

## Climate Change Impacts in Manitoba

IISD President looks at farming, the north, Lake Winnipeg and urban life

By David Runnalls

In March 2007, IISD's President and CEO, David Runnalls, produced a series on four aspects of climate change for the *Winnipeg Free Press*. The four editorials are reproduced together here.

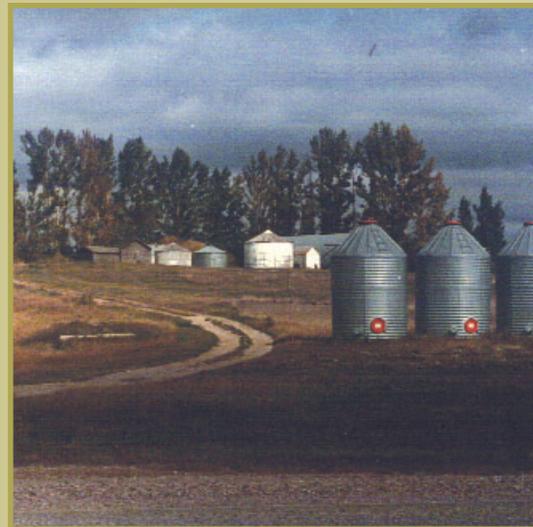
### 1. The End of Farming as We Know It

OUR climate is shifting and with it comes uncertainty, change and more frequent and intense extreme weather events. While Manitobans and other prairie dwellers are accustomed to weather conditions that change on a yearly, seasonal and even hourly basis, climate change is going to greatly amplify this variability. Our province is particularly vulnerable to climate change because of the importance of weather-dependent economic activities like agriculture, forestry, tourism, energy, fisheries and transportation.

Manitobans need to prepare in advance for these changes. Our agricultural sector in particular is highly vulnerable to the expected consequences of climate change. Agricultural exports contribute approximately \$3 billion to Manitoba's economy annually. Predictions are that average potential crop yields could fall by 10 to 30 per cent due to higher temperatures and lower soil moisture. Further disruption of this already stressed economic sector could have significant implications for the farm family and the overall economic well-being of our province.

What are some things Manitoba's farmlands may need to consider in order to anticipate the expected impacts of climate change? Some research suggests that there may need to be a shift in Manitoba 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. In drier areas, an increase in summer



"Our agricultural sector in particular is highly vulnerable to the expected consequences of climate change," writes David Runnalls. Photo by Don Berg.

fallow might be a way to compensate for the increased aridity. Diversification of crop production may help producers reduce income loss from year to year due to the risks associated with climate change.

The type and amount of agricultural inputs used by producers, such as fertilizers, pesticides and energy, will also need to change as cropping patterns are altered.

A changing climate will also affect the abundance and distribution of various weed, pests and diseases. It is anticipated that new weed species will arrive and place additional stress on crops already weakened by predicted shortfalls in summer precipitation. If droughts and floods become more frequent, more vigorous weeds might also appear.

Warmer winters could help some pests, such as aphids, over-winter and cause damage in the spring time. In addition, extra heat in the summertime might likely increase the possibility, frequency, and number of generations per year of pests such as grasshoppers or mites.

However, by far the greatest impacts will be those related to the availability of water. Through ingenuity and hard work, prairie farmers have established farms in a region prone to dryness. They have introduced crops that respond to expected levels of rain and, particularly in Alberta and Saskatchewan, established extensive irrigation systems. Agricultural production on the prairies currently consumes about half of all the water used in Canada.

Climate change brings with it projections of increases in temperature, precipitation and evaporation, the net effect being greater aridity. Along with these changes there is expected to be increased incidences of drought and less frequent, but significantly more intense, rainstorms.

As temperatures increase, demand for water will increase. In the absence of long-term planning, an increase in need for crop irrigation combined with a decrease in access to fresh water is a recipe for disaster.

There are numerous responses that can be taken to help Manitoba's agricultural sector prepare for and adapt to the impacts of climate change. These approaches should look beyond ad hoc interim solutions to a deeper level that addresses economic, social and environmental

concerns in an integrated manner. Clearly a no-regrets strategy involves soil and water conservation. However, building the capacity of farm families and the agriculture sector to adapt to climate change is going to require a combination of new and traditional farming and management skills, timely access to information, technology, infrastructure, and more reliance on informal and formal relationships among producers within the sector.

Efforts to integrate management of water and agriculture are already occurring in Manitoba. A recent analysis of Manitoba's Conservation Districts (CD) program by the International Institute for Sustainable Development noted that the community-based decision making approach of the CD program to water and soil conservation can play a leading role in supporting adaptation to climate change. The review found that CDs "consistently adapted to new conservation challenges, in some cases with completely unanticipated stakeholders and around unexpected issues." The most successful CDs were the ones with physical boundaries that conformed to watershed boundaries, and had clear jurisdiction rules in place, particularly over drainage issues. The decentralization of power and decision-making to local communities found in CDs can work with a defined role and clear authority. Encouraging and enhancing this type of community approach to adaptation will benefit not only farmers, but Manitobans as a whole.

Manitoba, already a leader in reducing the greenhouse gas emissions that are fuelling climate change, has the opportunity to also take a leading role in implementing sustainable agricultural practices that respond to climate change. We can

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lead the way in sustainable development practices that will prepare provinces and the country as a whole to adapt to the changes we can no longer prevent.

## 2. Northern Exposure: The people of Manitoba's high north facing a major upheaval

BY NOW most Canadians are aware that our Arctic environment is the proverbial “canary in the coal mine” of global warming. Canada's northern communities have been experiencing the effects of global warming for over a decade now. It is a terrible irony that those who have had little to do with the cause of the planet's warming will suffer its most harmful effects. From sub-Saharan Africa to Pacific Island States to Arctic communities, those who live closest to the land are feeling the effect of climate change first.

Projections show that as the climate changes, Manitobans will see a substantial change in the climate of the eco-zones in our province, particularly in our North. Some estimates suggest that the areas around Hudson's Bay could see an increase of up to 10°C in temperature. This will be a drastic shift for the region's landscape, wildlife and people. These communities are already experiencing the effects of climate change before the rest of Manitobans, and with greater strength. Planning now for projected changes will help lessen the impact and enable northern communities adjust to a new future.

One of the most critical factors affecting northern Manitobans is transportation into towns and remote communities. Northern life depends on access to winter roads for the transportation of goods, produce, construction material, equipment and people. Ironically, many remote First Nations communities rely on oil and diesel trucked in over ice roads to meet their energy needs. But over the past decade the period of time during which winter roads are available has shortened dramatically. What was once a transportation window of 50 to 55 days went down to a low of 20 days in the winter of 2000.

Reduced access to winter roads means that more goods need to be flown into remote communities, resulting in higher living costs and potential lower quality of life and health. For example, due to warmer temperatures in 1997–1998, \$14 million was spent flying supplies into communities normally served by winter roads. That figure will only increase as our planet warms if we do not take appropriate steps now to prepare for the future.

Significant changes are also projected with respect to the extent of continuous and discontinuous permafrost in Manitoba. Permafrost is extremely sensitive to changes in global temperatures. While snow and sea ice reflect much of the Earth's energy back into the atmosphere, dark earth and oceans absorb most of it. A temperature increase of only 1 to 2°C can seriously affect the ground and the permafrost within it.

Permafrost is the foundation material for much of Manitoba's northern communities. One of the most essential elements of this frozen layer of rock and ice was its permanency. Now that appears to no longer be a given. As the ice melts and re-freezes, the foundations of homes, buildings and infrastructure buckle. Disruption of the permafrost that underlies parts of northern Manitoba has serious implications for existing transportation corridors such as railway lines, roadways and landing strips of local airports. These vital links are critical to the health and welfare of northern Manitoban residents.

Another significant concern facing us today is the potential effect of large scale melting of permafrost. Scientists have recently suggested that the amount of carbon in a particular type of permafrost known as yedoma, found largely in Siberia, may yield 100 times the carbon that has already been released by the burning of fossil fuels. The thawing or, worse still, possible burning of Manitoba's permafrost peatlands has the potential to release a significant amount of stored carbon back into the atmosphere.

More drastic than the effects seen on our built environment are the effects of climate change on our natural northern landscapes. Loss of summer ice and longer ice-free periods in Hudson Bay is proving to be detrimental to polar bears and their ability to reproduce and nurture their young. The bears need the ice to hunt for ringed seals, their primary food source, in order to build up and store weight for the rest of the year. Scientists are already documenting a decline in the health of Hudson Bay polar bears. The extirpation of polar bears in Canada would be a tragic loss environmentally, but would also reverberate economically.

Tourism is critical to Manitoba's economy, accounting for \$1.39 billion in revenue in 2003 and approximately 17,100 jobs. For Churchill, polar-bear viewing brings in approximately \$23 million annually to this small northern town. Without this critical environmental

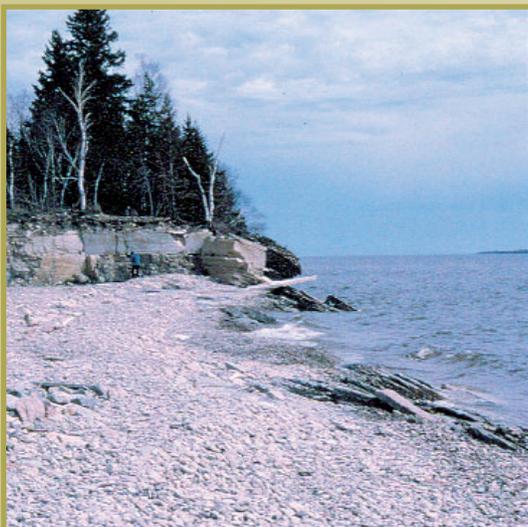
tourism industry, many northern communities may lose their largest single employer and industry.

What can we do? The province of Manitoba is already preparing for changes by moving winter roads onto land where possible instead of over rivers and lakes. The Climate Change Task Force was established by the province and with the assistance of the International Institute for Sustainable Development, made numerous recommendations for change. Many of these have been adopted by the province and a revised climate change plan is in the works.

The most important step, though, is the inclusion of northern people into the discussion of climate change and adaptation. The traditional knowledge of elders in the North helped illuminate a problem with the environment long before politicians saw the danger. Now that the results are evident, we need to ensure that northern communities have a say in how their region can adapt—sustainably.

### 3. Lake Winnipeg in Hot Water

LAKE WINNIPEG is the focal point of a complex basin. It is the catch basin for a land area an incredible 40 times its size, stretching from Thunder Bay to the Rocky Mountains and south to Minnesota, the Dakotas and Montana. Four provinces, four states and two federal governments all have a voice in the



A view of Lake Winnipeg from Hecla Island. Over 1,000 fishers are licensed to work on the lake. Photo by Don Berg.

determination of the future of this lake through their policies, laws and the activities of their citizens. Commercial and sport fishers, lodge owners, cottage owners, municipalities, parks departments, federal, provincial, municipal and First Nation governments, interest groups and the public at large all have a stake in the world's 10th largest fresh water lake.

The impacts of climate change will only add to the challenges already being faced by Lake Winnipeg. As Manitobans noticed last summer, the blue-green algae blooms in the lake's north basin are already a concern. However, the blooms are not just unsightly for cottagers and sailors on the lake. They are a real threat to the lake's inhabitants. After the algae blooms, it dies, absorbing precious oxygen needed by the fish in the lake as it decays. These blooms are only expected to increase in frequency and extent as the lake water warms. This very visible sign of the lake's distress is only one of the problems facing our favourite nature areas in Manitoba due to climate change and increasing pollution.

For over 100 years, Lake Winnipeg and Lake Manitoba have been home to Manitoba's commercial fishery. The majority of the fishery's production is sold out of the country and represents over \$30 million annually for Manitoba's economy—a significant contribution. About two-thirds of this amount is generated by the commercial fishery on Lake Winnipeg. Over 1,000 licensed fishers are employed on this lake, harvesting a variety of species including pickerel, goldeye, sauger and whitefish. Several smaller lakes in southern and northern Manitoba are also fished commercially, including Southern Indian Lake.

Climate is the single most important factor controlling biodiversity and the distribution of aquatic organisms in Canadian lakes. This finding is true for Lake Winnipeg, which is more vulnerable than other lakes to a warming climate because of its relative shallowness and a lack of thermal refuge for cold water fish. As climate change proceeds, the lake's temperature, pH, and oxygen levels are expected to be altered. These changes, either individually or collectively, will impact the health, composition and availability of fish. Research already shows significant temperature increases in the south and north basin of Lake Winnipeg since 1909 to 2004, with 1°C increase in average water temperatures in September in the north basin and a 1.9°C increase in average temperatures in August in the south basin. Ice break

up has also occurred earlier during this same time period.

Rising temperatures could benefit warm-water species such as walleye, yellow perch and white bass by creating conditions that promote the growth of offspring better able to survive through shorter winters. As most Lake Winnipeg fish species are nearer to their northern rather than their southern limit, climate change might not cause a large change in the overall fish community. However, warming waters could cause cold-water species like whitefish to die out or become less productive. Of the 56 fish species found in the northern and southern basins of Lake Winnipeg, the thermal tolerance of five to 17 species in the north basin might be exceeded by the maximum surface water temperatures predicted by current climate scenarios. In the south basin 16 to 31 species, or over half of the fish species, could be impacted.

Invasive species might pose an additional challenge for Lake Winnipeg. These species might thrive due to the warmer lake temperatures and could appropriate or destroy the habitat of native species. For commercial fishers, the arrival of invasive species could be negative if they displace current economic species, or beneficial if there is a market and ability to harvest the new arrivals. Exotic zooplankton, such as the *E. coregoni* might also become more common and compete with other native species.

In many ways forewarned is forearmed. A clearer understanding of the likely effects of climate change will help fishers, First Nations and the general public to adapt to the changes we are already seeing in the lake. But there are things we can do now to help the lake in its battle against the elements.

The catch basin of Lake Winnipeg represents only a small portion of the entire watershed region. Each action upstream affects Lake Winnipeg and every attempt to limit nutrient loading or pollution of the rivers and streams leading into Lake Winnipeg will help the lake heal and adapt to climate change concerns in the future.

One unique approach to upstream watershed management is a system that was successfully implemented in the New York City watershed. In 1989, the city received an order from the Environmental Protection Agency to install a new

filtration system costing an estimated six to eight billion dollars for the population's drinking water. Balking at the high cost, the city looked for an alternative approach and found one upstream in the Catskills region. Instead of building a treatment facility to clean the water after it's been polluted, New York decided to try to pay people to keep the upstream water clean. Called Payment for Ecosystem Services (PES) the plan ended up costing roughly one quarter of the original estimate for the treatment plant.

Manitoba is already experimenting with this form of local watershed protection in the Alternative Land Use Services (ALUS) research project in the rural municipality of Blanshard. The first of its kind of Canada, farmers and landowners will be paid to maintain and enhance four different landscape types that have public environmental benefits associated with them: wetlands, ecologically sensitive lands, riparian areas and natural areas.

Watershed management is only one of the many issues related to climate change that will need to be addressed and PES is only one of the many tools at our disposal for adaptation.

#### **4. The Urban Meltdown: Cities need plans to adapt to extreme weather**

CITIZENS of metropolitan areas often feel insulated from the effects of weather and its toll on the environment. Protected by a large urban infrastructure we think we are immune to the droughts, floods and other extreme weather events that can so adversely affect northern or rural areas. But as Vancouver found out with its mudslides and dramatic windstorms over the past year, cities are not immune. And climate change is only going to increase our vulnerability to the precariousness of extreme weather events in Canada.

The climate change issue presents society with a dual challenge. Not only must we mitigate the climate change impact by reducing our emissions of greenhouse gases. We must also quickly adapt to the changes which are occurring now and build our capacity to adapt to the future. Ideally we can do both, but we need to start now.

Over 70 per cent of Manitoba's population lives in the capital region and other urban centres such as

Brandon, the Pas, Thompson and Churchill. 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. Climate change is predicted to increase these costs, disrupt normal city functions and, particularly in the case of extreme events, create safety issues. Municipalities need to prepare for a future of uncertainty and build their organizational capacity to adapt quickly to those unforeseen risks which will inevitably surprise us in the future.

One of the most likely areas of concern for municipalities is a warming climate and larger variability in temperatures. This could drastically affect the operating costs of buildings, particularly with respect to heating and cooling. Warmer winters may increase precipitation in the form of heavy wet snow, potentially exceeding current snowload limits and standards. With these concerns, and volatile energy market prices, municipalities have more reason than ever to seriously consider energy-efficiency measures and renewable energy sources for new infrastructure.

The University of Winnipeg is going to provide an excellent example of the forward thinking required for new infrastructure. The newest building on the Portage block will be the Richardson College of the Environment, built to a certified LEED building standard. The Leadership in Energy and Environmental Design (LEED) rating system is in use in the U.S. and has been adapted for Canada. According to the Canadian Green Building Council that certifies buildings in Canada, LEED buildings are 44 per cent more energy-efficient than their conventional counterparts. That's good news because up to 40 per cent of greenhouse gas emissions come from the operation of buildings, where we live and where we work. A win-win approach would be to develop new municipal structures that both reduce operational costs and greenhouse gas emissions.

While mitigation and adaptation present society with a dual challenge, it is possible to achieve the two at the same time. For example, the planting of urban forests helps reduce greenhouse gases by sequestering carbon from the air, while at the same time it produces a cooling effect in the summer—a welcomed benefit for adapting to projected hotter summer temperatures. Water conservation efforts are another good example. With lower water consumption come lower energy use

and reduced greenhouse gas emissions. At the same time, such efforts facilitate adaptation by making more water available in times of drought.

Another major consideration for municipalities is transportation, both public and private. Since the transport of people and goods is a significant contributor to climate change it seems only fair that climate change will mean increased costs for transport as well. Oil prices are unlikely to decrease over the next few decades, but there will be other costs as well. There will be changes in freeze/thaw cycles with the potential to exacerbate our annual experience with potholes in our roads. These same cycles can affect the stability of buried water and sewer lines. An expected increase in winter snowfall along with more freezing rain, for example, means more sand and de-icing materials will be needed by cities and municipalities to maintain road safety. And even as public habits change and people begin to use bus and bicycle modes of transport more often, that will require increased expenditures from the city to support these new healthy habits.

But as New York City recognized way back in the 1880s, rapid transit may be the only means by which to manage the mobility needs of the citizens constrained by the physical reality of a city. Funnelling a large population spread out over a prairie landscape into a central area of work or a university involves either enormous emissions of greenhouse gases or a significant initial investment in a clean rapid transit system. The expense now will be minuscule compared to economic and environmental cost of the future.

Finally, insect and disease outbreaks in Manitoba's forests could also be affected by warmer summer temperatures, milder winters, and more frequent extreme weather events. Existing pest species like spruce budworm and forest tent caterpillars are likely to be encouraged by warmer conditions as milder winters increase their over-wintering success. And there is always the risk of warmer, moister springs leading to the hatching of more of Manitoba's mascot, the mosquito. Finding environmentally-friendly ways to reduce these pests now will greatly increase our comfort levels for the future.

One thing that would greatly assist the City of Winnipeg would be the establishment of a department or division that looks at the viability of new sustainable development projects and can absorb the

innovations and lessons learned from other cities that have forged ahead. The complex multi-stakeholder partnerships needed to implement sustainability require more than Winnipeg's one environmental coordinator to manage.

For example, the City of Montreal has an entire department of sustainable environment that worked with 60 local community groups to establish the first Montreal Charter of Rights and Responsibilities. While the Charter covers a wide area of social issues, democracy, recreation and security there is a section that specifically addresses the need for the municipality to protect the natural environment. Halifax and Calgary also have significant staff clustered into single teams focused on environmental management services.

Collaboration on these issues is critical and Mayor Sam Katz's new environmental committee is a step forward in the development of new priorities regarding our urban environment. Many of the recommendations for municipalities these days to adapt to and mitigate climate change may involve expenditures that make mayors quake. But as other communities have seen, the investment now will only pay much higher dividends in the future, both in our pocketbooks and in our world. The cost of doing nothing is too high.

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*David Runnalls is President and CEO of the International Institute for Sustainable Development.*