The Saskatchewan Institute of Public Policy

Public Policy Paper Series

Weathering the Political and Environmental Climate of the Kyoto Protocol

by Raymond B. Blake, Polo Diaz, Joe Piwowar, Michael Polanyi, Reid Robinson, John D. Whyte, and Malcolm Wilson

January, 2004
Public Policy Paper 22
ISBN# 0-7731-0469-0

UNIVERSITY OF REGINA

SIPP
www.uregina.ca/sipp

The Saskatchewan Institute of Public Policy (SIPP) was created in 1998 as a partnership between the University of Regina, the University of Saskatchewan and the Government of Saskatchewan. It is, however, constituted as an institute at the University of Regina. It is committed to expanding knowledge and understanding of the public-policy concerns in Canada with a particular focus on Saskatchewan and Western Canada generally. It is a non-profit, independent, and non-partisan Institute devoted to stimulating public-policy debate and providing expertise, experience, research and analysis on social, economic, fiscal, environmental, educational, and administrative issues related to public policy.

The Institute will assist governments and private business by supporting and encouraging the exchange of ideas and the creation of practical solutions to contemporary policy challenges. The Founding Partners intended the Institute to have considerable flexibility in its programming, research, contracting and administration so as to maximize opportunities for collaboration among scholars in universities and interested parties in the public and private sectors.

The Institute is overseen by a Board of Directors drawn from leading members of the public, private and academic community. The Board is a source of guidance and support for SIPP's goals in addition to serving a managerial and advisory role. It assists SIPP with fostering partnerships with non-governmental organizations, the private sector and the expanding third sector.

Saskatchewan enjoys a long and successful tradition of building its own solutions to the challenges faced by the province's citizens. In keeping with this tradition, the Saskatchewan Institute of Public Policy will, in concert with scholars and practitioners of public policy, bring the best of the new ideas to the people of Saskatchewan.

Weathering the Political and Environmental Climate of the Kyoto Protocol

SIPP Public Policy Paper No. 22
January 2004

Raymond B. Blake, Polo Diaz, Joe Piwowar, Michael Polanyi, Reid Robinson,
John D. Whyte, and Malcolm Wilson

ISBN# 0-7731-0469-0
ISSN# 1702-7810

Table of Contents

Introduction

When Canada's Minister of the Environment, David Anderson, notified the United Nations (UN) on 17 December 2002 that Canada would ratify the UN Framework Agreement on Climate Change, known best as the Kyoto Protocol, Canada joined nearly 100 countries to do so. Together, these countries represented about 40 per cent of the 1990 emissions, still some distance from the 55 per cent threshold necessary for the UN Agreement to come into effect. A day earlier, then Prime Minister Jean Chretien had signed the 1997 treaty limiting greenhouse gas emissions at a ceremony in Ottawa after the House of Commons had approved the treaty. Because the United States, which is responsible for more than 36 per cent of all emissions, had rejected the treaty, there was great hope that Russia would soon ratify the protocol. Once Russia became a signatory to the agreement, it and all other signatories would have committed themselves to reducing greenhouse gas emissions to six per cent below 1990 rates by 2012. In Canada, that necessitated a reduction of 20 to 30 per cent from current levels. However, Russia, like the United States and Australia, has not yet ratified the Kyoto Protocol and, without Russia, which accounts for 17.4 per cent of emissions, the Protocol may be in serious trouble.

As most will recall, there was considerable opposition to Kyoto in Western Canada before the ratification vote in the House of Commons in December 2002. Nevertheless, Prime Minister Chretien was determined that Canada would ratify the Protocol, despite the opposition of Alberta and considerable concern among Western Canadian politicians. However, the immediacy of Kyoto seems to have passed except for the occasional newspaper story, but there has been considerable interest in how Prime Minister Paul Martin would deal with Kyoto and Ottawa's plans for curbing the level of greenhouse gases in Canada, which remain the second highest per-capita level of emissions in the world. Canada had unveiled its plans in a document titled *Climate Change Plan for Canada* more than a year ago, and Mr. Martin said just days before he became prime minister that he supported Kyoto. However, he did not think that Canada's plan to deal with global warming was adequate,[1] suggesting that he would soon unveil a new plan to deal with climate change in Canada.

Given that the Government of Canada and Canadian citizens will soon revisit how we, as a country, will deal with our commitments under the Kyoto Accord and, more generally, deal with the increasing concentration of greenhouse gases, the Saskatchewan Institute of Public Policy (SIPP) is pleased to publish this public policy paper on the Kyoto Accord and global warming.

[1] See, *Globe and Mail*, 6 December 2003

This paper is a collaborative effort among scholars at SIPP and the University of Regina that examines various aspects of the Kyoto Protocol. It begins with an examination not only of the science of the atmospheric concentrations of greenhouse gases, but also of the complex world between science and public policy: How do policy-makers weigh the various scientific arguments? This paper moves from that conundrum to examining the impact of a changing climate on Saskatchewan with its delicate prairie ecosystems, suggesting, for instance, that one way to deal with greenhouse gases is to plant large numbers of trees. Not surprisingly, the debate over the ratification of the Kyoto Protocol in 2002 focused largely on the physical impacts of climate change as well as the economic implications of reducing greenhouse gas emission. Yet, as the next section of this policy paper argues, both climate change and the Kyoto Protocol have important human health implications. After reviewing what we know about the health impacts of climate change, it offers suggestions that might address climate change in a way conducive to protecting human health, with a particular reference to Saskatchewan. Clearly, climate has a tremendous impact on the quality of life of Canadians.

We are living in an era where technology is seen to hold the solution to many of our problems. Prime Minister Martin told the Western Canadian Environmental Technology Forum late last year that "I think in terms of environmental technologies, Kyoto is one of the drivers, but I think that the main driver is the necessity to have a higher quality of life, both in this country [and] worldwide."[2] He went on to suggest that the development of new technologies is the way to deal with the increasing pressures on the environment. The next section of this paper notes that technological change is often slow, but technology can do several things to reduce emissions of greenhouse gases, including replacing the energy from fossil fuels with energy from other sources; using the energy from fossil fuel more efficiently; or capturing the emission before it reaches the atmosphere and store it safely.

But, of course, technology may not be the only answer. As the fifth section of this policy paper suggests, social capital might hold the potential to be a fundamental tool for dealing with the adversities and opportunities created for climate change. Social capital refers to all those features of social life — networks, social trust, norms of reciprocity, and participation in organizations — that promote the coordination of collective actions, and it has become a central concept in the debate dealing with the social and economic problems faced by many national and regional

[2] See, *Globe and Mail*, 6 December 2003

economies. An important impact of climate change could be the scarcity of certain resources, such as water, creating the conditions for environmental conflicts and their negative consequences for economic investments, community livelihoods, and the legitimacy of governments. Given that social capital allows for a particular approach to action, it could also constitute an important mechanism for conflict resolution and the establishment of consensus among a variety of stakeholders, avoiding one of the more disturbing consequences of climate change.

The paper concludes with a discussion of how the Kyoto Protocol might be implemented, noting that in a federal state such as Canada, regulating climate change is a constitutional issue as well as a scientific, technological, economic, and social one. This section suggests that if Canada implements the Kyoto Accord – or follows any course of action at the policy level to deal with climate change – it will undoubtedly involve both important national and provincial interests. As noted legal scholar John Whyte suggests in the concluding section, joint accommodation of the federal and provincial interests might will lead to the most effective implementation of the Kyoto Protocol, as well as least disrupt the federal accommodation under which Canada's political stability is maintained.

Science, Public Policy, and the Kyoto Protocol

By Reid Robinson

Science influences public policy, but the question of *how* science influences public policy is a complex one. How do practitioners of public policy deal with issues that are increasingly complex in their reliance on sophisticated concepts rooted in science that are barely understood by the average legislator, let alone the general public? Take for example the impact on the climate of increasing atmospheric concentrations of greenhouse gases and the Kyoto Protocol. The question is particularly pertinent as science often becomes the currency of public policy debate even if many of those who are dealing with the complex issues, such as the greenhouse effect, have to rely on a community of scholars and researchers who do not themselves agree on the source or the impact of the problem.

The issue of smallpox vaccination in the 18th and 19th centuries is one case that illustrates the clash that arises when informed scientific opinion advocates a course of action which, while possibly hazardous for the individual, may have enormous benefits for society as a whole. Dr. Edward Jenner, the pioneer of the smallpox vaccination and generally regarded as the father of immunology, faced considerable opposition from colleagues, such as Dr. George Pearson, when he first developed his vaccination for the dreaded smallpox. He eventually persuaded government officials and the lay

public of the efficacy of his treatment. When the United Kingdom passed legislation in 1853 to make vaccination for smallpox compulsory, vehement opposition came from those who demanded freedom of choice. However, the British Government followed the advice of some of the scientists, and later strengthened the legislation for vaccination, believing that it was acting for the public good, even if it did so at the expense of individual choice. In retrospect the issue seems clear — the science of smallpox vaccinations is now well understood, but, at the time, Jenner had his critics.

There are times, however, when the science is clear. In the 1950s the United Kingdom passed *The Clean Air Act* which banned the burning of soft bituminous coal in cities. This caused considerable economic disruption as coal was the principal source of heating for many dwellings, but the legislation was triggered by the appalling pollution in many cities during winter, when fog and mist turned into 'pea soupers,' an evil brew of sooty particles and noxious sulphur dioxide. It was observed that the death rate rose dramatically during such occurrences, and it was relatively easy to make the deduction that the elimination of coal burning in the cities, despite the economic consequences, would greatly alleviate the health problems of many citizens. Again, in the 1980s when there was concern about the disappearance of ozone in the upper atmosphere, the chemistry was quite clear. Chlorofluorocarbons, used as refrigerants, were extremely stable and eventually found their way into the upper atmosphere. The sun's radiation caused a photochemical reaction producing chlorine atoms which in turn were exceedingly effective in catalysing the decomposition of ozone. In 1989 the Montreal Protocol was negotiated, and most industrial nations agreed to stop producing the offending chlorofluorocarbons. Again, there were significant economic consequences as refrigeration processes had to be redesigned, but the science was clear and undisputed. Margaret Thatcher, then British Prime Minister, not normally known for being "environmentally friendly" (and perhaps because her first degree at university was in chemistry) backed the political process which resulted in the ratification of the Montreal Protocol.

Flushed with the success of the Montreal Protocol, international attention was then turned to global warming and its potential link to the increasing concentration of carbon dioxide (CO_2) in the atmosphere. There is no question that the concentration of CO_2 has increased substantially in recent years, and that in many parts of the northern hemisphere many communities have experienced increasing temperatures. The Intergovernmental Panel on Climate Change (IPCC), a committee of the world's most respected climate researchers, prepared a report which formed the basis of the eventual Kyoto Protocol, calling for reductions in global CO_2 emissions. Fundamentally, the IPCC concluded that the significant increase in CO_2 concentration is due to the increased burning of fossil

fuel and deforestation, and that as CO_2 absorbs in the infrared region, it is a significant greenhouse gas and a major contributor to the observed pattern of global warming. Nevertheless, there exists within the scientific community diverse views on the issue of whether or not the increase of CO_2 concentration is the major contributor to global warming, as an exchange between climate specialists in the June 2003 edition of *PEGG*, the official publication of the Association of Professional Engineers, Geologists, and Geophysicists of Alberta, demonstrates. Furthermore, Richard Lindzen, Alfred P. Sloan Professor of Meteorology at M.I.T. and a participant in the proceedings of the IPCC, wrote in *The Wall Street Journal* on June 11 2001, in a article "Global Warming: The Press Got it Wrong" that:

> "Our primary conclusion was that despite some knowledge and agreement, the science is by no means settled. We are quite confident (1) that global mean temperature is about 0.5 degrees Celsius higher than it was a century ago; (2) that atmospheric levels of carbon dioxide have risen over the past two centuries; and (3) that carbon dioxide is a greenhouse gas whose increase is likely to warm the earth (one of many, the most important being water vapor and clouds).
>
> But—and I cannot stress this enough—we are not in a position to confidently attribute past climate change to carbon dioxide or to forecast what the climate will be in the future. That is to say, contrary to media impressions, agreement with the three basic statements tells us almost nothing relevant to policy discussions."

The Leipzig Declaration of 1997, signed by more than 100 atmospheric scientists and climatologists around the world, including a former president of the United States National Academy of Sciences, also states:

> "We believe that the dire predictions of a future warming have not been validated by the historic climate record, which appears to be dominated by natural fluctuations, showing both warming and cooling. These predictions are based on nothing more than theoretical models and cannot be relied on to construct far-reaching policies. As the debate unfolds, it has become increasingly clear that—contrary to the conventional wisdom—there does not exist today a general scientific consensus about the importance of greenhouse warming from rising levels of carbon dioxide." (http://www.sepp.org/Leipzig.html)

On the other hand, many scientists, despite various reservations, are concerned that there is a strong probability that, if nothing is done to curb CO_2 emissions, the world will face significant global warming over the next hundred years.

Sir John Houghton, co-chair of the IPCC, has stated that although some scientists felt that uncertainties were such that predictions of the future should not be made, the best possible information should be given to the public. He also suggested that without a clear message from the

scientific community, political leaders would never agree that the problem was severe enough to warrant an international convention to address the issue of CO_2 emissions. Thus the battle for public opinion has been to convince the general public and, through them, the politicians of a simple cause and effect relationship of carbon dioxide concentration and global warming. Similarly, in an interview in *Discover* magazine in October 1989, Dr. Stephen Schneider, a proponent of the CO_2 global warming theory, states "we have to make scary scenarios, make simplified dramatic statements, and make little mention of any doubts we might have." It is significant that earlier in his career he had predicted global cooling, and throughout the 1970s the issue exercising the world's climatologists was global cooling. In January 1975, the National Academy of Science issued a report entitled *Understanding Climate Change: A Program for Action*, noting that there is "a finite possibility that a serious worldwide cooling would befall the earth within a hundred years."

Thus in the span of thirty years we have had two definitive statements, one predicting global cooling and another predicting global warming. Digging deeper into both these assertions, it is apparent that there are many uncertainties and many unresolved questions on global climate change. Unfortunately, in the debate over the Kyoto Protocol the issue came down to the simplistic assertion that the increase in concentration of carbon dioxide is entirely responsible for global warming. Politicians and the general public could understand this, whether or not it stands up to scientific scrutiny. The issue, it seems, has been determined by listening to whichever scientific group had been speaking with the loudest and most authoritative voice. In a revealing comment in the book *The Politics of Climate Change*, Tim O'Riordan and Elizabeth Rowbotham (Chapter 8, "Struggling for Credibility" p.230) claim that, "Policy influence circulates around the 'gatekeepers', namely those who advise ministers, together with senior civil servants and client groups whose support is sought to legitimize or at least clarify policy acceptability." Hence, few ministers and policy makers have a sound appreciation of the nature of scientific debate. The very idea of uncertainty is abhorrent, and there is, therefore, a desire to reduce complex issues to simple ones.

In the debate about the efficacy of CO_2 as a greenhouse gas, very few have looked at the basic data provided by the infrared absorption spectrum of water and of carbon dioxide. If they had, they would realize that CO_2, present in a concentration of less than 2 per cent of the water vapour in the atmosphere, is responsible for no more than 10 per cent of the total greenhouse effect (M.Z.Jacobson, *Fundamentals of Atmospheric Modelling*, Cambridge University Press, 1999). The major contributor to this effect is water vapour. Very few scientists who supported the Kyoto Protocol were prepared to discuss this unfortunate fact and its implications. Moreover, weather

patterns are very complex issues. One thing we know for sure—they change and have done so dramatically over the historic and prehistoric past. They will change in the future, but it is foolish to suggest that by the simple expedient of controlling one component, carbon dioxide, governments will be able to control the destiny of the world's weather. Even the original group of scientists who sounded the warning about the connection between increased CO_2 concentrations and global warming expressed their concerns in a much more guarded way than is found in the political report produced by IPCC. In their book *Climate Change the IPCC Scientific Assessment*, Houghton, Jenkins and Ephraums claim that even though there are "uncertainties attached to almost every aspect of this issue, policymakers are looking for clear guidance from scientists, hence the authors [of the IPCC report] have been asked to provide their estimate wherever possible together with the assessment of the uncertainties. We have lost sight of the uncertainties in our desire to provide certainty." Similarly, in the preface to Lowell Ponte's *The Cooling*, Dr. Reid Bryson, then Director of the Institute for Environmental Studies at the University of Wisconsin, stated that "there is certainly no agreement about what the climate will do in the next century though there is a majority opinion that it will change ... Of that majority a majority believe that the longer trend will be downward." These comments were, of course, made in the aftermath of the period 1940-1970, when a significant cooling trend had been observed in the average temperature in the northern hemisphere. Incidentally, during that time the concentration of carbon dioxide had been increasing significantly. Today, of course, we are in a time of dramatic warming in the northern hemisphere, and the majority opinion amongst climatologists now reflects the view that this trend will continue and that the principal cause is the increase in carbon dioxide concentration.

There have been many occasions in the past where conventional scientific wisdom held sway only to be challenged by new and disturbing ideas. Einstein's theory of relativity caused consternation when it was first introduced, but gradually gained acceptance as experimental facts were found to be consistent with the new theory. Nevertheless, in the 1930s it was still being bitterly attacked by Nobel laureates in physics, Philipp Lenard and Johannes Stark. Controversial new concepts such as cold fusion and the existence of polywater caused considerable turmoil until they were finally rejected, but not before they had attracted the endorsement of some credible scientists and considerable research money. In the midst of scientific controversy it is sometimes difficult to chart a true course, as politics and personalities are so often involved. In the current debate about climate change the desire to influence political action has played an important role and the need to provide a simplistic analysis to give certainty to policy-makers has been paramount. However the

scientific community sometimes has to live with uncertainty. Some outcomes may be probable but not absolutely certain. At such times it is essential that clear guidance be given on the issues, which are clear and unambiguous. On issues, which divide the scientific community a more nuanced approach is called for. Even where our present state of knowledge is incomplete it is sometimes advisable to take preventative action. Such action should be based on as clear an understanding as possible of the underlying scientific issues.

Climate Change and Saskatchewan's Environment

By Joe Piwowar

To understand the impacts of a changing climate on Saskatchewan, it is important to review the present environment and its tolerance limits. Prairie ecosystems exist in a delicate balance that is largely controlled by the amount of available moisture.[3] The treeless plains have evolved over a millennia of limited rainfall, combined with large daily and seasonal temperature ranges. Where more moisture is available, vast expanses of boreal forests are supported. In drier regions, however, sparse vegetation barely covers great sand hills.

Over the past 100 years, the global average temperature has increased by approximately 0.6°C, and is projected to continue to rise at a rapid rate.[4] Most climate change projections for the Prairies show a continued increase in temperature under global warming. Mean summer and winter temperatures over the Central Prairies are projected to rise by 2.5°C by 2050 and 5°C by 2100.[5] Warmer winters may mean more intense winter storms, and increase the likelihood of rain. In the summer, flooding may increase due to heavier rainfalls.[6] Although annual precipitation is expected to stay within 10 per cent of the 1975-1995 average until late in this century, projections show a slight increase in winter precipitation and a slight decrease in summer rainfall.[7] Extreme events, such as severe thunderstorms, tornadoes, hailstorms, and heat waves, may become more common on the Prairies due to climate change.[8]

---

[3] Acton, D.F., G.A. Padbury, and C.T. Stushnoff, 1998. *The Ecoregions of Saskatchewan*, Regina: University of Regina Canadian Plains Research Center.
[4] Houghton, J.T. *et al.* (eds.), 2001. *Climate Change 2001: The Science of Climate Change*, New York: Cambridge University Press.
[5] Hengeveld, Henry G., 2000. *Projections for Canada's Climate Future*. Ottawa: Environment Canada, Report CCD 00-01.
[6] Climate Change Canada (2002): *Climate Change Plan for Canada*. http://www.climatechangecanada.ca, accessed on 2003.03.09.
[7] Hengeveld *op.cit.*
[8] Climate Change Canada *op.cit.*

However, it is the combination of the modelled temperature and precipitation predictions that will have the greatest impacts. Even if precipitation remains at present levels, there will be a net loss of available moisture due to temperature enhanced increases in evapotranspiration rates. This will be particularly evident in notable decreases in available soil moisture, with potentially serious implications.[9] The reduction in soil moisture will be greater in summer, and by the year 2100 the Southern Prairies could experience significant summer deficiencies in soil moisture. The Canadian Global Climate Model projects that this would result in less evaporation and more intense heating of the surface air mass, leading to increases in the daily maximum temperature extremes of up to 12°C by 2050.[10] These moisture deficits and temperature extremes will have a dramatic effect on Prairie ecozones and land uses. Some of the expected changes are highlighted below.

Agriculture

Nearly half of the population of Saskatchewan lives in rural areas, and agriculture is an important industry in the province. Global warming will have both positive and negative impacts on agriculture. On the positive side, much of the Prairies will experience longer frost-free growing seasons. Over the past 50 years the date of the last spring frost has advanced by about 10 days.[11] Combined with a delayed onset of the first autumn frost, the length of the growing season on the Prairies has increased, on average, by about 10 to 15 days. In addition, since carbon is a key element in plant growth, increases of atmospheric carbon dioxide (CO_2) will actually act as a fertilizer, thereby enhancing crop production.[12] Other positive effects include increased productivity arising from warmer temperatures, accelerated maturation rates, expanded agricultural land availability in the north, and an enhanced potential for the introduction of new crops.

On the down side, the hotter, drier summers that are predicted will dramatically increase the frequency of drought and severe drought conditions across the Prairies.[13] Over the past 50 years the amount of winter snowfall has decreased and the spring runoff has begun earlier. Both of these factors point to a reduction of soil moisture available for healthy plant growth.[14] Also on the

---

[9] Hengeveld *op.cit.*
[10] *ibid.*
[11] NRCan (2002): *Climate Change Impacts and Adaptation - Agriculture*. Ottawa: Natural Resources Canada; Parmesan, C. and Yohe, G. (2003): "A globally coherent fingerprint of climate change impacts across natural systems", *Nature*, 421(1), 37-42; Root, T.L., Price, J.T., Hall, K.R., Schneider, S.H., Rosenzweig, C., and Pounds, J.A. (2003): "Fingerprints of global warming on wild animals and plants", *Nature*, 421(1), 57-60.
[12] NRCan *op.cit.*
[13] *ibid.*
[14] Nyirfa, W.N. and Harron, B. (2002): *Assessment of Climate Change on the Agricultural Resources of the Canadian Prairies*. Regina: Prairie Adaptation Research Collaborative (PARC).

negative side, the warmer temperatures will prevent winter kill-off of some pests, and allow the introduction of new insects and weeds with an ensuing increase in crop damage. Other negative impacts include rising heat stress in plants and animals, increasing soil erosion, and planning problems due to less reliable forecasts.[15]

In balance, the positive and negative impacts might tend to offset each other, resulting in little difference in net agricultural production across the entire Prairie region. On the local level, however, the stresses of dealing with these uncertainties will put tremendous strain on the social cohesion within agricultural families and communities.

Grasslands

Since almost all of the native prairie grassland in Saskatchewan has been converted into agricultural production, the impacts discussed in the previous section are also applicable here. Of importance, however, are the shifting extents of the grasslands ecozone under a changing climate, since this generally mirrors the area available for agriculture. Summer precipitation is expected to decrease in Southeastern Saskatchewan which may push the region farther into a semi-arid state, and force out marginal crop production.[16] At the northern grassland boundary, however, temperature increases could lead to the expansion of the grassland ecozone into the boreal forest. Although many of the soils along the northern fringe of the grasslands are not suitable for intensive cropping, the opening up of new pasture lands could be seen to offset the loss of crop land in the south. Indeed, an average rate of northward migration of the ranges of many species has been estimated to be 6.1 km per decade, globally.[17]

Boreal Forest

The boreal forest ecozone occurs in the cooler, moister regions of the Prairie provinces. In the northern regions, forest growth may benefit from warmer temperatures, CO_2 'fertilization' and longer growing seasons, but may be limited by unsuitable soil.[18] Forest fires and insect infestations are also expected to increase throughout the provinces. In particular, spruce budworm outbreaks are thought to increase the occurrence of wildfires by encouraging the accumulation of dead tree

[15] NRCan *op.cit.*
[16] McGinn, S.M., Sheppherd, A., and Akinremi, O. (2001): *Assessment of Climate Change and Impacts on Soil Moisture and Drought on the Prairies*. Ottawa: Climate Change Action Fund (CCAF).
[17] Parmesan and Yohe *op.cit.*
[18] NRCan (2002): *Climate Change Impacts and Adaptation - Forestry*. Ottawa: Natural Resources Canada.

matter, which is a prime fuel for a fire.[19] Similarly, melting permafrost and increased soil drying could lead to higher fire risks along the northern limits of the boreal forest too.[20] In balance, drier climates and human pressures are expected to put northward pressure on these forests.

Water Resources

The availability of water is a limiting factor to the presence and extents of Saskatchewan's ecosystems. Thus, water has a critical role to play in understanding the potential impacts of a changing climate. The supply of water from Prairie streams comes mostly from snowmelt runoff and, to a lesser extent, rainfall runoff. Prairie streamflow is strongly affected by climate and exhibits wide variations from year to year. Longer and hotter summers will increase evaporation and reduce water levels in lakes and rivers.[21] This means that although there will generally be less water available for use, the risk of larger extreme flows will increase. Riverside flooding in low-lying areas already affects many communities. In the Northern Plains, thawing permafrost would greatly increase the risk of damaging floods. As a result, there is an increased likelihood of severe drought with negative impacts on agriculture, hydroelectric generation, and urban uses. Demands on groundwater could increase. Although groundwater is a renewable resource, it is not unlimited and we must ensure that its use remains sustainable.

How can the adoption of the Kyoto Protocol help?

Much of the atmospheric warming we have been experiencing has been the result of increased concentrations of greenhouse gases,[22] the principal of which is carbon dioxide. Through the process of photosynthesis all green plants absorb CO_2 and release O_2 back into the atmosphere. These plants hold on to the carbon atoms and use them to grow. Thus, green plants help reduce the amount of CO_2 in the atmosphere and are called "carbon sinks". Simply put, by increasing the number of green plants growing across Saskatchewan, we can reduce the amount of carbon dioxide that is in the atmosphere, and begin to slow the process of global warming.

[19] Fleming, R.A., Candau, J.N., and McAlpine, R.S. (2001): "Exploratory retrospective analysis of the interaction between spruce budworm (SBW) and forest fire activity", Unpublished report, Ottawa: Climate Change Action Fund (CCAF).
[20] Lindsey, Rebecca (2002): "The Migrating Boreal Forest", http://earthobservatory.nasa.gov/Study/BorealMigration, accessed 2003.03.09.
[21] NRCan (2002): *Climate Change Impacts and Adaptation - Water Resources*. Ottawa: Natural Resources Canada.
[22] Houghton *op.cit.*

Policy Implications: Climate Change, Kyoto, and Health

By Michael Polanyi

The Canadian debate over the ratification of the Kyoto Protocol focused largely on the physical impacts of climate change, and the economic implications of reducing greenhouse gas emissions (GHGs). Yet, both climate change and the Kyoto Protocol also have important human health implications, and this section summarizes what we know about the health impacts of climate change, and the efforts to reduce GHG emissions and adapt to climate change. It also suggests promising policies to address climate change in a way conducive to protecting human health, with a particular reference to Saskatchewan. Starting from the premise that ambient temperatures are increasing, and that an increase in GHG emissions is contributing to this change, the evidence of this is strong, though not unequivocal as noted above (IPCC, 2001; "The science of climate change", 2001). The main approaches to assessing the health risks associated with climate change are extrapolations of historical situations analogous to some aspects of climate change, formal mathematical modeling, and expert judgment of health consequences (Haines & McMichael, 1997). All are open to uncertainty due to the "unpredictability of future industrial activity, differences in sensitivity to disease systems and vulnerability of populations to climate change" (Haines & McMichael, 1997, 870). As social and environmental issues become more interdependent and complex, public discussion about how to deal with uncertainty is merited. From a health perspective, many citizens believe that a "protecting, precautionary approach" is preferred (Haines & McMichael, 1997, 874). In other words, we must ensure that we weigh the potential costs of doing nothing against the potential costs associated with taking action, as we endeavour to do below.

Rising Sea-levels and Flooding

There is a widespread expectation that climate change will lead to a rise of up to one metre in sea-levels over the next 50-100 years. The number of people affected by flooding is expected to increase from 13 million today to 94 million in 2080 if climate change is not countered (Haines, McMichael, Anthony, & Epstein, 2000). In Canada, coastal areas such as the British Columbia Lower Mainland, the Gulf of St Lawrence, and Prince Edward Island are particularly vulnerable. In addition, a predicted drop of up to 2.5m in the Great Lakes Water Basin could also lead to a decline in Prairie soil moisture, reducing agricultural productivity by 10-30 per cent (Last, Trouton, & Pengelly, 1998). Lower sea levels could also threaten food and water supplies, compromise sanitation, and put people at risk for diarrhoeal disease, scabies, conjunctivitis, and water-borne

diseases (Patz & Khaliq, 2002; Yoganathan & Rom, 2001). Floods and drought reduce biodiversity and increase extinction, preventing future medicinal use of various plants and animals (Last et al., 1998). Social and psychological impacts of natural disasters are also important, as increased suicide rates, for example, have been observed as a result of natural disasters (Yoganathan & Rom, 2001).

Heat Stress

Heat stress particularly affects the elderly and individuals with pre-existing illnesses, often leading to heat stroke and a range of heart, respiratory, and other heat-related illnesses. The July 1995 heat wave in Chicago led to 514 heat-related deaths (12 per 100,000), a 23 per cent increase in hospital admissions for patients with underlying cardiovascular disease, and compromised psychoneurological functioning (delirium, lethargy, disorientation, seizures) (Patz & Khaliq, 2002; Yoganathan & Rom, 2001). Outdoor workers are also susceptible to increased risk of heat stress (Yoganathan & Rom, 2001).

It is acknowledged that heat-related mortality is "uncertain science" (Chiotti & Maarouf, 2002). Skeptics say that heat waves only temporarily increase mortality (Moore, 2000; Shindell, Raso, & Stephen, 1997). Moore (2000) also suggests that cold-related deaths are more prevalent in the United States, and that reductions in such deaths will offset increased heat-related deaths, although others indicate that the relationship between cold and deaths is even more uncertain than the relationship between health and mortality (Haines et al., 2000). Still, many believe that overall morbidity and mortality due to heat stress is likely to increase due to climate change (Canadian Association of Physicians for the Environment, 1995; Canadian Public Health Association, 2002; Chiotti & Maarouf, 2002; McMichael, Haines, Slooff, & Kovats 1996).

Extreme Weather

Local weather trends are complex and open to variability due to fluctuating meteorological systems. At a regional level, there is some agreement that climate change is prompting more frequent extreme weather events (Chiotti & Maarouf, 2002), including more vigorous evaporation and precipitation (McMichael, Haines, Sloof, & Kovats, 1996). Weather records up to the 1990s do not necessarily reflect this (Moore, 2000), however numerous major hurricanes, cyclones, floods, and ice storms in the late 1990s, and an unusually strong El Nino in 1997-98 do suggest an

increase in extreme weather events. Weather disaster losses world-wide in 1997 alone ($89 billion) eclipsed the losses for the entire decade of the 1980s (Yoganathan & Rom, 2001).[23]

Vector-borne Diseases

Climate plays a role in vector-borne diseases or diseases transmitted by insects which are a major cause of illness and death in tropical countries. An indirect effect of rising temperatures, therefore, is the possible spread of diseases such as malaria, dengue, and yellow fever in the more temperate zones such as Canada. Fluctuations in malaria risk in India, Columbia, and Venezuela have been linked to the 1997-98 El Nino (The World Health Organization (WHO), 2001). In Canada, malaria disappeared at the end of the 19th century, yet in the late 1990s locally transmitted cases of malaria were reported (Haines et al., 2000). It is estimated that the percentage of the world's population living in zones of potential malaria transmission will increase from 45 to 60 per cent over the next 100 years (Waterston & Lenton, 2000). The spread of other infectious diseases such as schistosomiasis, Lyme disease, encephalitis, and cholera have also been observed (Yoganathan & Rom, 2001).

Respiratory and Cardiovascular Disease from Smog and Air Pollution

Climate change and air pollution are linked in two ways. First, they arise from the same source: the burning of fossil fuels. Second, temperature can magnify the effects of pollutants already in the air (Canadian Public Health Association, 2002). For example, smog episodes have been closely associated with hot temperatures in Ontario (Chiotti & Maarouf, 2002). Air pollution constitutes a "major environmental health problem affecting developed and developing countries alike" (WHO, 2002). WHO (2002) estimates that about 2.5 million people died in 1999 due to exposure to air pollution, roughly comparable to the number who died from HIV/AIDs (2.7 million) and diarrhea (2.2 million). The main causes of air pollution-related death are heart disease, respiratory inflammation, pulmonary disease, and perinatal conditions. Lost quality life years is high: children account for 30 per cent of all diseases, but 67 per cent of respiratory disease (WHO, 2002).

Approximately 16,000 Canadians die prematurely each year from air pollution caused by burning of fossil fuels such as oil, gas and coal, which represents one in twelve non-accidental deaths (Last et al., 1998). The Ontario Medical Association indicates that for every death due to

[23] In total, extreme weather causes about 80,000 deaths per year, 95 per cent in poor countries, as well as animal deaths, the destructions of homes, crops and resources, as well as damage to health and public infrastructure (WHO, 2001).

air pollution in Ontario (1,900 per year), there are an additional 5 hospital admissions, 6.8 emergency visits and 24,000 minor illness days (Suzuki, 2002). Finally, one in seven infant-respiratory admissions in Canada to are due to air pollution (Last et al., 1998). Last and colleagues (1998) suggest that 700,000 premature deaths due to air pollution would be prevented if climate change policies were implemented (140,000 in developed nations).

Economic Impacts of Climate Change

Health status is closely linked to economic conditions in various ways and at various levels. Access to work, income level and distribution, and access to health care and other services are all dependent on the vitality and robustness of economies. Some business groups suggest that cutting GHG emissions to Kyoto levels could cost the Canadian economy up to $40 billion and 450,000 manufacturing jobs by 2010 (Beatty, 2002; Canadian Association of Exporters and Manufactures, 2002). Canadian government estimates are less extreme, predicting a 0-2 per cent net reduction in total GDP growth over the period between 2000 and 2012 (Government of Canada, 2002b). This cost pales in comparison to estimates that the costs of inaction, pegged at 1-2 per cent of GDP in developed countries (and 4-8 per cent of GDP per year in developing nations) due to lost productivity, compromised natural resources, and increased costs for coastal protection, health care, and other services (Last et al., 1998).[24]

The potential gains of implementing Kyoto are sometimes overlooked. In its forecast the Government of Canada acknowledges that its economic predictions do not take into account potential environmental and health co-benefits of $300-500 million per year (Government of Canada, 2002b). Bailie and colleagues (2002) project net economic savings of $4 billion, and the net addition of 52,000 jobs by 2012 compared to the "business as usual" scenario. Others predict $8 billion savings in health care costs due to air pollution over the next 20 years (Last et al., 1998).

Addressing climate change: mitigation or adaptation?

There is a debate over whether climate change action should focus on reducing emissions or on minimizing the ill effects of climate change (adaptation). The Canadian government's plan for implementation of the Kyoto Protocol constitutes a mix of the two approaches. Proponents of

[24] In Canada, projected annual costs associated with a doubling of carbon dioxide emissions amount to 1.5 per cent of GDP, or $3.4-24 billion (Chiotto & Marouf, 2002). The costs are already visible: in British Columbia the warm winters are allowing the spread of mountain pine beetles which are destroying hundreds of thousands of hectares of pine forest, causing up to $4-billion in damage in 2001, and the 2002 drought in Saskatchewan and Alberta led to crop insurance payouts of $2-billion.

adaptation argue that mitigation at the level of Kyoto is costly and not going to significantly reduce warming (Shindell, Raso, & Stephen, 1997). While this perspective minimizes the politically importance of Kyoto as an incremental first step to further GHG reductions, it is true that some warming is now inevitable, and therefore focus on adaptation is merited. From a health perspective, this involves better monitoring and warning of health risks, improved disaster preparedness, enhanced public education, planting of trees, and actions to prevent spread of disease (Haines, & McMichael,1997; Shindell, Raso, & Stephen,1997; WHO, 2001).

Adaptational strategies are attractive to governments as they are perceived as being less costly, and less disruptive to the economy, in particular its dependency on fossil fuels. However, on their own, adaptive strategies are unlikely to be either effective or inexpensive. First, protection against sea-level rise, increased heat, and extreme weather can never be complete, and in some cases (i.e. increased use of air conditioning) is self-defeating or, at best, unsustainable. There will always be those who fall through the cracks of protection, especially poor people and poorer countries. Second, adaptation only buys time for the inevitable: we need to reduce GHGs sooner or later. Given the amount of negotiation needed to ratify even the minimal reductions of Kyoto, we need to start pursuing further reductions now. Third, adaptation is not necessarily less expensive, if full costs are incorporated.

Unfortunately, provinces have done little to mitigate GHGs (Bramley & Robertson, 2001). Education and voluntary measures are insufficient for the challenge. Instead, promising and cost-effective avenues for mitigation identified elsewhere entail investment, incentives and regulation in support of: more efficient passenger and freight transportation; improved building efficiency; renewable production of electricity; emissions caps, trading and co-generation in industry (Bailie et al., 2002). Many of these actions are hinted at in *Canada's Climate Change Plan for Canada* (Government of Canada, 2002a). Unfortunately, the Plan's targets are weak, timelines sometimes unstated, and some of its strategies (e.g. "clean" coal technology, expanded ethanol) belie an unwillingness to recognize the urgent need to start to sever Canadian economic dependence on fossil fuels.

Recently, Saskatchewan was rated last among provinces in addressing climate change, considered to be "failing almost completely to address climate change" (Bramley & Robertson, 2001). GHG emissions in Saskatchewan rose 28 per cent between 1990 and 1998 (Bramley & Robertson, 2001). It is true that Saskatchewan is a small province with limited resources and a high dependency on coal for electricity. Nevertheless, the stakes for the province are high, made amply

evident by recent and severe droughts that can only be expected to become worse under climate change scenarios.

There are also numerous opportunities for action. Unfortunately, the Government of Saskatchewan's recent strategy paper, *Saskatchewan Initiative on Climate Change*, (Saskatchewan, 2002) focuses almost exclusively on the potential costs of implementing Kyoto, and the desire not to be burdened with more than its share of such costs vis-à-vis other provinces. The more extreme dangers of inaction are largely ignored.[25] The Strategy focuses on very conservative actions, emphasizes adaptation, voluntary and incremental change. It fails to take a broader perspective on the economic and social benefits of developing an economy that is less dependent on fossil fuels. It also fails to set clear goals and a timeline for GHG emission reduction. In brief, Saskatchewan has taken some steps to address climate change, but there is much more the government can and should do (see Table 1).

In sum, a health-based approach to climate change would: a) focus on mitigation, or the reduction of fossil fuel dependency; b) incorporate the full social and economic costs of "business as usual" when assessing the costs of mitigation measures; c) articulate and seek co-benefits of reducing GHG emissions and improving air quality; and d) move towards full environmental and health impact assessments of policies. As Yoganathan and Rom (Yoganathan & Rom, 2001) state: "There is no greater challenge than to develop environmentally sensitive technologies for delivering energy to preserve the global commons and public health". The policy options are available as outlined below, but we await the political will to turn possibility into reality.

Table 1. Government of Saskatchewan Action Taken and Recommended Action on Climate Change

Policy Area	Actions Taken	Recommended Actions
Transportation	- removal of taxes on ethanol - advice on development of short-line railways and city transport options - negotiated agreements with shippers and carriers to improve energy efficiency - financial incentives for conversion of vehicles to natural gas	- impose fee on inefficient vehicles and offer rebates on purchase of fuel-efficient or alternative fuel vehicles - pass sustainable transportation legislation to ensure that tax dollars support cycling, transit and rail, not just roads and highways - reduce major highway speed limits - encourage sustainable land-use and planning that reduces vehicle dependency

[25] Government of Canada (2002c) forecasts suggests that meeting Kyoto's commitments would mean an overall reduction in GDP growth in Saskatchewan of 0.39% by 2010, and a delay in job creation of about 1,500 new jobs (small compared to the 5,520 jobs created in 2001 alone). These forecasts do not reflect the environmental and health benefits of taking action.

Policy Area	Actions Taken	Recommended Actions
Electricity and Power	- investment of $750,000/year in wind power and "green power" purchasing program - prime rate loans for installation of natural gas appliances	- create a Renewable Portfolios Standard (RSP) (minimum per centage of electricity that must come from renewable sources) - require energy utilities to undertake demand side management - set up a Public Benefits Fund to support energy efficiency and renewable energy through a small surcharge on electricity bills - invest in renewable energy rather than natural gas, which produces CO_2 and methane
Buildings	- recent buildings constructed by Saskatchewan Opportunities Corporation exceed National Energy Code - forgivable loans to low-income homeowners and renters to rehabilitate buildings (e.g. improve energy efficiency) - audit and financing of energy efficiency in commercial buildings -loans for installation of efficient furnaces - education of builders in energy efficient technology	- formally adopt the National Energy Code for Buildings and Houses and prohibit mortgages for buildings that do not meet the Code - make energy audits free, funded through Public Benefits Fund - partner with credit unions to provide retrofit loans that are repaid through subsequent savings
Industry	- support of two co-generation plants	- reduce incentives for investment in oil and gas development (or even put a moratorium on all new licensing for exploration) - provide incentives for industrial investment in energy efficiency and alternative energy sources - enter into binding voluntary covenants to reduce industry GHG emissions
GHG Emission Trading	- carbon credit transfer to SaskPower in return for planting of 5 million trees	- support a domestic emissions trading system - mandate GHG reporting by companies and institutions - give everyone the right to generate their own energy (solar, wind, fuel cell or microturbine) and feed it into the grid for credit - move towards a system of "Carbon Calculators" that monitors levels of carbon emissions and credits or rebates under-emitters
Government Leading by Example	- commitment to improve energy efficiency by 20 per cent in provincial office buildings, health care facilities, schools and other buildings - piloting new sanders/snowplows to reduce number of vehicles and increase fleet of natural gas vehicles	- adopt a GHG emission reduction target - reaffirm 1997 commitment to reduce energy consumption 20 per cent by 2005 - establish Green Purchasing Guidelines

Policy Area	Actions Taken	Recommended Actions
Other Sources of GHGs	- piloting capture of hog barn biogas - programs to reduce fertilizer use and energy inputs and improve carbon sequestration of soil - educational programs to reduce crop residue burning, enhance topsoil productivity convert marginal croplands to perennial forage cover	- tax methane emissions from gas, coal and oil production - mandate capture of methane from landfill sites - expand afforestation programs - increase land mass designated as parks and protected areas
Technology Development	- supports development of technologies to capture carbon dioxide	- support development of low-impact renewable energy technology
Taxation		- carbon tax on fossil fuels with income going as refund to residents/businesses - reduce motor vehicle licensing fees and increase fuel taxes - implement pesticide and fertilizer tax to provide tax credit to help farmers move towards organic and low-impact farming

Based on Bramley & Robertson (2001) Dauncey & Mazza (2001) and Saskatchewan Environment (2002)

Innovative Technological Solutions for Kyoto

By Malcolm Wilson

The targets set in the Kyoto Protocol negotiated in December 1997, and ratified by Canada in 2002, is a first step on a route towards significant reductions in greenhouse gas emissions (GHGs). Significant, or "deep", cuts in emissions will be required if we are to have any significant effect on global climate change. The target set for the industrialized nations in 1997 was 5.2 per cent below 1990 levels of emissions by the period 2008-2012. Meeting this target would, at best, slow the onset of change by a couple of decades. This is due to increasing emissions in developing nations, the continued increase in concentrations of greenhouse gases in the atmosphere, and the effect of greenhouse gases already present in the atmosphere. To effect stabilization of greenhouse gas concentration at today's elevated levels, or even higher concentrations, would require global reductions in emissions of 60 per cent or more below 1990 levels.[26] It is expected, therefore, that subsequent rounds of negotiations will increase the severity of targets and incorporate more countries in order to have an appreciable effect on greenhouse gas concentrations. In the interim,

[26] Significant work on this topic has been undertaken by the Intergovernmental Panel on Climate Change (IPCC), the science body reporting to the United Nations Framework Convention on Climate Change.

concentration of these gases will continue to rise, albeit a little more slowly if Kyoto comes into affect, and change to our global climate will continue.

Technology Development

Before examining some of the technologies that can effect deep reductions in greenhouse gas emissions, it is worth making a few general points about technology development. The most significant is the chain of events leading to the deployment of a new technology. Development goes from an idea to research to demonstration and, finally, deployment. While changes in the electronics industry can occur with great speed, this is not true for most technologies. Certainly, computer-aided design and the use of virtual systems or simulators can accelerate the process, but, in general, it takes 10-25 years to go from concept to broad deployment. In other words, the technologies that will have an impact in the Kyoto period of 2008-2012 are already well into the deployment stage. These are not new technologies.

The engineering of major facilities, such as refineries and electrical generation facilities, can take a decade from inception to full commissioning. As an example, once a decision is made to build a new electrical generating station, the engineering design, environmental approvals, tendering, construction, and commissioning is frequently a decade-long process. Even with urgency pushing the process, we can still be looking at 5-7 years. Once constructed, such facilities may be in use for 30-50 years: clearly, decisions today have implications for greenhouse gas emissions for many decades.

As we examine new technologies, there is also a need to understand the existing infrastructure and the foundation for this infrastructure. As an example, our transportation infrastructure is designed for the use of fossil fuels. A network of pipelines carries crude oil from the production site to refineries. From there, refined products are moved to fueling stations to be used by a variety of different vehicles. The result is that we can expect to be using fossil fuels to meet the majority of our energy needs for many decades. New technology must be developed with the existing infrastructure in mind and, as we look to technology to reduce emissions, we must be cognizant that technology can do one of three things: first, replace the energy from fossil fuels with energy from other sources; second, use the energy from fossil fuel more efficiently; and, third, capture the emission before it reaches the atmosphere and store it safely. Let us look at each in turn.

Replacing Fossil Energy

There are a number of alternative fuel sources, and a developing range of technologies to use these resources. From a Prairie perspective, the most obvious fuels are water, wind, the sun, and biomass. Considerable work is underway to improve the efficiency with which the conversion process occurs. Wind turbines are able to take more energy from the wind, and photovoltaic cells are becoming cheaper and more efficient, but neither is yet competitive with fossil fuels unless used in off-grid locations.

For hydroelectric development, because of the relative flatness of the Prairie provinces, it is generally necessary to impound the water to create an effective flow for the turbines. Many of the best sites are already being utilized. There is also a need to examine the potential impacts of climate change and determine the long-term availability of water to run the turbines.

Biomass can be used in a variety of ways to produce energy: it can be burned directly to produce heat for space conditioning or electricity production; it can go through a liquefaction process to produce a refinable oil or gasified to produce gas for heaters and gas turbines; and it can be also turned into other liquid fuels like ethanol. In almost all cases, there is considerable on-going research to improve the effectiveness of the conversion process, to use lower-quality feed stocks (for example, ethanol from cellulose and lignin from wood and straw instead of the sugars and starches in grain) and to reduce the production of pollutants and odours.

The sun and wind both have obvious problems as energy can only be produced while the sun shines or the wind blows. Even in Saskatchewan, it is not windy all the time. In fact, the windiest areas of the province can only produce electrical energy 35-40 per cent of the time, and this means that the electrical utility must have a reliable system in place to meet the needs of consumers for the remaining 60 per cent of the time — this is usually a service provided by fossil fuels. When the Prairies were first settled, many farms had wind generators that charged batteries to meet electrical requirements. Batteries are a very expensive and inefficient way of storing electricity, however. The alternative, if the wind were used to provide water, would be to pump the water into a raised tank to allow gravity feed to keep water available. Today, there is much innovative research underway to improve storage. One interesting alternative is to use some of the electricity to compress air and pump it into a storage cavern, usually hollowed out of salt, deep in the earth. When the wind quits blowing, the air is released through the turbine used to compress it to produce electricity. More advanced work is underway with light-weight fly-

wheels and the use of superconductors, among others. Effective storage systems will be developed over time. One additional benefit of using these forms of renewable energy to produce electricity is that they use the existing infrastructure for distribution.

The final alternative, worthy of note, is the opportunity to move to nuclear energy in Saskatchewan. While the province is a major producer of uranium, it does not utilize any for electricity production. The nuclear industry continues to research improved and safer nuclear electrical power generation.

Using Energy More Efficiently

We are seeing significant progress in the development of ways to use energy more efficiently. This allows us to obtain the same benefits with lower energy use and fewer emissions. Perhaps the most obvious improvements are in the gas furnaces that heat our homes and workplaces. Indeed, it is no longer possible to buy lower efficiency furnaces. Household furnaces are now readily available that convert more than 90 per cent of the heat energy in natural gas to useable heat. The standard for thirty to forty years ago was around 60 per cent. We are also seeing continuous improvements in the coatings on windows, again with the goal of separating us better from the heat or cold outside. New design, engineering, and electronics also enable the manufacturers of automobiles to make them more efficient. Not only are the engines better, but also the innovative use of materials allows them to make cars lighter without sacrificing safety. This overall improvement in efficiency has gone hand-in-hand with a general reduction in other emissions such as NOx as well. Hybrid vehicles are already gradually making in-roads, and continual improvements are being made to battery technology.

Lighting is also undergoing significant improvement. The change from incandescent lights to new fluorescent lighting has created a significant reduction in energy use; compact fluorescents use approximately one-quarter the energy of an incandescent for the same light output. The next generation, using light-emitting diodes will cut this back even more dramatically. The change is even more beneficial in sealed office buildings where the better lighting creates less heat, requiring less cooling in summer.

There is a large amount of research and development underway that is less obvious in our everyday lives. This includes everything from less energy intensive ways to make steel, to increased use of control systems, to better chemicals for industrial use. Of particular interest in this category is the huge amount of effort going into improving fossil fuel combustion for electricity

production. Today, we use primarily natural gas and coal to produce electricity. The new natural gas-fired turbines (essentially jet engines attached to generators) convert well in excess of 40 per cent of the energy in natural gas to electricity. When the waste heat is captured and used for the production of steam for electricity (combined cycle generation) or heat for space conditioning (known as co-generation), the efficiency can reach well over 80 per cent. Similar gains are being made with coal, with efficiencies climbing from approximately 30 per cent to well over 40 per cent and approaching 50 per cent in combined cycle use (electricity from coal gasification and waste heat utilization). Similarly, much innovative work is going into fuel cells, which basically use hydrogen and a chemical conversion of this energy form to electricity and water. Fuel cells can be used as stationary and mobile energy producers. There is great potential for fuel cells in distributed generation, particularly in remote areas.

Hydrogen

Hydrogen, as a fuel, is much touted as the next mainstay of the energy economy. Hydrogen in fuel cells and internal combustion engines can power the automobile and provide the power turbines to produce electrical energy. As an energy source, hydrogen does, however, have a number of serious drawbacks. It has a low energy density, so even if compressed to a liquid state, at very high pressures, the range of a car would be limited. Storage as a metal hydride is more effective, but still storage is a problem. Current research is looking at storage in carbon tubes using nanno-scale technology. Hydrogen also has safety issues besides the high pressures used for storage and that is its tendency to spontaneous combustion in air and that it burns with a colourless flame. In other words, leaks are difficult to detect, and can be dangerous. Some innovative work is ongoing looking at methanol as an energy carrier for hydrogen. Liquids fit much better with our current infrastructure for transportation fuels.

The other problem is the production of hydrogen. It is currently produced through the steam reformation of natural gas. In other words, hydrogen is produced from fossil fuels with greenhouse gas as a co-product. Hydrogen can also be produced from the electrolysis of water, making it a possible storage mechanism for wind or solar energy in the future. However, the energy penalty of cracking water is high, making the process inefficient unless wind, sun, or nuclear energy is used. Research is currently underway to look at more efficient ways of reducing water to its two components of hydrogen and oxygen, for example with specially designed catalysts. It is quite possible, even likely, that hydrogen will be the fuel of the future,

but there are many hurdles yet to overcome before it becomes a viable technology to replace fossil fuels in our transportation and electricity sectors.

Capture and Storage of Greenhouse Gases

It is very unlikely that the use of energy efficiency and renewable energy technologies can make sufficient reductions in energy use and fossil fuel emissions to meet the deep cuts that are necessary for greenhouse gas concentration stabilization and ultimate reduction. This is certainly true for the coming half-century. The use of biologic sinks, such as soils and forests, have limited capacity for carbon sequestration, but can offer a transition period for technology to take a hold. Capture can be accomplished by removing the carbon from fossil fuels prior to combustion. The process of steam reformation of natural gas, for example, produces a pure steam of CO_2 that is easy to capture. Gasification processes, particularly oxygen gasifiers with coal as the feedstock, also produce a relatively pure CO_2 stream. The alternative is to capture the CO_2 after combustion using a variety of techniques. In short, the nitrogen must be removed by either using oxygen for combustion or by separating the CO_2 from nitrogen after combustion with air. Canada is a world leader in the development of carbon-capture technologies, and the University of Regina is the leader in one particular technology, the use of chemicals to separate CO_2 from the nitrogen and other gases after combustion has occurred. To store CO_2, it is necessary to compress it and place it deep in the earth or deep in the ocean. In either case, it is too expensive to compress CO_2 with the nitrogen (i.e. an untreated stream of flue gas) for deep injection. For example, flue gases from a coal-burning electrical generating station have a CO_2 concentration of about 13-15 per cent. This must be increased to 95 per cent or above for injection or use, although there remains some debate about the exact purity level.

The subsurface and the oceans have enormous capacity for CO_2 storage. In oceans, the CO_2 can be injected at 1500m or deeper as small droplets to dissipate (dissolve) in the ocean. Alternatively, it can be injected into very deep oceans, approximately 3000m, to sit as a bubble of liquid CO_2 on the ocean floor, only gradually dissolving over thousands of years. Certainly, vast amounts of CO_2 can be stored for long periods of time this way. Research is looking at the best ways to do this, and the potential environmental effects that may occur. In subsurface storage, the CO_2 can be stored in the porous rocks. These are not just empty spaces, the fluids in the rock must be displaced to allow space to be made for the liquid CO_2. The most common use for large volumes of CO_2 is the displacement of oil known as CO_2 Enhanced Oil Recovery and many

millions of tones are annually injected to recover incremental oil. The problem we have is that most of this CO_2 comes from naturally fossilized sources not from the combustion of fossil fuels. The CO_2, which in supercritical state is an excellent solvent, helps move the oil trapped in the rock to the producing well. In so doing, some of the CO_2 is permanently trapped in the oil and water remaining in the reservoir. A major reservoir in southeastern Saskatchewan, near Weyburn, is currently undergoing CO_2 Enhanced Oil Recovery using CO_2 from a fossil fuel source in North Dakota. There is also a large research project underway using information from this commercial oil recovery project to determine the integrity of the storage in this type of environment.

Large volumes of CO_2 can be stored in depleting oil reservoirs, but this is not available in all parts of the world, neither would these reservoirs take CO_2 indefinitely. Other subsurface opportunities include deep, unmineable coal seams. In this setting, the CO_2 will force the release of methane from the coal, storing two molecules of CO_2 for every one molecule of methane released. Much larger storage volumes can be found in deep saline aquifers, certainly enough space to accept very large volumes of CO_2 (billions of tonnes) in the coming decades. In these environments, the CO_2 will initially displace the non-potable water, but over several thousands or tens of thousands of years will dissolve in the water. This would appear to be a very reliable storage mechanism. Clearly, there is much innovative work ongoing in the capture of CO_2 and in understanding the storage options and how to monitor these storage sites.

Policy Implications

The policy implications of technology and technological innovation as a response to climate change are broad. They also fall into several categories based on the technologies they are designed to encourage and deploy.

- In the case of encouraging consumers to utilize more energy efficient technologies, there must be a broad range of consumer-based incentives. To begin with, consumers need more information on the benefits, the education, and awareness process. Beyond this, there may need to be fiscal incentives, such as tax breaks on energy efficient equipment, subsidies, etc., or regulations forcing compliance. In the latter case, federal regulations mandating higher minimum efficiency standards for appliances such as furnaces are in effect. It is now no longer possible to buy the lower efficiency furnaces. Additionally, an awareness program, Energuide, identifies the energy consumption expectations of appliances under normal use, encouraging the consumer to purchase more energy-efficient appliances. Creating a shift in consumer preferences requires a broad range

of policy initiatives and awareness programs to allow broad deployment of technologies. Appropriate policies can also encourage the development of new technologies to meet the needs of reduced emissions.

- Alternative fuels are often more expensive than the fossil fuels we currently use, and North Americans are particularly accustomed to the price and convenience of fossil fuels. To make changes require significant fiscal and awareness initiatives. With biomass, there may also be physical limitations to prevent soil degradation in the short term to meet energy needs. Because of the need for more technology development, policies must be directed at supporting technology development as well as creating the incentive for deployment once technologies reach maturity.
- Capture and storage represent an opportunity beyond the time frame of the first Kyoto time-period. While technologies are being tested, they will not be deployed in time to have a major effect on the first Kyoto period of 2008-2012. Policy must be more focused on research and development of more cost-effective capture technologies, public acceptance of the integrity of storage and the development of an appropriate fiscal structure to encourage storage to become a viable option for deep cuts in emissions.

Social Capital and Climate Change Strategies

By Polo Diaz

During the last decade, social capital has become a central concept in the debate dealing with the social and economic problems that many national and regional economies face. This concept refers to all those features of social life, such as networks, social trust, norms of reciprocity, and participation in organizations, that promote the coordination of collective actions (Putnam, 2001). These features promote social networks that facilitate both the coordination and development of social cooperation around tasks that require collective efforts and social integration. In these terms, it has been defined as a fundamental component of the process of social cohesion (Reimer, 2001). The genealogy of the concept of social capital is found mainly in sociology, especially in the works of Bourdieu and Coleman (for a discussion of the historical development of the concept, see Schuller, Baron, and Field, 2000). In the early 1990s, the concept left the academic scene and became part of the political mainstream as a result of the work of Robert Putnam, who argued that the economic and institutional performance of a country was

dependent on the level of social capital, an argument that had a strong influence in the agendas of many national and international bodies (1993, 1996, 2000, 2001).

What makes social capital attractive to policy-makers and stakeholders is its capacity to act as a bridge between the micro levels of the community and the macro level structures of the country (Lechner, 2002). Social capital is a phenomenon that takes place at the level of communities, with consequences that impact more general processes such as social cohesion. Moreover, social capital seems to be strongly related to human capital, a concept widely used in policy thinking, especially in the areas of education and training (Field, Schuller, and Baron, 2000; Cote, 2001; Schuller, 2001). While human capital is applied to the individual, and refers to the knowledge, skills, and competences embodied in each person, social capital deals with formal and informal relationships among individuals and the networks that emerge from these relationships. The social nature of social capital is expressed in different forms: family structures, informal networks, formal institutions, neighborhood organizations, and others forms of association. In these terms, social capital is a feature of the social structure.

The large number of empirical works indicates that social capital could have positive implications; it has been argued that social capital correlates with strong economic performance (Woolcock, 2001), lower crime (Putnam, 2001), better health (Veenstra, 2001), immigrant adaptation (Lauglo, 2000), tolerance (Putnam, 2001), and community development (MacGillivray, A. and P. Walker, 2000), among other important social and economic dimensions.

Social Capital and Climate Change

To deal with the phenomenon of climate change, two strategies are being discussed: mitigation and adaptation (Harper, 2001). Mitigation involves all those mechanisms geared to the reduction of greenhouse gas emissions. The Kyoto Protocol is perhaps the best-known institutional manifestation of this strategy. The faster we set up these mechanisms, and the more efficient they are, the stronger will be our capacities to reduce the perils of climate change. Alternatively, finding we could not influence the course of events through a strategy of mitigation, we could still pursue a strategy of adaptation oriented to facilitate the process of coping with the new climate conditions.

These two strategies, of course, could and should be combined into one. Given the global complexities that surround the production of greenhouse gases — a multiplicity of sources, strong economic interests against their reduction, limited knowledge about their specific impacts, and lack of political will from many nations — it is fundamental to engage in a strategy that assumes all

possibilities. Moreover, the Kyoto Protocol calls for a very limited reduction in emissions below 1990 levels when what is required to stabilize their concentration in the atmosphere is a significantly higher level of reduction. Recognition of this fact makes the strategy of adaptation a fundamental political task.

Could social capital contribute to the establishment and implementation of these strategies? The response is clearly positive. Social capital could not only facilitate to a large extent the development of these two strategies; it is rather central to their success. Three important reasons support this statement. First, the challenge of these strategies requires the integrated effort of both government and the whole civil society. It involves more than the simple administration of mitigation and adaptation measures — the traditional role of the state — or the adoption of new technologies, but also the active integration of all the sectors of the civil society into the design and implementation of the two strategies. Only a collective effort will ensure the attainment of the goals and targets of mitigation and adaptation. In such an effort, the role of social capital is crucial. Second, the recognition that social behaviours are determined not only by the reactions of individuals to good information and public education programs, but also by the extent to which broader contextual factors support the performance of such behaviours (Campbell, 2000). The promotion of behaviours that could support mitigation and adaptation measures requires not only educational programs aimed at the individual, but also a social context encouraging the individual to adopt those behaviours. Social capital could be the most important social context required for this task. Third, climate change is a problem that requires a lasting solution, at least in terms of the current use of certain natural resources. The co-ordination of many actors, and the appropriate institutions that promote dissemination of information, is necessary in the implementation of decisions (World Bank, 2003). Social capital is part of this institutional make-up in both a formal and informal manner. In this vein, social capital could be an important instrument in fostering mitigation measures, such as changes of social behaviour, consumption patterns, and values. The local organization could be an avenue for learning about climate change and mitigation alternatives, for establishing relationships with other stakeholders, for organizing mitigation awareness activities, and many other actions that could help to disseminate the value of mitigation and to implement related measures (Dauncey and Mazza, 2001).

Social capital could also be central to a strategy of adaptation. Strong support for this argument is found in the existing literature, and research on the adaptive capacities of peasants and farmers to new economic conditions. The existence of strong informal networks among peasants

facilitates their capacity to understand the new economic conditions and the reorganization of available resources in order to deal with those conditions (see, for example, Redclift, 1986; Schminck, 1984). Social capital allows for a more cooperative and generous orientation to action, facilitating the establishment of collective objectives and the organization of groups in the pursuit of those objectives.

An important impact of climate change could be the scarcity of certain resources, such as water, creating the conditions for environmental conflicts and their negative consequences for economic investments, community livelihoods and the legitimacy of governments (Buckler, 1999; Homer-Dixon, 1999). Given that social capital allows for a better orientation to action, it could also constitute an important mechanism for conflict resolution and the establishment of consensus among a variety of stakeholders, avoiding one of the worse consequences of climate change.

The Limitations of Social Capital

The use of the concept for policy purposes requires careful consideration. Increasing popularity has led to the term's indiscriminate usage, whence its original meaning and heuristic value are seriously tested (Portes, 1998). At a theoretical level, the concept requires further discussion and analysis. Most of the work in this area has been focused on the effects of social capital, without much attention given to the mechanisms that allow for the existence of social capital in its many forms (Glaeser, 2001), thereby limiting any action toward increasing the levels of social capital. The absence of a systematic understanding of the events and processes that cause social capital impede the development of effective policies in this area. A good example is the distinction between "bonding" and "bridging" forms of social capital. Bonding social capital makes a community internally cohesive and bridging social capital strengthens the links that bring different communities and different institutional levels together. It is clear that these two forms of social capital should be used *in tandem* in any strategy dealing with climate change. The problem, however, is that we have not a theoretical agreement or an empirical understanding about how bridging capital works and how it is affected by bonding social capital. One could easily think, for example, of situations in which bonding capital becomes stronger in a community as the result of the lack of bridging capital. In the same vein, not all forms of social capital contribute to better integration and social cohesion. There is no doubt that in terms of providing better employment and higher incomes, the social capital existing in an association of young professionals is radically different of the social capital that groups of disabled people may have. It is clear that conceptual

refinement is required. Social capital, however, has all the potential to be a fundamental tool for dealing with the adversities and opportunities created for climate change. An intellectual and political investment seems to be well worthwhile.

Constitutional Perspectives on Implementation of the Kyoto Protocol

By John D. Whyte

Constitutionalism is not an abstract inquiry. At heart, it entails investigation into whether the structures of our political society are well suited to the purposes and values of the state. In this calculation, political dynamism is a constant challenge; a constitution's value, or efficacy, can be measured by how well it accommodates changing social contexts and shifting political values. After all, the chief meta-purpose of a constitution is to sustain political stability and that goal depends on forestalling the need for radical political dislocation. In turn, this goal is best achieved through a constant process of constitutional revision under which the state is enabled to address effectively the challenges presented by new social, economic and physical challenges[27]. For this reason, the context of global warming is a necessary first step to grasping the constitutional dimension of regulating emissions.

The currency of the Kyoto Protocol is megatonnes of carbon dioxide or carbon dioxide equivalents, which are collectively known as greenhouse gases (GHG). Although there are six greenhouse gases targeted in the Protocol, some of which have a stronger effect on the climate than CO_2, emissions, reduction targets for all gases are translated into CO_2 equivalents. Carbon dioxide accounted for over four fifths of the GHG emissions from developed countries in 1995. Most of these emissions come from fuel combustion, namely the use of coal, oil and natural gas.

Life on the earth depends on solar energy eventually radiating back into space. But not directly, since that would make the earth a cold and lifeless planet. Due to the earth's atmosphere, which consists largely of water vapour, the radiation process is slowed and this produces a temperate climate which allows life. However, when the concentration of GHG in the atmosphere

[27] Constitutional revision occurs through a number of processes of which formal constitutional amendment may, in normal political times, be the least significant. Three other processes of constitutionalism are the creation (and abandonment) of constitutional conventions, unchallenged assertion of power (normally by the national government) and constitutional reform through judicial interpretation of the terms of the constitution. It is this last process that is of special significance in the context of emissions regulation. For an examination of the dynamics of constitutional change, see B. Ackerman, *We The People: Transformations* (Cambridge, MA: Belknap Press, 1998) and J Smith, "Informal Constitutional Development: Change by Other Means" in H. Bakvis & G. Skogstad (eds.), *Canadian Federalism" Performance, Effectiveness and Legitimacy* (Don Mills: OUP, 2002) 40.

is increased, the atmosphere's ability to absorb infra-red radiation (through which energy returns to space) is increased. In short, the rate at which energy can be shed into space is reduced. Energy cannot simply accumulate. In order to maintain the balance between energy arriving from the sun and energy going back into space, the climate changes – it warms. It is predicted that the level of CO_2 will double from its pre-industrial level some time in the current century and that this will produce global warming of from one to five Celsius degrees. Global warming has been produced naturally as well as through human activity, and when that has happened the earth's species have experienced significant injury and dislocation. What is not scientifically controversial is that climate change, whatever its cause, is damaging to existing life patterns. It is also not scientifically controversial that changes in the scale and nature of human industrialization have led to increased fuel consumption, that this has changed the composition of the earth's atmosphere and, in turn, this change has caused the planet to warm to some extent. What is controversial, however, is whether GHG reduction targets contained in the Kyoto Protocol can be a truly significant element (or cause) of climate change and whether, especially if reductions are offset by the "leakage effects" that may be induced through implementation of Kyoto[28], the Kyoto targets will be effective in significantly delaying the effects of CO_2 accumulation in the atmosphere. Of course, if the 1997 Protocol were to become a precursor to more stringent measures, the international emission reduction project would have a greater impact on climate change.[29]

Under the Kyoto Protocol, Canada is required to reduce GHG emissions by 6 per cent of its 1990 levels on average over the period from 2008 to 2012, and is required to have made substantial progress towards this target by 2005.[30] In 1990, GHG emissions amounted to 606 MT. This level increased by nearly 100 MT by 1997 and, under a business as usual model, emissions would be at

---

[28] Leakage effects, or counter productive inducements, would result if high production and high energy consuming nations reduce, as a result of Kyoto Protocol commitments, fossil fuel consumption and thereby depress prices and induce in those countries not constrained by the Protocol higher levels of energy intensive investment and, hence, greater use of fuels and higher emissions. There is considerable debate over the scale of this "leakage" in the reduction effects of Kyoto.

[29] See, R. McKitrick and R. Wigle, *Commentary No. 169*: *The Kyoto Protocol: Canada's Risky Rush to Judgment* (Toronto: C.D. Howe Institute, 2002) at 6.

[30] Of course, Canada's obligations under the Kyoto Protocol arise only if it becomes legally binding. This will happen when 55 countries, including developed countries accounting for at least 55% of developed countries' 1990 emissions, have ratified it. Well over 55 nations have now ratified Kyoto but ratifications from developed countries represent under 40 per cent of developed countries' emissions. The United States has stated that it will not ratify the Protocol. Its emissions count for over a third of the emissions target. The result is that that target cannot be met without the ratification of Russia – accounting for a sixth of the emissions target – but that, once Russia does ratify the Protocol, it will become binding. It was thought likely that Russia would ratify the Protocol during 2003. That did not occur. In the world of multilateral international relations the nature and impact of national interests changes constantly and nothing stays clear – or predictable – for long. In any event, the issue of GHG emissions seems to have faded as a matter of international urgency, eclipsed by the management of terrorism and Middle East conflict.

about 810 MT by 2010. Since Canada's Kyoto target is 570 MT this means that Canada needs to adopt measures that would reduce emissions by 240 MT, or nearly a 30 per cent reduction from business as usual levels. This will not be easy and it will not be cheap, either as a matter of the cost of private sector changes to emission practices or as a matter of public sector regulatory costs and publicly funded incentives and subsidies. Without doubt, implementing the Kyoto Protocol represents a major Canadian policy challenge.

The currency of policy implementation is jurisdiction. The federal government has proceeded on the clearly correct assumption that it has every right to enter into international obligations, even in respect of activities that fall within provincial jurisdiction. Canada's status in the community of nations is exercised by the national government, and its international undertakings can be affirmed – or ratified – by the national Parliament. The federal government has also seemed to proceed on the more questionable constitutional assumption that it has the legislative capacity to institute a regulatory regime to implement fully the obligations arising from the Protocol. Part of this appearance of constitutional confidence comes from a lack of regulatory specificity and, indeed, the published federal plan is ambiguous on the question of which instruments will need to be deployed to effect targeted emissions reductions. In constitutional law, answers to questions of legislative competence cannot be provided by reference only to general policy areas; an important question is always whether the enacting jurisdiction has authority to deploy the precise regulatory instrument that it has in mind. For instance, the national government can involve itself in traditional areas of provincial concern through expenditure and tax measures and through criminal proscription, but it cannot regulate the same activities through legislative and administrative orders.

In *Climate Change Plan for Canada*[31] the government speaks of encouraging Canadian industry to make a transition to a less carbon intensive economy. It talks of providing Canadian businesses with tools and incentives to become more energy efficient, and of investing in energy efficient technologies and in research into carbon-management, bio-technologies, and fuel cells. None of this seems to engage the question of federal regulatory power, as opposed to the spending power which can be exercised with virtually no limit.[32]

---

[31] Canada, *Climate Change Plan for Canada* (October, 2002) (available at: www.climatechange,gc.ca).

[32] The federal government may spend monies for purposes that lie outside federal jurisdiction. For an excellent review of the extensive literature, and the case law, on the federal spending power, see S. Choudhry, "Recasting Social Canada: A Reconsideration of Federal Jurisdiction Over Social Policy" (2002), 52 *University of Toronto Law Journal* 163, at 181 to 192

On the other hand, elsewhere in its document, the government becomes less committed to moral (and fiscal) suasion and talks more concretely of "reductions of emissions by industry through a comprehensive approach including targets established under covenants with a regulatory or financial backstop."[33] This is, constitutionally speaking, decidedly evasive. Any government may avoid jurisdictional concerns through the consent of enterprises to be regulated.[34] However, when the plan is to "backstop" covenants with industry through regulatory measures what is it that is actually being planned? It could mean that Canada intends to enforce agreements it has entered into (in which case it would not be exercising regulatory power so much as invoking its contractual entitlements) or it could mean that emission reduction covenants will be required. This would raise directly the question of the scope of federal jurisdiction over production within the provinces. The federal document talks of regulating domestic emissions trading[35] and this, too, raises questions of the federal capacity to regulate contracts that bear on production in the provinces. Perhaps, however, the federal plan is simply to encourage, or reward, trading in emission offsets and credits, which would likely not attract constitutional question. Alternatively, it may mean to confine its regulatory role to international and interprovincial aspects of the market in offsets and credits and thereby likely keep within the recognized sphere of federal trade regulation.

However, the assumption of constitutional analysts has been that the federal government believes it can enter into the regulation of both local production conditions and local emission credit trading in order to ensure the effective implementation of the Kyoto Protocol. If this is its view, then it gives rise to a series of questions with respect to a number of constitutional ideas and concepts such as: federal jurisdiction arising from the power to enter into international treaties; the federal 'national concern' jurisdiction under the 'peace, order and good government' clause; federal criminal law jurisdiction; federal jurisdiction over the general regulation of trade under the federal 'trade and commerce' power; federal regulation over specific market activity that has an interprovincial or international character; provincial jurisdiction created in 1982 over the development, management, and taxation of non-renewable resources; provincial jurisdiction over property within the province; federal jurisdiction that possibly arises with respect to new property created through new international legal regimes; and, finally, federal jurisdiction to raise money by any system of taxation so long as property that belongs to the province is not taxed.

---

[33] *Ibid.* at 12.
[34] *Attorney General of Ontario v. Attorney General of Canada* (Canada Standard Trade Mark Reference) [1937] Appeal Cases 405 (J.C.P.C.)
[35] *Supra*, note 3 at 12.

Each of these constitutional topics is seriously engaged by any federal attempt to implement the Kyoto Protocol through mandatory measures. The provinces have been alert to the possibility of there being significant constitutional barriers to implementation[36] and are, no doubt, concerned about the possibility of their jurisdiction being invaded and, as well, the effect of federal constitutional expansionism resulting from a possible judicial and political reluctance to stand in the way of a good faith effort by the federal government to participate in the global response to climate change.

Notwithstanding the diversity of issues, the essence of the constitutional conflict over Kyoto implementation is, on the one hand, the relative weight of traditional provincial jurisdiction over property and markets in the province and, on the other hand, federal jurisdiction that arises when matters that are originally a matter for provincial property and civil claims regimes acquire such national importance that provincial interests become secondary. Subscribing to a change of constitutional character in order to get to national treatment often seems compelling; there are few areas of public regulation for which we cannot understand the benefits of this. But resisting this allure is part of Canada's constitutional tradition. The stability and the long-term political welfare of Canada depend on sustaining the integrity of the political communities that comprise Canada. How we regulate people with respect to their property and private market relations can, of course, become nationally important, but what may be more important in the long run is not to strip historic communities of their capacity for significant jural autonomy and, hence, their ability to shape an important element of their cultural distinctiveness.

Another appealing claim for federal jurisdiction is the necessity of the Canadian Parliament having the capacity to preserve the honour of Canada in international ordering projects. Since 1937, the constitutional rule has been that the federal level does not acquire the capacity to ensure the performance of international obligations simply because it has the power to create such obligations.[37] This has given rise to a consistent lament that this situation has impaired Canada's ability to play an

---

[36] The Government of Saskatchewan in *Making It Work: A Saskatchewan Perspective on Climate Change Policy* (October, 2002) (available at: www.se.gov.sk.ca/environment/climatechange/KyotoPositionPaper/pdf) identifies respecting provincial jurisdiction as a foundational condition for success in climate change policy. In this, it matches Point 3 of the Federal, Provincial and Territorial Statement of Principles on Climate Change Policy (November, 2002) ("The plan must respect the jurisdictional authorities of all orders of government.") Likewise, the Government of Alberta in introducing in April, 2003, Bill 37, The Climate Change and Emissions Management Act, has clearly staked out exclusive provincial jurisdiction over regulating emission targets, property rights in emission offsets, credits and sink rights and the market in emission offsets. In the Bill's preamble it is stated, with clear jurisdictional purpose, that "the Government of Alberta … manages the exploration, development and production of renewable and non-renewable resources in Alberta."

[37] *Attorney General of Canada v. Attorney General of Ontario* (Labour Conventions Reference) [1937] Appeal Cases 326 (Judicial Committee of the Privy Council).

effective a role in international relations. In 1977, the Chief Justice of Canada suggested that this constitutional situation warranted judicial re-consideration[38] and, since then, constitutional centralists have been looking for the case that might produce such revision. Kyoto Protocol implementation could well be the compelling case for recognition of a federal treaty implementation power. On balance, however, this is not likely in light of the concern over the damage to national unity if it became a general constitutional rule that Canada gained jurisdiction as soon as a state matter is dealt with by treaty – regardless of how much its substance is a matter of provincial concern.

Furthermore, the impetus for recognizing new federal regulatory space for treaty implementation may have diminished. The Supreme Court of Canada has expanded the conditions under which a state project, although traditionally a matter under provincial legislative authority, can attain a national dimension and, hence, fall under federal authority. This new constitutional sense was expressed in *R. v. Crown Zellerbach Canada Ltd.*[39] in which the Court upheld federal regulation of dumping in ocean waters within provincial boundaries because ocean dumping had become a matter of national concern. Significantly, the conclusion that this dumping had gone beyond a local concern may have been driven, in part, by the fact that Canada had entered into an international treaty dealing with ocean dumping. The majority of the Court, however, did not adopt this basis for its decision and made it clear that the fact of a treaty did not create federal jurisdiction, rather it resulted from the concern to "Canada as a whole" of marine pollution. One can certainly imagine similar reasoning applying to the regulation of GHG emissions. It would be wrong, however, to come to a quick conclusion that *Crown Zellerbach* reasoning will work to give Kyoto implementation jurisdiction to the federal order of government. Ocean dumping was not general behaviour that touched all aspects of provincial economic activity, whereas GHG emission is involved in almost all areas of enterprise that fall within the domain of provincial regulation. Ocean dumping is a specific form of polluting behaviour while emitting GHG is an unavoidable everyday occurrence of almost all economic activity. Recognizing federal regulation of marine pollution represents a tolerable alteration to the federal balance in Canada because it has a limited effect. Recognizing a general federal capacity to control energy consumption in order to reduce its long term harmful effects would create a new and broad constitutional norm.

The judges in *Crown Zellerbach* were, in fact, concerned about the dangerous expansiveness of a liberalized conception of the national dimension concept. They articulated two

[38] *MacDonald v. Vapor Canada* [1977] 2 Supreme Court Reports 134, per judgment of Laskin C.J.
[39] [1988] 1 Supreme Court Reports 401

limiting ideas. The first was that a regulatory interest could fall under the concept of national dimension only so long as it touched on distinct and narrowly defined activities so that the impact on provincial jurisdiction would be limited. In an earlier decision[40], Mr. Justice Beetz had warned against recognizing new federal authorities that are simply aggregates of "several subjects some of which form a substantial part of provincial jurisdiction" and the recognition of which "would render most provincial powers nugatory." The majority's second condition was that in deciding whether to recognize federal jurisdiction under the idea of national concern, future courts had to decide that the national effects of inadequate provincial regulation were substantial. While the federal government will certainly have difficulty in meeting the first of these tests, it will be able to make much of the injury to the national (and world wide) Kyoto project that would be produced by provincial inaction. But if, as seems to be the case, there isn't provincial inaction but, rather, a concerted effort by the major energy consuming provinces to create regulatory and incentive programs to reduce GHG emissions, will the federal claim of the necessity of federal regulation be blunted? The answer is that consistent and effective provincial programs to reach Kyoto targets would certainly have the effect of closing down the federal national dimension jurisdiction, although the courts might recognize, as a matter of regulatory efficacy, a residual federal role to set sector by sector emission targets so long as federal regulation did not become facility specific.[41]

Of course, if the conclusion of the analysis of the scope of federal jurisdiction with respect to Kyoto implementation is that some federal regulatory space will be created but not comprehensive authority, then our constitutional norms will drive the implementation process to federal-provincial negotiations. Naturally, this is not an unhappy result. It reflects best the clear fact that there are both important national interests and important provincial interests and it matches the reasonable sense that joint accommodation of these interests will lead to the most effective implementation of the Kyoto Protocol, as well as least disrupt the general federal accommodation under which Canada's political stability is maintained.

This sort of happy ending, however, may seem a little dissatisfying from the perspective of the rule of law. While mediation of conflict is an undoubted social good, we know that successful mediation is driven by the realization that if it fails the legal system has sufficient clear normative

---

[40] *Reference re Anti-Inflation Act* [1976] 2 Supreme Court Reports 373.

[41] This jurisdictional saw-off is suggested in P. Barton, "Economic Instruments and the Kyoto Protocol: Can Parliament Implement Emissions Trading Without Provincial Co-operation?" (2002) 40 Alberta Law Review 417. See, also, C. Rolfe, *Turning Down the Heat: Emissions Trading and Canadian Implementation of the Kyoto Protocol* (Vancouver: West Coast Environmental Law Research Foundation, 1998) in which it is argued that federal jurisdiction under the national concern concept is clear, although it may not be a complete or expansive jurisdiction.

content to arrive at a legal disposition. On the other hand, it is uncertainty over the exact content of legal norms and the inability to predict the outcome of legal conflict that also spurs agreement. Perhaps, Canada is blessed by having both a court that will, if required, make necessary constitutional decisions and, as well, constitutional texts and jurisprudence that give only ambiguous signals about the constitutional value of regulating climate change.

Select Bibliography

Ackerman, B., (1998) *We The People: Transformations*, Cambridge, MA: Belknap Press.

Attorney General of Canada v. Attorney General of Ontario (*Labour Conventions Reference*) [1937] Appeal Cases 326 (Judicial Committee of the Privy Council).

Attorney General of Ontario v. Attorney General of Canada, (1937) (Canada Standard Trade Mark Reference) Appeal Cases 405 (Judicial Committee of the Privy Council).

Bailie, A., Bernow, S., Dougherty, W., Runkle, B., & Goldberg, M. (2002). *The Bottom Line on Kyoto: Economic Benefits of Canadian Action*. Canada: Tellus Institute, MRG and Associates, and David Suzuki Foundation.

Barton, P., (2002), *Economic Instruments and the Kyoto Protocol: Can Parliament Implement Emissions Trading Without Provincial Co-operation?*, 40 Alberta Law Review 417.

Bramley, M., & Robertson, L.-A. (2001). *Provincial government performance on climate change*. Drayton Valley, AB: Pembina Institute.

Buckler, Daniel, ed., 1999, *Cultivating Peace. Conflict and Collaboration in Natural Resource Management*, Ottawa: IDRC/World Bank Institute.

Burns, W. C. G. (2002). Climate change and human health: The critical policy agenda. *Journal of American Medical Association, 287*(17), 2287

Campbell, C., 2000, "Social Capital and Health: Contextualizing Health promotion within Local Community Networks", in S. Baron, J. Field, and T. Schuller, *Social Capital. Critical Perspectives*, N.Y.: Oxford University Press.

Canada, (October, 2002), *Climate Change Plan for Canada* (available at: www.climatechange.gc.ca).

Canadian Association of Exporters and Manufacturers. (2002). *Pain without gain: Canada and Kyoto Protocol*: Canadian Manufacturers and Exporters.

Canadian Association of Physicians for the Environment. (1995). *Implications for human health: The greenhouse effect and global climate change*. Canadian Association of Physicians for the Environment [2002, November 28, 2002].

Canadian Public Health Association. *Health effects of climate change and air pollution*. Canadian Public Health Association [2002, November 28, 2002].

Chiotti, Q., & Maarouf, A. (2002). Feeling hot, hot, hot: Assessing the health risks and response opportunities under climate change.

Choudhry, S., (2002), "Recasting Social Canada: A Reconsideration of Federal Jurisdiction Over Social Policy", 52 *University of Toronto Law Journal* 163: 181 to 192.

Cote, Sylvain, 2001, "La contribution des capacities humaines et sociales", *Isuma*, 2,1: 25-33.

Dauncey. G., & Mazza, P. (2001). *Stormy weather: 101 solutions to global climate change.* Gabriola Island, B.C.: New Society Publishers

Federal, Provincial and Territorial Statement of Principles on Climate Change Policy (November, 2002).

Field, John, Tom Schuller, and Stephen Baron, 2000, "Human and Social Capital Revisited", in S. Baron, J. Field, and T. Schuller, *Social Capital. Critical Perspectives*, N.Y.: Oxford University Press.

Glaeser, E., 2001, "The Formation of Social Capital", *Isuma*, 2,1: 34-40.

Government of Canada. (2002a). *Climate change plan for Canada*. Canada: Government of Canada.

Government of Canada. (2002b). *A discussion paper on Canada's contribution to addressing climate change*. Canada: Government of Canada.

Government of Canada (2002c, November 26, 2002). Climate change in Saskatchewan. www.climatechange.gc.ca/plan_for_canada/climate/sask.html [February 14, 2003].

Government of Saskatchewan (2002). *Making it work: A Saskatchewan perspective on climate change policy*. Saskatchewan: Government of Saskatchewan.

Haines, A., & McMichael, A. J. (1997). Climate change and health: Implications for research, monitoring, and policy. *British Medical Journal, 315*(7112), 870-874.

Haines, A., McMichael, A. J., Anthony, J., & Epstein, P. R. (2000). Environment and health: 2. Global climate change and health. *Canadian medical Association, 163*(6), 729-734.

Harper, C., 2001, *Environment and Society. Human Perspectives on Environmental Issues*, New Jersey: Prentice Hall.

Homer-Dixon, Thomas, 1999, *Environment, Scarcity, and Violence*, Princeton University Press, Princeton.

Houghton, John T., G.T. Jenkins and J.J. Ephraums. *Climate Change the IPCC Scientific Assessment*, Cambridge, Cambridge University Press, 1990

Intergovernmental Panel on Climate Change. (2001). *Climate change 2001: Synthesis report - Summary for policymakers* (Synthesis Report). Wembley, UK.

Last, J., Trouton, K., & Pengelly, D. (1998). *Taking our breath away: The health effects of air pollution and climate change*. Vancouver, BC: David Suzuki Foundation.

Lechner, N., 2002, "El capital social como problema cultural", Revista Mexicana de Sociologia, 64. 2: 91-109.

Lauglo, J., 2000, "Social Capital Trumping Class and Cultural Capital? Engagement with School among Immigrant Youth", in Baron, J. Field, and T. Schuller, *Social Capital. Critical Perspectives*, N.Y.: Oxford University Press.

MacDonald v. Vapor Canada, (1977) 2 Supreme Court Reports 134, per judgment of Laskin C.J.

MacGillivray, Alex and Perry Walker, 2000, "Local Social Capital: Making it Work on the Ground", in S. Baron, J. Field, and T. Schuller, *Social Capital. Critical Perspectives*, N.Y.: Oxford University Press

McKitrick, R. and R. Wigle, (2002) *Commentary No. 169*: *The Kyoto Protocol: Canada's Risky Rush to Judgment*, Toronto: C.D. Howe Institute: 6.

McMichael, A. J., Haines, A., Sloof, R., & Kovats, S. E. (1996). *Climate change and human health*. World Health Organization.

Moore, T. J. (2000). *In sickness or in health: The Kyoto Protocol versus global warming*. Stanford, CA: Stanford University.

Patz, J. A., & Khaliq, M. (2002). Global climate change and health: Challenges for future practitioners. *Journal of the American Medical Association (JAMA), 287*(17), 2283-2284.

Ponte, Lowell. *The Cooling*, New York, Prentice-Hall, 1976

Portes, A. 1998, "Social Capital: Its Origins and Applications in Modern Sociology", *Annual Review of Sociology*, 24: 1 – 24.

Putnam, Robert, 1993, *Making Democracy Work*, Princeton University Press, Princeton.

Putnam, R.D., 1996, "Who Killed Civic America", *Prospect*, March: 66-72.

Putnam, R. D., 2000, *Bowling Alone: The Collapse and Revival of American Community*, New York: Simon Schuster

Putnam, R. 2001, "Social Capital: Measurement and Consequences", *Isuma* , 2, 1: 41-52.

R. v. Crown Zellerbach Canada Ltd. (1988), 1 Supreme Court Reports 401.

Redclift, M., 1986, "Survival Strategies in Rural Europe: Continuity and Change", *Sociologia Ruralis*, 26, 3 and 4.

Reference re Anti-Inflation Act, (1976), 2 Supreme Court Reports 373.

Reimer, B., 2001, "Understanding and Measuring Social Capital and Social Cohesion", New Rural Economy Webpage: ftp://132.205.151.25:21/spss_2001/3csmeasures1.pdf

Rolfe, C., (1998), *Turning Down the Heat: Emissions Trading and Canadian Implementation of the Kyoto Protocol*, Vancouver: West Coast Environmental Law Research Foundation.

Saskatchewan Environment. (2002). *Saskatchewan initiatives on climate change*. Regina: Government of Saskatchewan.

The science of climate change: A joint statement of the Australian Academy of Sciences, Royal Flemish Academy of Belgium for Sciences and the Arts, Brazilian, Academy of Sciences, Royal Society of Canada et al. (2001).

Schminck, M. "Household Economic Strategies: Review and Research Agenda", *Latin American Research Review*, 19, 3.

Schuller, T., 2001, The Complementary Role of Social and Human Capital", *Isuma*, 2,1: 18-24).

Schuller, Tom, Stephen Baron, and John Field, 2000, "Social Capital: A Review and a Critique", in S. Baron, J. Field, and T. Schuller, *Social Capital. Critical Perspectives*, N.Y.: Oxford University Press.

Shindell, S., Raso, J., & Stephen, R. D. (1997). *Global climate change and human health* (Position Paper). New York, NY: American Council on Science and Health.

Smith, J, (2002) "Informal Constitutional Development: Change by Other Means" in H. Bakvis & G. Skogstad (eds.), *Canadian Federalism Performance, Effectiveness and Legitimacy*, Don Mills: OUP: 40.

Suzuki, D. (2002, December 9, 2002). *Climate change and health*, [Internet]. Canadian Women's Health Network [2003, January 31, 2003].

Veenstra, G., 2001, "Social Capital and Health", *Isuma*, 2,1: 72 – 81.

Waterston, T., & Lenton, S. (2000). Sustainable development, human induced global climate change, and the health of children. *Archives of Disease in Childhood, 82*(2), 95-97.

Woolcock, M. 2001, "The Place of Social Capital in Understanding Social and Economic Outcomes", *Isuma*, 2,1: 11 – 17.

World Bank, 2003, *Sustainable Development in a Dynamic World. Transforming Institutions, Growth, and Quantity of Life*, World Bank and Oxford University Press: New York

WHO. (2001). *Climate and health*. World Health Organization [2003, February 5, 2003].

WHO. (2002). *WHO strategy on air quality and health*.

Yoganathan, D., & Rom, W. N. (2001). Medical aspects of global warming. *American Journal of Industrial Medicine, 40*, 199-210.

About the Authors

RAYMOND B. BLAKE has been the Director of the Saskatchewan Institute of Public Policy since January 1, 2000. He also holds an appointment in the Department of History, and has taught at a number of Canadian Studies, including Mount Allison University where he was the Director of the Center for Canadian Studies and a member of the Department of History and Canadian Studies. He completed his graduate studies in Canadian History at York University in North York, Ontario, and his undergraduate studies at Memorial University of Newfoundland. His primary research and publishing interests are in contemporary Canadian politics, social policy, resource management, foreign policy, nationalism and 20th century Canadian history. Dr. Blake has authored and edited six books and numerous scholarly articles.

POLO DIAZ is a Professor of Sociology and Social Studies. He has been with the University of Regina since 1985. His academic work experience has been mostly focused on rural development issues in Chile, Costa Rica, Nicaragua, and Canada. He has participated in several large research projects in areas such as regional labour market and rural villages (Chile, 1982); community based organizations (Chile, 1985 –1989); economic and social changes of farm households and farm communities (Saskatchewan, 1986 - 1989); the diskilling of farm labour (Saskatchewan 1991-1995). Currently, he is participating in three interdisciplinary research projects: (a) a study of the different dimensions of social cohesion of the farm community in Saskatchewan, (b) a study about climate change and water use in the city of Regina, and (c) an international comparative study on institutional adaptation to climate change. He is also the co-Director of a CIDA international training program in regional sustainable development with Chile and Costa Rica. His research interests are related to adaptation to climate change; rural communities and rural organizations; environmental policies and environmental conflicts; sustainable development; and social capital. He is a Research Associate of the Prairie Action Research Collaborative (PARC - University of Regina), a Research Fellow with the Canadian Plains Research Center (CPRC); and a Fellow of the Center for Research on Latin America and the Caribbean, York University. He is an active member of the Canadian Association for Latin America and Caribbean Studies and of the Canadian Sociology and Anthropology Association.

REID ROBINSON studied at Balliol College Oxford where he received a B.A. and a D.Phil. in physical chemistry. He did postdoctoral work at Cornell University and joined the Chemistry Department in Regina in 1965. He has held positions at the University of Regina of Dean of Arts, Associate Vice-President Academic and retired as University Secretary. He has served on numerous boards and was Vice-Chair of the South Saskatchewan Hospital Centre from 1985 to 1991.

JOE PIWOWAR holds a Ph.D. in Geography & Remote Sensing from University of Waterloo. He has been involved in remote sensing since1980 with a particular interest in identifying the responses of Arctic sea ice to climate change. Joe's current research interests include the use of geomatics (i.e., remote sensing and GIS) for observing and monitoring environmental responses on the Prairies to a warming climate. He is currently an Assistant Professor of Geography at the University of Regina.

MICHAEL POLANYI has worked professionally in the areas of community development and health promotion. He has a Ph.D. in Environmental Studies from York University. He was a researcher at the Institute for Work & Health in Toronto from 1995-2002, after which he joined the University of Regina as a Faculty Researcher with the Saskatchewan Population Health Research and Evaluation Unit (SPHERU) and an Assistant Professor in the Faculty of Kinesiology and Health Studies. Polanyi researches the social determinants of health, and designs and evaluates interventions to improve workplace and community health.

JOHN D. WHYTE holds degrees from the University of Toronto, Queen's University and Harvard University. He taught at the Queen's University Faculty of Law from 1969 to 1997, and served as the Dean of Law from 1987 to 1992. He also served with the Government of Saskatchewan, as the Director of Constitutional Law in the Department of the Attorney General from 1979-82, in the Department of Intergovernmental Affairs in 1995 and in Executive Council in 1997. From 1997 to 2002 he was appointed Deputy Minister of Justice and Deputy Attorney General for the Government of Saskatchewan and served in this position until August 2002. Currently he is Senior Policy Fellow at the Saskatchewan Institute of Public Policy and Professor of Political Science at the University of Regina.

MALCOLM WILSON is the Director of Energy and Environment at the University of Regina, and as such, assists the Malcolm Wilson is the Director of Energy and Environment at the University of Regina, and as such, assists the University in building research capacity in the area of energy and the environment and acts as a liaison with the governments of Canada, Saskatchewan and other provincial jurisdictions, various research organizations such as the Saskatchewan Research Council and the National Research Council, and various industrial partners. Prior to this position, Malcolm worked for Saskatchewan Energy and Mines as a research geologist, program manager of a federal-provincial fund supporting research and development in fossil fuels, and in research and policy development in the area of climate change. While the Director of Energy and Environment is not an academic appointment, Wilson is currently an adjunct professor in the Faculty of Engineering and the appointment is made in partnership with the Engineering faculty., Wilson is currently an adjunct professor in the Faculty of Engineering and the appointment is made in partnership with the Engineering faculty.

SIPP Public Policy Papers

Through **SIPP Public Policy Papers**, the Institute aims to provide background information, encourage discussion and contribute to the debate on policy-related issues. The opinions and views expressed in the papers are those of the authors.

Other works in the SIPP Public Policy Papers series:

No. 21 *Righting Past Wrongs: The Case for a Federal Role in Decommissioning and Reclaiming Abandoned Uranium Mines in Northern Saskatchewan* by Ian Peach and Don Hovdebo (December 2003).

No. 20 *Youth Justice Policy and the Youth Criminal Justice Act* by Ross Green (November 2003).

No. 19 *Demographic Trends and Socio-Economic Sustainability in Saskatchewan: Some Policy Considerations* by Janice Stokes, SIPP Senior Policy Analyst (October 2003).

No. 18 *Labour Issues in the Provision of Essential Services* by Pavel Peykov, SIPP Policy Analyst (September 2003).

No. 17 *Should Saskatchewan Adopt Retail Competition for Electricity?* by Dr. Michael Rushton (June 2003).

No. 16 *A Survey of the GM Industry in Saskatchewan and Western Canada* by Dr. Cristine de Clercy, Dr. Louise Greenberg, Dr. Donald Gilchrist, Dr. Gregory Marchildon, and Dr. Alan McHughen (May 2003).

No. 15 *Saskatchewan's Universities – A Perception of History* by Dr. Michael Hayden, Dr. James Pitsula, and Dr. Raymond Blake (May 2003).

No. 14 *Productivity and Popular Attitudes Toward Social Welfare recipients in Saskatchewan, 1970-1990* by Dr. Robert Wardhaugh (April 2003).

No. 13 *Self-determination, Citizenship, and Federalism: Indigenous and Canadian Palimpsest* by Dr. Joyce Green (March 2003).

No. 12 *Higher Education Policy in Saskatchewan and the Legacy of Myth* by Dr. James M. Pitsula (February 2003).

No. 11 *Value-for-Money in Saskatchewan K-12 Educational Expenditures* by Dr. John R. Allan (2002).

No. 10 *Responding to Wife Abuse in Farm and Rural Communities - Searching for Solutions that Work* by Jennie Hornosty and Deborah Doherty (March 2002).

No. 9 *Equalization Reform in Switzerland: Ideal Solutions, Unpredictable Outcomes* by Anne-Béatrice Bullinger (March 2002)

No. 8 *Changes in the Prairie Economy, 1980 to 2000: With Emphasis on Agriculture and Some Implications for Prairie Transportation Policies* by Peter Arcus and Graham Parsons (February 2002).

No. 7 *Economics, Equity and Urban-Rural Transfers* by Michael Rushton (November 2001).

No. 6 *On the Concept and Measurement of Vertical Fiscal Imbalances* by G.C. Ruggeri and R. Howard (December 2001).

No. 5 *Should Canadians Be Concerned? Food Safety in Canada* by Dr. Louise Greenberg (December 2001).

No. 4 *Public-Private Partnerships: A Review of Literature and Practice* by Dr. John R. Allan (June 2001).

No. 3 *Saskatchewan's Commission on Medicare: Five Commentaries* by Tom McIntosh, Michael Rushton, Denise Kouri, Martha E. Horsburgh, Ronald Labonte and Nazeem Muhajarine (April 2001).

No. 2 *The West and the Liberal government at the beginning of the new mandate: the need to work better together* by The Honourable Stéphane Dion, PC, MP (March 2001).

No. 1 *Debt Accumulation, Debt Reduction, and Debt Spillovers in Canada, 1974-98* by Ron Kneebone and John Leach (October 2000).

Papers are available for download at no charge **at www.uregina.ca/sipp**.