

Adapting to a Changing Climate

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Manitoba Green Leaders Conference
October 23, 2007

1. Introduction

In the spring, the Intergovernmental Panel on Climate Change (IPCC) released its fourth assessment report, which demonstrated that:

- The continuing process of global warming is human-induced. This is a very conservative group of scientists and this is the first time that they have concluded that climate change is primarily man-made.
 - global average temperatures rose by 0.74°C (+/- 0.18°C) between 1906 and 2005
- Significant changes in climate, ecosystems, economies and societies will take place over the next one hundred years, with the degree of change increasing with the rate of greenhouse gas emissions.
 - at the global level, the resilience of many ecosystems is likely to be exceeded by the end of this century. Another global panel has already concluded that the majority of the earth's ecosystems are already being overexploited.

Climate change is already taking place; the degree to which this change takes place depends on how quickly and how deeply we are able to cut our greenhouse gas emissions.

Now, I do not want to spoil your lunch, but the rather sober language of the IPCC does contain some rather sober warnings. We are used to thinking of climate change as a gradual process with warming occurring along a steady curve until it levels off, hopefully sometime this century.

This is not likely to resemble reality, as any of you who work on the land for a living will well recognize. There is plenty of evidence to indicate that this process is already proceeding much more rapidly than had been previously predicted. A few examples include:

- melting of the Arctic sea ice;
- opening of the Northwest passage; and
- the Russian ship, the Kapitan Sviridov, which has just docked at Churchill.

At the same time, greenhouse gas emissions are growing at a rate much faster than predicted.

- China has just become the largest source of GHG emissions, some 10–15 years earlier than had been predicted.



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Prairies will experience temperature increases greater than anywhere else in southern Canada.

The objective of the United Nations Framework Convention on Climate Change, the UNFCCC, is to achieve “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”

- No definition provided of what constitutes dangerous concentrations of atmospheric greenhouse gas concentrations.
- In response, then Prime Minister Blair organized the Exeter conference “Avoiding Dangerous Climate Change” in February 2005.
- Led to EU conclusion that we need to hold the increase to 2°C at most, compared to 1900. Beyond this rise of global temperature, the consequences could be truly dire.
- According to the science, this means restricting atmospheric concentrations of GHGs to 400 to 450 ppm. However, we could well achieve this concentration of GHGs by 2015 or 2020, or even earlier.
- There is no hope of avoiding a 2°C rise in temperature. But can we stop emissions growth before we reach an overall warming of 3°C?

The Intergovernmental Panel on Climate Change, or the IPCC, is leaning toward a 3°C rise in temperature. An upcoming report from the International Energy Agency is likely to confirm this projection.

- At that level, scientists fear all sorts of feedback loops which could make the situation much, much worse—melting of permafrost, loss of all or part of the Antarctic or Greenland ice sheets, leading to catastrophic sea level rise and even faster warming of the globe.
- And this could begin to happen in our children’s lifetime.

The economic costs of this kind of climate change are incalculable. But even the costs of lower levels of climate change could be considerable; potentially in the *trillions* of dollars per year if significant reductions in greenhouse gas emissions do not take place soon.

- A temperature rise of 2°C to 3°C (as is expected to take place within the next 50 years) is projected to result in a permanent economic loss of up to three per cent of global GDP.
- Cost of inaction over the next two centuries could rise to five to 20 per cent of global GDP per year (Stern 2006).

This means that climate change has now become the single most important economic challenge facing humankind today. It is also a political challenge of enormous complexity. I want to congratulate Premiers Doer and Campbell and all of the others here today for their political courage in stepping forward. The deadline for reducing emissions by at least 70 per cent is likely to come in six elections time. In Canadian terms, this is as far ahead as the Diefenbaker Government is behind us.

And the figures, which are cumulative, demonstrate quite conclusively that we have to act now.

Coming closer to home we are increasingly witnessing events in Manitoba that are consistent with the expected consequences of climate change:

- In 2003, drought caused Manitoba Hydro’s hydroelectricity production to decline to 40 per cent below normal;¹ the utility lost \$436 million dollars in 2003-04, making it one of its worst years ever.²
- Two years later, the situation was completely reversed. During the summer of 2005, more of Manitoba was flooded at one time than at any other time on record; more roads were closed at one time than ever before, summer or winter; and 22 municipalities declared a state of emergency.³
- This past summer, the town of Elie was hit by a F5 tornado, the first tornado of this magnitude ever recorded in Canada.
- Last week, the Russian ship, the Kapitan Sviridov, arrived in Churchill with cargo of fertilizer for North American farmers, marking the first time goods were imported from Russia to Canada through Churchill; first step in establishing the “Arctic Bridge.”⁴

1 Brown, Curtis. 2003. Drought means Manitoba is importing electricity. *Winnipeg Free Press*, 23 December. Accessed March 29, 2006. <http://www.justenergy.org/news/122303freepress.html>.

2 Lett, Dan. 2004. Natural gas, drought cost Hydro dearly - Utility loses \$436 million. *Winnipeg Free Press*. 12 August. Accessed March 29, 2006. Available at: <http://www.justenergy.org/news/081204freepress.html>.

3 Environment Canada, Canada’s Top Ten Weather Stories for 2005. Manitoba’s Worst Widespread Flooding Ever, Available at: http://www.msc.ec.gc.ca/media/top10/2005_e.html

4 See the Globe and Mail article for more details: <http://www.theglobeandmail.com/servlet/story/RTGAM.20071018.wChurchill18/BNStory/National>

2. What climatic changes are expected to take place in Manitoba?

- By 2080, average summer temperatures in Manitoba are projected to be 3°C to 4°C higher than today.
 - even greater warming could take place during the winter months, with average temperatures rising by 5°C to 8°C
 - prairies will experience temperature increases greater than anywhere else in *southern* Canada, reminding us that Colonel Palliser was right when he told us that the southern prairie ecosystem is by nature very dry
 - Spring is expected to arrive earlier and be wetter, and be followed by warmer and drier summers.
 - precipitation levels could decrease by 10 to 20 per cent⁵ in the summer
 - Greatest warming and increases in precipitation are projected to be in the north-eastern part of the Prairies (i.e., in the area surrounding Churchill).
 - There will also be changes in evaporation, humidity and wind patterns.
- However, the most significant threat posed by climate change for the prairies is the projected increase in climate variability and the frequency of extreme weather events like droughts, heat waves, hailstorms, tornados, intense rainstorms and floods.⁶
- Climatic extremes (like a 1-in-1000 year drought) pose a greater risk than a change in the long-term average.
 - The most costly climate events in Canadian history have been droughts on the prairies.

3. What are the implications for Manitoba?

Water

- Models indicate there will be greater variability in the availability of water from season to season and from year to year, and in precipitation form (rain, snow and hail). For example, rainstorms are expected to be less frequent, but significantly more intense.
- In the summer, higher temperatures and decreased rainfall might result in low water flows, affecting the timing, amount, and quality of water in Manitoba's waterways and lakes. This could have dire consequences for Lake Winnipeg.
- Increased movement of surface water during spring flooding could put more pressure on existing infrastructure and flood protection systems. Larger floods could also increase the spread of pollution from suspended solids over larger areas.

Agriculture: Good news and bad news

- Average potential crop yields could fall by 10 to 30 per cent due to higher temperatures and lower soil moisture.
- Might need to shift type of crops grown from small grain cereals to corn and soybeans, which adapt better to warmer climates.

- If precipitation during the growing season is highly variable, pulse crops that have indeterminate growth habits (e.g., lentils) or longer reproductive growth periods (e.g., chickpeas), might have an advantage over crops that have more determinant (e.g., cereals) or shorter reproductive growth periods.

Forestry: Goodish news and bad news

- As climate change progresses, the range of the boreal forest will shrink—its southern edge will transform into aspen parkland or prairie ecosystems, while northward expansion will be hampered by the limited development and the highly acidic nature of arctic soils.
- Increased frequency and intensity of forest fires.

5 Manitoba and Climate Change: A Primer. Manitoba Clean Environment Commission and the International Institute for Sustainable Development. 28 pp. Accessed on February 14, 2006, Available at: http://www.iisd.org/pdf/cc_2nd_ed_wcov.pdf

6 Canadian Environmental Assessment Agency, Appendix A: Summary of Projected Regional Climate Change Impacts, Water Supply and Demand, http://www.ceaa-acee.gc.ca/015/0002/0004/appendixA_e.htm#Anchor-10501

- Spread of pests and diseases, such as the potential arrival of the Mountain Pine Beetle, which also feed on jackpine.

Urban

- Weather and climate significantly affect the layout, operation and budget of today's cities and towns—

affecting snow removal, street repairs, storm drains and flood protection measures. If you think Winnipeg has sewer problems now, just wait a while.

- Climate change is predicted to increase these costs, disrupt normal city functions and, particularly in the case of extreme events, create safety issues.

4. Vulnerability

The degree to which climate change will negatively affect Manitobans depends upon our adaptive capacity—our ability to adjust to a changing climate, to moderate potential damage, and take advantage of opportunities.

Our adaptive capacity depends upon non-climatic factors:

- strength and diversity of our economy;
- access to information, technologies and skills;
- design and robustness of our infrastructure;
- underlying health of our ecosystems;
- equitable distribution and availability of resources; and
- policies and institutions that are in place.

(Smit *et al.* 2001)

In general, adaptive capacity is high in Manitoba, as in all of Canada. We have a strong economy, knowledgeable and highly-skilled citizens, access to technologies, and functioning governance structures and institutions. But:

- Adaptive capacity varies between populations and regions; some have lower capacity to adapt than others.
 - the elderly, the poor, those whose health is compromised; resource dependent, isolated and aboriginal communities—these groups are more vulnerable to climate change
- This capacity needs to be mobilized if we are to reduce our vulnerability to climate change; if appropriate adaptation actions are not taken, then negatives impacts are more likely to be experienced.

5. Adaptation

As the impacts of climate change are increasingly being felt, and are projected to be greater in the future, we need to increasingly think about adapting to climate change. This is what human beings do best and as with most things affecting climate change, the sooner we do something about it, the better. And the more cost-effective.

- This means adjusting to conditions that might be new and unfamiliar (e.g., F5 tornados), or changed parameters of current climate (e.g., 1 in 100 year storm becoming the 1 in 50 year storm).

Adaptation is more likely to be effective and less expensive if it is planned in advance and implemented systematically.⁸

Successful adaptation requires:

- Integrating consideration of the implications of climate change into day-to-day decision making.
 - cannot treat the need to adapt to climate change as a separate issue; climate considerations need to be integrated into routine decision making (as they are in a variety of ways today)
 - integrated approach is expected to be more cost-effective

⁸ Intergovernmental Climate Change Impacts and Adaptation Working Group. 2005. National Climate Change Adaptation Framework: Final Draft.

- Local-driven
 - adaptation will largely take place at the local level, in response to the local manifestations of climate change and local capacity to respond
 - therefore governments, businesses, First Nations—as the main decision-makers—need to have the capacity, resources and tools to effectively respond to climate change
- Access to information, tools and technologies
 - information is needed regarding the projected physical and socio-economic consequences of climate change; and how these impacts might be addressed
 - tools are needed to screen initiatives for their vulnerability to climate change and to integrate climate change considerations into decision-making
- technologies are needed to help people adapt, such as the development of more drought- or disease-tolerant trees
- Policy environment that facilitates adaptation
 - national and provincial governments have a critical role to play in establishing the enabling environment needed for effective local responses to take place
 - to do this, government decision-makers need to understand the implications of climate change for their work and have access to the information and tools needed to reduce vulnerability to climate change

6. What are other provinces doing?

Across Canada, various jurisdictions are responding to the threat of climate change. Actions by municipal and provincial governments can provide insight for Manitoba as it prepares its own response.

Adaptation to climate change in Halifax:

The Regional Municipality of Halifax has developed adaptation strategies to reduce the risks and potential liabilities associated with the predicted climatic changes.

- Climate impact assessments for Nova Scotia indicate the province is especially vulnerable to sea level rise, storm surges and extreme weather events. Projected climatic changes include:
 - Up to 100 mm increases in annual precipitation;
 - Magnitude and intensity of tropical storms to increase and hurricanes expected to increase – the 1 in 100 year event becoming a 1 in 50 year event; and
 - Sea level rise of up to 80 cm.
- Examples from the Halifax Regional Municipality of adaptive responses to these predicted impacts include:
 - Mapping over 1,200 square kilometres of coastline around Halifax Harbour using highly accurate Light Detection and Ranging (LIDAR) Mapping to track sea level rise and using this data to inform future development decisions.
 - New wastewater treatment plants are being constructed to cope with an anticipated one metre rise in sea level.
 - The development and publication of a cost-benefit analysis on burying utility lines as a response to reduce power outages, widespread utility infrastructure damage and other impacts from future extreme weather events.
 - Development of *Climate Change: Developer's Risk Management Guide* to assist proponents of new development and infill development in the HRM to raise awareness of projected impacts of climate change.

These responses are part of the HRM's Climate Sustainable Mitigation and Adaptation Risk Toolkit (Climate SMART), an integrated strategy responding to the lack of adaptive capacity at the municipal level.

- Climate SMART provides information and decision-making resources supporting a wide range of adaptation and mitigation initiatives.
- Includes a variety of tools, including:
- Risk Management Tool – helps assess vulnerability of physical and environmental assets and impacts/activities to climate impacts;
- Community-based Vulnerability Assessment and Risk Management Tool – identifies, quantifies and evaluates anticipated vulnerabilities;
- Cost/benefit Assessment Tool – assists in the identification and quantification of economic costs and benefits of proposed climate adaptation planning and management measures compared to “business as usual” approaches;
- Environmental Impact Assessment Tool – assists project managers assess the impact of environment on the project; and
- Communications and Outreach Tool – provides communications and outreach approaches targeted to vulnerable residents and businesses on adaptation activities and programs.

Climate SMART has proven to be a highly effective management tool because it mainstreams GHG emission reductions and climate change impacts and adaptation considerations into the corporate-decision making process.

Adaptation to climate change in British Columbia

B.C. recognizes that the government has a dual role in advancing adaptation:

- As a facilitator, promoting development of the knowledge, tools and capacity required for adaptation across the province.
- As an adaptor responsible for identifying and managing risks to public goods and emerging opportunities for B.C.

As a facilitator:

- The B.C. Ministry of Water, Land and Air Protection has had two people working on

adaptation issues since 2002. The ministry also coordinates an Interagency Adaptation Committee to facilitate information sharing between government agencies.

- Works with the Pacific Climate Impacts Consortium to understand the projected impacts of climate variability, change, and extreme weather events for the West Coast.
- Is engaged in numerous outreach activities to inform government officials and the general public about the implications of climate change and assist them in their efforts to adapt.

As an adaptor:

B.C.'s initial focus is on water management, biodiversity management and risk management.

- An example of adaptation planning that addresses all three of these areas is the Mount Robson Provincial Park management strategy that is currently under review.
- Also, B.C.'s Forest Futures Ecosystem Initiative, the objective of which is to adapt B.C.'s forests and range management framework to a changing climate, is undertaking projects aimed at increasing the resilience of forests and rangelands to stress.
- B.C. is also responding directly to the impacts of climate change through efforts to address the Mountain Pine Beetle epidemic.
 - approximately 22 per cent of B.C.'s merchantable lodgepole pine has been lost since the mid-1990s (about 400-million m³)
 - an estimated 80 per cent of lodgepole pine in British Columbia could be lost by 2013.⁹

B.C.'s efforts reveal that getting to the point of developing effective adaptation strategies requires a foundation of information, communications and vision. You cannot appropriately design adaptation strategies without understanding:

- Historic trends in climate and related biophysical systems (Indicators);

9 British Columbia Ministry of Forests. *British Columbia's Mountain Pine Beetle Action Plan 2006–2011*. Victoria: MOF, p 3. <http://www.for.gov.bc.ca/hfp/mountain%5Fpine%5Fbeetle/>

- The current state of capacity to monitor and assess climate data (Evaluation and Gaps Analysis);
- What the future might bring to a region or ecosystem (Modelling);
- How to develop and utilize decision-making frameworks that take climate change into account (Tools for Adaptive Management); and
- That knowledge in this area needs to increase dramatically and capacity building needs to occur (Research, Education and Communications).

7. What could Manitoba do?

Manitoba has already initiated efforts that serve to reduce our long-term vulnerability to climate change. These include:

- The upgrade of the Red River Floodway
 - will provide the City of Winnipeg with 1 in 700 year protection from spring floods
 - also includes operational designs that ensure its capacity to manage more frequent and intense storm events during other times of the year
- Strengthening our winter roads system
 - approximately 38,000 Manitobans living in 28 communities not served by permanent roads
 - the number of days that winter roads are safe to use had fallen from an average of 50 or 55 days to as low as 20 days, experienced in 1999–2000.
 - due to warmer temperatures in 1997–98, \$14 million was spent flying supplies into communities normally served by winter roads
 - Manitoba Infrastructure and Transportation has now moved over 90 per cent of Manitoba's winter roads away from lakes and rivers and installed many permanent bridges
- Integrated Watershed Management Plans through Conservation Districts
 - enable Manitobans to undertake local level planning that takes into consideration the linkages between water, land and societal needs
 - holistic, ecosystem based approaches to agricultural planning are widely recognized for the positive contribution they can make to adapting to climate change.
- Need a better understanding of the probable physical and socio-economic impacts of climate change for Manitoba
 - an IPCC/Stern-like review of past climatic extremes in the province, changes being witnessed today, projected changes in the future, and an assessment of the economic and social consequences of these changes
 - identify gaps in our scientific and economic understanding that need to be addressed
 - use as the basis for awareness raising activities
- Look for opportunities to reduce our greenhouse gas emissions and our vulnerability to the impacts of climate change simultaneously
 - improving the health of Lake Winnipeg through changes in on-farm management practices will increase adaptive capacity in the agricultural sector as well as the ability of the lake to cope with rising water temperatures
- Need better monitoring of the changes already taking place
 - such as monitoring changes in Manitoba continuous and discontinuous permafrost
 - melting will result in changes to the landscape that will affect infrastructure, hydrology (and in turn water bodies and fish populations), plant communities and local communities
 - also have the potential to become significant sources of greenhouse gas emissions, as methane trapped below the ground is released, or if carbon is released due to degradation or fires in previously frozen peatlands

However, significantly greater effort is needed if Manitoba is going to ensure that it is able to successfully adapt to the changes in climate that are

- Integration of climatic change into policies and decision-making processes. For example:
 - into our building codes;
 - standards for infrastructure construction;
 - water stewardship initiatives;
 - land use planning;
 - disaster preparedness systems; and
 - the environmental assessment process for major development projects.

8. Conclusions

Adapting to climate change is critical to the long-term development of Manitoba.

- If we bring consideration of the implications of climate change into our decision making processes today, we are less likely to be surprised in the future.
- If we don't, there is greater potential for us to take actions that increase the likelihood of economic decline and loss of life in the future.
 - e.g., building in areas that are likely to be increasingly flooded in the future
- To avoid this situation, action is needed by all Manitobans.
 - governments need to facilitate change by providing Manitobans with the information and tools needed to integrate adaptation into decision making, and through a review of policies to ensure that they help, and do not hinder, adaptation efforts
 - governments also need to be adaptors, integrating adaptation considerations into their policies, programs and projects
 - businesses, such as the insurance sector, can review their activities to see how climate change could affect their activities, and how these risks might be mitigated
 - academic community can encourage research in critical areas
 - NGOs in raising awareness about the long-term impacts of climate change for Manitobans, and how they can begin to prepare for this future
- There is also the potential for these changes to bring new opportunities to Manitoba, as illustrated by the emergence of the Arctic Bridge; need careful planning to identify and take advantage of these emerging opportunities.