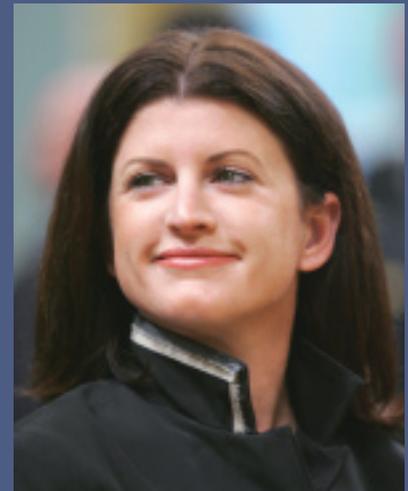


# AN INTEGRATED APPROACH TO AIR POLLUTION, CLIMATE AND WEATHER HAZARDS

Gordon McBean

“Since climate is the statistics of weather,” writes the former head of Canada’s national weather service, “climate change is about changing the hazards of weather, and also its benefits, which include rain water for drinking and irrigation, snow for skiing, and warm, pleasant days for recreational enjoyment.” Gordon McBean adds: “Weather-related hazardous events have always mattered to Canadians, but their impacts have been increasing.” And the impact of such hazards will only increase with global warming. McBean offers some pertinent advice to federal and provincial governments for dealing with the impact of increased weather hazards.

Selon l’ancien directeur du Service météorologique national du Canada, « les changements climatiques ont pour effet de modifier les risques liés à la météo mais aussi ses avantages, c’est-à-dire l’eau de pluie qui nous désaltère et irrigue nos terres, la neige indispensable à la pratique du ski ou les journées d’agréable chaleur qui agrémentent nos loisirs ». Gordon McBean ajoute que « les Canadiens se sont toujours intéressés aux incidents climatiques, dont les répercussions ne cessent toutefois de se multiplier ». Et leurs conséquences ne feront que s’aggraver avec le réchauffement planétaire. L’auteur offre aux gouvernements fédéral et provinciaux de sages conseils pour faire face aux dangers croissants liés au climat.



In 1869-70, horrific storms on the Great Lakes caused the deaths of more than 500 mariners. Prime Minister John A. Macdonald responded, and in 1871 the Meteorological Service of Canada was established to provide storm warnings on the Great Lakes and the St. Lawrence River areas. This followed the basic tenet of public policy that there is no role more fundamental for government than the protection of its citizens. Hence, most governments have armies, police and fire departments, and weather services. However, the capacity for governments to provide this protection varies considerably, as the Report of the UN Secretary General’s High-Level Panel on Threats, Challenges and Change (2004) noted, “it cannot be assumed that every State will always be able, or willing, to meet its responsibility to protect its own peoples and not to harm its neighbours.”

This paper is about this role of governments in protecting its citizens, and in particular about providing advice to the Canadian government on its role in the context of atmospheric-related hazards affecting Canadians. This role involves a mixture of informing and, where appropriate, warning Canadians about hazards, and regulating Canadian activities within the national and international context and

the overall perspective of economic, health and environmental policy. Atmospheric hazards include storms, hot and cold days, smog, floods and drought. Since climate is the statistics of weather, climate change is about changing the hazards of weather, and also its benefits, which provide us with rain water for drinking and irrigation, snow for skiing, and warm, pleasant days for recreational enjoyment.

The theme of this paper is that consideration of these hazards needs to be integrated across issues, across government ministries and between levels of government, and policy development needs to be based on surveillance and prediction systems and science (natural, physical, social, engineering, health, etc.).

Hazards matter because of their impact on people, their property and their socio-economic activities. When the impact is large, we call it a disaster. In the field of disaster management, a hazard is defined as “a potentially damaging physical event, phenomenon or human activity that *may* cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.” I have emphasized “may,” because the role of governments is to prevent hazards becoming disasters. The damage they

cause depends largely on vulnerability, which is “conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.” Disasters result when hazards occur in vulnerable communities. Reducing the impact of disasters requires an approach that addresses both hazards and vulnerabilities.

Weather-related hazardous events have always mattered to Canadians, but their impact has been increasing. Although the number of geophysical hazardous events (earthquakes, volcanoes, etc.) in Canada has remained approximately constant, the number of weather-related hazardous events has increased from 2-4 per year in earlier decades to about 12 per year in the last decade (with considerable year-to-year variability). Last April, the prime minister said in Gander, Newfoundland that “Newfoundlanders and Labradorians deserve accurate forecasts that reflect the reality of the province’s unique weather.” I would say that weather is unique all across Canada and that all citizens equally deserve accurate forecasts. If you lived in Nova Scotia in September 2003, you would have heard of the warnings from the Meteorological Service about Hurricane Juan, which hit Nova Scotia with wind gusts up to 230 km/h, waves in excess of 20 metres and widespread damage; at least 8 lives were lost and more than 300,000 people were without power for up to a week and a half.

In Saguenay, Quebec in 1996 it was heavy rains causing a flash flood and 10 deaths; a year later it was slower accumulation of water in the Red River creating another massive flood. In 1998 Quebec and Ontario heard the warnings of freezing rain and then were hit by an ice storm, with at least 28 deaths and economic costs near \$7 billion. In July 2004, it was heavy rains resulting in over \$400 million in insured losses in

the Peterborough area. In August, 2005, a line of severe thunderstorms swung eastward across southern Ontario, leaving a trail of damage totalling over \$500 million — the greatest insured loss in the province’s history. The Prairies were impacted by droughts in 2001 and 2002; agricultural production dropped an estimated \$3.6 billion during these two years. Twice in the 1990s hailstorms hit Calgary with damages over \$100 million each time. Tornadoes also wreak havoc across Canada, particularly the Prairies. In 1987, 29 people died in Edmonton, although Saskatchewan has the unfortunate lead in total number of deaths over the past 150 years. Ontario is second, with the Barrie tornado of

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1985 with 12 deaths being the most recent major event. One of my more depressing days was in 2004 visiting the memorial at Pine Lake, Alberta, where on July 14, 2000, a tornado struck, resulting in 12 deaths and 140 injuries, and \$15 million in economic losses to the small community. Families had been torn apart, bodies permanently scarred and life savings lost. Yet the community had been rebuilt just as it was before the storm.

The impact of hazards on Canadians means that governments, insurance companies and individuals have financial obligations. Under the *Disaster Financial Assistance Act*, the federal government ends up paying most of the costs of these disasters, totalling \$1.6 billion over the past 30 years. Canadian property insurers experienced record

disaster claims in 2005, exceeding \$2 billion, and a trend of alarming cost increases over the past few decades.

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In Ontario, the number of hot and smoggy days has been increasing, setting new records in the past two years. According to the Ontario Medical Association, smog resulted in over 5,800 premature deaths and a total economic impact of \$7.8 billion in 2005 in Ontario alone. In August 2003, over 35,000 Europeans, almost half in France, died in an extensive and record-setting heat wave. Climate scientists predict that this type of record-setter will occur about one summer in two by mid-century.

Hazard-human interactions range from the localized, short-lived phenomena such as tornadoes that come and go within a few hours, to events of a few days extending across an urban sprawl, such as urban smog or a major snow storm of several days, to regional droughts for seasons to global climate change over decades to centuries. They are interconnected. In the summer, there are smog and no-smog days, not because of different emissions, but because the weather sometimes blows the pollution away and sometimes causes it to accumulate. Drought conditions lead to the risk of wildfire triggered by the lightning. Each of these phenomena creates risks for Canadians, and we are augmenting those risks through the burning of fossil fuels and industrial processes that create the chemicals for smog, and the greenhouse gases for climate change.

It is important to understand the time scales of hazardous events. Water



Hurricane Katrina blows through the Gulf Coast in August 2005. Gordon McBean recommends establishing a national service agency in Canada “on the issues of weather, climate, air quality, water resources and related hazards...including information about how our activities may impact on the future so that the future could become a choice.”

goes into the atmosphere by evaporation and out by rain, typically within about 10 days. Many ingredients of smog, like sulphur dioxide, are very water soluble and are washed out by rain — acid rain — so they seldom spread beyond the continent. From a policy point of view, that means actions can be taken by governments on a regional basis and the impacts of changes in emissions will be seen quickly. Further, since the atmosphere takes a few years to mix chemicals around the globe, sulphur dioxide does not become globally mixed.

**O**n the other hand, the main human-influenced greenhouse gases, carbon dioxide and methane, are removed by much slower processes, so

their atmospheric lifetimes are about 100 years and about 10 years, respectively. Due to the slow response of the oceans, the climate system itself has not yet adjusted to the accumulated greenhouse gases, and it will continue to catch up for many decades after the greenhouse gases concentrations are stabilized. These long lifetimes mean that:

- A global policy approach is needed, because emissions from around the world become mixed and reductions in emissions anywhere have an equivalent global benefit.
- Emission reductions taken now will only deliver benefits in many decades to come.
- Since the developed countries have contributed about 80 percent

of present accumulated extra carbon dioxide, the onus should be on the developed countries to take action first, and China and India, which have only recently become big emitters, should join in the emission reduction commitments in subsequent rounds.

Hence, since the benefits of reductions will come well after the next election, and global solutions are difficult to achieve and easier to opt out of, the political imperative for addressing climate change has been lacking.

**W**e can compare these atmosphere-earth system time scales with some societal time scales. It is estimated that to change energy end-use technologies (e.g., household

appliances, automobiles, buildings) takes 1 to 10 years, while it takes 10 to 50 years to change energy-supply technologies (e.g., hydropower, nuclear,

and legislation, such as land-use planning and building codes. Proactive adaptation, with direct intervention of government, is usually the most cost

To achieve acceptable levels of impact on human health, or other risks, what level of emissions can be allowed and how should those emissions be allocated across the economy? The assumption is that there is a threshold value below which human health is not affected, but the threshold usually turns out not to be the same for all people. This puts governments in the position of deciding how much protection is appropriate, given the economic implications and recognition that some

**As a basis for these approaches, governments need to undertake environmental surveillance and prediction. Surveillance, which needs enhanced investment, in part to compensate for lack of investment over the past decade, is the basis for prediction of what will or might happen and how actions taken will affect the level of protection. As we look ahead, there will always be some uncertainty in the predictions and impact. In the end, one of the roles of government is the management of risk: how much risk is acceptable?**

solar, wind). It is also estimated that it takes about 30 to 100 years to significantly change social norms and governance; think about how long it has taken to change society on cigarette smoking.

Since disasters result when hazards and vulnerable systems interact, we can decrease the occurrence of disasters by some combination of reducing the hazards and reducing the vulnerability. How can we reduce the hazards? For smog, we can reduce the quantity of pollutants that we put into the atmosphere. The government has said that clean air is a priority. The questions are, how much reduction in emissions is needed, and how can we use regulation and enforcement to make it happen? What about weather; does it not just happen? Yes, but we can influence the changes in weather hazards by addressing climate change through global greenhouse gas emission reductions.

The second and complementary approach is to reduce the vulnerability of communities. Comprehensive vulnerability analyses can lead to an adaptation strategy to reduce the impacts and capture the benefits, if any, of the hazard. An adaptation strategy would provide Canadians with information and advice and a regulatory regime to reduce their vulnerability to dangerous or hazardous extremes in weather, climate and air pollution. It would also involve modifications to existing regu-

effective and efficient plan of action. While we must act bi-nationally to address emissions of the chemicals causing smog and globally to address emissions of greenhouse gases, adaptation strategies need to be developed locally and the full benefits of the investment will come locally: a made-in-Canada approach.

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Daily smog forecasts allow individuals to respond to reduce their vulnerability by reducing exposure. Smog forecasts for a few days allow governments, through regulation, to control emissions and reduce the smog hazard. These predictions of future states should lead to actions that change the outcome; fate can become a choice and choices can make the prediction wrong. A conflict can arise if one agency issues a multi-day smog forecast and another is then pressured to invoke emission reduction regulations.

Canadians will still be impacted. One helpful approach is that being taken in Atlantic Canada. Combined forecasts of weather and an air quality index are given all the time, with a health advisory included, so that individual Canadians can “self-calibrate” and respond appropriately. This approach needs to be undertaken across Canada. Another issue is that there will often be pollutants transported across provincial and national boundaries, so one government does not have the authority to directly limit all emissions.

When we think about climate change, there is an analogous situation. The objective of the UN Framework Convention on Climate Change (UNFCCC) is the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-induced] interference with the climate system.” A key question has been, what is “dangerous,” and to whom and when? Canada needs to undertake its own analysis of this question.

Governments, particularly our federal government, now need to address the issues of climate change, lack of clean air and weather-related hazards. My concern is that the approach, based on past history, will be to look at them as separate issues, whereas there is need for a common national strategy. Speaking on Clean Air Day on

June 7, 2006, Minister Ambrose said that she “arrived without the preconceived notions and the silo mentality that exists all too often in this [climate change] debate.” I would suggest that breaking down the silos across these issues and between and within levels of government is what is needed.

At the UNFCCC Workshop on the Adaptation Fund, the minister stated, “To be successful, greenhouse gas mitigation, coupled with adaptation measures, should be integrated into broader sustainable development objectives, such as economic development, energy security, public health, air quality and local environmental protection.” The minister later followed up with these themes at a preliminary session of the UNFCCC conference in Bonn, saying that, “Under the Convention Dialogue, we are to find new ways to work together that can stimulate sustainable development, effectively address the issue of adaptation, realize the full potential of technology, and fully utilize all of the policy tools available to us.”

The concept of sustainable development: “to ensure that development meets the needs of the present without compromising the ability of future generations to meet their own needs,” may be the way to bring together the issues. There are tools now in place, with the requirements for each federal ministry to prepare a sustainable development strategy and the position of the commissioner for sustainable development within the Office of the Auditor General. What is needed is the mainstreaming of these issues into the all functions of government.

The minister has clearly identified “adaptation” as a key issue in the context of climate change and that equally applies to air quality and hazards. There is need for government leadership in the development and implementation of proactive adaptation

strategies that deal with the integrated effects of changing air quality, weather and climate and hazards. An adaptation strategy must include actions on disaster management, where the responsibilities at the federal level fall to the Department of Public Safety, which is currently largely fixated on

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terrorism-related issues. A national disaster risk reduction strategy has been talked about for about a decade but never moved beyond that stage. It needs to be part of this integrated strategy and include investments in disaster risk reduction or adaptation, which will reduce the long-term costs to governments under the present disaster financial assistance mechanisms. That means investing now for benefits to come — which is part of what sustainable development and protecting citizens is all about.

The second part of the national strategy must be to constrain emissions of air pollutants and GHGs into the atmosphere that are causing or will cause Canadians (and others) grief in the decades to come. There is only one atmosphere, and the sources of pollutants are very similar. Because a significant fraction of smog pollutants cross provincial and international boundaries, the approach must be nationally and bi-nationally coordinated. Real targets with measurable benefits and time schedules should be set, so that Canadians can hold governments accountable — part of the accountability regime.

Climate change is a long-term issue. It is unfortunate that the issue too quickly became one of Kyoto — Yes or no? rather than using Kyoto

with its limitations as one part of the UNFCCC process. Why should Canada do anything to reduce emissions, since we contribute only about 2 percent of global emissions? Most important is that the climate matters to Canada; warming of our weather, with more extreme events, will have impacts. We

have vested interests in limiting climate change, and we must work internationally. We cannot expect China and India to undertake emission reductions if Canada and other developed countries do not lead.

While I was writing this paper the *Economist* magazine came out a special report on climate change, “The Heat Is On.” It framed the argument from a management-of-risk point of view. It asks whether it is really worth using public resources to avert an uncertain, distant risk, and it concludes “yes.” As it notes, Canada and other countries maintain armies for just such threats. Canada is now engaged in Afghanistan on the basis of the principal logic that the investments are reducing a long-term risk to Canadians and to the world, and that we should do our part. Well, the *Economist* and climate scientists have concluded that action on climate change also deserves investment. The question, then, is, “How much investment and on what time scale?” Since we are going to make investments in clean air, let’s look at how much in the way of co-benefits for greenhouse gas reductions can be gained as well. Can we not analyze each step and have an additional set of criteria, so that our choices maximize the payoff for climate change? Economic efficiency and energy security should be part of the drivers. The

National Roundtable on the Environment and the Economy, in its report *Advice on a Long-term Strategy on Energy and Climate Change*, looking to 2050, also linked clean air and climate

Environment Canada. The provinces have responsibility for predictions of floods and smog, while there is a mix of players on the drought scene. It is unlikely that a province will give up its

to provide the best information on clean air, weather, climate, hazards and other areas such as fisheries management result in strong return on investment. There are also functions, such as monitoring our natural environment and the maintenance of major facilities, which are the appropriate direct role of governments. Lack of funding support has now eroded the capacity of government science to deliver the necessary scientific advice, and we have no mechanisms to effectively bring in the university researchers. There is now a need for re-appraisal of our traditional model of science for decision-making. Better

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change and provided specific recommendations. That long-term view is critical and must become part of the public and political debate.

Speaking at the UNFCCC in Bonn, the minister also said that “The situation that each country faces is unique. Each country’s stage of development, levels and sources of emissions, vulnerabilities, adaptation needs and the make up of their economies all differ.” Canada needs to integrate these issues into our international development assistance strategy.

Given that there is agreement on an integrated approach to clean air and climate change, what about weather and related natural hazards? One issue is the fragmented approach within our federal system not only on the emission reductions but also on adaptation. Prime Minister Mulroney gave us some of the tools that are needed for the effective development of policy on these linked issues, namely the National Round Table on the Environment and the Economy, the International Institute for Sustainable Development, and the position of ambassador for the environment.

However, we also need an operational side. We can note that the responsibility for forecasting the weather event falls to the Meteorological Service, the usually forgotten part of

regulatory role, but perhaps there could be a merging of responsibilities on the information, as the scientific basis for adaptation and emission reductions. A national agency, implying a merging of federal, provincial, territorial and perhaps municipal interests, in these very scientific, technical areas could be made to happen with the right leadership. A national service agency would provide — on the issues of weather, climate, air quality, water resources and related hazards — information to make informed decisions on personal and economic matters, on our changing future, for today, tomorrow, next season and next decade, including information about how our activities may impact on the future so that the future could become a choice. The information would be policy relevant but also policy neutral. A national adaptation strategy is dependent on this information. Such an agency would need to have responsibilities and be resourced to also do surveillance of the appropriate systems.

Science would form the basis of this service and policy-making. Since the mid-1990s, the government has invested increasing funds in Canadian universities in support of the innovation agenda, but little of that has gone into what I would call science in support of public-good decision-making. Investments in science

integration of university and government-based research capacity, specifically for advice, needs to be pursued. A model could be scientific research institutions, based on sustained government support and directly linked to universities, with accountable roles for delivery of science-based information for decision-making.

During the time of writing this paper, my ideas on the importance of adaptation and linking climate change and hazards were repeatedly reinforced. From September 11 to 14, I participated as a review editor for the North American chapter at the meeting of authors for the Intergovernmental Panel on Climate Change fourth assessment report on climate change impacts, adaptation and vulnerability. The meeting, bringing together authors from around the world, was held in Cape Town, South Africa, and their Minister of Environmental Affairs and Tourism opened the meeting with a call for “real action of adaptation” as the top priority for African countries. He also spoke of the need for deeper emission reductions in the post-Kyoto regime. Another speaker was the Western Cape provincial minister of environmental affairs and planning, whose comments reflected the title of her department. The following week I was in Kuala Lumpur, Malaysia, as the opening scientific speaker at a Regional Conference

on Natural and Human-Induced Environmental Hazards and Disasters. Among my comments were that since the beginning of this century, there have been about 470 disasters per year globally, more than one per day where a community was likely overwhelmed beyond its capacity to cope. Weather was the trigger for over 75 percent of the events. At the welcoming ceremonies, the Malaysian deputy prime minister expressed his deep concerns about the impacts on countries. On the way home, I met with economics professors at the National University of Singapore who have established a new institute on risk management.

I opened this paper noting the creation of the weather service by Prime Minister MacDonald 135 years ago. Three factors made that possible. First, the science had progressed enough to make a useful weather forecast possible; second, technology had provided the telegraph to make dissemination of the forecast quick enough to be useful; and third, the disaster provided the political motivation to do it. We have the science and technology, and now we need the motivation; hopefully we do not need await another major disaster.

The challenge before government is then to integrate approaches to these issues and provide the capacity

for adaptation strategies for Canadians while addressing emission reductions for Canadian interests. And to provide the institutional change that can make these happen — as a long-term legacy to Canada and global humanity. It is a challenge worth addressing without preconceived notions.

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# the art of the state

## Volume III



Edited by  
Keith Banting,  
Thomas J. Courchene  
and F. Leslie Seidle

## Belonging? Diversity, Recognition and Shared Citizenship in Canada

*Belonging? Diversity, Recognition and Shared Citizenship in Canada*, a collection of papers originally presented at the IRPP's third "Art of the State" conference, will be published in 2007. Edited by Keith Banting, Thomas J. Courchene and F. Leslie Seidle, the volume will shed light on Canada's approaches to recognizing and accommodating diversity, including instruments of shared citizenship, and their capacity to respond to new pressures and concerns. Analysis of the approaches of certain other countries and the critiques that have emerged will provide a comparative perspective.

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