to high resolution topographic and other information. Where this gap prevents the proper assessment of landscape change there will exist a lack of understanding of the broad benefit and trade-offs of land and water management decisions and programmes (Liu et al. 2013, in UNU-IHDP 2014).

Additionally, in the context of exploring the continuum of water storage options on the landscape for integrated flood and drought management, the International Water Management Institute developed a Water Storage Management Tool to help provide a rapid assessment of the need and effectiveness of specific agriculture water storage schemes (McCartney et al. 2013).

**Key Insight #8:** Aquifer recharge/storage schemes being tested and proposed at the watershed level in other countries for integrated management of flood and drought risks.

The IMWI reported on ‘future-proofing’ water and made the recommendation to “rethink water storage
emphasizing underground opportunities to minimize impacts of variability and utilize the storage continuum (see Figure 2) (IWMI 2013).” In Thailand, a 2012 study in the country’s Chao Phraya River Basin identified that “downstream-focused engineering solutions that address flooding are vital, but do not necessarily capture the potential for basin-scale improvements to water security, food production and livelihood enhancement (Pavelic et al. 2013).” Instead, the researchers of the study advocate that “managed aquifer recharge, typically applied to annual harvesting of wet season flows in dry climates, can also be applied to capture, store and recover episodic extreme flood events in humid environments.” In the Chao Phraya River Basin this involves “capturing peak flows approximately 1 year in four by dedicating around 200 km² of land to groundwater recharge”. It is suggested that this would in turn “reduce the magnitude of flooding and socio-economic impacts and generate around USD $250 million per year in export earnings for smallholder rainfed farmers through dry season cash cropping without unduly compromising the demands of existing water users.”

In the state of California, the Stanford Woods Institute for the Environment makes the following observation related to the potential to store water in aquifers as a drought risk management approach:

“Now in its third year, the current drought reminds us that California’s water supplies are limited. Calls are growing louder to enlarge dams – or build new ones – to expand the state’s water storage capacity. But far less attention is given to a cheaper but less visible option – storing water under our feet (Stanford University 2015).”

In this drought context the Stanford researchers suggest that “groundwater storage represents both a practical solution to the state’s additional water storage needs and a tool to help manage groundwater more sustainably. Groundwater levels are continuing to decline across the state, not just from California’s current drought, but from decades of chronic overuse. Augmenting water supply through recharge into aquifers presents a cost-effective way of increasing the availability of groundwater for the inevitable dry times ahead (Stanford University 2015).”

**Farm Level**

**Key Insight #9:** Surface water storage schemes are being tested and proposed at the farm level in other countries for integrated management of floods and drought risks.

Surface water storage, in both built and natural forms, is also being proposed at the farm level as a climate change risk management approach. In the state of Indiana, researchers studying wetlands as a form of green infrastructure for the dual purpose of groundwater recharge and storing excess rainfall found that creating wetlands on 1.5% of the landscape can reduce peak floods by 29% (EDF 2015).

Alberta’s new Watershed Resiliency and Restoration Program illustrates that there is increased interest in paying farmers to invest in this type of green infrastructure (in EDF 2015). The objective of this government program is “to increase the natural ability of the province’s watersheds to reduce the intensity, magnitude, duration, and effects of flooding and drought through watershed mitigation measures (ESRD 2015).”

Similar flood and drought management objectives can be achieved through the use of built landscape infrastructure at the farm level. For instance, starting in 2002 researchers at the University of North Dakota’s Energy and Environment Research Center began advancing the ‘waffle’ concept as a tool for water management in the Red River Basin (Kurz et al. 2008). The ‘waffle’ concept is about small-scale
distributed water storage and takes advantage of the state’s extensive raised road network, existing low relief areas, and drainage structures to temporarily store excess water until after flood waters have passed. Analysis of the economics of the ‘waffle’ concept across the Red River Basin suggest direct net benefits on the order of $350 to $400 million (DeVuyst et al. 2009, cited in UNU-IHDP 2014).

Field Level

**Key Insight #10:** An array of farming practices are being used by producers and are being suggested by non-governmental organizations and governments to increase resilience under climate change.

As part of its recommendations on climate change and agriculture recommendations for the U.S. Farm Bill Conservation Program Implementation, the National Sustainable Agriculture Coalition drew attention to the USDA’s 2013 Climate Change Effects and Adaptation report which “found that sustainable agriculture practices and systems can improve the ability of agriculture to adapt to a rapidly changing climate (NSAC 2014).” Specifically, the USDA report cited the following types of adaptation measures that can be implemented:

- Diversifying crop rotations;
- Integrating livestock with crop production systems;
- Improving soil quality;
- Minimizing off-farm flow of nutrients and pesticides; and
- Production practices that enhance the ability of healthy soils to regulate water resource dynamics at the farm and watershed scales.

Additionally, the Environmental Defense Fund in the U.S. promotes the implementation of ‘green infrastructure’ for agriculture adaptation to climate change including such field-level practices as:

- “Conservation tillage, which prevents soil erosion and helps keep water on the farm to reduce floods and cope with drought. Estimates are that reduced tillage increases water infiltration by 30-45% – a huge saving for farmers with irrigated cropland; and
- Cover crops, whose deep root systems help expand the soil’s capacity to store water, and their leaves help move water from the soil to the atmosphere, so they can reduce the impacts of floods and droughts (EDF 2015).”
Integration of Risk and Landscape Management

**Key Insight #11**: The integration of flood and drought risk management is cited as being essential in a changing climate and can be addressed through a combination of policy and landscape interventions.

The top recommendation of the 2014 report of the International Human Dimensions of Global Environmental Change Program on Land, Water and People was the following (UNU-IHDP 2014):

> *An Urgent Need for Integrated Flood and Drought Policy:* Reducing water resource variability—which is instrumental for both floods and droughts can significantly enhance global GDP and reduce loss of life and property damage. There needs to be a greater understanding among decision-makers at all levels about hotspots where drought and flood issues converge and the importance of seeking landscape level changes that have co-benefits for floods and drought. Several integrated river basin management projects during the last decade have shown that the collaboration and integration of different sectors is fruitful and supports sustainable water and land use development."

Additionally, the Australian Government’s 2015 White Paper on Agriculture Competitiveness has made a move toward such an integrated policy and landscape approach as evidenced by its 2nd and 3rd priorities relating to water security infrastructure and drought risk management policy measures, and its 4th priority dealing with farm and field level interventions (Australian Government 2015).

- **Priority 1 – A fairer go for farm businesses**: Helping farmers achieve better farm gate returns with fairer competition, better regulation and improved tax system
- **Priority 2 – Building the infrastructure of the 21st century**: Planning ahead and thinking innovatively about infrastructure, including securing water supplies
- **Priority 3 – Strengthening our approach to drought and risk management**: Practical measures to help manage drought and other risks facing farmers
- **Priority 4 – Farming smarter**: Access to advanced technologies and practices including better R&D and skilled workers
- **Priority 5 – Accessing premium markets**: Improving international trade to grow farm businesses
Many of these insights gleaned from programs being implemented in other jurisdictions are already being explored to varying degrees in Manitoba and provide a good foundation for improving risk management programming. For example:

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<tr>
<th>Insights from Literature Review</th>
<th>Relevance of Insights to Manitoba</th>
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<tr>
<td><strong>Key Insight #1:</strong> Computer modelling studies conducted by AAFC and the OECD suggest that the demand for, and public cost of, crop insurance programming across the Prairie region of Canada is not expected to increase significantly under future climate change.</td>
<td>The AAFC crop insurance resiliency modelling was conducted using data from Manitoba, Saskatchewan and Alberta and the OECD modelling used Saskatchewan data.</td>
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<td><strong>Key Insight #2:</strong> Many countries appear to be moving toward the use of multi-peril crop insurance as a tool for helping producers adapt to a changing climate.</td>
<td>AgriInsurance is a core pillar of the Growing Forward suite of business risk management tools in Manitoba and research conducted in 2008 by the University of Manitoba and IISD under the Prairie Climate Resilience Program revealed that AgriInsurance is among the top risk response strategies of producers and has performed well as evidenced by producer comments6 (Meyers 2008, p. 50, 62 and 73).</td>
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<tr>
<td><strong>Key Insight #3:</strong> The U.S. GAO recommended in 2014 “that the Federal Emergency Management Agency (FEMA) and the Risk Management Agency (RMA) take additional steps to encourage flood and crop insurance policyholders to adopt building and agricultural practices that reduce long-term risk and federal exposure to losses.”</td>
<td>The potential for crop insurance to incent maladaptive practices was observed in Manitoba by Meyers (2008, p. 74) in research conducted under the Prairie Climate Resilience Project. It was observed that “during the wet periods of 1999 and 2005 the government made two key amendments to the Crop Insurance program that influenced the wait out response. First, the extension of sowing deadline dates later into the spring was negatively perceived by many producers.”7</td>
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<td><strong>Key Insight #4:</strong> In a review of agriculture risk management in Canada the OECD recommended in 2011 to “Improve the definition of boundaries between [Business Risk Management] programs and layers of risk.”</td>
<td>The OECD recommendations were made based on analysis of farm data from neighboring Saskatchewan.</td>
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6  Producer comment: ‘Weather is unpredictable, and CI is the only option … they need to keep those options – CI is predictable, you know your level of coverage, what you’re getting it for – you can go ahead and move forward – ad hoc payments are OK, but unpredictable’ (Respondent 59) (Meyers 2008, p. 73).

7  Producer comment: ‘Crop Insurance drove some of the poor decisions made in the spring of 1999 – the late seeding deadline led to recklessness, and the coverage afterwards doesn’t cover the costs incurred … they need to stop extending the seeding deadline – here, it is craziness to seed beyond and sets you up for a total wreck in the fall’ (Respondent 22) (Meyers 2008, p. 74).
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<td><strong>Key Insight #5:</strong> To support innovation in the agriculture sector, and to help align farmer expectations of changing climate risk, some jurisdictions are investing in better information for producers on climate impacts combined with support for innovative adaptation measures.</td>
<td>Programming for climate change adaptation in Manitoba is ongoing. Examples from other jurisdictions can help with continuous improvement. For example, the Climate Action Initiative in the province of British Columbia, supports the assessment of climate impacts and tests agricultural adaptation measures in the province’s regionally diverse climate zones and agro-ecosystems.</td>
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<td><strong>Key Insight #6:</strong> Planning and investment in surface water storage infrastructure at the watershed level is being recommended in other countries for the integrated management of floods and drought risks under climate change.</td>
<td>Examples of planning and investment in water storage and diversion include the Winnipeg Floodway and the Portage Diversion. One of the three pillars of Manitoba’s Surface Water Management Strategy is preparing for extreme events and addresses water retention and storage, drought preparedness, and flood management and mitigation (Manitoba Government 2015). A 2012 note on ‘Provincial Planning on Adaptation for Excessive Moisture in the Manitoba Interlake Region’ addressed watershed and farm scale practices for dealing with the risks of excess moisture, including drainage systems (MCWS 2012).</td>
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<td><strong>Key Insight #7:</strong> Improved landscape modelling and assessment tools are needed for integrated flood and drought risk management</td>
<td>Proposals such as the development of a HydroGeoSphere (HGS) modelling platform for the Assiniboine River Basin by the Waterloo-based Aquanty Inc. and submitted to the Manitoba Forage and Grasslands Association are designed to address landscape modelling and assessment needs in Manitoba for integrated flood and drought management.</td>
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<td><strong>Key Insight #8:</strong> Aquifer recharge/storage schemes being tested and proposed at the watershed level in other countries for integrated management of flood and drought risks.</td>
<td>The 2003 Manitoba Water Strategy recognized that “the knowledge and management of ground water sources is incomplete” as is “comprehensive hydrological and ground water supply data” (MCWS 2015).</td>
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</table>

8 “...new integrated thinking about drainage aims to sustain a prosperous agricultural sector while protecting and improving the health of our watersheds. Reviving and enhancing the natural storage capacity and resiliency of watersheds will help to address flood, drought, and nitrogen and phosphorus run-off, producing a triple dividend for Manitobans (Manitoba Government 2015).”
<table>
<thead>
<tr>
<th>Insights from Literature Review</th>
<th>Relevance of Insights to Manitoba</th>
</tr>
</thead>
</table>
| **Key Insight #9:**  
Surface water storage schemes being tested and proposed at the farm level in other countries for integrated management of floods and drought risks. | Ongoing research at the University of Manitoba recommends a three-part approach for integrated flood and drought risk management including water management at the watershed, farm and plant scale (Lobb 2015), including improved drainage systems. The ALUS (Alternative Land Use Services) program has been proposed and tested by the Keystone Agriculture Producers (KAP) and now is being applied in four provinces across Canada (ALUS 2015). Research conducted by Meyers (2008, p. 74) in Manitoba under the Prairie Climate Resilience Project observed that drainage was a key response strategy for producers in some regions, and that drainage regulations were often an impediment to this strategy. |
| **Key Insight #10:**  
An array of farming practices are being suggested by non-governmental organizations and governments to increase resilience under climate change | Ongoing research at the University of Manitoba recommends soil management practices at the plant scale for integrated flood and drought management (Lobb 2015). Research conducted by the University of Manitoba and IISD under the Prairie Climate Resilience Project revealed that Manitoba producers were implementing a range of farming/plant scale practices to cope with weather variability (Meyers 2008, p. 58). A 2012 study commissioned by Manitoba Conservation and Water Stewardship in the Interlake region took note of several farming practices used by producers to cope with excess moisture (MCWS 2012). |
| **Key Insight #11:**  
The integration of flood and drought risk management will be essential in a changing climate and can be addressed through a combination of policy and landscape interventions. | This is a salient insight for Manitoba where ‘weather whiplash’ in the form of excess moisture, flooding and drought is a recurring trend (see first section of this paper). |
Appendix A

References


IWMI (2013). Tackling Change: Future-proofing Water, Agriculture and Food in an Era of Climate Uncertainty. International Water Management Institute. Available at: https://books.google.ca/books?id=hbgcAgAAQBAJ&pg=PA30&lpg=PA30&dq=Balancing-out+floods+and+droughts:+Opportunities+to+utilize+floodwater+harvesting+and+groundwater+storage+for+agricultural+development+in+Thailand&source=bl&ots=3ZZnY8V0Lc&sig=g4euhCD9oUqExVCvQ-Qc4peEh8&hl=en&sa=X&ved=0CDEQ6AEwA2oVChMIsrjQ3L-ayAlVjmlCh1Y3wE1#v=onepage&q=Balancing-out%20floods%20and%20droughts%3A%20Opportunities%20to%20utilize%20floodwater%20harvesting%20and%20groundwater%20storage%20for%20agricultural%20development%20in%20Thailand&f=false.


Appendix B: Briefing Note

Synopsis of Climate Change Vulnerabilities and Adaptation Needs as Identified through Previous Assessments

December 4th 2015

Prepared by:
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Submitted to:
Manitoba Agriculture, Food and Rural Development (MAFRD) Secretariat for the Agriculture Risk Management Review Task Force

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Introduction and Context

Climate change is generally expected to modestly increase Canada’s agricultural food production in the medium-term due to elevated CO2 concentrations, and longer and warmer growing seasons that would allow for the cultivation of higher-value and warmer-weather crops to be grown further north (Campbell, Durant Hunter & Hyatt (2014)).

A negative effect of climate change, however, is the introduction of new pests, weeds and diseases and more severe outbreaks of current ones. In addition, heavy and variable precipitation, heat waves, intense wind, drought and floods may become more frequent and intense, which could further disrupt the productivity of agro-ecological systems (Fischer, 2011). In addition, farm planning will become increasingly difficult due to the reduced reliability of climate forecasts in the face of greater climatic variability (Table 1).

Climate adaptation in Canada has historically taken the form of autonomous farm-level actions. However, the systemic nature of climate change, and the important risks that it presents for Canadian producers, demands that a more strategic and co-ordinated approach be taken. A number of studies have been undertaken to measure and monitor the adaptive capacity, actual adaptation and related policies of agriculture in Canada. Recently, a number of studies were conducted to look at specific adaptation needs of producers in Manitoba and across Canada.

The purpose of this paper is to provide a synopsis of agriculture production vulnerabilities (production challenges) and adaptation needs (actions) for climate change as identified through these previous assessments.

<table>
<thead>
<tr>
<th>Region</th>
<th>Trends due to climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern and Central Canada</td>
<td>- Increasing spring precipitation and higher intensity storms; possible impact on manure storage, runoff of manure and soil nutrients, and soil erosion</td>
</tr>
<tr>
<td></td>
<td>- Increasing spring flooding; possible disturbance to spring seeding</td>
</tr>
<tr>
<td></td>
<td>- Increasing summer temperature; lengthening of growing season and northern productivity</td>
</tr>
<tr>
<td></td>
<td>- Increasing evaporation due to heat; greater water stress</td>
</tr>
<tr>
<td></td>
<td>- More variable frost; increase in crop losses and possible increase in pests, diseases and weeds</td>
</tr>
<tr>
<td></td>
<td>- More frequent and severe heat waves; livestock weight loss, reduced milk production, disease infection rate increase</td>
</tr>
<tr>
<td>Northern and Remote Communities</td>
<td>Decreased in quality and quantity of wild foods (e.g. berries, game animals)</td>
</tr>
<tr>
<td></td>
<td>Shorter ice road season; food shipments to the north could be affected</td>
</tr>
<tr>
<td></td>
<td>Decreased sea ice; marine transportation of food can be increased</td>
</tr>
<tr>
<td>Prairies</td>
<td>- Reduced summer rainfall; decreased water quality and availability</td>
</tr>
<tr>
<td></td>
<td>- Increased drought frequency and intensity; limited ability to expand irrigation</td>
</tr>
<tr>
<td></td>
<td>- Increasing occurrence of spring flooding; soil nutrient runoff, and greater algal blooms</td>
</tr>
<tr>
<td></td>
<td>- Reduced winter snow cover; wind erosion of soil during winter</td>
</tr>
</tbody>
</table>
Overview of Producer Climate Change Vulnerabilities and Adaptation Actions from Previous Studies

This report summarizes key results from four recent assessments that collected information relating to the vulnerabilities and adaptation needs of producers in Manitoba and across Canada. The following information sources are covered:

- 2012 application of the Adaptive Design and Assessment Policy Tool (ADAPT Tool) to a set of policies on agriculture in Manitoba: Including an expert-generated list of producer vulnerabilities and adaptation actions for climate change (IISD 2012);
- 2004 Prairie Climate Resilience Project: Including a summary of interviews with Manitoba producers conducted by the Natural Resources Institute at the University of Manitoba (Meyers 2008);
- 2007 Adaptive Capacity Indicators from the Prairie Climate Resilience Project (Swanson et al. 2009);
- 2011 Agri-Foresight Initiative: Including a cross-Canada multi-stakeholder exercise to identify and prioritize climate change adaptation actions for the Canadian Agriculture system (Ari-Foresight Initiative 2011a and 2011b); and

2012 Expert-based list of Producer Vulnerability and Adaptation Needs in Manitoba

In 2012 Manitoba Agriculture, Food and Rural Initiatives (MAFRI) undertook an analysis of seven provincial policies to assess the ability to contribute to both anticipated and unanticipated adaptation needs for increased drought and excess moisture. A beta version of the Adaptive Design and Assessment Policy Tool (ADAPT Tool) develop by the International Institute for Sustainable Development (IISD) in collaboration with the Prairie Regional Adaptation Collaborative was used to undertake the analysis.¹

Using a rapid consultation with a limited number of agriculture experts in Manitoba a total of 57 vulnerabilities were identified for eight agriculture subsectors (Table 2). In addition, 98 anticipated adaptation actions were also identified to address these vulnerabilities (Table 3). The actions least supported by the policies examined included covering income losses due harvest losses; losses in multiyear crops; pest and diseases, quality of the crops/livestock and access to harvest during flooding.

TABLE 2: Expert-generated list of producer vulnerabilities by sub-sector (IISD 2012).

<table>
<thead>
<tr>
<th>Agriculture Subsector</th>
<th>Vulnerabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beef Cattle</strong></td>
<td>Shortage of feed; Grazing season length; Water quality (impact both on cattle, and on watersheds); Feed quality; Health (Access to water, foot rot); Water quantity/supply; Natural shelter diminished; Manure, compost, and dead stock management (floods)</td>
</tr>
<tr>
<td><strong>Forage</strong></td>
<td>Feed quality; Access to the field for harvest and grazing; Length of the grazing season; Loss of stands and legumes due to drowning out; Decreased yields; Decreased soil quality; Heat stress; Early dormancy (length of grazing season); Grasshoppers</td>
</tr>
<tr>
<td><strong>Cropping (Annual Grains and Oil Seeds)</strong></td>
<td>Access to the land (for seeding and for harvest); Yield; Quality; Pests &amp; disease (insects and weeds); Increase in summer fallow &amp; unseeded acres; Soil quality – soil blows away; salinity; erosion; compaction; Multi-year crop loss</td>
</tr>
<tr>
<td><strong>Forage seed</strong></td>
<td>Access to fields; Disease (e.g., mildew) in forage &amp; bees; No harvest / decreased yield; Field conditions poor due to standing water (loss of forage stand); Reduced bee pollination due to excess moisture; Death of bees due to rainfall; Increased grasshopper population</td>
</tr>
<tr>
<td><strong>Hogs</strong></td>
<td>Water quality; Possible feed shortages (less likely because it can be sourced from many places); Barns could flood (possibility of death); Increased energy costs to cool the barns; Slowed growth in pigs (if it is really warm)</td>
</tr>
<tr>
<td><strong>Dairy Cattle</strong></td>
<td>Water quality – supply contamination; Water quality – run-off; Heat stress; Barns could flood (possibility of death); Shortage of feed (excess moisture = can’t get it off; drought = there isn’t any feed); Water quantity/supply; Pests and disease; Manure, compost, and dead stock management (floods); Increased energy costs to cool the barns</td>
</tr>
<tr>
<td><strong>Poultry</strong></td>
<td>Water quality – supply contamination; Possible feed shortages (less likely because it can be sourced from many places); Barns could flood (possibility of death); Increased energy costs to cool the barns; Slowed growth in chickens (if it is really warm); Manure, compost, and dead stock management (floods)</td>
</tr>
<tr>
<td><strong>Potatoes</strong></td>
<td>Accessing water out of rivers (high or low); Water supply – lack of spring runoff resulting in dry dug outs; Accessing land during floods; Low yields; Pest and diseases; Irrigation water supply</td>
</tr>
</tbody>
</table>

The rapid assessment also identified a list of anticipated necessary adaptation actions for each of the vulnerabilities listed above and these results are detailed in Table 3.
TABLE 3: Expert-generated list of producer vulnerabilities and adaptation actions (IISD 2012).

Rows in grey are those that were the least supported by the accessed policies

<table>
<thead>
<tr>
<th>In what ways is the sector vulnerable to excess moisture and drought?</th>
<th>What adaptation actions might be necessary if excess moisture and drought are more severe in the future?</th>
</tr>
</thead>
</table>
| Shortage of feed (excess moisture = can’t get it off; drought - there isn’t any feed) | - Alternate feeding methods  
- Alternate feed sources (e.g. grain pellets)  
- Stockpile feed  
- Improving feed efficiency through good quality feed and forages  
- Promoting rotational grazing |
| Grazing season length | - Improving feed efficiency through good quality feed and forages  
- Promoting rotational grazing and maintaining ground cover |
| Water quality (manure - how much is running off => impact both on cattle, and on watersheds - nutrient loading) | - Nutrient management  
- Alternate watering sources [cattle are often watered from wells, dugouts - both of these could be contaminated - a heightened stakeholder issue]  
- Farmyard runoff control - Farmyard runoff control away from wells;  
- Water treatment |
| Feed quality (drought) | - New varieties of feed  
- Alternative feed sources (i.e., grain, pellets)  
- Grazing management plan  
- Feeding management plan  
- Feed testing  
- Nutritional monitoring and ensuring supplementation  
- Equipment modification to prevent shattering (dry conditions) |
| Health (Access to water & heat stress) | - Shading structures  
- Transition to different livestock types  
- Health (foot rot) through prevention, better feedlot design and feedlot location |
| Water quantity / supply | - Well capacity maintenance  
- Water storage  
- Waste Water or Run-off water treatment  
- Farmyard runoff control |
| Natural shelter reduced – lead to the loss of cover (drought) | - Shading structures  
- Woodlot management (species) |
| Manure, compost, and dead stock management (floods) | - Covering compost facilities  
- Farmyard runoff management  
- Nutrient management BMPs |
<table>
<thead>
<tr>
<th>In what ways is the sector vulnerable to excess moisture and drought?</th>
<th>What adaptation actions might be necessary if excess moisture and drought are more severe in the future?</th>
</tr>
</thead>
</table>
| Length of the grazing season | - Different forage species on pasture and haylands (e.g., Tall Fescue Grass)  
- Rotational grazing;  
- Managing your carrying capacity; |
| Loss of stands and legumes due to drowning out | - Different forage species on pasture and haylands (e.g., Tall Fescue Grass)  
- Equipment modification (Broadcasting of seed in drowned out areas)  
- Improved drainage |
| Decreased yields | - Different forage species on pasture and haylands (e.g., Tall Fescue Grass, legumes)  
- Maintaining ground cover/ rotational grazing / residue management (windrows)  
- Improving drainage  
- Forage blend |
| Heat stress | - Different forage species on pasture and haylands (e.g., Tall Fescue Grass);  
- Irrigation;  
- Flexibility in operation;  
- Increase ventilation system and evaporative cooling |
| Early dormancy (length of grazing season) (drought) | - Different forage species on pasture and haylands (e.g., Tall Fescue Grass);  
- Maintain ground cover / rotational grazing |
| Access to the land (for seeding and for harvest) | - Improved surface and tile drainage  
- Equipment modifications;  
- Flexibility: flexibility in operations and equipment and crop residue management and to make decisions based on conditions – possibly involving equipment modification |
| Yield | - Diversify crops, including specialty crops and increasing rotations  
- Flexibility: flexibility in operations and equipment to make decisions based on conditions – possibly involving equipment modification  
- Assistance programming; R&D in crop breeding and development (i.e., Assistance programming for equipment modification) |
In what ways is the sector vulnerable to excess moisture and drought?

| What adaptation actions might be necessary if excess moisture and drought are more severe in the future? |
|---|---|
| Quality | - Diversify crops, including specialty crops and increasing rotations  
- Flexibility: flexibility in operations and equipment to make decisions based on conditions - possibly involving equipment modification and crop storage (including technology);  
- better storage of water on land;  
- R&D in crop breeding and development;  
- Marketing strategies |
| Pests & disease (insects and weeds) | - R&D for herbicide efficacy; adoption of insect control methods currently used in areas where the pests have historically been present  
- Flexibility: flexibility in operations and equipment to make decisions based on conditions - possibly involving equipment modification  
- Assistance programming  
- Information sharing - control methods - for pest and disease; actions depend on the scale  
- Increase crop rotations;  
- Effective and proper timing of fungicide application (more research is needed in this area b/c there are many unknowns due to field conditions)  
- For bees (chalk brood - prevalence is increasing due to high relative humidity): research re: the disease itself as well as pesticide options.  
- For bees (foliar mould - moisture related): treatment of nests and cocoons (e.g., paraformaldehyde at the beginning of the season) |
| Increase in summer fallow & unseeded acres | - Flexibility: flexibility in operations and equipment to make decisions based on conditions - possibly involving equipment modification;  
- inclusion of forage in crop rotation |
| Soil quality - soil blows away; salinity; erosion; compaction | - Erosion controls (maintaining ground cover, shelter belts);  
- Diversify crops, including specialty crops and increasing rotations (for salinity);  
- Maintaining ground cover/ rotational grazing |
| Multi-year crop loss | - Improving rotations, use of legumes in rotations;  
- Beefed up insurance mechanisms / enhanced insurance,  
- Alternative sources of income;  
- Mixed farming option;  
- and land use management;  
- Water storage |
Appendix B

In what ways is the sector vulnerable to excess moisture and drought?

<table>
<thead>
<tr>
<th>Vulnerability</th>
<th>Adaptation Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>No harvest / decreased yield</td>
<td>- Assistance programming - staffed by staff that are technically</td>
</tr>
<tr>
<td></td>
<td>- Beefed up insurance mechanisms / enhanced insurance,</td>
</tr>
<tr>
<td></td>
<td>- Alternative sources of income;</td>
</tr>
<tr>
<td>Increased grasshopper population</td>
<td>- Forage mix</td>
</tr>
<tr>
<td></td>
<td>- Improved pesticide management and varieties</td>
</tr>
<tr>
<td></td>
<td>- Border management - a buffer between the ditches and the edge of the field.</td>
</tr>
<tr>
<td>Barns could flood (possibility of death)</td>
<td>- Raising barns</td>
</tr>
<tr>
<td></td>
<td>- Farmyard runoff control</td>
</tr>
<tr>
<td>Increased energy costs to cool the barns</td>
<td>- Implementing energy efficient heating/cooling options;</td>
</tr>
<tr>
<td></td>
<td>- Explore biomass options;</td>
</tr>
<tr>
<td></td>
<td>- Backup options &amp; temperature management</td>
</tr>
<tr>
<td>Slowed growth in pigs or chicken (if it is really warm)</td>
<td>- Implementing energy efficient heating/cooling options;</td>
</tr>
<tr>
<td></td>
<td>- Explore biomass options;</td>
</tr>
<tr>
<td></td>
<td>- Backup options &amp; temperature management</td>
</tr>
</tbody>
</table>

2008 Manitoba Farmer Interviews from the Prairie Climate Resilience Project

The Prairie Climate Resilience Project was a 2004-06 collaboration among the International Institute for Sustainable Development, the then Prairie Farm Rehabilitation Administration (PFRA), and the University of Manitoba’s Natural Resources Institute. Under this project sixty farm-level interviews were conducted in two areas in southwestern Manitoba (Myers, 2008). The top weather-related stresses cited by farmers for the study period (1999-2005) included excess moisture, heavy rainfall, frost, dry periods, drought, and cold summer temperatures. Excess moisture was the predominant weather-related stress which occurred over the study period.

The top 15 actions cited by producers for coping and adapting to these weather-related stresses are summarized below (Myers 2008):

- **Employ a standard farm practice for less than one season** – for example, cultivate the soil, drain the land, maintain the existing drainage system, burn the stubble, make a chemical application, allow the field to stand idle for the growing season;

- **Alter a farm cycle (some season)** – for example, put cattle on feed early, put cattle to pasture early, grain feed cattle later into the spring, sow crops late, sow varieties with a shorter growing season, overwinter the cattle using feeding formulas to reduce hay consumption;

- **Hire outside help from within the local agricultural sector** – for example, hire local help, import local feed, use a local abattoir;

- **Wait out**;

- **Work longer or do extra work**;

- **Crop Insurance and other claims**;

- **Work with the weather** – for example, harvest wetland for feed, silage failed crops; use technological advances;
Several factors were cited by producers as either aiding or impeding their adaptation actions (Table 4). Among the factors aiding adaptation actions were good neighbors, recognizing the need to outsource, knowledge of crop insurance claims process, and knowledge of their individual constraints for working longer and doing extra work. Among the factors cited as impeding producer adaptation were increased stress level and work load, unpredictable outcomes, short growing season, and drainage regulations.

| TABLE 4: Factors aiding and impeding producer adaptation actions (from Meyers 2008). |
|---|---|---|
| **Top responses (n=30)** | **Aid (top 3)** | **Impediment (top 3)** |
| Get outside help from within the local agricultural sector (18) | Good neighbours (5) | Increased stress level (3) |
| Employ a standard farm practice (17) | Recognize need to outsource (3) | Increased work load (2) |
| Alter a farm cycle <=one season (14) | Recognize need to outsource (8) | Unpredictable outcome (8) |
| Crop Insurance (13) | Knowledge of claims (1) | Drainage regulations (1) |
| Work longer or do extra work (13) | Knowledge of constraints (2) | |

2007 Adaptive Capacity Indicators from the Prairie Climate Resilience Project

Also under the auspices of the 2004 Prairie Climate Resilience Project, a geographic information system (GIS)-based indicator system representing the adaptive capacity to climate change of agriculturally-based communities across the Prairies was developed by IISD and PFRA (Swanson et al. 2009). Twenty indicators representative of adaptive capacity were derived for Census Divisions across the Prairies from Statistics Canada sources, most notably the 2001 Census of Agriculture from which 17 of the indicators were derived. The indicators were organized into six determinants of adaptive capacity to climate change based on Smit et al., (2001), namely: (1) economic resources; (2) technology; (3) infrastructure; (4) information, skills and management; (5) institutions and networks; and (6) equity.

The indicator system was created for the following purposes: to advance an understanding of the vulnerability and adaptive capacity of Prairie agriculture to climate variability and longer-term change; to guide the selection of sites for farm-level study of successful adaptive behaviours; to identify the types of policy interventions that support farm- and community-level adaptation to climate variability and change; and to help identify Prairie locations that are most vulnerable to climate variability and change.

As illustrated in Figure 1, Census Divisions exhibiting the highest adaptive capacity were clustered near
large urban centres whereas Census Divisions exhibiting the lowest adaptive capacity were typically along the northern boundaries of the Prairie agricultural region.

Census Divisions exhibiting higher rankings were associated with the following: proximity to major urban centres; higher off-farm earnings; greater diversity of employment opportunities; greater use of computer technology; more use of computers in farm management; a higher density of transportation networks; more e-mail and use of the World Wide Web; and closer proximity to agricultural education institutions. Census Divisions along the northern extent of agriculture ranked much lower on these indicators of adaptive capacity.

FIGURE 1: Adaptive capacity index across the Prairies (Swanson et al., 2007).

Based on the spatial analysis of adaptive capacity indicators the following policy insights were put forth:

• To build the adaptive capacity of remote rural areas, attention should be paid to policy interventions that contribute positively to indicators of adaptive capacity not highly correlated with proximity to urban centres. These indicators include:
  - Ensuring agricultural commodity prices are sufficient to maintain adequate farm incomes;
  - Ensuring access to irrigation and associated equipment;
  - Promoting sustainable soil management practices;
  - Discouraging farming on marginal land; and
  - Investment in farm machinery and equipment versatile enough to adjust production decisions to variable climatic conditions.

• Other policy interventions to increase the adaptive capacity of producers, regardless of proximity to urban corridors, could include:
  - More opportunities to increase off-farm earnings;
- Enhanced employment prospects through diversification within the agricultural and agri-food sector as well as in other sectors of the economy;
- Improved access to and use of computer technology in general and, in particular, for farm management;
- Increased density of transportation networks;
- Improved use of e-mail and the Internet to keep abreast of climate trends and innovative farming practices; and
- Greater access to agricultural education institutions.

2011 Agri-Foresight Initiative on Climate Change Adaptation in Canada

Beginning in 2009 the Agri-Foresight Initiative of Agriculture and Agri-Food Canada convened a series of workshops to identify opportunities and constraints for achieving sustainable competitiveness in the face of climate change. Approximately 150 participants representing an array of agriculture stakeholders from across Canada contributed to the workshop deliberations. The focus question guiding the workshop series was: “By 2030, what will a world challenged by climate change require of the Canadian agricultural system to assure resiliency, sustainability and adaptability?”

Through a multi-stage scenario planning process the agriculture stakeholders put forth a set of 14 key climate change adaptation actions for the Canadian agriculture system. These actions are summarized in Table 5 and were organized into six themes (Agri-Foresight Initiative 2011a):

- **Resource constraints:** The exploration of the scenarios identified some critical resources, including water, oil, land, fish and food that would be significantly constrained by rising average global temperatures and increased frequency, volatility and intensity of weather events associated with climate change. Adaptations need to address these plausible future resource constraints.

- **Risk management:** Greater variability, frequency and intensity of weather events affecting agricultural production, the environment, and the economic viability of farming threaten to overwhelm existing risk-management initiatives. This creates the need for a more integrated approach to managing financial, production and environmental risks to ongoing agricultural production and distribution systems. The critical paradigm shift is from an approach based on prediction and management of specific risks to anticipating the types of risks that may arise and being proactive in developing adaptive capacity to respond quickly and effectively to risks as they arise.

- **New opportunities:** Peak oil, water, arable land, fish and food will drive a global shift towards a renewable resource-based economy. Agriculture will be a critical sector for Canada and the world. The following will create many new opportunities for farmers and agri-processors: rising demand for food, the link between food and health, the use of agricultural materials for industrial purposes, the role of agriculture in helping to mitigate climate change and the development of sustainable production systems.

- **Policy and regulatory environment:** The policy and regulatory environment influences both the pace of, and the capacity for, adaptation and adjustment to changing circumstances. It requires a shift from a reactive policy and regulatory process that actively slows down adaptation and adjustment to a more proactive process that accelerates agriculture sector capacity for, and the pace of, adaptation.

- **Science and innovation system:** Science and technology are critical enablers for adaptation; the convergence of biotech, genotech, infotech, nanotech and robotics offers the potential for new systems, new thinking and new tools and capacities to address possible impacts from climate change. The state of Canada’s science and innovation system will directly affect Canada’s influence in global
affairs and its capacity to effectively adapt to climate challenges and opportunities.

- **Sustainable competitiveness**: Climate change represents significant change in the economic, ecological and social environment affecting agriculture. The increased frequency, scope, intensity, impact and irreversibility of climate-induced changes suggest the need for a more proactive approach and the development of new business models for agriculture. Sustainable competitiveness is critically affected by the sector’s ability to successfully adapt to ongoing change.

**TABLE 5**: Prioritized adaptation actions for the Canadian Agriculture System (Agri-Foresight Initiative 2011b).

<table>
<thead>
<tr>
<th>#</th>
<th>Description of Key Actions</th>
<th>Lead Key Player</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant, Animal Resilience: Development of plants and animals through breeding focused on improving ability to cope with abiotic (heat, cold, drought, flood) and biotic (pests, diseases) stress, including the use of genetic engineering as an important tool in the rapid development of adapted species and varieties needed to keep pace with climate change (action #10).</td>
<td>Private Sector/Academia/Government</td>
</tr>
<tr>
<td>2</td>
<td>Crop Resilience: Development of agricultural crops that require less water, improved water use within plants, efficient water distribution systems (action #3).</td>
<td>Academia/Government</td>
</tr>
<tr>
<td>3</td>
<td>Integrated Water Policy: Development of an integrated water strategy by federal, provincial, territorial and municipal governments supported by an integrated and coherent cross-jurisdictional policy and regulatory environment, a clear redefinition of public versus private water rights, and water pricing and metering as a tool for managing water use (action #1).</td>
<td>Private Sector/Government</td>
</tr>
<tr>
<td>4</td>
<td>Soil Conservation: Development of farm practices and farming systems that enhance soil conservation through reduced erosion from wind and water, improve soil quality through the addition of organic matter, and increase soil productivity through nutrient management and rotational cropping systems integrated with livestock production (action #12).</td>
<td>Private Sector</td>
</tr>
<tr>
<td>5</td>
<td>Enhanced Productivity: Development of increased productivity and lower carbon/GHG footprint of agricultural production systems that maintain productivity and reduce the use of chemicals, pesticides and petroleum-based nutrients, and emphasize sustainable practices such as crop rotations to control weeds and enhance soil fertility, biocontrol of pests and diseases, and reduced tillage systems (action #6).</td>
<td>Private Sector/Government</td>
</tr>
<tr>
<td>6</td>
<td>Biofuel Systems: Development of economically viable farm-scale and community-scale biofuel systems (action #6).</td>
<td>Private Sector/Academia/Government</td>
</tr>
<tr>
<td>7</td>
<td>Integrated Regional Farming Systems: Development of integrated regional farming systems suited to the resource base, ecosystems and environmental conditions within watersheds and ecozones—a shift in focus from individual farm practices to integrated farming systems that consider not only specific farm businesses but the collective interactions of all farming businesses within a region, watershed or ecozone (action #5).</td>
<td>Private Sector</td>
</tr>
<tr>
<td>8</td>
<td>Weather Monitoring: Enhanced weather monitoring and tracking at the farm, local and regional levels to supplement the national weather service and provide better location-specific forecasting to enable improved and informed decision-making on farms (action #19).</td>
<td>Government</td>
</tr>
<tr>
<td>9</td>
<td>Sustainability Farming Practices: Enhanced understanding of the interrelationship between agriculture and ecosystems and development of a sustainable systems approach to regional agricultural production and enhanced environmental performance (action #20).</td>
<td>Academia/Private Sector</td>
</tr>
<tr>
<td>10</td>
<td>Environmental Goods and Services: Development of sustainable farming systems in harmony with natural ecosystems that generate measurable collateral benefits in air quality, water quality and conservation of biodiversity as a basis for market returns to environmental goods and services from agriculture (action #91).</td>
<td>Private Sector</td>
</tr>
<tr>
<td>11</td>
<td>Science-Policy Integration: A strong focus on science-policy integration (i.e. communication and joint decision-making) and on policy and regulatory coherence within and between jurisdictions and across nations (action #33);</td>
<td>Academia/Government</td>
</tr>
<tr>
<td>12</td>
<td>Farm Responsiveness: Development of enabling policies that build resilience in the agriculture system and assist stakeholders in responding in a timely manner to fluctuating climate, market and social conditions (action #30).</td>
<td>Private Sector/Government</td>
</tr>
<tr>
<td>13</td>
<td>Science and Innovation: Innovation System Coordination: Improved coordination along the innovation system, from discovery science through to market development of new innovations, with increased attention to the relationships among stakeholders (including consumers) along this continuum; it’s not enough to have good parts, the parts need to work well together to achieve success (action #40);</td>
<td>Private Sector/Government</td>
</tr>
<tr>
<td>14</td>
<td>Sustainability Competitiveness: Sustainability Assessment: Appropriate metrics that allow the integration of environmental and social costs (including health) and benefits into the business models used by farmers, processors and other industries and governments so that decisions reflect sustainability, and trade-offs could be effectively assessed in decision-making; in particular, trade-offs in energy use, water use, and GHG emissions (action #41).</td>
<td>Private Sector/Government</td>
</tr>
</tbody>
</table>
2015 *From Farms to Regions* Scenario Project – Eastern Ontario

This section summarizes the key outcomes of the collaborative project “From Farms to Regions: Development and Testing of an Integrated Landscape Assessment and Decision-Support Process and Tool Kit for Mainstreaming Adaptation into Regional Planning” led by Agriculture and Agri-Food Canada (AAFC), IISD, Oregon State University and others and focused on the Eastern Ontario region.\(^2\)

Five clusters of adaptation actions were identified by Eastern Ontario agriculture stakeholders. These are summarized below and detailed in Table 6.

- **Farm-level** action on production and management often falls within the responsibility of the farmers and producers in response to vulnerabilities identified for by their production practices and location. For example adjusting livestock herd and/or acreage dedicated to livestock, changing crop type or rotation (no new equipment necessary or minor alterations); or shifting to different varieties, and modifying pest management practices

- **New actions** such as new forms of crop insurance to allow farmers to manage risks to climate change. Given the high uncertainty, these would serve as a cushion to bridge gaps and surprises especially related to extreme climate change. For example changes in insurance premiums to consider vulnerability of flood risk zones, or farm size or crop diversity

- **Support for maintaining ecosystem goods & services** to reduce vulnerability at the farm and regional–levels to ensure that natural systems act as buffers in reducing vulnerability of the agricultural and human systems. This includes actions through policy support and incentives to encourage implementing actions, such as. changing river set-back areas and stronger regulation on riverbanks protection, and changes in land-use change that increases run-off\(^2\)

- **Providing tools and information** to farmers, farmers’ groups and regional and local policy-makers to understand vulnerability, identify risks and plan for adaptation by using for GIS data and tools, access relevant weather prediction and seasonal forecasting tools, improving data availability and timeliness and sharing between the communities and local policy-makers

- **Awareness raising and education** for public and key stakeholders to create support for acceptance adaptation measures in agriculture, encouraging cultural shifts both in the farming community and between policy-makers including the importance of mainstreaming adaptation into sectorial policy-making

The identified adaptation needs indicated that adapting to climate change is a multi-scale and multi-sectoral challenge that requires co-ordination between agricultural policy and other sectoral approaches. These sectors include municipal, provincial and federal agencies which should be considering measures ranging from support to ecological goods and services, different types of insurance mechanisms, addressing infrastructure challenges and ensuring that agriculture also provides societal and natural benefits. This approach has implications for monitoring to ensure that mainstreaming efforts (as well as the actual change in agriculture at the landscape level) are tracked and recorded.

TABLE 6: Adaptation priorities and actions from the Eastern Ontario Farms to Regions climate change adaptation initiative (Waldick et al. 2015).

<table>
<thead>
<tr>
<th>Adaptation priorities and actions</th>
<th>Prior scenario development process</th>
<th>Based on the qualitative scenarios</th>
<th>Based on the quantified scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm-level actions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools for land owner to respond to CC – trade policy, remote/GIS data to help agriculture, weather prediction</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Carbon tax</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Review of habitat allocations (especially species at risk) and this could mean changes in land-use/agriculture management practices and land allocations</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Methods of more efficient water delivery/irrigation</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Stronger regulation on riverbanks protection, land-use change that increases runoff</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Source protection measures in areas prone to water contamination, nutrient in-flows especially in areas that could be affected by heavy rainfall (may limit expiation of operation in these areas)</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Crop-breeding programs</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Economic and technology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New technology – adoption of specific land management technologies to better fit changes in land-use, crop rotations, and pest management options.</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>New storage and processing technologies to fit better to a new crops and market needs</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>New approaches to marketing – to reach out to new markets, consumers, whole-sellers/grocery chains</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>New crop insurance to manage risks</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Alternative models of insurance for smaller and larger farms</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>New business models/longer contracts</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Support for maintaining ecosystem goods &amp; services</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion protection measures in areas prone to erosion to reduce impacts on heavy rainfall</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Plant breeding – excess moisture, dry weather conditions</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
### Comparing Past Assessments with the Recent Task Force Consultations

This section provides a comparison of the past assessments with feedback received by the task force during its public consultation phase. This provides a sense for how things have changed, or not, over the past decade with regard to weather stresses and related agriculture production challenges and adaptation actions.

Table 7 provides a summary of the comparison of past and currently cited weather-related stresses. The tabulation reveals that excess moisture continues to be a predominant stress in Manitoba, with drought conditions also on the minds of producers along with greater weather variability overall.
TABLE 7: Synthesis of weather-related stresses – comparison of past assessments and current task force consultations.

<table>
<thead>
<tr>
<th>Weather-related Stresses</th>
<th>Past Assessments in Manitoba (Meyers 2008)</th>
<th>Prior scenario development process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stresses cited</strong> (Meyers 2007, in order of response rate):</td>
<td>- excess moisture,</td>
<td>- Currently experiencing periods of extremes; don’t seem to have an average year to recoup</td>
</tr>
<tr>
<td></td>
<td>- heavy rainfall,</td>
<td>- Rain in abundance i.e. 4 inches at a time</td>
</tr>
<tr>
<td></td>
<td>- dry periods, drought,</td>
<td>- Two floods in short period of time (2011, 2014)</td>
</tr>
<tr>
<td></td>
<td>- frost,</td>
<td>- Very dry along SK border; light soils, inability to capture moisture</td>
</tr>
<tr>
<td></td>
<td>- cold summer temperatures</td>
<td>- More rain and more unpredictability</td>
</tr>
<tr>
<td></td>
<td>- Late snow</td>
<td>- Big hail</td>
</tr>
<tr>
<td></td>
<td>- Heavy snowfall</td>
<td>- There has not been an early frost for a long time</td>
</tr>
<tr>
<td></td>
<td>- Weather variability in general</td>
<td>- Weather patterns are more volatile. History is no longer a useful indicator of future events</td>
</tr>
<tr>
<td></td>
<td>- Warm winter temperatures</td>
<td>- Too wet, then too dry, then hailed out</td>
</tr>
<tr>
<td></td>
<td>- Hail</td>
<td>- No crop in 2011 and 2013; still without 1/3 of acres due to excess water</td>
</tr>
<tr>
<td></td>
<td>- High speed winds</td>
<td>- Excess moisture, serious yield reduction</td>
</tr>
<tr>
<td></td>
<td>- Cool spring temperatures</td>
<td>- Drought prone</td>
</tr>
</tbody>
</table>

Table 8 compares production challenges cited in the expert consultations conducted in the 2012 adaptive policies study by IISD and MAFRD with the recent task force consultation feedback. The comparison illustrates that there is a considerable overlap between the identified production challenges during the task force consultation and actions listed in the past assessment in 2012. There are number of specific actions such as livestock raising and related feed availability and management, water availability and its impacts on production and land, and plant management practices. The comparison of the two consultations shows that for the production challenges listed in 2012 there is a much stronger focus on adaptations to droughts and floods compared to the more recent one, which is more centred on improving the resilience of the agricultural sectors regardless of the specific stressors.
TABLE 8: Synthesis of agriculture production challenges – comparison of past assessments and current task force consultations.

<table>
<thead>
<tr>
<th>Agriculture Production Challenges in a Changing Climate</th>
<th>Past Assessments in Manitoba (IISD 2012)</th>
<th>Preliminary Synopsis of Task Force Public Consultations</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Shortage of feed (excess moisture = can’t get it off; drought – there isn’t any feed)</td>
<td>- Hay shortages, pasture shortages</td>
<td></td>
</tr>
<tr>
<td>- Feed quality (drought)</td>
<td>- Price of hay will increase due to demand</td>
<td></td>
</tr>
<tr>
<td>- Grazing season length</td>
<td>- Less native hay</td>
<td></td>
</tr>
<tr>
<td>- Natural shelter reduced – lead to the loss of cover (drought)</td>
<td>- Bulrushes in canola</td>
<td></td>
</tr>
<tr>
<td>- Length of the grazing season</td>
<td>- Poor feed quality</td>
<td></td>
</tr>
<tr>
<td>- Water quality (manure - how much is running off =&gt; impact both on cattle, and on watersheds – nutrient loading)</td>
<td>- Producers don’t want to cull cattle, due to climate; i.e. sell cows because feed is hard to source</td>
<td></td>
</tr>
<tr>
<td>- Health (Access to water &amp; heat stress)</td>
<td>- Less places to hold water so more draining into local watershed</td>
<td></td>
</tr>
<tr>
<td>- Water quantity / supply</td>
<td>- Peat bogs – need to get water off – a lot of carbon released</td>
<td></td>
</tr>
<tr>
<td>- Yield, Quality of production</td>
<td>- Crown land relinquished – too wet</td>
<td></td>
</tr>
<tr>
<td>- Loss of stands and legumes due to drowning out</td>
<td>- Good soils affected</td>
<td></td>
</tr>
<tr>
<td>- Decreased yields</td>
<td>- Salinization</td>
<td></td>
</tr>
<tr>
<td>- Heat stress</td>
<td>- Water running downhill to Whitewater Lake – will cost millions for an outlet</td>
<td></td>
</tr>
<tr>
<td>- Early dormancy (length of grazing season) (drought)</td>
<td>- Changes to natural waterways in the past have caused changes to the impact of water flow</td>
<td></td>
</tr>
<tr>
<td>- Increase in summer fallow &amp; unseeded acres</td>
<td>- Area producers holding water to save urban areas</td>
<td></td>
</tr>
<tr>
<td>- Soil quality - soil blows away; salinity; erosion; compaction</td>
<td>- Lack of proper management has caused erosion in the last few years</td>
<td></td>
</tr>
<tr>
<td>- Multi-year crop loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Manure, compost, and dead stock management (floods)</td>
<td>- How to encourage crop rotation when commodity prices determine the crops grown by producers (economics vs. Environmental issues)</td>
<td></td>
</tr>
<tr>
<td>- Access to the land (for seeding and for harvest)</td>
<td>- Increased yields as result of new and existing crop varieties</td>
<td></td>
</tr>
<tr>
<td>- Barns could flood (possibility of death)</td>
<td>- What producers are growing is changing – soybeans now a production option</td>
<td></td>
</tr>
<tr>
<td>- Increased energy costs to cool the barns</td>
<td>- Had to downsize livestock operations due to excess moisture</td>
<td></td>
</tr>
<tr>
<td>- Slowed growth in pigs or chicken (if it is really warm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pests &amp; disease (insects and weeds)</td>
<td>- Lacking infrastructure, effective water management,</td>
<td></td>
</tr>
<tr>
<td>- Increased grasshopper population</td>
<td>- Need cohesiveness between NGO and government for overall water management plan (conservation, irrigation, drainage)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Opptunities to extend information is limited i.e. limited staff and resources, lack of programming, funding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Infrastructure damage and impacts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Land values increased</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Infrastructure – can’t haul to rail line because of bad roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Increase in failure of small farms will result in large corporate farms leading to food safety issues, skilled labour shortage, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Expensive if mistakes are made; equipment is too expensive to misuse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Expansion of woody species; reduced productivity of native grassland</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Human factor – with new developments, water has less places to go</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- No new entrants to farming unless family supported</td>
<td></td>
</tr>
</tbody>
</table>
Related to the adaptive actions of producers, in the recent task force consultations there were roughly 75 actions and suggestions. These listed adaptations focused on different areas of agricultural production, infrastructure, policy development and implementation and farmers’ situation. Among these identified adaptive actions, those which have also been cited in the previous assessments are synthesized in Table 9, grouped into five apparent categories related to feed quality and availability; cropping and management; soil quality; infrastructure and machinery; and policy.

TABLE 9: Overview of areas of overlaps between adaptation actions cited in the public consultations and the reviewed projects.

<table>
<thead>
<tr>
<th>Feed quality and availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>This includes actions to address feed availability issues, as it was indicated that due to shortages, prices can increase; less native hay availability; there also identified challenges in terms of feed storage and in terms of finding alternative feed sources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crop planting and management changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased yields due to new crop varieties; changing crop rotations, although this links to commodity prices; crop diversification; significant reduction in some crops such as potatoes;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil quality and erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>This includes decreasing soil quality because of weather events both droughts and heavy rain; increasing erosion and soil damages due to drainage back-up; higher water table; destroyed shelter belts in many locations due to flooding; salinization of soils</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure and machinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lacking and/or damaged infrastructure, effective water management, needs of energy infrastructure and support for heating and cooling options; road network development to ensure access to fields and or alternative access modes during flooding; challenges of reinvestment in machinery and/or different machinery technology (i.e., tracked equipment) is needed due to more wet land; challenges in terms of the maintenance of drainage infrastructure to respond to flood impacts; past changes in waterways can impact water flow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy and management issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomous adaptation precedes government policy and actions; limited information and extension support; support with addressing the unpredictability of weather; lack of program funding; need for more integrated management; no tax breaks for organic farmers</td>
</tr>
</tbody>
</table>

Among those areas that were mentioned in the task force consultations, but not picked up in the previous assessments are the following:

- Reducing number of livestock due to climate impacts and related challenges;
- Addressing labor shortages;
- Addressing increasing failure of smaller farms and related food security challenges;
- Assessing impacts of increasing land prices on adaptation choices;
- Addressing drought and flooding issues simultaneously;
- Creating opportunities from other sources of income, especially for new farmers to start; and
- Since 2011 as a result of the flood, beef producers have been trying to restore the land. Some producers have not been able to restore the land and as a result cannot get crop insurance and cannot qualify for EMI.
Finally, it is also important to note that compared to the previous assessments the recent task force public consultations mostly described risk reduction and improving coping mechanisms. In the past assessments, there were also actions to explore opportunities for new crops, new markets, and new ways of production such as biofuels and organics. Some of these actions which were revealed in the past assessments may be relevant for the current task force deliberations.
References


Appendix C: Briefing Note

Review of Policy Adaptability Insights for Agriculture Risk Management Programs in Manitoba

November 9th 2015

Prepared by:
Darren Swanson and Stephen Tyler
for the International Institute for Sustainable Development (IISD)

Submitted to:
Manitoba Agriculture, Food and Rural Development (MAFRD) Secretariat for the Agriculture Risk Management Review Task Force

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Summary

In January 2015 the Premier of Manitoba formed the Agriculture Risk Management Review Task Force with a mandate to work with industry to ensure that risk management tools are responsive to the changing needs of producers. The International Institute for Sustainable Development (IISD), through its ongoing technical support to the Manitoba government on sustainable development issues, summarized for the task force secretariat the results of previous analyses on the degree of adaptability of the AgriInsurance, AgriStability and AgriRecovery undertaken by IISD in partnership with the governments of Manitoba and British Columbia.

This paper summarises the results of previous analyses using the Adaptive Design and Assessment Policy Tool (ADAPTool). The ADAPTool is a web-enabled, Excel-based tool that guides policy-makers through a structured, participatory process that compares existing policies and programs to the principles of adaptive policies as set out in the book Creating Adaptive Policies: A Guide for Policy-making in an Uncertain World (Swanson and Bhadwal 2009). More specifically, the tool analyses the ability of a policy or program from two perspectives: (1) The ability to support stakeholder adaptation actions (e.g., for climate change); and (2) The ability of the actual policy or program itself to be adaptive to changing circumstances.

In relation to AgriInsurance, both the Manitoba (2011) and BC-MACAT et al. (2014) ADAPTool studies indicated that the program has been working well in relation to helping support the adaptive capacity of producers in the context of a changing climate, but that outstanding questions remain to be addressed, such as:

i) How does producer behaviour change as premiums increase? Are business risk management objectives still being met?

ii) What happens to the risk pool as premiums increase? Do producers drop out and self-insure? Does this pose actuarial risks? and

iii) Does the program and premium structure adequately support the introduction of new and potentially better-adapted crops and cultivars and encourage other innovative adaptation measures that farmers adopt due to climate change?

The key insights for the AgriStability program emanating from the Manitoba and B.C. adaptive policy analyses relate to the importance of regular monitoring of the program to ensure that it is meeting its objectives and to employing a greater use of multi-stakeholder deliberation in implementation and more decentralization of decision making to aid the program in responding to regional diversity and increasing climate variability.

For the AgriRecovery program, the key insights gleaned from the Manitoba (2012) adaptive policy analysis involved the importance of a broad review of government agriculture programming in the wake of repeated use of the program to assess how other climate change adaptation programming is being effected by budget cuts. It was also considered important to have time-triggered reviews to better detect emerging issues.
The Manitoba Context

In January 2015 the Premier of Manitoba formed the Agriculture Risk Management Review Task Force with a mandate to work with industry to ensure that risk management tools are responsive to the changing needs of producers. As the paragraphs below illustrate, the financial cost and social impact of recovering from recurrent flooding and drought are upsetting the development trajectories of rich and poor nations alike and illustrate the urgency and timeliness of the task force’s deliberations.

In recent years, producers in Manitoba have been challenged by a changing climate. For example, in what has been referred to as “weather whiplash”, the 2011 flood cost taxpayers $1 billion with a record one-third of cropland unable to go to seed (Winnipeg Free Press 2011). Yet the flood was immediately followed by two months without any rain, wilting what crops remained (Globe and Mail 2011). One producer described the events as “jarring”, noting that “I could be receiving flood and drought insurance payments at the same time. That’s crazy. You would never believe it to be possible (Globe and Mail 2011).”

This story is not unique to Manitoba. A report by the International Human Dimensions of Global Environmental Change Program cited the above Manitoba experience within the context of similar events in North America and elsewhere (UNU-IHDP 2014). In 2013 for instance, approximately 90 percent of the state of Colorado was in a drought condition. Unprecedented wildfires ravaged 140,000 acres with many ranchers needing to cull their herds due to a lack of feed. But during September a perfect storm converged over the Rocky Mountain state delivering flood damage estimated at $2 billion (Reuters 2013). This was the same year that inflicted Calgary with $6 billion in flood damage (Calgary Herald 2013), making it the most costly natural disaster in Canadian history (CBC 2013, cited in UNU-IHDP 2014).

Also in 2013, “much of Central Europe was affected by extreme flooding in many areas: causing damages to houses, infrastructure, and services (Europa 2013). Then in July, crops in Austria and Hungary were subjected to unusually high temperatures in excess of 40 degrees Celsius which shriveled the harvest (Deutsche Welle 2013, in UNU-IHDP 2014).” Furthermore, in China the same year saw record high temperatures in parts of the country and a drought that caused an estimated USD $2 billion and “affected 2 million hectares of farmland, with about 350,000 hectares unable to be harvested at all (Xinhuanet 2013).” At the same time and in the northern part of China, the Gansu Province received “double the normal annual precipitation and in Tianshui City, four successive rainfall events triggered floods, landslides, and mud-rock flows across seven townships and affecting 1.22 million people (Xinhuanet 2013).”
Scope of the Review

The purpose of this report is to summarize the results of previous policy adaptability analyses of three agriculture business risk management programs, namely: AgriInsurance, AgriStability and AgriRecovery.

This report summarizes the results of previous analyses using the Adaptive Design and Assessment Policy Tool (ADAPT tool). The ADAPT tool is a web-enabled, Excel-based tool that guides policy-makers through a structured, participatory process that compares existing policies and programs to the principles of adaptive policies as set out in the book *Creating Adaptive Policies: A Guide for Policy-making in an Uncertain World* (Swanson and Bhadwal 2009). More specifically, the tool analyses the ability of a policy or program from two perspectives: (1) The ability to support stakeholder adaptation actions (e.g., for climate change); and (2) The ability of the actual policy or program itself to be adaptive to changing circumstances.

The beta version of the tool was developed and applied in a 2011 drought and excess moisture (DEM) pilot initiative carried out by IISD in partnership with the Saskatchewan Water Security Agency and MAFRD. Two of the programs examined in this pilot initiative were AgriInsurance and AgriStability. The results of these studies were previously unpublished and are summarized in this paper. A follow up study was undertaken by IISD and MAFRD in 2012 which examined the AgriRecovery program, among others (IISD 2012). Additionally, in 2013 the Saskatchewan Water Security Agency and IISD in collaboration with the provinces of British Columbia, Nova Scotia and Manitoba, with funding and collaboration from Natural Resources Canada Impacts and Adaptation Division, set out to apply the ADAPT tool in the context of policies designed to support climate change adaptation efforts in a variety of sectors, and to refine and enhance the tool for wider application (Bizikova et al. 2014). This 2013 analysis included AgriInsurance and AgriStability in the context of application in British Columbia. The ADAPT tool analyses were all undertaken recognizing that the programs studied were not necessarily developed with the intent of supporting climate change adaptation. The point of the analyses was to assess existing programs with climate change in mind, pointing out where adaptation strengths and gaps may exist. This was not an evaluation of the programs, but only an adaptability assessment.

Additional information on the methodology and concepts of the ADAPT tool are Annexed to this paper.
AgriInsurance is part of the Growing Forward 2 suite of business risk management tools. It is “a federal-provincial-producer cost-shared program that stabilizes a producer’s income by minimizing the economic effects of production losses caused by natural hazards (AAFC 2015a).”

In 2013 the ADAPTool was used to examine Production Insurance in British Columbia with the analysis carried out by the B.C. Ministry of Agriculture Climate Action Team, IISD and Adaptive Resource Management Ltd (BC-MACAT et al. 2014). In B.C. the Production Insurance Unit is headquartered in Kelowna and the program is delivered through seven regional offices located in Abbotsford, Dawson Creek, Fort St. John, Kamloops, Kelowna, Oliver and Williams Lake. In 2012 a total risk premium of $26 million was contributed to the insurance fund to cover expected losses; however, due to a favourable growing year, the program paid out only $13 million in crop losses in 2012 (BC-MACAT et al. 2014).

The ADAPTool analysis concluded that “production insurance is a key support for producer financial resilience. It will become more important with greater variability and extremes in weather as the climate changes (BC-MACAT et al. 2014).” It scored well in its “ability to support anticipated adaptation needs.” It was also noted that “program adaptability is strengthened by its breadth across many sectors and adaptation domains, its extensive consultations with producers and its predictable program review schedule.” Additionally, the following conclusions and recommendations were made:

- “The program’s adaptability could increase with greater use of multi-stakeholder deliberation in implementation and more decentralization of decision making—for example, in relation to best practices and eligibility. (The corporate structure for production insurance delivery in other provinces tends to be more decentralized and conducive to adaptability compared to B.C.)”;
- “As new and potentially better-adapted crops become available, their production risks will need to be evaluated and incorporated into the program. But with limited experience, their premiums will be high to reflect the actuarial uncertainty associated with the lack of local production history. This feature creates a potential adaptation barrier for producers…”
- “Another uncertainty is the trend towards self-insurance, which may reduce the base for loss sharing and increase actuarial risks for the program. Producers who are better able to adapt might disproportionately opt out of buying insurance. On the other hand, program coverage may act as a disincentive to adaptation by shielding producers from climate shifts. The interaction between premium rates, risk management and adaptation practices may therefore increase actuarial risk for the program.”
Among the detailed conclusions of the adaptive policy analysis on production insurance in B.C. were the following (BC-MACAT et al. 2014):

<table>
<thead>
<tr>
<th>Adaptive Policy Analysis of Production Insurance in B.C.</th>
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</thead>
<tbody>
<tr>
<td><strong>Adaptive Policy Aspect</strong></td>
</tr>
<tr>
<td>Are anticipated adaptation actions supported by the program?</td>
</tr>
<tr>
<td>Is the policy/program itself vulnerable to climate change?</td>
</tr>
<tr>
<td>Does the program enhance the capacity of producers to undertake the anticipated adaptation actions?</td>
</tr>
<tr>
<td>Was multistakeholder deliberation used in the design of the program?</td>
</tr>
<tr>
<td>Is multistakeholder deliberation used in program implementation?</td>
</tr>
<tr>
<td>Does the policy/program enable self-organization and social networking?</td>
</tr>
<tr>
<td>Is decision making for program implementation adequately decentralized?</td>
</tr>
<tr>
<td>Does the program have a regular formal review?</td>
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</tbody>
</table>
The B.C. ADAPTool analysis concluded that the climate adaptability of the AgriInsurance program in that province was fairly high, in part because climate related insurance claims trigger premium increases, in a mechanism that promotes adaptation and reduces the moral hazard issue. However, in the longer term, as climate variability increases, and if farmers are subject to repeated climate hazards, there is some question about how producer behaviour and coverage may shift as premiums increase. The program itself does not appear to be facing significant financial risk, but as the pace of change accelerates and producers adapt by introducing new and potentially better-adapted crops and cultivars, it may be difficult to establish appropriate premium rates for insurance coverage as practices change.

B.C.’s agricultural sector is also highly diversified and regional in scale: agriculture in the Fraser Valley is completely different than in the Peace River district in the northeastern part of the province. Climate hazards are also regionally differentiated. The result is that in B.C., even a series of severe climate events in different parts of the province generate limited insurance risk at a provincial scale.

An earlier version of the ADAPTool was used by MAFRD and IISD in 2011 to study the AgriInsurance program in the Manitoba context. The conclusions from this analysis are summarized below.

<table>
<thead>
<tr>
<th>Adaptive Policy Analysis of AgriInsurance in Manitoba</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive Policy Aspect</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Percentage of Potential Adaptation Actions Supported Directly or Indirectly by the Programme</td>
</tr>
<tr>
<td>Can the program cope with an increased range of expected climate conditions?</td>
</tr>
<tr>
<td>Does the program enhance the capacity of actors within each sector to adapt?</td>
</tr>
<tr>
<td>Enables Self-Organization?</td>
</tr>
<tr>
<td>Decision-making is Decentralized?</td>
</tr>
<tr>
<td>Formal Review Mechanism in Place?</td>
</tr>
</tbody>
</table>

Based on the AgriInsurance analysis conducted using the ADAPTool in Manitoba, the main recommendation put forth for program improvement was to undertake a scenario analysis to stress test and quantify the vulnerability of the program under climate change.

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2 The six determinants of adaptive capacity cited by Smit et al. (2001) including: (i) Access to Economic Resources; (ii) Access to Relevant Technology; (iii) Access to relevant Info and Skills; (iv) Access to Relevant Infrastructure; (v) Access to Institutions and Networks; (vi) Equitable Distribution of Resources.
AgriStability

AgriStability is “a margin-based program which allows producers to protect their farm operations against large declines in farm income (AAFC 2015b).” A payment within the program is “triggered when a producer’s margin (allowable revenue less allowable expenses) in the program year drops below their average margin from previous years (historical reference margin).”

The 2013 ADAPTool analysis in B.C. also examined the AgriStability program (BC-MACAT et al. 2014). Among the cited strengths of the program with regard to adaptability were “its regular reviews and scheduled updates, and the broad consultations that have gone into its design” and also due to its importance across multiple sectors, crops, regions and climate stressors. Regarding weaknesses, the limitations of its support as climate variability increases and the narrow focus of its support on financial capacity, was noted. It was also observed that “best practices used as program criteria are likely to shift as climate changes, making it more challenging for producers to meet restrictive program requirements” and that “the program may not provide adequate support under conditions of increasing climate variability and more diverse field conditions if these lead to consistently declining margins for several years in a row for a particular set of producers.”

Among the detailed conclusions of the adaptive policy analysis on AgriStability in B.C. were the following (BC-MACAT et al. 2014):

<table>
<thead>
<tr>
<th>Adaptive Policy Analysis of AgriStability in B.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis Conclusion (2013)</td>
</tr>
<tr>
<td>Are anticipated adaptation actions supported by the program?</td>
</tr>
<tr>
<td>Is the policy/program itself vulnerable to climate change?</td>
</tr>
<tr>
<td>Does the program enhance the capacity of producers to undertake the anticipated adaptation actions?</td>
</tr>
<tr>
<td>Was multi-stakeholder deliberation used in the design of the program?</td>
</tr>
<tr>
<td>Is multi-stakeholder deliberation used in program implementation?</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Does the policy/program enable self-organization and social networking?</td>
</tr>
<tr>
<td>Is decision making for program implementation adequately decentralized?</td>
</tr>
<tr>
<td>Does the program have a regular formal review?</td>
</tr>
</tbody>
</table>

The key recommendations made for the program to enhance its ability to support adaptation and to be adaptive itself to changing conditions included (BC-MACAT et al. 2014):

- Changes in climate may affect producer margins in successive years, as well as producers’ abilities to meet program criteria. Monitoring the program to assess whether increasing climate variability and extremes are affecting the AgriStability program’s ability to meet its policy objectives is recommended, as a means of preparing for future program design discussions.
- Employ greater use of multi-stakeholder deliberation in implementation and more decentralization of decision making to aid the program in responding to regional diversity and increasing climate variability.
The AgriStability program was analyzed in the Manitoba context in 2011 by IISD and MAFRD. The conclusions of this ADAPTool analysis are summarized as follows:

<table>
<thead>
<tr>
<th>Adaptive Policy Aspect Analysed</th>
<th>Analysis Conclusion (2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Potential Adaptation Actions Supported Directly or Indirectly by the Programme</td>
<td>The program directly or indirectly supports 14% of adaptation actions identified across the cattle, forage, cropping, forage seed, and hog sub-sectors. The adaptation actions directly supported included the use of insurance, while the indirect adaptation actions supported included treatment of bee nests and the effective and proper timing of fungicide application (i.e., will partially compensate for additional expenses).</td>
</tr>
<tr>
<td>Can the program cope with an increased range of expected climate conditions?</td>
<td>Income and expenses directly related to the production of farm commodities are included in the program's calculation, e.g., commodity sales or purchases, fuel, inputs, and only a few of these will be weather-related (e.g., cost of feed, seeds). AgriStability fees paid by farmers are directly related to the amount paid out.</td>
</tr>
<tr>
<td>Does the program enhance the capacity of actors within each sector to adapt?</td>
<td>With regard to supporting broad adaptive capacity of producers, the program directly supports 'Access to Economic Resources' and the 'Equitable Distribution of Resources'.</td>
</tr>
<tr>
<td>Enables Self-Organization?</td>
<td>The program does not contribute directly to the self-organization of social networking of producers.</td>
</tr>
<tr>
<td>Decision-making is Decentralized?</td>
<td>The program is not decentralized</td>
</tr>
<tr>
<td>Formal Review Mechanism in Place?</td>
<td>Components are reviewed annually</td>
</tr>
</tbody>
</table>

Based on the AgriStability analyses conducted using the ADAPTool in Manitoba, the recommendation was made relating to assessing the potential merits for further decentralization of design and delivery of the programme.
AgriRecovery

AgriRecovery is a federal-provincial-territorial “disaster relief framework intended to work together with the core BRM programs to help agricultural producers recover from natural disasters (AAFC 2015c).” The types of natural disasters covered under the program include “disease, pest or weather-related event, such as flooding or a tornado”, but not events which are cyclical “such as pricing cycles, or part of a long-term trend, such as a change in markets.”

In a 2012 drought and excess moisture study conducted by IISD and MAFRD, the AgriRecovery program was analysed using the ADAPTool. The conclusions of the analysis were as follows:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Percentage of Potential Adaptation Actions Supported Directly or Indirectly by the Programme</td>
<td>This program provides direct or indirect support to 33 out of 159 anticipated adaptation actions.</td>
</tr>
<tr>
<td>Can the program cope with an increased range of expected climate conditions?</td>
<td>There is some vulnerability in the program: an increase in the frequency in flood and drought related disasters could put fiscal pressure on federal and provincial governments.</td>
</tr>
<tr>
<td>Does the existing suite of programmes enhance the capacity of actors within each sector to adapt?</td>
<td>This program contributes to adaptive capacity directly via access to financial resources to stakeholders for recovery.</td>
</tr>
<tr>
<td>Is multi-stakeholder deliberation used in the design and implementation of the program?</td>
<td>Yes – the program framework was developed as part of a broader set of consultations around the Canadian Agriculture Income Stabilization (CAIS) Program in conjunction with an assessment of crop insurance and AgriStability. Widespread consultation during implementation is not feasible at all levels given the urgency of response required.</td>
</tr>
<tr>
<td>Enables Self-Organization?</td>
<td>While there are strong mechanisms for sharing of lessons learned among provinces and federal government, the sharing of lessons among stakeholders impacted post recovery would be beneficial.</td>
</tr>
<tr>
<td>Decision-making is Decentralized?</td>
<td>The program is a joint review by provincial and federal governments and includes examination of need with the local stakeholders or farmers group. The assessment itself is usually started at the provincial level which is appropriate.</td>
</tr>
<tr>
<td>Formal Review Mechanism in Place?</td>
<td>Formal reviews are undertaken, but not at specified intervals.</td>
</tr>
</tbody>
</table>
Among the key recommendations made based on the ADAPTool analysis on the AgriStability program in Manitoba were:

- Multi-year drought or flooding can pose a threat to the ability of several programmes in achieving their broader mandate, including AgriRecovery. A review of this program is recommended when successive years of drought or flooding occur to detect which other government agriculture program objectives, functions, and services might be suffering from lack of attention;
- Some review of the AgriRecovery assessment framework with regard to the alignment with the other six determinants of adaptive capacity would be beneficial (e.g., providing access to relevant Technology; Info and Skills; Infrastructure; Institutions and Networks; and Equitable Distribution of Resources.; and
- A more formal time-triggered review of the program would help detect emerging issues (i.e., potential for increased frequency of disasters).

Other Programs

Other agriculture programs were analyzed using the ADATPool in Manitoba in addition to AgriInsurance, AgriStability and AgriRecovery (see Figures 1 and 2). The insights from this broader analysis are relevant to climate change adaptation programming and agriculture risk management in Manitoba more broadly. For instance:

- Extension programs like the Manitoba Go Teams program scored high on policy adaptability owing to an overall broad mandate which addressed many of the anticipated climate change adaptation actions of producers and owing to its on-the-ground extension service which enabled self-organization and networking among producers as well as decentralized decision making;
- None of the policies examined (in Figure 1) provided direct support for producers to access relevant technology for adapting to drought and excess moisture (aside from some support via EFAP: Environmental Farm Action Program). It was believed that this could be signalling a significant policy gap if the suite of policies examined is representative of the broader package of government policies relevant to drought and excess moisture;
- The studies noted that all of the policies analysed could benefit from enhanced mechanisms for sharing of best practices and lessons learned among producers across Manitoba; and
- While most programs examined were said to have active formal review programmes, it was recommended that these review processes be assessed more specifically for their ability to consider and react to the risks and opportunities posed by potential future increases in drought and excess moisture.
FIGURE 1. ADAPTool results for the 2012 Manitoba study (IISD 2012).

Note: CPP: Community Pasture Program; ASI: Agriculture Sustainability Initiative; Prov Land Use Reg: Provincial Planning Regulation - Policy Area 3, Agriculture; EFAP: Environmental Farm Action Plan; Ag Weather Program

FIGURE 2. ADAPTool results for the 2011 Manitoba study (previously unpublished).

Note: MSAPP: Manitoba Sustainable Agriculture Practices Program; Environmental: Environmental Farm Plan; ARDi: The Agri-Food Research and Development Initiative.
References


Annex: Overview of the ADAPTool

The ADAPTool is a Microsoft Excel-based tool designed to assist policy-makers to undertake two specific and related analyses of existing policies or programs:

1. Analysis of the ability of the policy/program to support stakeholder adaptation actions necessary to address a specific stressor (i.e., climate change or market price fluctuations, etc.); and
2. Analysis of the adaptability of the actual policy or program itself to be adaptive to changing circumstances (based on the seven guidelines for creating adaptive policies outlined in Swanson and Bhadwal 2009 and summarized in this section).

The ADAPTool is structured around four worksheets to address a series of 15 questions as outlined in Box 1 below. For more details see the ADAPTool Guidebook (Tyler et al. 2013).

BOX 1. ADAPTool questions and worksheet structure

Scope of Analysis Worksheet:
1. What is the geographic scope of the analysis (e.g., watershed, municipality, region, province/state)?
2. What is the stressor of concern (e.g., climate change impacts such as drought and excess moisture)?
3. What are the policies/programs to be assessed?

Adaptation Analysis Worksheets (for planned adaptability):
4. What are the main sectors relevant to the policy(ies)?
5. In what ways is the sector vulnerable to the stressor?
6. What adaptation actions might be necessary to address the vulnerabilities?
7. Are the identified adaptation actions supported by policies/programs?

Adaptive Capacity Analysis Worksheet (for both planned and autonomous adaptability):
8. Is the policy itself vulnerable to the stressor identified?
9. Does the policy enhance the capacity of actors within each sector to adapt?
10. Was multi-stakeholder deliberation used in the scoping and design of the policy?
11. Was multi-stakeholder deliberation used in the implementation of the policy?
12. Does the policy enable self-organization among affected stakeholders?
13. Is the policy sufficiently decentralized to the lowest and most accountable unit of governance with appropriate resources and capacity?
14. Are a variety/mix of policy instrument types used?
15. Does the policy have a regular formal review process in place that can detect emerging issues?

Synthesis Worksheet
An aggregate ranking of planned adaptability and autonomous adaptability is provided for the overall suite of policies/programs, as well as for each individual policy/program.
Appendix C

The questions asked in the ADAPTool are based on the seven principles for Creating Adaptive Policies (Swanson and Bhadwal 2009; Swanson et al. 2010). These principles are summarized below.

1. **Integrated and Forward-Looking Analysis.** By identifying key factors that affect policy performance and scenarios for how these factors might evolve in the future, policies and programs can be made robust to a range of anticipated conditions. Such an approach uses indicators for monitoring and triggering policy adjustments when needed. Modelling tools of varying sophistication can be used to support this kind of analysis, which is often integrated through rapid scenario planning methods.

2. **Multi-stakeholder Deliberation.** Multi-stakeholder deliberation is a collective and collaborative effort to examine an issue from different points of view as part of a decision-making process. Deliberative processes strengthen policy and program design by building recognition of common values, shared commitment and emerging issues, and by providing a comprehensive understanding of causal relationships. The key aspects of this process are that it involves participants, including the public, in sharing multiple perspectives in an attempt to reach consensus on a relevant decision. This goes beyond stakeholder consultation.

3. **Automatic Policy Adjustment.** Automatic adjustment mechanisms can speed up the response to conditions that are more or less anticipated. They can be used in complicated policy environments by separating the various issues into units (both qualitative and quantitative) in which the understanding of the system is high, allowing for fine-tuning and making adjustments that help reduce risks and maintain performance. Automatic adjustments can be both fully and semi-automatic.

4. **Enabling Self-Organization and Social Networking.** The intent of this principle is to ensure that policies do not undermine existing social capital, but instead create forums that enable social networking, facilitate the sharing of good practices and remove barriers to local self-organization. Local responses, self-organization and shared learning all strengthen the ability of stakeholders to respond to unanticipated events through innovation.

These practices take advantage of the capacity of complex adaptive systems to generate solutions beyond external input or formally organized interventions. The ability of individuals and groups to self-organize in response to stresses, crises or unexpected problems is well documented in social and ecological literature, and a key aspect of healthy adaptation. For policy-makers and program managers, the idea is to foster self-organized responses to unexpected conditions by enabling and supporting interaction, learning and networking, without trying to control or dictate outcomes. This includes facilitating sharing and copying of best practices, providing resources to reduce barriers to self-organization and creating spaces for adaptive collaboration.

5. **Decentralization of Decision Making.** In governance terms, the principle of “subsidiarity” means decentralizing decision making to the lowest effective and accountable unit of governance. The adaptive advantages are better opportunities for feedback and information sharing to ensure that decision-makers are aware of unexpected problems and effects of proposed interventions, as well as the nature of different interests. For policies directly concerning natural resources and ecosystems, field staff typically notice significant change earlier and can mobilize affected local interests to address these changes more simply.
Because local conditions vary widely, decentralization provides a way to implement policies and programs more flexibly, to ensure effectiveness and adaptation to change. The potential for decentralization in any particular policy or program area will depend on the scale of intervention needed, the extent of local knowledge and capacity, and the structure of governance mechanisms for accountability and co-ordination.

6. **Promoting Variation.** Given the complexity of most policy settings, implementing a variety of policies to address the same issue increases the likelihood of achieving desired outcomes. Another common risk-management approach is developing diverse responses, which make it easier to perform efficiently in the face of unanticipated conditions. Variation may be actively designed, to provide a range of alternative options to meet the diverse needs of different stakeholders. This process can be facilitated by: using a mix of policy instruments; exploring synergies with other policies; providing opportunities for risk spreading.

Another approach is to use policy tools to facilitate variation by removing barriers to alternative solutions and providing information to support the exploring of options.

7. **Formal Policy Review and Continuous Learning.** Even when the policy or program is performing well, regular review and well-designed pilots administered throughout the life of the policy/program to test assumptions related to performance can help address emerging issues and trigger value-added policy adjustments. Formal review is different than automatic adjustment, where triggers and responses may be determined in advance. Formal review is a mechanism for identifying and responding to unanticipated circumstances and emerging issues. This assessment process can be very useful in detecting emerging issues that can affect the policy’s performance. A formal review mechanism can include triggers for the review (such as time intervals or other performance triggers), definition of the nature of the review and a learning process about who needs to be involved in the review, who will take action on the results and what actions are to be considered.

Together, these seven characteristics of adaptive policies are relevant in the planning and design of policies and programs, as well as in their implementation and evaluation. The ADAPT Tool is intended to encourage assessment and discussion of these characteristics in various phases of the policy cycle.