

**ENVIRONMENTAL TRENDS AND ENVIRONMENTAL GOVERNANCE
IN CANADA¹**

**Edward A. Parson,
Associate Professor of Public Policy,
John F. Kennedy School of Government, Harvard University
617-495-1404
ted_parson@harvard.edu**

SUMMARY: Since the 1960s, environmental stresses in the industrialized world have shifted from predominantly local to global scale, from separate to increasingly tightly coupled stresses, and from readily observable acute stresses to subtle, chronic, and long-term ones. Central challenges in successful governance of the environment over the next few decades will involve developing more effective ways to integrate high-quality, objective scientific and technical assessment with key decision needs; learning more effective processes for managing under uncertainty and responding adaptively to advances in knowledge; and effectively coordinating inevitably shared authority and capacity across multiple levels of government, and between diverse public and private actors.

Environmental protection is the most prominent new domain of politics and public policy to arise over the past few decades, in Canada and

internationally. Since the 1960s, environmental governance in Canada, and throughout the industrialized world, has shown two waves of concern and activity, peaking around 1970 and around 1990 with surges of policy innovation, new legislation, and establishment or transformation of institutions. In a pattern broadly replicated throughout the OECD countries, the first wave in Canada saw the establishment of Environment Canada and the provincial environmental ministries; the enactment of laws governing air and water pollution, hazardous chemicals and wastes, and environmental assessment; and the founding of Canada's first national environmental advocacy organizations. While the elaboration of domestic environmental protection has continued since then, the center of environmental policy-making since the 1980s has increasingly shifted to the international level, with the increasing priority of issues that cross borders and cannot adequately be managed by nations acting alone.

The second wave of activity, centered around 1990, reflected this shift toward the international level, with the negotiation of several major international environmental treaties.² This period also saw several further important domestic initiatives, including the enactment of the Canadian Environmental Policy Act (CEPA);³ a proliferation of consultative processes both within and outside government; and the Green Plan. Each wave of activity, however, was followed by a fading of concern and a retreat from ambitious initial goals. Consequently,

the initial promise of new initiatives each time has been only partially realized, as anticipated resources, legislative authority, and regulatory initiatives were weakened or did not appear, and other public priorities re-asserted themselves.

This paper summarizes and synthesizes the volume on environmental trends in the Trends series. It considers prominent current trends in governing the environment, and its human implications, with a focus on two aspects: key challenges that environmental issues pose for governance; and significant innovations that have been proposed to address them. The first section provides a brief overview of recent development in the status of, and trends in, the biophysical environment. The remaining sections discuss themes in environmental governance that have emerged from the papers and discussions of the project. The closing section seeks to draw out of these thematic discussions a set of the most prominent tasks for research to advance policy-relevant understanding of the problem of governing the environment.

Environmental Status and Trends: an Overview

Trends in human governance of the environment take place against a background of trends in the biophysical environment -- e.g., trends in human-caused disruption of natural systems, pollutant burdens or emissions, ecosystems protected or degraded, resources depleted or conserved -- that form the substrate of environmental concerns and environmental policy. But though comprehensive

and useful metrics of the biophysical environment's status, trends, and stresses have been sought since the 1970s, defining, interpreting and using such measures has turned out to be a profoundly more difficult problem than it first appears. Even the operational challenges of monitoring a specific environmental characteristic -- establishing sufficiently accurate and stable measurement, at appropriate frequency and spatial scale, sustained for long enough to establish baselines, natural variability and trends -- are severe and infrequently surmounted. But in many cases, identifying what environmental characteristics to measure, interpreting the measurements, and integrating them into policy and management pose even more fundamental and severe challenges.

The environment's contribution to human well-being is vast, but imperfectly known and usually taken for granted. We rarely attend to how some aspect of the environment matters to us until it is damaged or threatened. Moreover, the attempt to define the state and trends of the environment must confront the diversity of ways that people value and depend on the environment. What aspects of the environment you care about depends on where and how you live, how you earn your living, your values, and your wealth. Poor or vulnerable communities, or those deriving most of their livelihoods from a single resource, may be severely threatened by a single dimension of environmental change, such as rising sea-level or depletion of a fishery, whose impact on a richer or more

diversified community would be insignificant. People's values and ways of life shape the relative priority they accord to protecting different aspects of the environment, e.g., environmental quality in cities where most people live, versus protecting wild places, species, and ecosystems. Environmental concerns consequently reflect a blending of imperfectly understood dynamics of biophysical systems and people's reliance on them; and of human conceptions of what things are sacred or valued, and what changes are feared.

Our ability to identify and interpret important indicators of the state of the natural environment, or associated risks or harms to people, are consequently limited by imperfect knowledge of natural systems, perceptual habits and biases, and disparate bases for valuing environmental attributes. Particularly striking examples of these limits arise when qualitatively new and previously unsuspected mechanisms of environmental damage are identified, such as bioaccumulation of persistent organic pollutants in the 1960s, destruction of stratospheric ozone in the 1970s and 1980s, and potential endocrine disruption from synthetic chemicals in the 1990s. Each time such a new mechanism is discovered, it can imply that chemicals or concentrations that were previously thought benign are in fact harmful.

While these conceptual limitations must be borne in mind, programs of environmental measurement and assessment do proceed, and do provide

information that is widely used, typically by reporting extensive lists of environmental measures that meet reasonable criteria of practicality and potential usefulness: e.g., that they can be adequately measured at low cost; that they are of widely accepted relevance to issues that many people care about, or that are on current policy agenda; and that they are well correlated, where possible, with other environmental characteristics of concern. The process of gathering and reporting such measures is well developed in Canada, and the available measures tell a coherent story about the character of the Canadian environment, its trends, and the salient pressures on it.

Like the particular aspects of the environment that Canadians care about, this story of Canadian environmental trends and pressures depends on the character of Canada's landscape, society and economy: a large, cold, rich, lightly populated country, in which most people live in cities and close to the American border, with a diversified national economy but many regions dependent on particular natural resources. The major environmental stresses are consequently those of the rich, associated with high levels of consumption, transport, and energy use. Aggregate environmental stresses are comparatively low, although the major metropolitan areas face the universal problems of air pollution, noise, congestion, and waste. Central Canada's proximity to the US industrial heartland exposes it to long-range oxidizing air pollution and acid deposition, to which the

lakes and forests of the boreal shield are especially sensitive because of their low buffering capacity. Sensitive Arctic ecosystems, and the subsistence livelihoods and cultures that depend on them, are increasingly recognized to be vulnerable to both global climate change and long-range transport of persistent organic pollutants. The regional concentration of resource industries creates a highly variable pattern of sometimes extreme local and regional environmental stresses, including loss of old-growth forest and habitat, disruption of fish stocks and marine ecosystems, and local air and water pollution. Moreover, the political power of industries that dominate local economies has in some cases allowed scandalous environmental abuses, of which perhaps the most extreme examples have been the mercury poisoning of the Grassy Narrows Band in Northwestern Ontario, and the extremely contaminated tidewater area in Nova Scotia known as the Sydney tar ponds, the largest toxic waste site in North America.

Since the 1960s, the broad character of major environmental stresses in Canada has shifted, roughly in parallel to those in all rich industrialized countries. The acute environmental stresses that provoked the first round of environmentalism are mostly resolved or improving, largely due to technological changes and investment in pollution controls that have allowed production to continue growing with reduced environmental insult, and to policies encouraging such changes. But as these stresses have been relieved, and population and

economies have continued to grow, other more complex and recalcitrant stresses have arisen that pose greater challenges to processes of assessment, decision-making and implementation. This broad pattern is replicated in specific examples as diverse as water and air pollution, conservation of natural resources, and the recent emergence of novel global-scale issues such as ozone depletion, global climate change, and preservation of global biodiversity.

For example, acute pollution of major freshwater bodies such as Lake Erie and the St. Lawrence has abated markedly since the 1970s due to reductions in toxic emissions, pulp mill and other industrial effluents, and expanded construction of municipal wastewater treatment plants. Growing population and industrial output and continuing needs for more wastewater treatment (large populations in Quebec and the Atlantic Provinces still have no treatment),⁴ however, maintain continuing pressure on these bodies, while all waters, even remote ones, are increasingly suffering from long-range transport of both acidifying and toxic pollutants.

The story is similar for air pollution. Canada has made strong progress in controlling particulate pollution, with concentrations falling nearly by half between 1980 and 1996, but much weaker progress in controlling the tropospheric ozone precursors, volatile organic compounds (VOCs) and nitrogen oxides (NO_x).⁵ Since these are both transported hundreds of kilometers, however,

Canadian air quality depends on both Canadian and US emissions. American emissions are of order ten times higher than Canadian emissions, but have been more effectively controlled in recent decades.⁶ The aggregate effect for Canada has been a large reduction (more than 70%) in the frequency of extreme summer air-pollution episodes in Canadian cities, but a continuing increase in annual average air-pollution levels.⁷

Acid deposition is caused by emissions of NO_x and sulfur dioxide (SO₂), which can both be transported hundreds of kilometers. Canada reduced SO₂ emissions more than 40% from 1980 to 1994, but since more than half of the sulphate deposited in central and eastern Canada originates in the United States, US reductions were also required to reduce Canadian deposition. These were finally achieved in the 1990s after years of struggle, following amendment of the US Clean Air Act and the Canada-US Air Quality Agreement that followed. These cuts have brought a marked reduction in sulphate deposition, but little improvement in overall lake acidity, principally due to the much more limited success in reducing NO_x emissions in both countries.⁸

Because of the increasing importance of regional transport of air pollution, air pollutants are now managed at three levels: domestically, bilaterally with the United States, and under the multilateral Convention on Long-Range Transboundary Air Pollution (LRTAP). Separate Protocols under this

Convention have controlled SO₂, NO_x, VOCs, persistent organic pollutants (POPs), and heavy metals.

The most prominent environmental issues on the current policy agenda are all global in scale, and are principally being driven by international policy: climate change, stratospheric ozone depletion, protection of biodiversity, and most recently, international control of POPs. Anthropogenic climate change arises from emissions of several “greenhouse gases” that absorb the infrared radiation that cools the earth to maintain its temperature, thereby changing the heat structure of the atmosphere and the climate. The most important anthropogenic greenhouse gas is carbon dioxide (CO₂), which contributes about two-thirds of present warming and which we mainly emit by burning fossil fuels. The past two centuries of fossil-fuel use have increased CO₂'s atmospheric concentration from about 280 parts per million (ppm) to about 360 ppm at present, while present emissions continue to raise this concentration by about 1.5 ppm per year.⁹

In 1995, Canada contributed about 2.1% to global CO₂ emissions, a per capita rate of 20.5 tonnes per person second only to the USA among major nations, and a 9% increase in emissions since 1990. Other major greenhouse gases include methane (CH₄) and nitrous oxide (N₂O), which are both increasing in the atmosphere (methane by 4% from 1987 to 1996, N₂O by 2.2%) but have

more complex budgets that include both natural and anthropogenic sources, as does the contribution of net CO₂ emissions from land-use change. The two existing international treaties on climate change, the 1992 Framework Convention and its 1997 Kyoto Protocol, provide a minimal institutional framework to address the issue, but the basic mechanisms and political will to manage this gravest of environmental challenges still largely remain to be developed.

While climate change is essentially a problem of human disruption of the global carbon cycle, large human disruptions of other global biogeochemical cycles have not yet gained similar levels of popular and policy attention. The largest human perturbation of all is to the nitrogen cycle: human nitrogen fixation through fertilizer manufacture, legume cultivation, and combustion, already more than doubles the global natural rate.¹⁰ This disruption causes multiple environmental effects including acidification, eutrophication of waterways, and smog, but has only recently begun to receive policy attention, in particular through negotiation of a "multi-pollutant, multi-effect" Protocol under the LRTAP Convention, which will jointly control emissions of sulphates, NO_x, ammonia and VOCs, to limit acidification, photochemical smog, and eutrophication. Similar but smaller human perturbations are occurring in other global biogeochemical cycles.

In contrast to climate and these other issues, there has been great progress in managing depletion of the stratospheric ozone layer. Treaty commitments to reduce the offending emissions have been enacted and implemented, and the problem is now on its way toward resolution. Global emissions of ozone-depleting chemicals have declined about 80% due to industrial-country phaseouts agreed in the 1987 Montreal Protocol and its amendments. A similar phasedown schedule for developing countries is now coming into effect. Canada, like all OECD countries, phased out all but a few small essential uses of these chemicals by the end of 1996.¹¹ The beginning of environmental recovery following these phaseouts is already observable, and expected to proceed to the point where the Antarctic ozone hole will cease to appear by about 2050. Ozone depletion is now near its maximum, with about 3% - 6% loss in northern mid-latitudes and 15% loss in the Arctic spring.¹² Important challenges remain, such as ensuring developing countries are able to achieve their promised phaseouts, and controlling the CFC black market; but if nations stay the course they have begun, ozone depletion is likely to be the first global environmental problem to be solved.

Loss of biological diversity has become another prominent environmental issue of global concern, even though most threats to species, ecosystems, and biodiversity act at local or regional scales. Biodiversity is the primary modern label for the "nature" agenda, subsuming all concerns for protection of species,

ecosystems, and wilderness. A biodiversity treaty was signed in 1992, but has since largely strayed from the mission of protecting ecosystems and habitats, into tangentially related matters of ownership of biological resources and sharing of proceeds from their exploitation, and safety from genetically modified organisms.

While confusion is widespread about the meaning, measurement and valuation of biodiversity, a common heuristic approach is to measure biodiversity by numbers of species. It is widely believed that species extinctions are occurring at an unprecedented rate, but neither the total number nor the rate of loss is known with any precision. Worldwide, 1.7 million species have been identified. A recent assessment puts the total at 14 million, while other estimates range from 4 to more than 100 million. Species diversity is highly uneven across taxa and locations: a third of all identified species are beetles, while many regions are extremely diverse in particular taxa and not in others. Worldwide, the present extinction rate is estimated at 100 to 1,000 species per year, compared to a natural rate of about one per year. More than 30,000 species have been identified as at risk of extinction, while estimates of the true number at risk range as high as 20% of all species. In Canada, about 71,000 species have been identified and a further 66,000 are suspected to exist. Of these, 186 vertebrates and plants have been identified as endangered or threatened (no estimates are available for invertebrates), including about 10% of known mammal species, 5% of birds, and

8% of reptiles and amphibians.¹³ Only four Provinces have endangered species legislation,¹⁴ while federal legislation was introduced in 1996 but not enacted. Two expert committees address threats to species, one that determines endangerment status, and one that prepares non-binding recovery plans.

The newest environmental issue now prominent on the international agenda concerns the persistent organic pollutants (POPs), principally organochlorine pesticides, whose risk of bioaccumulation in wildlife played a strong role in the 1960s arousal of environmentalism. Through domestic regulation in Canada and elsewhere, recently supplemented by voluntary programs, environmental concentrations of these chemicals declined sharply from the 1970s to the early 1990s.¹⁵ Three new factors, however, have brought these chemicals to prominence on the international policy agenda since then: a leveling off in concentration declines in the 1990s; increasing evidence of long-range transport and accumulation in seemingly pristine environments like the Arctic; and the recent hypothesis that low levels of certain POPs previously thought benign can disrupt endocrine function. Several international initiatives to restrict a dozen of the most persistent, toxic and bioaccumulative POPs have been undertaken or are now underway, including the recently concluded Protocol under the LRTAP Convention.

The broad shifts occurring in all these areas of the environment have several dimensions: from issues operating at predominantly local or regional scale, to continental or global scale; from issues that can be managed separately, to increasingly tightly coupled issues; from readily observable harms to subtle issues of risk or potential harm that require increasing reliance on expert judgement and assessment; and from acute stresses that bring immediate harm, to chronic, cumulative stresses for which both the harm and its correction move slowly, requiring action long in advance of evident harm. This description applies to the industrialized world, but elsewhere the most urgent environmental problems remain acute local air and water pollution, including indoor air pollution and septic contamination of drinking water. While much of the world desperately needs to develop and raise consumption levels, doing so will increase their contribution to those environmental stresses that increase with income. The increase in material and energy flows necessary to meet this development imperative, and the disruption this increase would imply for global processes, remain profoundly contested questions.

Thus far, the rich world has largely succeeded at deflecting its environmental challenges at very modest cost to income growth. But environmental problems rarely disappear; as human activities continue to grow, old problems re-emerge in new forms, and new ones appear. They require

continuing monitoring, an increasing capacity for far-sighted and integrated understanding, and commitments to sustained yet adaptable management. Moreover, as human society expands, the trade-offs between the environment and economic growth are likely to grow sharper and clearer. But while the environment may be the most important long-term social problem, it is rarely the most urgent one. Personal and national security, and jobs and incomes, remain persistently at the top of policy agendas, certainly when they are perceived to be in any way threatened. In contrast, certain and peremptory environmental threats that compel specific social action are rare, making the challenge of effective and timely response all the greater.

Science, Assessment, and Governance:

Against this backdrop of substantial but mixed progress against persistent, uncertain, and shifting environmental problems, the Environmental Trends project has considered the social and political problem of governing the environment to manage these persistent trends. The challenges discussed here map out some of the requirements for environmental governance, whatever its details, to move effectively toward sustainable development. Contributions to the project have considered the challenges to environmental governance posed by the need to integrate scientific knowledge into policy-making; the cross-scale nature of environmental problems; and the need for detailed coordination of action across

levels of governance, policy areas, and among groups with distinct authorities and interests. They have also considered proposed innovations in environmental governance intended to address these challenges, including a shift to voluntary and co-operative measures from coercive regulation; increased direct citizen involvement in environmental decision-making; and the increasing authority over resources and environmental decision-making being vested in First Nations.

Although the conditions necessary for sustainable development are not well known or specified, they surely must include adequate knowledge of the properties of the natural systems on which society depends, and adequate means to ensure the application of available knowledge to guide development decisions. The knowledge that must be generated, synthesized, and applied may be specific or general: from stock assessment for managing a particular fishery, to broad knowledge of regional or global systems to provide early warning of potential risks, or identify and assess potential responses.

Useful and legitimate synthesis of expert knowledge with democratically accountable deliberation and decision-making poses grave challenges, both conceptual and practical, to the design of policy processes and institutions. At a conceptual level, the domains of science and of democratic politics have different goals, standards of merit, norms of participation, and procedures for reaching agreement and resolving conflicts. At a practical level, desired relevant

knowledge is often unavailable, and available relevant knowledge is often not adequately employed. Our knowledge is often not adequate to yield high confidence in the consequences of decisions, while the environment cannot be managed by making uncertainty go away, or by delaying all decisions until high confidence is obtained. This unavoidable, pervasive uncertainty has two consequences of fundamental importance for environmental governance.

First, costly decisions to avert an environmental risk must sometimes be taken without strong verification of the magnitude and character of the risk. This insight is increasingly recognized, and expressed in the "Precautionary Principle": that precautionary measures should be taken against likely but unconfirmed risks. Though the precautionary principle would seem to evoke a rational decision-analytic approach, through which the level of protection to take against a risk is decided by weighing its likelihood and severity against the cost of action to avoid it, the operational meaning of the principle is scarcely more precise than that of sustainable development. The principle does, however, clearly reject one view of the burden and standard of proof needed to impose restrictions for the sake of the environment, which was once dominant – at least in rhetoric, if not always in practice. According to this view, inappropriately drawn from criminal law and now widely recognized as erroneous, activities and materials (e.g., chemicals) are presumed environmentally benign until demonstrated harmful beyond a

reasonable doubt. The Precautionary Principle is the slogan for the realization that sometimes activities should be restricted in absence of decisive demonstration of harm. The opposing extreme view, that activities are "guilty when charged" with any environmental harm, is of course equally insupportable – leaving ample room for judgement and dissent over what the Precautionary Principle requires in any particular decision.

The second consequence of pervasive uncertainty is less widely recognized: that decisions carry unavoidable a risk of error. Any environmental regulatory or management decision may, with advancing understanding or further monitoring of the system, be revealed to be too stringent, too weak, or simply mis-conceived. Rational environmental governance consequently requires some means of adapting policies and decisions to advancing knowledge, a goal known as "Adaptive Management". As for so many abstract environmental desiderata, the concrete meaning of adaptive management has never been fully specified, but a few of its basic requirements are evident.

First, resources must be invested in learning. Monitoring and research must continue, not cease when initial management decisions are made; and they must be designed not just to advance general understanding, but for their relevance to informing potential future decisions. Often, a powerful way to advance understanding is to design policies and decisions to be *informative*, in

addition to their other goals. The requirements for informativeness differ from decision to decision, but certainly include that decisions should perturb the system strongly enough to generate a signal, and be sustained long enough for the system to respond.¹⁶ Loose federal systems like Canada routinely generate potentially informative variation in management, as different jurisdictions take different approaches. But this potential for learning is seldom realized. It requires unbiased, consistent monitoring and evaluation; and also benefits greatly from coordination of the policy "experiments" as to their form, time of enactment, and duration.

In addition, policy institutions must have both the capacity to assimilate new knowledge and the flexibility to respond to it appropriately. While the other conditions for adaptive management have proved challenging, this one is the hardest. It requires that systems of governance be able to distinguish between three classes of supposed new knowledge: important new information that reveals earlier decisions to be so bad that it is worth bearing the cost of changing them; new information that does not meet this threshold; and rear-guard actions by the initial decision's opponents, claiming that new information supports their view when a competent and impartial observer would judge that it does not. The ability to draw such distinctions in turn requires that pluralistic and partisan governance processes have access to objective high-quality scientific advice,

including non-partisan expert judgements that synthesize multiple competing claims, weigh the importance of new findings, and assess the relative merits of conflicting claims. Moreover, the ability to act on new information and modify prior decisions requires a governance process, and individuals in it, capable of acknowledging error -- or, more plausibly, that the political or bureaucratic cost of acknowledging error be reduced, while still maintaining adequate standards of professional competency.

The implications of a commitment to adaptive management in public policy are not confined to government. Because regulatory decisions affect the permissible uses and commercial value of private property, a commitment to adaptive management would necessarily reduce the security of private property rights. If all environmental regulatory decisions are subject to revision, then the risk of future restrictions hangs over every activity and property. Government cannot even promise when it imposes restrictions that the same activity or property will not be subject to stricter or different restrictions in the future.¹⁷ This battle is already engaged in several areas in the United States. Many western property owners have negotiated agreements with EPA over the Endangered Species Act, which thwart attempts to manage adaptively by granting release from any future restrictions in return for present accommodations. In contrast, in US regulation of alternative chemicals for CFCs restricted by the Montreal

Protocol, industry sought -- and EPA refused -- promises of specified commercial lifetimes for chemical substitutes once EPA had authorized their initial introduction to market.

These conditions appear to be essential for systems of governance that advance understanding and act on it, but they are a tall order. Schrecker provides several examples of failures to obtain or appropriately use essential information in Canadian policy. These cautionary tales reveal how difficult it is for government to maintain a support for high-quality, independent, policy-relevant research, and to act on it. Schrecker proposes three specific reforms to promote more responsible science-based policy – and concludes, pessimistically, that the challenges they would pose to Ministerial discretion are so great that they are unlikely to be realized, so prospects for more responsible use of scientific knowledge in Canadian environmental policy are likely to be limited.¹⁸ How do his three prescriptions for better science-based policy measure up to the task he has identified?

His first proposal is for "firewalls", organizational barriers strong enough to protect publicly employed or funded scientists from suppression of results or professional retaliation when the results of their work offend their superiors. Some such barriers appear to be essential if policy-relevant research, data, and conclusions that are politically uncomfortable are to be conducted and publicly

available. But there is a potential cost. Since professional incentives in many fields do not value policy-relevant research highly, there must be enough managerial control over researchers to ensure they are addressing important policy-relevant questions. The detailed design of such barriers to ensure that publicly supported research addresses the most important questions, but to prevent control of its content for political ends, would be a delicate matter.

Schrecker's second and third proposals both seek to increase the transparency of government decision-making processes. Responsible officials would have to reveal both the evidence on which decisions were based, and the general guidelines they follow (assuming they know and can articulate them) in weighing evidence and deciding what they believe saying what in support of what kind of decisions. Such transparency is clearly attractive in principle, but what might its consequences be?

Public actors often have a strong interest in the opposite, obscuring the actual criteria and tradeoffs that guide their decisions. Indeed, it can be politically advantageous to maintain discretion to act while being able to demonstrate, at will, that compelling argument or overwhelming force left only one conceivable choice. The *force majeure* so invoked may be an international obligation, a classic strategy of Canadian bureaucrats to overcome domestic blockage, even when they have been instrumental in creating the international commitments;¹⁹ it

may be the risk of capital leaving, or not coming; or it may be science. Any of these forces can be made to seem to bind decision-makers' hands, forcing on them the action they in fact wish to take. In many cases, this is simple deception: power is only seemingly lost, or is voluntarily given up and can be readily reclaimed. Sometimes, however, enough delay in taking required action can lead to real compulsion: a fishing moratorium may be imposed "by the fish".

But when science is the pretext used in this charade, the cost can be high. If scientific advice is made to compel policy choice, then political debate and discretion are likely to be pushed back into the processes of developing the scientific advice. Accountability is likely to be lost if the decisive political debate is moved into closed and non-representative fora; and high-quality objective scientific advice is likely to be lost if advisory bodies' output is manipulated to appear to support decisions adopted. Paradoxically, pursuit of greater transparency in political decision-making may jeopardize both the quality of advice and the accountability of decisions.

Several other approaches have been proposed to ensure that scientific advice is high in quality, independence, and relevance. In some cases, merely avoiding explicit policy conclusions may protect advisory bodies from political interference, even if such conclusions are plainly implied. But this is a balancing act: avoiding recommendations may be essential, but failing to state policy

implications may be a large step toward irrelevance, particularly since advisory bodies speak to multiple audiences, and what is obvious to some is not to all. Conversely, unexplicated policy implications, or even pure statements of scientific data or theory, can sometimes be embarrassing enough to provoke attempted suppression or disavowal.

Another approach, practised with some success in the 1990s, has been to move scientific and technical assessments to the international arena. For several global issues, including both ozone depletion and climate change, international assessments have largely supplanted national assessments. While the substantive rationale for international assessment of global issues like these is compelling, there may also be political advantages. The extreme diversity of political interests, and the reduced likelihood of control by any faction or perspective, may facilitate assessments that attain both high quality and relevance. Such advantages may account for the increasing internationalization in the 1990s of some issues whose intrinsic character is much smaller in scale, such as biodiversity and desertification. Even when understanding the issue requires local knowledge, international bodies can still specify standards for national assessments or national contributions to an international assessment.

Spatial Scale and Environmental Authority:

The environment is extreme in the extent to which authority overlaps and is shared between levels of government, and between state, non-state, and inter-state actors. Such sharing and overlap is unavoidable because of the complex spatial structure of environmental processes, and because effective environmental governance depends on the behavior and knowledge of many diverse actors, which the state lacks the knowledge and authority to specify. Moreover, in Canada as in many federal states, the environment is distributed among multiple related Constitutional powers, some held provincially and some federally.

Because of environmental issues' complex mixture of local, regional and global-scale dynamics, it is usually impossible simply to match the primary scale of a problem with the primary scale of authority to manage it. The appropriate division of small-scale and large-scale environmental authority has been particularly hotly debated in Canada, where decision-making is simultaneously pulled both outward, toward environmental management through international treaties and institutions; and inward, toward increasing decentralization of authority to the Provinces. Paehlke examines the challenges that these complex spatial linkages pose for effective sharing of authority between sub-national, national, and international levels of governance.²⁰

An enduring theme in this debate is the bioregionalist aspiration for primary political authority to reside in local communities organized along

ecosystem boundaries. Paehlke rejects this aspiration for three reasons. First, ecosystems do not possess clear, coherent boundaries along which to divide such communities; rather, they comprise multiple, interlinked systems whose boundaries do not coincide and are often diffuse. Second, sovereign local authority can and often does violate widely held democratic norms. Third, and most important, the political and economic forces that dominate modern society and the environment are increasingly organized globally, and even nearly autarkic local communities could not manage their local economies and resources in isolation from them.

Turning to the division of environmental authority between existing levels of government, Paehlke assumes a Constitutional blank slate and argues for the inherent preferability of national supremacy in the environment -- while noting that nearly the opposite is occurring in Canada, as environmental authority is being ceded at once downward to the Provinces and upward to an increasingly dense web of international institutions. Three factors favour federal predominance, which are offset -- but in Paehlke's view, only partially -- by the greater knowledge and concern that smaller jurisdictions are likely to have for their particular environmental resources. First, federal governments have the resources and the legal standing to act in the international domain, where the crucial balancing of environmental authority with existing economic power must

occur. If a state is to be a credible participant in this process, it must have the authority to deliver on its commitments. In addition, national governments are better than sub-national governments at resisting two structural forces that systematically favour weaker than appropriate environmental protection: the race to the bottom in fiscal and regulatory policy, as jurisdictions compete to attract and retain investment; and the greater sectoral concentration of smaller-scale economies.

These claims are controversial, particularly in the recent Canadian climate of provincial assertiveness and federal diffidence. Still, they carry some force: the first is correct as a matter of law, and appears to be supported by diplomatic experience; the other two are empirical claims, and are at least plausible. The argument from the sectoral concentration of provincial economies is supported by Canadian experience, where provincial governments are highly solicitous of the interests of predominant local industry and resource sectors. British Columbia policy rarely and only with the greatest of difficulty goes forcefully against the interests of the forest industry; likewise for oil in Alberta, for automobiles, smelters, and pulp mills in Ontario and Quebec, and for fisheries in the Atlantic Provinces.

The race to the bottom claim, while also theoretically plausible and observed in some policy domains,²¹ is more complex and the evidence more

ambiguous. Two parts of the claim must be distinguished, one concerning how firms make location decisions and one concerning how governments try to influence those decisions. Location decisions by firms must consider a host of factors, including transport costs, quality and cost of workforce, political and currency risk, and many dimensions of government fiscal and regulatory policy. The cost of meeting environmental standards must surely enter into these decisions, but as one factor among many. Empirical studies in the 1980s found that environmental standards were a strong location factor only for a few extremely dirty industries. While these studies had significant weaknesses and are now out of date, recent studies of location decisions still conclude that other factors nearly always overwhelm environmental standards. When they do not, the investment that goes elsewhere may well be investment that a rich, environmentally concerned nation would rather not have. To observe that capital rarely leaves (or fails to come) due to environmental regulations does not, however, mean that firms rarely *threaten* to do so; abundant narrative evidence suggests that such threats are made frequently.

But do officials believe them? Governments sometimes do relax environmental standards, grant exceptions to them, or fail to enforce them. Such decisions sometimes target a particular firm, sometimes in response to a threat, but are often broadly targeted. When offered, the public justifications for such

decisions are often – but not always -- to protect jobs or attract new investment. It would appear that politicians and officials, at least some of the time, do believe that strong environmental standards effectively enforced risk loss of investment, despite the studies showing the risk to be small.

Why? Only three explanations appear plausible. Perhaps officials are bad poker players, easily misled or intimidated; perhaps the empirical studies understate the true risk of capital flight; or perhaps officials use the threat of lost jobs and investment as a pretext, "forcing" them to do what they wish to do for other reasons -- whether those other reasons are a sincere belief that the standard in question was too strict, an ideological opposition to regulation in general, or a desire to favour their friends and supporters. Determining the actual patterns of bargaining between firms and officials over environmental standards, and the mix of interests that motivate each side, are important, potentially researchable questions, though the difficulties of obtaining reliable data are likely to be severe.

Paehlke contends that appropriate environmental protection is systematically more likely to be blocked at smaller scales of government authority than larger ones. But evidence, of several kinds, is mixed. In Canada, the federal government has by no means always led on the environment, even considering constitutional limits on its authority. Indeed there have been occasions when the

federal government had to be compelled, reluctantly, to exercise environmental regulatory authority that it clearly did possess.²²

Other bodies of evidence initially appear to favour local authority, though their applicability to questions of division of authority between levels of government are questionable. For example, both theory and empirical evidence suggest that the most successful management of common-property resources is at local levels, when at most a few hundred agents must develop means of mutual restraint,²³ but with competent and legitimate governments in place, few environmental problems have the structure of a commons. Municipalities have shown substantial interest in global environmental issues, but their concrete actions have typically been symbolic and nearly costless, or have brought local benefits sufficient to justify their costs, so they provide only weak evidence of local willingness to contribute to global environmental goals. Finally, the hypothesis that there may exist a "race to the top", by which jurisdictions seek competitive advantage in advanced clean technologies by adopting stringent environmental regulations, appears to be of extremely restricted validity.²⁴

A more persuasive basis for favouring substantial environmental authority at sub-national levels is suggested by the preceding discussion of adaptive management. Locating authority at smaller scales allows diverse standards and approaches. While such diversity is most often advocated as a response to

variation in local conditions and preferences, it can also allow jurisdictions to experiment with diverse and innovative approaches. Such diversity could greatly promote learning about the effects and effectiveness of alternate responses, if sufficiently controlled that the variation is informative and if programs and results are adequately monitored. The diversity would also carry real costs, such as allowing local jurisdictions to choose weaker standards than a national or international consensus, and enduring the risk of failed policy experiments. Moreover, as for all pursuit of adaptive management, the political challenges would be substantial. The approach would require institutional capacity to admit ignorance, admit error, and revise policies revealed to be inadequate, even after they have accreted constituencies with stakes in their continuance.

A promising direction for resolving competing claims of environmental authority at multiple scales would be to construct cross-scale networks of shared authority and negotiated joint decisions that mirror the complex cross-scale structure of the issues. Canada's loose federal structure may facilitate such an approach, or indeed compel it if redrawing lines of constitutional authority for the environment is out of the question. In fact, Canada did experience several years of such effective collaboration under the Canadian Council of Ministers of the Environment (CCME), following a series of decisions that strengthened its role in the late 1980s. Benefiting from strong commitments from several key Ministers

and Deputy Ministers, and careful attention to institutional design, CCME contributed to coherent and effective national environmental policy in several ways. It helped build technical capacity in smaller jurisdictions; it invested provincial and territorial officials with a national perspective when they held the rotating chair; and it provided key research and analysis to address technical problems shared by multiple jurisdictions. CCME's subsequent decline reflected weakened commitment from several key jurisdictions, for both fiscal and ideological reasons. It also followed an attempt to harmonize all responsibilities for environmental protection across jurisdictions, an attempt that in retrospect clearly over-reached, and ended in embarrassing failure. The experience of CCME remains to be mined, and likely holds valuable lessons about the scope, limits, and conditions for environmental policy coordination and harmonization, both in Canada and in the international arena.

International Economic Regimes and Environmental Protection

While the future path of domestic sharing of environmental authority is quite obscure, the international path is substantially clearer. We are in the midst of a powerful shift of economic activity and its regulation toward global integration. Not only is economic activity becoming more global; international institutions are also becoming more economic, in that the most powerful global

institutions are increasingly those dedicated to the economic goals of income growth through free movement of goods and services, capital, and labour.

Consequently, in addition to requiring sharing of authority across spatial scales, effective environmental governance requires similar sharing across policy domains, in particular between environmental and economic institutions. At present, economic regimes are paramount, with strong effects on other domains including the environment. Present economic regimes must often resolve disputes over environmental or conservation measures, thereby judging the acceptability of environmental measures as regards both their intent (i.e., are they disguised trade protection?) and their effect (i.e., does their harm to trade outweigh their environmental benefits?). They thereby render far-reaching judgements of the relative weighting, and the reconciliation, of liberal economic goals and environmental goals.

In examining the challenge to environmental governance posed by the increasing internationalization of economic power and authority, Juillet argues that different economic regimes conduct this reconciliation differently, both in their dominant ideologies and in their institutional frameworks. Most lack expertise or sympathy for environmental goals, and make liberal trade goals supreme. Moreover, many make these high-stakes judgements without democratic accountability, rendering their decisions in closed and non-

representative proceedings or deferring to standards developed by private bodies. Still, some do better than others. In particular, Juillet argues that the EU better balances economic and environmental values than either NAFTA or WTO. NAFTA's Chapter 11 is particularly egregious in this regard, providing expedited secret procedures through which firms can attack national environmental regulations.²⁵

More fundamentally, Juillet argues that seemingly reasonable principles to guide such decisions may inappropriately constrain national authority over the level of environmental standards, the form of policy instruments used, or the manner of implementation, thereby directly threatening national pursuit of sustainable development. For example, the widely endorsed principle that environmental controls must have a "scientific basis" has been frequently interpreted, simplistically, to require high levels of confidence in the severity of a risk before allowing a regulatory response – effectively reversing the hard-won 20-year shift toward more precautionary management of the environment. Similarly, the "risk assessment" principle and the product-process distinction might both, depending on details of interpretation, excessively restrict the scope of permissible environmental controls. The "risk assessment" principle, that an environmental measure's economic costs must be balanced against the risk of environmental harm (or more narrowly, the direct harm to people) that it avoids,

might exclude environmental measures whose clearly demonstrable contribution to risk reduction, perhaps narrowly defined, is less than their more readily measurable economic burdens. The product-process distinction, which says that when products themselves are identical, those made by environmentally preferable processes may not command any regulatory advantage in international trade, would clearly exclude measures to reduce the environmental burden of foreign production, even when resources being harmed are of international consequence or concern.

So what way forward? Trying to protect the environment by resisting economic forces of globalization is clearly futile. Rather, the present imbalance between liberal trade and environmental principles must be redressed at the international level. This is an essential component of the vision of an environmentally benign globalism, which Juillet and Paehlke share though their specific proposals differ. For environmental issues of global significance, the path forward appears fairly clear. One requirement would be that economic institutions must explicitly acknowledge the legitimacy of multilateral environmental commitments, at least in their core environmental protection provisions. Trade restrictions in environmental agreements would require more careful negotiation, which might differ between the cases of trade restrictions that are essential to effecting the treaty's environmental goals (e.g., in CITES and the

Basel Convention), and the cases of targeted trade restrictions included to give states incentives to join and comply with the treaty, as in the Montreal Protocol. While universal deference of trade regimes to environmental ones is no more likely to be acceptable than the present, nearly opposite situation, both these types of trade restrictions in environmental treaties could, with certain restrictions, likely be acceptable to a liberal international economic system and be granted a conditional presumption of deference.

A second requirement would be the construction of countervailing institutional strength and expertise on environmental issues at the international level, to ensure reciprocal consideration of primary environmental and economic principles in determining policies in each domain. While it might appear advantageous to graft environmental mandates and expertise onto existing international economic institutions, this path would be unlikely of success. Trade agreements define valuable property rights for their parties, which are extremely rigid once enacted and do not readily admit modification to incorporate additional concerns. The lamentable experience thus far of the attempts to infuse environmental concern into the WTO and the World Bank, and indeed the limited clout of the environmental agreements and institutions belatedly grafted onto NAFTA, all speak to the difficulty of this task. The construction of parallel international environmental capacity, while also a tall order, is with sufficient

initial political resolve, less clearly doomed. Paehlke describes the need as "globaliz(ing) environmental protection at least as much as we have globalized economic activity", and argues that this ambitious goal can be achieved if governments make it the price of further economic globalization, e.g., through the proposed Multilateral Agreement on Investment.

For national or local environmental concerns, the path is even murkier. Even on global issues, leading nations often wish to enact national measures stronger than their treaty obligations, which most often reflect a middle-of-the-road or lower level of concern. For issues that lie predominantly within national borders, or that evoke idiosyncratically national concerns, international treaties may be neither feasible nor appropriate. In these cases, it is neither clear how to protect national discretion in environmental governance, nor even how much discretion ought to be protected. Paehlke's advocacy of global environmental authority can be read as rejecting national or sub-national divergence in environmental protection, regardless of local conditions or the spatial scale of the issue, as the price of elevating the global political status -- and force -- of environmental protection to equal that of economic growth.

The present situation is indeed hostile to divergent or idiosyncratic national measures. The dominant presumptions are that a single level and form of environmental protection is appropriate everywhere; that protection should be

harmonized at that level, and implemented through least trade-restrictive instruments; and that this level can be determined through universally accepted processes of scientific reasoning and assessment. As Juillet argues, the EU is a partial exception to this pattern, able to sustain greater international diversity in part because of its dense network of institutions and commitments that permits complex trades on many dimensions. In other economic regimes, the forces favouring such leveling now largely prevail.

But some jurisdictions may not want to harmonize standards. They may want to protect more strongly, or with more precaution, than an international consensus supports; to protect unique national resources or values; to protect against certain risks for expressive or cultural reasons that lack a strong scientific foundation; or to implement environmental protection through idiosyncratic policy instruments that fail the "least trade-restrictive" test. Alternatively, in order to gain broad enough political support to protect a sincerely held environmental value, a jurisdiction might have to pay off groups seeking trade protection by implementing environmental measures in a form that advances their interests. While any of these decisions might be legitimate, the emerging principles of international economic regimes would forbid them all. Any of these would indeed be difficult to distinguish from disingenuous measures, primarily motivated by protectionism but construed as environmental protection. Drawing

these distinctions would require some fair adjudication process that grants sincere pursuit of environmental protection equivalent standing to liberal-trade principles.

These possibilities suggest that environmental measures might be understood in part as expressions of local or national cultural diversity. Framed in this way, idiosyncratic local or national measures should perhaps be permitted, or permitted under certain conditions (e.g., when judged by a neutral body to be sincere; or with a requirement of compensation, to encourage their enactment only when they are sincere). Canada's decision to ban the gasoline additive MMT provides a useful illustration. Two hypothetical descriptions of the basis for the Cabinet decision have been advanced: first, that advisers judged MMT likely to cause substantial environmental harm, though acknowledging the scientific evidence remained ambiguous; second, that a political decision was made to favour the automobile industry, which supported the ban, over the oil industry, which opposed it. While it is possible that the ban might be judged acceptable in either case – just because oil prevailed over autos in the US, it is not clear that they should be allowed to use international trade regimes to extend their victory worldwide – it surely appears more acceptable, and MMT's US manufacturer less entitled to compensation, if the first reason predominated. Similarly, should Europeans be allowed to decide they do not want to eat hormone-fed beef or genetically modified foods, despite the weak present evidence of health risk,

simply because the products frighten or offend them? Product labeling would obviously mitigate some such conflicts, including this one; the fact that producers oppose labeling suggests they have other concerns than mere market access. But labeling would not resolve conflicts such as MMT, because the need for coordinated modification of fuel and vehicles requires a centralized system decision, precluding reliance on informed individual consumer choice.

Allowing some national discretion in such matters has much to commend it, but would create a serious moral hazard. A promising approach to resolving the tension might involve two elements. First, some dimensions of environmental authority would be shifted to international bodies, even for predominantly local issues, to counter-balance the economic bias of present global institutions. Such international authority need not imply complete rejection of diverse approaches across jurisdictions, but would likely have to delimit their acceptable scope, or judge the acceptability of particular measures case by case. The basic difference from the present situation would be that these decisions would be made from a basis of primary concern for the environment rather than liberal trade. The second element would combine neutral international expert assessment of environmental measures in dispute, with graduated compensation to parties harmed by the measures. The compensation would be scaled according to neutral

judgements of the measure's trade effects, its motivation, and the gravity and basis of the environmental value it seeks (or purports) to protect.

The Public-Private Interface: Regulation, Voluntarism, and Sharing of Authority:

As Canadian environmental institutions are challenged by federal sharing of authority, and by erosion of national authority in the face of international economic regimes, they are also following a widespread trend toward intentionally devolving some aspects of their authority to non-state actors. Harrison, Doyle-Bedwell and Cohen, and Dorsey and McDaniels all consider different aspects of this devolution.

Harrison examines voluntary programs that devolve some authority over defining, implementing, or even enforcing environmental measures to private actors, replacing coercive state regulation. While limits to state power and knowledge inevitably imply *some* sharing of effective authority with non-state actors, she provides several grounds for caution in endorsing a major shift toward explicit reliance on voluntary measures.²⁶

She reviews present experience to ask why such measures are adopted, and how well they work. She argues that they may be adopted for various reasons, of greater or lesser legitimacy. On the one hand, firms have better access to, and information about, their operations than regulators do, so delegating

implementation to them could realize environmental goals with greater efficiency and reduced burden. On the other hand, such delegation may simply be regulators' response to political or organizational weakness; or worse still, a way to appear to tackle an environmental problem without commitment, burden on firms, or hope of success. In the first case, the policies are adopted because they work, in the second because they do not; which of these is the case in any particular instance depends on the details.

Examining the effectiveness of voluntary measures in practice, Harrison argues that inflated claims are rampant, and that even serious attempts to assess effectiveness accurately are often obstructed by confounding factors, implementation lags, and lack of reliable information. The programs' design often exacerbates these problems, in that they typically lack clear targets, reporting requirements, or provisions for independent performance audits. Indeed, a major purpose and effect of voluntary measures may be to thwart democratic accountability, by shifting important decisions on environmental protection into closed bargaining sessions.

As Harrison points out, the term "voluntary measures" embraces so diverse a collection of approaches as to foster confusion. In particular it is often used, rather misleadingly, for approaches in which the state requires firms to do *different things* than under conventional regulation, imposing environmentally

relevant requirements but granting flexibility in deciding how best to attain them. Examples include shifting from technology standards to performance standards; shifting from command-and-control regulation to market-based mechanisms such as tradable emission permits; and substituting information disclosure and reporting requirements for standards. The essence of these approaches is not that they reduce state coercion: any of them could equally well be adopted through binding laws and regulations, voluntary negotiations, or a combination of the two (e.g., binding regulations implementing a negotiated agreement). Rather, they seek a more efficient division of responsibility, in which the state attends to environmental ends and the non-state regulatory targets attend to means. By giving firms the flexibility to decide how to meet a performance standard; by extending that same flexibility to groups of firms, allowing them to meet a target jointly rather than separately; or by requiring firms only to disclose publicly their environmental behavior, deciding for themselves how to deal with the resultant pressure from markets or advocacy groups once this information is widely distributed; the state allows firms' greater knowledge of technical possibilities, and more detailed influence over internal behavior, to yield better and cheaper ways of meeting environmental goals.

Harrison considers a different class of instruments, which more unambiguously merit the title "voluntary". She considers measures that relax, to

at least some extent, *any* direct use of the state's coercive authority. These remain a highly diverse set in many characteristics, including both the degree of effective coercion they retain for practical purposes, and its source. Few are *entirely* voluntary, in the sense of relying entirely on sincere environmental concern as the basis of behavior change with *no* externally applied incentives. Rather, the great majority manipulate incentives in three ways: through varying non-zero use of actual state power; through varying saliency of the *threat* of coercive state action as an alternative to negotiated agreement; and through varying degrees of coercion by non-state actors, acting in lieu of the state.

The state has abundant resources to influence behavior without invoking its legal authority to coerce. It can offer resources, expedited processing of other business, exhortation, public praise for achievements, and public censure for failure. Even such limited use of state authority can elicit changes in target behavior, altering both their incentives and their capacity. Second, voluntary measures typically reflect the outcome of negotiations between the state and regulatory targets; but as in all negotiations, the agreements reached depend in part on each party's perceived alternatives to a negotiated agreement.²⁷ Both for firms and for the state, one salient alternative to agreement is unilateral imposition of regulation by the state. Though exercising this authority may be costly and difficult for the state as well as for the targets, the threat of using it -- if

credible -- can encourage targets to agree "voluntarily" to substantial and costly behavior changes to avoid the risk of its imposition. The threat succeeds although -- or rather, because -- it is not carried out.²⁸ Moreover, as in mediated settlement of legal disputes, the state and firms may reach a more nuanced, cheaper agreement that both prefer to the blunter outcome they would likely obtain through adversarial regulatory proceedings.

One way to implement such a nuanced agreement is to delegate authority for the more coercive aspects of the agreement, such as monitoring, verification, and reporting, to non-state bodies acting in lieu of the state. This approach can offer several important advantages. The non-state monitor can be chosen for their relevant knowledge and the respect in which the targets hold them; and also for perceiving the threat of the regulatory alternative more saliently than do some of the targets. The monitor might, for example, be an industry association, typically allied with the largest or most technically advanced firms, who can solve their collective-action problem by disciplining small bad actors that besmirch the industry and harm them all. Moreover, non-state actors may gain access and discretion that government officials doing the same job could never have, in part precisely because they are not backed by the blunt coercive authority of the state, in part because most people prefer being instructed by people they know and like, rather than by people they do not know and do not like.

Some programs may appear to be entirely voluntary, in that they include no use of state authority and no salient threat of regulation. Though the state must not and cannot fully renounce its legitimate authority to act in the public interest to protect the environment, some governments try (or pretend) to do so out of general opposition to regulation. Alternatively, conditions of political or organizational weakness sometimes render governments unable even credibly to threaten regulation. Under these conditions, the incentives that states can apply to target behavior are modest, and exclusively in the positive direction. These may still bring behavior change, under certain conditions: they may increase targets' capacity to undertake environmental measures they were willing but unable to do; or they may, through learning, exhortation, or modeling, change firms preferences for good environmental conduct. But the lack of even the threat of regulatory action surely limits what such programs can accomplish.

A potential offsetting advantage of voluntary programs is provided by the psychological theory of cognitive dissonance, which finds that when people find themselves acting contrary to their preferences or beliefs, they are likely to adjust their preferences or beliefs to be more consistent with their behavior. The adjustment is stronger, the less is the external pressure that was applied to induce the behavior. Consequently, applying the minimum coercive pressure to gain a desired behavior change is likely to yield the greatest change in attitudes, and

hence in likely future behavior. If this process applies to organizations, for example through changing internal organizational values and routines, external incentives may become less and less relevant over time, conferring an important advantage on voluntary programs.

First Nations and Environmental Governance

A related dimension of shifting authority is the increasing recognition in Canadian law and policy of First Nations' aboriginal and treaty rights, which is effecting the transfer of ownership and authority over large quantities of land and resources. Doyle-Bedwell and Cohen argue that this process will transform relationships between First Nations, government policy-makers, and other citizens, in ways that are sure to challenge all three, but whose shape is not yet clear.²⁹ While many domains of society and governance will be affected by this transformation, its effects on natural resource management and environmental protection will be particularly profound. Novel systems for sharing access to resources, and authority over their conservation and management, must be developed. Reactions to the 1999 Marshall decision of the Supreme Court have revealed just how little prepared policy-makers, and others dependent on natural resources, are for the regime shift that is already underway.

Resource conservation occupies a prominent role in current policy debates over these new regimes. On the one hand, resource conservation has been

identified as one example of a compelling justification by which aboriginal and treaty rights may be curtailed; on the other hand, many First Nations leaders are concerned, with some basis, that fabricated conservation concerns may be used as a pretext to weaken their legitimate rights. Consequently, arguments over whether First Nations as resource managers are likely to be more or less competent, and more or less conservationist, than present regimes, have become a high-stakes side battle in a conflict that is principally about competing claims to exploit and control resources. Charges of plundering have been exchanged in both directions. Though Canadians' history of natural resource management does not confer much standing to denounce First Nations as potential plunderers, some have done just that in the heated aftermath of the Marshall decision.

On the other hand, others romanticize First Nations as simple Arcadians, whose deep identification with and knowledge of the land promise the salvation of the environment, indeed of western society. While many First Nations societies do deeply hold principles of respect for the earth and its resources, restraint, and obligation, such a naively romantic view is surely as demeaning as viewing them as plunderers. Either view may threaten to deny them rights that the Constitution and courts have affirmed, and to obstruct their ability to earn livelihoods, develop their communities, and participate equally in governance. The threat of the romantic view arises in holding First Nations to an impossible

standard of restraint and skill in resource management, one that industrial societies have never approached and that neglects the profound challenges First Nations will face in developing their communities and putting their traditional principles into practice in the modern world.

Still, rejecting both these rhetorical extremes, the practical question of how First Nations will operate as resource managers in Canada is of great importance, and little information is available on which to base projections. Traditional teachings, though providing one powerful rhetorical and moral basis (among others) for reclaiming authority over lands and resources, cannot provide precise predictions of how resources will subsequently be managed. Predicting a people's behavior from the teachings of its wisest elders is likely to lead to serious error, certainly for mainstream Canadian society and likely for First Nations as well. Moreover, the evidence from First Nations' management of resources where they have gained control over them, notably in the United States, is highly variable. American tribes' resource management has ranged from sophisticated and judicious development within strict conservation standards, to rapid and destructive exploitation; faced with opportunities for commercial development of sacred sites, some tribes have done so, others not; while tribes in New Mexico, Montana and Idaho have used the courts to force strict environmental protection on their neighbors, the Goshute of Utah have promoted their lands for nationwide

storage of toxic and nuclear wastes. The cultural, economic, and political bases for these extremely disparate choices are not well understood.

In speculating on the likely environmental consequences of the regime shift underway in Canada, Doyle-Bedwell and Cohen find mostly opportunity. While properly noting the need for caution, they argue that First Nations' traditional principles and practices concerning people's relationship and responsibilities to the land may support management regimes that are more conservationist and more long-viewed than present ones. Several challenges stand in the way of realizing this vision, however. First Nations as resource managers will face many of the same problems as other governments, including finding means to control the exploitative ambitions of individuals. Traditional teachings and practices, as well as social pressures available within tight-knit communities, may help provide the required incentives.

A related challenge will be learning how to apply traditional teachings of connection to the natural world, restraint, and obligation to guide concrete management decisions in the modern world. As Borrows has noted, what worked under past conditions -- small homogeneous communities with strong social networks and pre-industrial technology -- cannot necessarily be applied successfully under the vastly different conditions of the present crowded, technological, and heterogeneous world.³⁰ Translating the ethical and prudential

content of traditional teachings into guidance for management and action in the 21st Century will require a demanding exercise of reconstructing them from their essential moral foundations.³¹

Despite these challenges, the increasing role of First Nations may hold substantial opportunities for environmental and resource management in Canada. Whatever the historical accuracy of the image of First Nations as restrained, wise conservationists, the power this image holds might make it a useful vision to animate new approaches to protecting the environment, for First Nations and others. This would require that traditional principles be articulated and elaborated into specific practices and strategies that can be applied under modern conditions, that can be understood and applied even by people and institutions that do not share First Nations' cultural heritage. This is not to ask First Nations to save the world, but only that others might benefit from whatever applicable insights or wisdom might be derived from their traditions. Realizing such an optimistic vision of the influence of First Nations in environmental governance would impose demanding requirements on all parties, principally that they sincerely attempt to manage resources wisely, not holding conservation decisions hostage to allocation conflicts.

Environmental Governance through Direct Citizen Involvement

A further trend in shifting relationships of authority between state and non-state actors is the increasing use of processes of Citizen Involvement (CI) to engage citizens directly in deliberations or decision-making on matters of traditional state authority. Dorsey and McDaniels identify two historical waves of enthusiasm for such processes in Canadian environmental governance, in the early 1970s and the early 1990s. Both waves receded, due to several factors: over-promising and consequent disappointment with results, lack of clarity regarding mandate and responsibilities, and -- at least in the second wave -- overload and diffusion of attention from pursuing too many CI activities simultaneously. Dorsey and McDaniels predict -- and endorse -- a third wave, that will be characterized by more selective use of CI, with mandate and process tailored to specific issues where there chances of contributing are greatest; by routine and systematic evaluation of CI processes -- woefully inadequate at present, as for voluntary measures; and by the progressive development of a tested body of professional knowledge, which will both clarify the appropriate circumstances for different processes, and enable better evaluation and training of that crucial input, facilitator skill. To realize this potential, they caution that sponsors must be more explicit than they typically have been regarding the mandate of CI processes, particularly the extent to which the process is advisory or authoritative.

CI is not a return to an idealized direct democracy, but a selectively employed augmentation to representative government. It may serve certain functions of public decision-making more effectively than representative or bureaucratic institutions, for example by helping to define questions, clarify relevant values, objectives and tradeoffs, and marshal knowledge -- including local knowledge -- from diverse sources. CI processes can be particularly useful at explicating values, counter-balancing the widely noted tendency for representative bodies to resist clear articulation of objectives and priorities. It may even bring clearer consideration of ethical perspectives into public decision-making. It has also been suggested that CI processes may bring intrinsic benefits, independent of their effect on decisions, through enhancing perceived legitimacy or empowering citizens through meaningful participation in their communities.³²

Clarification of goals in a diverse polity is not without risks, however. If the obstacle to decision-making is that goals are obscure, then deliberative processes may help to clarify and elaborate them; but if the problem is that goals are deeply contested, or interests are recalcitrantly opposed, such elaboration may exacerbate rather than mute conflict. It is sometimes easier to agree on actions than on goals. Expanded and effective use of CI must surmount three central challenges: the need to articulate a legitimate basis for participation; the risk of reducing the broad public interest into bargaining among stakeholders; and the

need to ensure responsible use of available scientific and technical information in CI-based decision processes.

The question of which citizens participate and how they are chosen is a tension that runs through many discussions of CI. Participants might self-select for various reasons; alternatively, they might be invited because the decision affects them, they represent a class of affected people, or their participation is expected to improve the quality of decisions.³³ Each criterion is likely to yield a different set of participants, and managing participation so CI processes are widely perceived as legitimate is likely to pose great challenges – especially for issues with acute conflict and high stakes, in which case CI processes may have to be limited to advisory roles.

A related tension concerns the responsibility of government in CI. All citizens have an interest in the kind of nation they inhabit and the conduct of their government, but not all citizens are stakeholders – i.e., have a direct material interest -- in any particular decision. To divert public decision processes exclusively to stakeholder bargaining risks losing accountability for the broader public welfare and the ethics of state conduct. Government has the responsibility to seek, support, and when necessary arbitrate the public interest. It can no more escape this responsibility than it can escape its ultimate coercive power in implementing laws. Use of CI must not let officials or legislators evade this

responsibility by being only mediators among stakeholders, or bankers who bring public funds to the table to facilitate agreement.

Dorcey and McDaniels take note of each of these concerns, and propose correctives. To mitigate the risk of biased or illegitimate participation, they exhort facilitators to be alert to the risk of over-representation of the most acutely interested and the powerful, and to take special measures to ensure that important interests not participating are effectively represented. To mitigate the risk of loss of government accountability, they argue that all CI processes must have clear mandates and lines of accountability, including an explicit statement of whether its outputs are advisory or authoritative. Regarding the risk of inadequate consideration of scientific and technical information, they note that conventional decision processes often succumb to the same risk, and propose mitigating it by using facilitators with relevant substantive expertise.

While these suggestions are all likely to be helpful, they have some evident limitations. To make facilitators responsible for substantive expert knowledge, and to charge them with discerning and speaking for all important interests not otherwise adequately represented, is to give them an enormous job and rely heavily on their expertise and integrity. To demand clear statements of mandate is surely desirable, but likely not sufficient to obviate all concerns about illegitimate delegation of government authority. Where authority is explicitly

delegated for decisions with primarily local implications, as in recent resource co-management arrangements with local communities, sufficiently broad participation from the local community and government process oversight may well be adequate. But for decisions with larger-scale implications, ensuring legitimacy can be extremely difficult even without explicit delegation of authority, because the CI process's actual degree of influence over subsequent government decisions may be impossible to determine. Moreover, achieving enough of both legitimacy and technical adequacy, properly integrating expertise and participation, analysis and deliberation, is surely more difficult in CI than in conventional governance processes, with their greater reliance on the impartial authority of experts operating within democratically delimited bounds.³⁴

Environmental Pressure and Paradigmatic Policy Change

Both the increasing use of voluntarism in implementation, and of consultative processes in policy formation, represent reductions in the exclusivity of state authority for environmental governance. Howlett argues that a broader diminution of state authority is making traditional coercive policy instruments less viable in general, and indirect, procedural instruments more prevalent. In this context, he examines the prospects for major change in Canadian environmental policy, proposing a theoretical scheme by which the rate and character of policy change is determined by the presence or absence of new actors and new ideas: the

presence of new actors determines whether change is slow or fast; the presence of new ideas determines whether its character is "incremental" or "paradigmatic". For the environment, the current prominence of both new actors and new ideas suggests forces are aligned for rapid, paradigmatic policy change. In the face of these forces, government can only modestly adjust the pace, direction, or character of change, or make it slightly more orderly. The methods available for such fine-tuning are the procedural instruments regulate new actors' and new ideas' access to policy-making, e.g., more or less standing and support for NGOs, dissemination of information, and independence, resources, and participation in advisory bodies.

New ideas clearly do matter in political and social change, and there are clearly new ideas around in environmental policy -- or at least new forms of old ideas, or ideas only a few decades old. Candidate "new" ideas of large potential impact in the environment might include global limits (1970s); biogeochemical cycles (1930s, revived in the 1970s); geoengineering to manage the earth system actively (1960s); the Tragedy of the Commons (1840s, then 1970s); the commodification of environmental insult through such instruments as tradable emission permits, the modern analog of the enclosure of the commons (1970s); the Precautionary Principle (1980s); Sustainable Development (1980s); and Adaptive Management (1980s).³⁵ New actors are also clearly present, such as

environmental NGOs, especially ones of international scope; and in Canada, increasingly organized and legally empowered First Nations.

But these ideas and actors are not, for the most part, very new; nor are claims that environmental stresses are about to make a fundamental transformation of society. Projections of rapid change must consequently be weighed cautiously against the record of similar, erroneous past predictions, asking what has changed, or what cumulative factors are building to a breakpoint, to make things different now (or whether the meaning of “rapid” is to be understood historically, referring to multi-decade periods over which vast changes of all kinds are likely).

Citizen concern for the environment has been persistently mixed, labile, and ambiguous, only infrequently reaching and holding the intensity required to trigger major policy change. Moreover, citizens' declared concern for the environment often exceeds the evidence of concern discernible in their major consumption choices such as residence and transport. Consequently, governments most often treat environmental protection as a secondary priority, and sometimes with active hostility. While periodic short-term environmental crises (e.g., the tire fire or St-Basil-le-Grand) can be expected to occur, these usually provoke specific, narrowly targeted responses, not the proposed fundamental re-orientation of thinking and behavior. Even the two waves of

strong general environmental concern were each followed by a retreat. In contrast, some argue that the required (as opposed to the likely) changes in behaviour are enormous, and that the modest policy initiatives now on the agenda are vastly inadequate to bring them about.³⁶

That new environmental ideas have not yet brought fundamental change in governance and behaviour does not mean they cannot: their effect might be felt over decades, rather than years. But if they in fact cannot, two types of historical events are often proposed as required to bring the required changes. The first would be a major environmental scare -- not a catastrophe, but an event like the Antarctic ozone hole, vividly illustrating the possibility of sudden, major environmental transformation without itself causing such severe harm that society's ability to respond is impaired. The second, equally beyond the reach of calculated pursuit, would be a widespread transformation of people's ethical or religious world-view toward the environment. The longing for such a transformation may partly explain the hopes (and projections), perhaps excessive and unfair, that some environmentalists continue to vest in First Nations.

But vesting hope for large-scale behaviour change in such transformative events may set the standard too high, avoiding collective responsibility for more prosaic changes. Major social change does happen, but outside revolutionary times it happens on a decadal scale or slower. Moreover, such change is not

driven exclusively, or perhaps even primarily, by government policy. Policy can help, but cannot force social change through its exclusive efforts; rather, many causal forces interact. Moreover, many distinct kinds of change also interact, so changes each seemingly inadequate to the task can add up. In particular, the cumulative transformative power of technological change is not to be casually dismissed. It interacts with policy and ideas, is usually industry-driven, and has already relieved a host of environmental stresses this century, at least for the rich world. The remaining contribution toward easing global environmental stresses from this source, while most unlikely to be sufficient in itself, is likely to be substantial.

Conclusions and Research Priorities:

The notion of sustainable development directs our attention toward fundamental questions – e.g., what social and political factors shape human development or its stagnation; and how much, in what ways, with what possibilities for substitution, does human welfare depend on the natural environment – but has thus far provided only limited progress toward answering these questions. The discussions of the environmental trends project have identified a set of sharply drawn themes and challenges for environmental governance in pursuing the grail of sustainable development, and a set of

potentially researchable questions of fundamental importance in seeking to improve environmental governance over the coming decades.

One basic theme of the project's discussions was that realizing the aspiration of adaptive management will impose demanding conditions both on the institutions that advance scientific knowledge of natural systems and synthesize it to inform policy, and on the institutions responsible for public and private decision-making. More effective methods are needed to conduct scientific and technical assessment, and to draw their borders and interactions with policy processes to ensure relevance while protecting assessments from political control. Other methods, probably different, are needed to do prospective assessment, to identify emerging stresses not yet on policy agendas. Closely related is the acute need for more commitment to environmental monitoring, both to understand current trends and to scan for coming changes. Useful monitoring must integrate multiple dimensions of physical, chemical, and ecological observations, conducted to high scientific standards of accuracy, stability for trend detection, documentation, and replicability; and must be sustained consistently over long enough periods to identify long-term trends. Such an endeavor requires national support, but global reach and coordination, to realize the long unfulfilled vision of UNEP's "Earthwatch" project.

A second strong theme of the deliberations was the need for substantially increased institutional capacity to protect the environment at the international level, to counterbalance the present overwhelming predominance of principles of free trade. This further shift of environmental authority to the international level must, however, allow room for some degree of diversity in environmental standards and measures, and in the specific aspects of the environment chosen for protection. A third and related theme was the need to construct networks of shared authority and negotiation, to reconcile inevitable areas of overlapping capacity and authority between levels of government, and between state and non-state actors. Managing the environment over the medium term involves sufficient uncertainties and complexities that precise and static division of responsibilities is unlikely to be viable.

Several key knowledge needs also emerged from the discussions, which can be clustered into four areas. The first area concerns problems of environmental governance under both global limits and uncertainty. Questions of the character of global limits, and the conditions under which they can be probed and anticipated, have remained unresolved for decades, but nevertheless urgently require continuing attention. Priority research areas would include integrated modeling and assessment of simultaneous human perturbations of multiple environmental systems and biogeochemical cycles; identifying characteristic

modes of system behavior when breakpoints are being approached, to help understand how long in advance we might be able to anticipate significant environmental changes; and identifying potential technical and policy interventions that might provide rapid reductions of specific human material or energy flows, such as active geoengineering, in case these should become necessary. Since questions of global limits are inevitably suffused with uncertainty, further research into governance under uncertainty is a related priority need. Though research and analysis have continually noted the need for effective means of managing and making decisions under uncertainty, few institutions have developed these. Key research areas would include empirical studies of the use of scientific consensus and uncertainty in particular environmental policy debates; further elaboration of the specific conditions likely to be associated with better implementation of adaptive management; and identification, through both empirical and analytical studies, of the the most significant pitfalls and obstacles associated with the pursuit of adaptive management.

A second area for inquiry concerns the resolution of coordination problems under conditions of shared and overlapping authority, between different levels of government and between private and public actors. Detailed empirical studies are needed of how these conditions are managed in different institutional

settings and on different issues, to identify the conditions associated with more and less effective linkage of decisions, information, and authority across spatial scales. A specific study of great value would be a detailed examination of the successes and failures of CCME, and of other vehicles employed to coordinate federal and provincial environmental activity in Canada, identifying the capabilities and limits of such vehicles and the conditions apparently associated with success. Good detailed empirical studies are needed of competitive dynamics among jurisdictions (municipal, provincial, and national) in seeking to attract and retain investment, to complement the growing literature on firm location decisions by examining the public side of the associated bargaining: how and under what conditions do firms bargain for favourable regulatory treatment on environmental issues; and how and under what conditions do officials and politicians grant, or withhold such treatment. How do environmental issues fit into the broader patterns of accommodations that firms seek, and that jurisdictions make to attract them? A closely related set of needed empirical studies would examine salient reciprocal influences between environmental and economic policies and outcomes, at the domestic and international levels, including effects of short-term financial flows as well as trade and direct investment, and the potential effects, scope and limits of international market-like policy instruments such as tradable emission permits.

A third area of required investigation concerns the evaluation of particular innovations that have attempted and proposed. The discussions of both citizen involvement and voluntary measures made clear that almost nothing is known about the conditions and scope of effectiveness of these measures, principally because so little adequate evaluation of them has been conducted. Further experimentation with such programs, in various forms, with thorough, systematic, independent monitoring and evaluation, is essential to correct this situation. Such studies might also serve to illuminate broader questions of the conditions for effective sharing of decision authority between public and private bodies, between levels of government, and between representative processes and direct consultations.

More broadly, systematic examination of the potential effects of currently proposed innovations is needed, relative to the behaviour change that might be required to manage environmental stresses and pursue sustainable development. Relative to the more expansive views of the required changes, the innovations discussed here, voluntary measures and citizen involvement, may appear rather feeble. Indeed, since each of these amounts to a renunciation of certain dimensions of state authority, it is at least plausible that they may represent movements in the wrong direction. Although market-based measures have not been discussed here, their adequacy to effect similarly large-scale behavioural

change also remains undemonstrated. On the other hand, there is a near-unanimous consensus that conventional command-and-control regulation is an inadequate response to present environmental challenges, for several fundamental reasons: it is too short-term; it provides inadequate incentives for innovation; and, because its costs are higher than necessary, it is less likely than other responses to be politically sustainable. While the innovations discussed here may appear unlikely to achieve the behaviour shifts required, this view may understate their cumulative influence over several decades, particularly in conjunction with other measures and medium-term technological change. Moreover, if these changes in processes of environmental governance are judged inadequate, it is not clear what kind of collective responses would be both feasible and adequate to address an expansive view of the challenge. Still, the magnitude of the challenge that environmental change poses to governance remains deeply uncertain. Looking forward even a few decades, neither extreme view – that modest changes in policy, technology and practice will be adequate, or that fundamental realignment of human societies is necessary to avert global catastrophe – can be confidently rejected from the available evidence. The enormity of this uncertainty demonstrates how imperative it is to learn more effective ways of governing our use of the environment under uncertainty, and of responding adaptively to incremental advances in knowledge.

¹ This synthesis draws extensively on contributions from Trends authors F. Cohen, A. Dorcey, P. Doyle-Bedwell, K. Harrison, M. Howlett, L. Juillet, T. McDaniels, R. Paehlke, and T. Schrecker; from discussions at the project workshop led by J. Clapp, L. Coady, E. Dowdeswell, R. Gibson, G. Hoberg, G. McBean, J. McCue, W. Rees, and H. Swain; from discussions with A. Sutherland; and from the research assistance of V. Chow.

² E.g., the Montreal Protocol on the ozone layer (1987) and amendments; the Basel Convention on hazardous wastes (1989), and conventions on climate change and biodiversity (1992).

³ CEPA consolidates five previous statues authorizing regulation to control air and water pollution, acid rain, ozone depletion, toxic substances, and ocean dumping.

⁴ Environment Canada, "Municipal popuation served by wastewater treatment", National Environmental Indicator Series, <http://www3.ec.gc.ca>, Spring 1998.

⁵ Canadian VOC emissions grew 40% from 1980 to their 1988 peak of 3 million tonnes, and have since dropped about 8%. Canadian NOx emissions have changed little since 1980 (LRTAP emission data at <http://www.unece.org>).

⁶ American VOC emissions declined about 20% from their 1980 peak to about 18 M tonnes at present, while NOx emissions decreased a few percent in the early 1980s and have remained relatively constant since then (LRTAP emission data).

⁷ The ozone objective (0.82 ppm for 1 hour) was exceeded 5.35 days in summer 1980, 1.55 days in summer 1996. Over the same period, annual average ozone increased 37%. (National Environmental Indicators Series)

⁸ J L Stoddard; D S Jeffries; A Lukewille; T A Clair; et al, "Regional trends in aquatic recovery from acidification in North America and Europe". *Nature*, 401, no. 6753 (October 7, 1999): 571.

⁹ J.T.Houghton, L.H.Meira Filho,B.A.Callander, *et al* (eds.), *Climate Change 1995: The Science of Climate Change* (Cambridge: Cambridge University Press, 1995), p. 15.

¹⁰ Robert Socolow, "Nitrogen management and the future of food", *Proceedings of the National Academy of Sciences* 96 (May 1999): 6001-6008.

¹¹ National Environmental Indicators Series.

¹² Montreal Protocol Science Assessment Panel, *Scientific Assessment of Ozone Depletion: 1998*. (Geneva: World Meteorological Organization, 1999).

¹³ Environment Canada, *The State of Canada's Environment 1996* (Ottawa: Environment Canada, 1996), Tables 14.3, 14.11. (available at <http://www1.nrc.ec.gc.ca/~soer/SOE>).

¹⁴ New Brunswick, Quebec, Ontario, and Manitoba.

¹⁵ For example, concentrations of two monitored POPs in double-crested cormorant eggs at four sites across Canada declined 70% to 90% from the 1970s to the 1990s, but leveled off or reversed in the 1990s. (National Environmental Indicators Series).

¹⁶ Kai N. Lee, *Compass and Gyroscope: Integrating Science and Politics for the Environment* (Washington DC: Island Press, 1993).

¹⁷ I am indebted to Rod Dobell's comments in the workshop for this observation.

¹⁸ Ted Schrecker, "Using Science in Environmental Policy: Can Canada Do Better", in E.A.Parson (ed.), *Governing the Environment: Challenges and Innovations* (Toronto: University of Toronto Press, 2000 – forthcoming).

¹⁹ E.A.Parson with A.R. Dobell, Adam Fenech, Don Munton, and Heather Smith,, "Leading While Keeping in Step: Management of Global Atmospheric Issues in Canada," in W.C.Clark, Jill Jager,

Josee van Eijndhoven, and Nancy M. Dickson (eds.) *Learning to Manage Global Environmental Risks: A Comparative History of Social Responses to Climate Change, Ozone Depletion, and Acid Rain*, (Cambridge: MIT Press, 2000 forthcoming).

²⁰ R. Paehlke, "Spatial Proportionality: Right-Sizing Environmental Decision-Making", in Parson (ed.), *Governing the Environment*.

²¹ Paul E. Peterson, *The Price of Federalism* (Washington, DC: Brookings Institution, 1995).

²² K.Harrison, "Voluntarism and Environmental Governance", in Parson (ed.), *Governing the Environment*.

²³ Elinor Ostrom, *Governing the Commons: the Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990).

²⁴ See, e.g., M.E.Porter and C. van der Linde, "Toward a New Conception of the Environment-competitiveness Relationship", *Jrnl of Econ Perspectives* 9, no.4 (Fall 1995): 97-118; and K. Palmer, W.E. Oates and P.R. Portney, "Tightening Environmental Standards: the Benefit-cost or the No-cost Paradigm?", *Jrnl of Econ Perspectives* 9, no.4 (Fall 1995): 119-132.

²⁵ Luc Juillet, "Regional Models of Environmental Governance in the Context of Market Integration", in Parson (ed.), *Governing the Environment*.

²⁶ Harrison, "Voluntarism".

²⁷ D.A. Lax and J.K.Sebenius, *The Manager as Negotiator* (New York: Free Press, 1986).

²⁸ Thomas C. Schelling, *The Strategy of Conflict* (Cambridge: Harvard University Press, 1960).

²⁹ Patricia Doyle-Bedwell and Fay Cohen, "Aboriginal Peoples in Canada: Their Role in Shaping Environmental Trends in the 21st Century", in Parson (ed.), *Governing the Environment*.

³⁰ John Borrows, "Living between Water and Rocks: First nations, Environmental Planning, and Democracy", *University of Toronto Law Journal* 47 (Fall 1997): 418-67.

³¹ See, e.g., R. Trosper, "Traditional American Indian Economic Policy," *American Indian Culture and Research Journal* 19, no. 1 (1995): 65-95.

³² O. Renn *et al*, *Fairness and Competence in Citizen Participation* (Dordrecht: Kluwer, 1995).

³³ This discussion draws on comments of Jeremy Rayner in the workshop.

³⁴ Committee on Risk Characterization, National Research Council, *Understanding Risk: Informing Decisions in a Democratic Society* (Washington, DC: National Academy Press, 1996).

³⁵ For early cites to these ideas, see D.H.Meadows *et al*, *The Limits to Growth*. (New York: Universe Books, 1972). V.I. Vernadsky, "The Biosphere and the Noosphere," *American Scientist* 33, no. 1 (January 1945): 1-12. C. Marchetti, "On Geoengineering and the CO2 Problem". *Climatic Change* 1, no.1 (1977): 59-68. G. Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (13 December 1968): 1243-48; John Dales, *Pollution, Property, and Prices* (Toronto: University of Toronto Press, 1968); World Commission on Environment and Development, *Our Common Future* (New York: Oxford University Press, 1987). C.S.Holling (ed), *Adaptive Environmental Assessment and Management* (Chichester: Wiley, 1978).

³⁶ This discussion draws on comments of William Rees in the workshop.