

The Canada Country Study: Climate Impacts and Adaptation

NATIONAL SYMPOSIUM PROCEEDINGS

*held 24-26 November 1997
Toronto, Ontario, Canada*



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This is a component report of the Canada Country Study: Climate Impacts and Adaptation. In addition to a number of summary documents, the first phase of the Canada Country Study produced six regional volumes, one volume comprising twelve national sectoral reports, and one volume comprising eight cross-cutting issues papers. This is the Canada Country Study National Sectoral Proceedings.

Ce rapport est une partie composante de L'Étude pan-canadienne sur les impacts et l'adaptation à la variabilité et au changement climatique. En plus de quelques documents sommaires, la première phase de L'Étude pan-canadienne a produit six tomes régionaux, un tome comprenant douze rapports nationaux au sujet des secteurs sociaux et économique, et un tome comprenant huit papiers concernant les questions intersectorielles. Ce rapport est L'Étude pan-canadienne .

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<http://www2.ec.gc.ca/climate/ccs/>

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I hope that on reading the presentations and results of our deliberations that are chronicled in the following proceedings that you will continue to benefit from the CCS National Symposium.

Finally, thanks goes to the efforts of the proceedings editors, and the staff at BTT Communications in producing this document.

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CANADA COUNTRY STUDY NATIONAL SYMPOSIUM PROCEEDINGS:

EXECUTIVE SUMMARY

The Canada Country Study: Climate Impacts and Adaptation (CCS) is a national assessment of the impacts of climate change and variability on Canada as a whole, including consideration of existing and potential adaptive responses. In presenting this national perspective, the CCS consists of studies of a number of regional, sectoral and cross-cutting issues*. The study was initiated by Environment Canada (EC) and is being lead by the Environmental Adaptation Research Group, a component of EC's Atmospheric Environment Service located in Downsview, Ontario.

The results of the Initial Assessment Phase (IAP) of the CCS are presented in a suite of publications including a national policy makers summary, a national plain language summary, and six regional plain language summaries. In addition, the basis of these summaries - 26 component studies and papers - are being published in eight volumes (six regional ones, and one each comprising the 12 national sectoral papers and 8 national cross-cutting issues papers). The information contained in these publications is directed to a broad spectrum of users: Canadian policy makers in the public and private sectors, socio-economic decision makers, the scientific community both domestically and internationally, non-governmental organizations, and the Canadian general public.

To mark the completion of the CCS's Initial Assessment Phase, a National Symposium was held in Toronto during the period November 24-26, 1997. The symposium convened first at the University of Toronto's Hart House for the opening day sessions and then moved to the downtown Crowne Plaza Hotel and adjoining Metro Toronto Convention Centre complex for the first evening's reception and final two days. Approximately 150 attendees participated.

The holding of such a symposium was intended to meet five specific objectives:

- Officially release the CCS national summaries
- Present the results of the CCS Initial Assessment Phase
- Acknowledge the work of the many participants in the CCS Initial Assessment Phase
- Seek stakeholders' views on the results, and
- Determine the next steps for the CCS.

The final structure of the National Symposium programme reflected these objectives strongly.

During the first morning, the Honourable Christine Stewart, Minister of the Environment, gave the opening address and officially announced the release of the CCS national policy makers and plain language summaries. Four subsequent addresses outlined the background science of climate change (Gordon McBean, AES), presented the national results of the CCS (Roger Street, AES), and indicated the international linkages to the IPCC (Richard Moss, U.S.) and to the United States National Assessment (Paul Dresler, U.S.).

In the afternoon of the first day, a series of five panel sessions began and continued until the middle of the afternoon of the second day. These sessions were intended to present specific results from the individual regional, sectoral and cross-cutting papers completed by CCS participants as well as to introduce some stakeholder perspectives on such results. There were five such sessions in all, each lasting about an hour and a half. The topics used to focus the sessions were:

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- Natural environment (water resources, wetlands, terrestrial and aquatic ecosystems)
- Sustaining food and fibre production (agriculture, fisheries, forestry)
- Social and economic well-being (human health, tourism and recreation)
- Protecting infrastructure (built environment, insurance)
- Maintaining vibrant industry (energy, transportation)

Each panel comprised two or three sectoral paper authors, one regional report lead author, one or two cross-cutting issues paper authors, and one stakeholder. The first panel was moderated by Bob Stewart (Canadian Forestry Service, NRCan), the second and third by Barry Smit (Univ. of Guelph), and the final two by Joan Masterton (AES). Each moderator had an opportunity to summarize the key issues arising from his or her session(s).

A break-out session was held during the second afternoon and evening. Seven groups in all convened with the purpose of addressing the communications and research gaps arising from the initial phase of the CCS, and sketching a generic outline identifying the important components that should be part of a next CCS (response) phase. The seven groupings of participants were made according to government (3), academic (2), or stakeholder/NGO (2) background.

The results of each break-out group's deliberations were presented during a plenary session (chaired by Rodney White, University of Toronto) on the morning of the third day. Active question and answer periods followed each presentation.

The Canada Country Study National Symposium met all its objectives successfully and sent a strong message that continuation of the Canada Country Study is needed. The CCS's Initial Assessment Phase has provided a firm basis from which to launch a Response Phase. That phase will need to address research and communications equally in order to succeed and the large number of conclusions and recommendations arising from the Symposium panels and break-out sessions will be very useful in its planning. Issues such as data gaps, improved scenarios, stakeholder engagement, a regional/local focus, integrated assessment, and improved understanding of adaptation are some of the main needs which the Response Phase's research and communications components will need to take into account.

* Regions: Arctic, Atlantic, Ontario, Pacific and Yukon, Prairies, Québec

Sectors: agriculture, built environment, energy, fisheries, forestry, human health, insurance, recreation and tourism, transportation, unmanaged ecosystems, water resources, wetlands

Cross-cutting issues: changing landscapes, costs, domestic trade and commerce, extra-territorial issues, extreme events, integrated air issues, sustainability, two economies

CANADA COUNTRY STUDY NATIONAL SYMPOSIUM PROCEEDINGS

CONCLUSIONS AND RECOMMENDATIONS

The results of the Canada Country Study's National Symposium contained a strong message that the work begun in the CCS's Initial Assessment Phase (IAP) needs to continue. This was reflected in all of the panel discussions, the break-out group sessions, and the final plenary. It was clear that there was a large measure of satisfaction with the work that had been completed during that initial phase and a strong feeling that a firm basis from which to go forward had been developed. Part of that basis was a recognition that many gaps in our knowledge and understanding of the impacts of climate change and variability and particularly adaptation responses to such impacts remain. A Response Phase of the CCS can now be planned around some very specific needs identified or confirmed by the National Symposium.

A number of those gaps or needs as identified by the panels and break-out groups are given in more detail at the end of this section, but it is useful to highlight some common threads that recur. These include:

Data sets - The need to preserve, extend, and broaden data gathering programs of environmental, economic, and social importance to the climate change issue.

Scenarios - Improved climate change scenarios that provide temporal information as well as improved resolution at regional and local scales.

Stakeholders - The need to involve all stakeholders from the beginning and engage them throughout the process.

Communications - A thorough communications strategy needs to be recognized as a vital component of the CCS response phase.

Research - The other vital component of the CCS response phase. Particular characteristics should include a focus on integrated assessment; emphasis on the regional/local scale; targeted efforts on improved understanding of the sensitivities of systems and communities, on extreme events, and on methods of adaptation.

Adaptation - In addition to methodological research, there is a strong need to evaluate the costs of adaptation, the issue of acceptability, and the consequences for mitigation.

The Panels

Natural Environment

- extreme sensitivity and all components react to different stimuli and are affected by climate change in different ways - natural resilience of certain components may be overpowered
- incomplete ecological data sets are responsible for part of the knowledge gaps - those sets that exist must be made more effective
- other scenarios apart from the standard 2xCO₂ need to be looked at in order to address uncertainties in how systems may react

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- interdependence of ecosystems requires greater understanding so that synergistic effects can be appreciated when impacts occur to a particular system - need for multisector vs. single sector studies
- humans need to adopt a more conservationist point of view
- need to target stakeholders to pick up gauntlet and join in the challenge as opposed to speaking to the converted

Sustaining Food and Fibre Production / Social and Economic Well-Being

- impact assessment needs emphasis - thus, more focus on the sensitivities of communities which rely on activities is required
- consideration of extremes and sensitivities of systems should be approached through attention to year to year variability
- rather than try to remove scientific uncertainty, attempt to recognize and characterize it (risk approach) thus by better explaining what we do know, more support is attained
- important to define, document, measure and articulate adaptation costs

Protecting Infrastructure / Maintaining Vibrant Industry

- reliable data both domestically and internationally essential for reducing uncertainty
- opportunities for action with little cost - renovation, for example
- communication now, to capitalize on people's motivation to action
- non-traditional thinking and a collective effort required to address complex systems involving people, economy, environment

The Break-Out Groups

Initial Assessment Phase (IAP)

- first order impacts well documented and better understood than second and third order impacts
- details of impacts at regional and local scales still rather uncertain and details are needed before specific policies can be developed
- role of adaptation needs attention
- results could have been more integrated through increased coordination between research activities
- differences between mitigation and adaptation need to be clarified and linkages developed
- cumulative and integrated impact assessments involving issues other than climate change should be the next step

Response Phase (RP)

Organization

- should focus on early involvement of *all* interested parties - particularly important will be engagement of stakeholders, locally impacted communities, and young Canadians
- lead coordinating role for EC (other possibilities could be the Royal Society of Canada, Canadian Climate Program Board, university research chair or centre of excellence)
- RP not EC-driven, but depend upon a wider spectrum of interests such as the 4 federal natural resource departments and communities expected to be directly affected by impacts of climate change and variability
- both research and communications will be vital components
- promote integrative approach possibly based on watersheds, ecozones or political boundaries
- both adaptation and mitigation to be considered

Research

- define working rules or guidelines so that all participants are clear as to the “big picture”
- priorities to be determined by a carefully planned process involving both stakeholders and researchers and emphasizing a regional approach which builds on existing structures and engages people who will be affected in actual research projects
- important bases will be appropriate data and realistic scenarios
- impacts research needed - look at whole time scale from the historic to present to the short (next decade or so) to the longer term (next 100 years)
- response option research needed - evaluation of social acceptability and economic viability are important aspects
- priority areas: water, ecosystems, urban issues, human health, integrated air issues, costing, TEK (traditional ecological knowledge), adaptation process
- case studies focussing on extreme events

Communications

- IAP provides solid information upon which to base a communications plan to include the general public, NGOs, and stakeholders in industry and government
- important to communicate the climate change issue as well as possible adaptation strategies equally
- take care not to let identification of winners and losers become divisive
- comprehensive strategy needed - to include partnerships, varied educational approaches, strong emphasis on message content and style

CCS NATIONAL SYMPOSIUM

INTRODUCTORY SESSION

This National Symposium was held in Toronto, Ontario from November 24-26, 1997 to mark the completion of the Canada Country Study's Initial Assessment Phase (IAP). During the first morning, the Honourable Christine Stewart, Minister of the Environment, gave the opening address and officially announced the release of the CCS national policy makers and plain language summaries. Two technical sessions followed the Minister's speech. The first session dealt with the science of climate change, with presentations on the background science of climate change (Gordon McBean, AES), and the national results of the CCS (Roger Street, AES). The second session dealt with international aspects that relate to the Canada Country Study, with presentations on the international linkages to the IPCC (Richard Moss, U.S.) and to the United States National Assessment (Paul Dresler, U.S.). The Minister's opening address and summaries of the four subsequent presentations follow.

Minister's Address to the Canada Country Study Symposium

*The Honourable Christine Stewart, P.C., M.P.
Minister of the Environment*

Good morning.

It is a true pleasure to be here today to convey to you personally my appreciation of the tremendous work you have all accomplished on the Canada Country Study. My colleague, Natural Resources Minister Ralph Goodale asked me to convey his regrets at not being able to be here to also congratulate you.

One of the most difficult things for many people to understand is how an increase of one degree in global average temperatures can have such a large impact on our lives. One degree – from minus three to minus two, from 22 to 23 – doesn't ameliorate a cold day, doesn't make a hot day appreciably worse.

It is only when we can show what this one degree increase really means to people in the communities where they live that it becomes meaningful for them.

And that is your accomplishment in this study.

You have shown Canadians living on the coast of Prince Edward Island that rising temperatures mean rising sea levels, and that this threatens their homes.

You have shown Canadians in Quebec and Ontario that rising temperatures could result in lower water levels in the St. Lawrence River and Great Lakes.

You have shown Canadians living on the Red River flood plain that rising temperatures mean more of what they experienced last spring.

You have shown Canadians in British Columbia that rising temperatures could mean more landslides endangering their homes and infrastructure.



In fact, as the details of the two national reports being released today make eminently clear, you have shown Canadians everywhere that climate change is something that will happen to them.

And, in doing so, you have served Canadians well.

And Canadians agree with you. Almost 90 per cent of Canadians believe climate change is already occurring or will occur, and similar numbers believe that, if no action is taken, climate change will have serious negative effects on both the environment and our economy.

We've all heard those who will discount the science of climate change. Those who will say that the evidence isn't there. Those who will say that there is no consensus among scientists.

Well, taking differing views and subjecting them to the weight of scrutiny is what science is all about. And, while there will always be a minority somewhere who do not accept the weight of evidence, the predominant view among scientists here in this room, across the country, and around the world, is that the science is compelling and sound. We may not know everything, but we know enough to make avoiding action irresponsible – irresponsible to ourselves, and irresponsible to future generations.

We cannot let the views of a minority, no matter how vocal, distort the strength of the science on climate change.

And that science says that unchecked climate change could cause global environmental problems on a scale not yet seen on this planet.

We have the opportunity – we have the responsibility – to do something about it – to rise above our competing national interests, to rise above arguments about who should act first.

The simple truth is that everyone has to act to do something about climate change. That is why the Canadian government is going to Kyoto intent on reaching an agreement that sets out realistic, meaningful, and equitable targets for developed countries, and one that engages developing countries in the challenge of reducing emissions.

We have difficult choices to make in Kyoto. We know we must protect our environmental heritage. To do otherwise would be to squander our own future and that of our children. But when the science is right, as it so clearly is, I have faith that the policy will flow from it.

Through my years in community work, I also have faith in people. I have learned that no model, scientific or economic, can capture the will of a community. We can. We can harness all of our constructive energies, and all of our powers of innovation, our entrepreneurial spirit and our will to succeed, and direct them to fighting climate change.

And that is where the real work will be. Not in reaching agreement at Kyoto, although I certainly don't discount the efforts that will be required to walk out of the meeting with an agreement in hand. But Kyoto is but the first step. The real work starts after agreement is reached. That is when we will have to sit down together, as a country, to decide how we are going to fulfill our obligations.

I firmly believe that this has to be a cooperative process, one that involves all levels of government, the private sector, non-governmental organizations, communities, and individual Canadians.

Part of that effort is going to be providing Canadians with the information they need to make informed choices.

The Canada Country Study is a vital part of that information process. We want Canadians to understand the gravity of this issue, to understand just what rising global temperatures mean for Canadians in all regions of this country.

That is why we made the Canada Country Study the cover story of the new Science and Environment Bulletin. This bulletin will provide Canadians with the results of Environment Canada research, so that they can better understand the science that underlies policy decisions. Today marks the publication of the first issue of this bulletin, and I am pleased to be releasing it at this symposium.

I have faith that, presented with the information they need, Canadians will make the choices that are good for our environment, good for our future. With the kind of data gathered in the Canada Country Study, Canadians will be able to ask themselves what they are willing to do to reduce greenhouse gas emissions and to mitigate the impacts of climate change.

But the choices are not always dramatic. Earlier this year, I had my departmental car tested for its emissions quality. I am happy to say it passed with flying colors. But I know that thousands of cars, trucks and buses on Canada's roads today are not properly tuned. They pollute more than they have to, and their owners buy more fuel than they would otherwise have to.

Do you know that the average car in Canada emits more than its own weight in carbon dioxide each year?

An improvement in the average fuel efficiency of these cars of just 1 liter per 100 kilometers would reduce Canada's carbon dioxide emissions by about 3.3 million tons per year. That would have roughly the same impact as closing down two modern 450 megawatt coal-fired power plants.

And to think much of this could be achieved by simply fine-tuning our vehicles.

Provincial emissions testing programs, like the ones currently operating in Ontario and B.C., are effective at cleaning up smog and reducing greenhouse gases. They are also cost effective for the consumer because whatever is spent up front on tests and tune-ups is more than recouped over time in fuel savings.

We also cannot forget that emissions due to human activity have been accumulating in the environment for more than 200 years. No matter how quickly we reduce our emissions, we can only mitigate, we cannot eliminate, the impacts of climate change. Canadians have to prepare themselves to adapt to the inevitable changes. This is not an excuse to avoid reducing emissions. It is simply reality.

Canadians have always been good at adapting to climate – we've been doing it all of our lives. Now, with the information we have thanks to your work, we will be better prepared than ever for what lies ahead.

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So once again, please accept my congratulations on a good job well done. You have made an invaluable contribution to Canadians' understanding of the problem and their involvement in the solution.

I look forward to learning more from your work as you continue in the next stages of the study.

Thank you.

The Changing Climate

*Gordon McBean
Assistant Deputy Minister
Atmospheric Environment Service
Environment Canada*

The science of climate change and its impacts is one for which a large amount of information is known while at the same time a certain number of uncertainties exist.

There is a strong scientific consensus that human activities such as the burning of fossil fuels and the changing of the Earth's land cover are altering the composition of our atmosphere and doing so in ways that are increasing the greenhouse effect. Carbon dioxide is the most important radiatively active gas so affected. While the concentration of carbon dioxide in the atmosphere has varied over geologic time, it has increased steadily since the early part of the past century from a value of about 280 parts per million to an historically high level of 360 parts per million. Even with significant actions to reduce the rate of this increase, there will in all probability be a further increase to about twice the pre-industrial value by the end of the next century.

Much of what is anticipated in the future is based on models - syntheses of our best scientific understanding. Depending upon the particular scenario of carbon dioxide concentration used, a global warming of 1 to 5°C is projected. Such warming will not occur uniformly, however, and certain parts of the globe including the Canadian Arctic and southward into the Canadian central plains will warm by amounts several times that of the global average. Part of the confidence that exists in these projections is due to their consistency with the observed temperature changes and patterns in various parts of the globe during the past 40 years.

Uncertainty increases as consideration is given to the exact magnitudes and rates of change of the various components of climate as well as their spatial variability. Thus, in comparing what may happen to temperature in southwestern Ontario versus northern Ontario or in one part of the Prairies versus another part, there is lower confidence than what is expected to happen to temperature globally. Response times are an important contributor in this uncertainty. For example, land surfaces warm more quickly than does the deep ocean. In assessing impacts, response times are equally important. Ecosystems may take decades-to- centuries to react to a temperature change that occurs over several-years-to-decades. Similarly, different parts of the industrial sector respond at different rates, much of that related to the magnitude of the capital costs related to a particular industrial activity or structure.

In summary, there is a strong consensus both in Canada and internationally that the basis for concern regarding climate change is scientifically sound. The affect of human activities on climate appears to be discernible and the risk of danger at the global scale is real and significant. Uncertainty in the magnitude and distribution of regional climate change does, however, exist.

The Canada Country Study: Climate Impacts and Adaptation

Roger Street

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The Canada Country Study (CCS) was launched in the summer of 1996 with its first aim that of understanding the current level of scientific understanding with respect to the potential impacts of climate change on Canada as a whole and how such impacts might be adapted to. A broad spectrum of Canadians (including scientific and technical experts in the fields of climate, impacts and adaptation as well as policy and decision makers) were involved under the general leadership of AES' Environmental Adaptation Research Group. The CCS initiative resulted in a number of reports including six regional reports (Pacific and Yukon, Arctic, Prairies, Ontario, Quebec, and Atlantic) representing the broad geographical diversity of the country, twelve national sectoral reports (e.g. agriculture, energy, human health), and seven national cross-cutting reports (e.g. costs of impacts and adaptation, domestic trade and commerce, extreme events). There are, of course, important international linkages with the IPCC and the U.S National Assessment.

The impacts elaborated upon by the CCS are not predictions but projections founded on Canada's known sensitivities to climate and vulnerabilities therefore arising. The key findings include:

- Impacts are expected to vary significantly across the country, reflecting Canada's diversity. Looking at the regional texture is essential because it is there that the positives and negatives are going to be felt.
- Water is a key factor. Depending upon the particular area of the country, there could be too much, or too little, or not at the right time.
- Changes in Canada's natural ecosystems, as a result of projected changes in climate, will have impacts upon Canada's economic and social well-being.
- Adaptation needs to be included in any response to climate change impacts. Doing so can help to minimize their social, economic and environmental consequences.
- The impacts of climate change on other countries will have implications for Canada. These would be reflected in Canada's relations with trading partners and competitors and in its economic and social systems as a consequence of pressures arising from increased numbers of environmental refugees.
- Canadian forestry and agriculture are generally expected to adapt successfully to climate change. Imperfect responses may jeopardize this, however.
- Impacts on human health could put additional stress on Canada's social and health infrastructure.
- Traditional lifestyles followed by indigenous peoples in Canada may be at risk as the ecosystems upon which they depend are expected to change. Such change may challenge the ability to use traditional knowledge as a basis for response.

In order to reduce some of the uncertainties, there is a need to address a number of issues, including: developing better projections of climate, particularly regionally; determining thresholds at which ecosystems components can no longer resist change; and increasing the use of integrated assessment.

In summary, the impacts of climate change are significant and will be so in all regions and on all sectors. There will be both positive and negative impacts and opportunities will result. There will be social, environmental and economic costs associated both with the impacts as well as any adaptation to them. It will be vital that all Canadians be engaged not only in the future phase of the CCS but also in identifying impacts and response strategies, including how they will adapt to changes in climate and the impacts thereof.

IPCC: Impacts and Adaptation

Richard Moss

Head

IPCC Working Group 2 Support Unit

The IPCC (Intergovernmental Panel on Climate Change) was founded in 1988 by the United Nations Environment Programme and the World Meteorological Organization. Its objective is to assess information on climate change, on potential impacts, on adaptation options, and on options for reducing greenhouse gas emissions. Peer reviewers - members from the scientific community around the world with expertise relevant to the climate change issue - participate in the assessment process. The two main, current IPCC activities are the completion of a Special Report on the Regional Impacts of Climate Change and the initiation of the Third Assessment Report.

The Regional Impacts Special Report, which was originally suggested by the UN Framework Convention on Climate Change, has just been published. It is organized to cover ten global regions - Africa, Australia, Europe, Latin America, Middle East and Arid Asia, North America, Polar Regions, Small Island States, Temperate Asia, and Tropical Asia. Several important interpretative annexes are also included.

The report acknowledges that there is a fair amount of uncertainty about the regional distribution and the pattern and timing of climate change as manifest in temperature and precipitation. Sensitivity and adaptation are the two core concepts upon which the Report rests; in this way, the vulnerabilities of specific systems and regions are highlighted. As an example, Africa was judged in the report to be one of the most vulnerable regions to change, in part due to drought, inequitable land distribution, overdependence on rain-fed agriculture, and widespread poverty. Adaptation will be held back by infrastructural and institutional impediments. The difficulties for three sectors in Africa - agriculture and food security, settlements, and human health - illustrate these concepts clearly.

Adaptation is strongly highlighted in the report as requiring much more attention than received to date, both with respect to research as well as assessments. Economic growth cannot be expected to permit everyone to adapt by allowing all to grow out of the problems created by climate change. Since not all societies are going to experience growth, technology and resource transfer will be essential. Recognition of the benefits of adaptation other than in respect to climate change is also needed.

The issues of impacts and adaptation will be an important component of the Third Assessment Report, which will rely on the Canada Country Study as well as similar assessments in other countries as basic inputs.

U.S. National Assessment

*Paul Dresler
Chairman*

U.S. National Assessment Working Group

The U.S. National Assessment of the Potential Consequences of Climate Variability and Change for the United States -- its environment, economy, and society will be conducted under the auspices of the U.S. Global Change Research Program (USGCRP). The USGCRP was established through the Global Change Research Act of 1990 (P.L. 101-606) and mandated through the statute with the responsibility to undertake scientific assessments of the potential consequences of global change for the United States. The first National Assessment will analyze and evaluate what is known about the potential consequences of climate variability and change for the United States over the next 25-30 years, and also over the next 100 years.

In order for the assessment to focus on the issues of most importance to the United States -- its environment, economy, and society, the national assessment process will involve a broad spectrum of stakeholders from state, local, tribal, and federal governments; business; labor; academia; non-profit organizations; and the general public. The assessment is founded on the principles of scientific excellence and openness, and will be integrative and iterative. Fundamental questions that are to be addressed through the assessment include: (1) What are the current environmental stresses and issues for the United States that form the backdrop for potential additional impacts of climate variability and change; (2) How might climate variability and change exacerbate or ameliorate existing problems; (3) What coping options exist that can build resilience to current environmental stresses, and also possibly lessen the impacts of climate change; and (4) What are the priority research and information needs (near- and long-term) that can better prepare policy makers to reach wise decisions related to climate variability and change?

The national assessment will be comprised of three components: (1) National synthesis. This report will be both synthesis and summary of sectoral and regional analyses, studies, and workshops combined with additional quantitative analysis to provide an integrated national assessment; (2) Sectoral analyses. These analyses will consider potential consequences on major economic sectors such as agriculture, forestry; environmental sectors such as the coastal zone; and societal sectors such as human health, water resources. These analyses will be quantitative and national in scope; and (3) Regional analyses. Regional analyses will characterize potential consequences of climate variability and change on the specific geographic regions identified -- their environment, economy, and society. There are twenty regions covering the nation with some degree of overlap to encourage dialogue among the regions. The regional analyses will be performed by teams of experts from both public and private sectors and the spectrum of stakeholder communities within the regions. At a minimum qualitative analyses of the potential consequences of climate variability and change will be conducted by the regions.

To facilitate comparison, integration, and synthesis of each of the assessment components, all regional, sectoral, and synthesis analyses will use a common set of scenarios for climate change and changes in socio-economic conditions.

Specific responsibilities have been defined for oversight of the components of the national assessment and for coordination activities. A National Assessment Synthesis Team (NAST) will provide overall intellectual oversight of the national assessment process and has responsibility for the development of the Synthesis Report. The NAST members are drawn from government, academia, and

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the private sector. A National Assessment Working Group under the auspices of the USGCRP has lead responsibility for organizing and sponsoring the sectoral analyses and oversight and coordination responsibilities for regional analyses. A National Assessment Coordination Office has been established to facilitate coordination of the entire national assessment process.

The National Assessment Synthesis Report is targeted for completion by January 1, 2000 and is intended to serve as part of the U.S. contribution to the IPCC Third Assessment Report. Further information about the U.S. National Assessment is available over the Internet at <http://www.nacc.usgcrp.gov/>.

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PANEL SESSIONS

In the afternoon of the first day, a series of five panel sessions began and continued until the middle of the afternoon of the second day. These sessions were intended to present specific results from the individual regional, sectoral and cross-cutting papers completed by CCS participants as well as to introduce some stakeholder perspectives on such results. There were five such sessions in all, each lasting about an hour and a half. The topics used to focus the sessions were:

- Natural environment (water resources, wetlands, terrestrial and aquatic ecosystems)
- Sustaining food and fibre production (agriculture, fisheries, forestry)
- Social and economic well-being (human health, tourism and recreation)
- Protecting infrastructure (built environment, insurance)
- Maintaining vibrant industry (energy, transportation)

Each panel comprised two or three sectoral paper authors, one regional report lead author, one or two cross-cutting issues paper authors, and one stakeholder. The first panel was moderated by Bob Stewart (Canadian Forestry Service, NRCan), the second and third by Barry Smit (University of Guelph), and the final two by Joan Masterton (Atmospheric Environment Service, Environment Canada). Each moderator had an opportunity to summarize the key issues arising from his or her session(s).

Natural Environment - Panel 1

Moderator: Bob Stewart, **Speaker:** Richard Robarts

Panelists: Linda Mortsch, Hague Vaughan, Eric Taylor, Tony Diamond, Kenneth Cox

In the Summary for Policy Makers (SPM), two foundation blocks were identified: natural ecosystems and water resources, and these were grouped under the Natural Environment category. The lead speaker, **Richard Robarts**, spoke about the impact of climate change on wetlands, which constitute 14% of Canada's land area, highlighting Prairie wetlands. Canadian wetlands, which are important to many ecological processes as well as having strong socioeconomic value, are a largely understudied group that has diminished in size by 60% in the last 25 year period.

Beginning the first of three national presentations, **Linda Mortsch** gave a summary of the implications of climate change for water in Canada, noting some of the impacts in terms of hydrology and water use, and then identified some gaps and adaptation strategies that are required. Mortsch noted that more work needs to be done on potential water resource impacts in Atlantic Canada and the Eastern Canadian Arctic on a regional level, as well research on extreme events, and groundwater resources. Mortsch then raised adaptation questions such as what economic instruments could be used to make people more responsive to the water system and conservation, as well as how to include adaptation to climate change in river basin management and planning.

Examining the potential impacts of climate change on terrestrial ecosystems and the link to altered landscapes, **Hague Vaughan** stressed that such alterations would impact the social and economic values associated with those ecosystems. Shorelines are particularly at risk under climate change, and hydrology issues are paramount with more channels and dredging needed. Vaughan noted that one of the significant

areas requiring attention is that there is no equivalent mechanism for making policy decisions at a landscape level, and that interjurisdictional, interdisciplinary area studies are crucially needed.

Focussing on unmanaged ecosystems, **Antony Diamond** noted that knowledge of the impacts of weather and climate on wildlife tends to be incomplete and that understanding the competitive and predatory interactions between populations, and how these will alter in response to climate change, will be important in understanding impacts. Diamond named the polar bear and caribou as species that might be particularly vulnerable to climate change. He suggested that an ecosystem approach would be the best overall strategy to employ to understand and mitigate impacts of climate change on wildlife.

Eric Taylor highlighted some of the impacts of climate change on the natural ecosystems of British Columbia and the Yukon, an area with both distinct geography and topography. After outlining anticipated changing climate conditions, Taylor identified potential impacts and knowledge gaps. Water resources and hydroelectric power, fisheries, agriculture and the forestry industry are expected to be greatly affected and more research is needed in these areas.

Kenneth Cox outlined the activities of the North American Wetlands Conservation Council (NAWCC), the primary role which is to administer and deliver the North American Waterfowl Management Plan (NAWMP) between Canada, the United States and Mexico. The plan is completely voluntary with tens of thousands of contributors, and takes an ecosystem-based approach setting certain population goals that are translated into waterfowl habitat on the ground. Much of the plan focuses on wetlands systems on a landscape basis. The plan is intended to be expanded in 1998, including a “current challenges” section. Cox reported that one of the biggest challenges is the increase in poultry consumption in Southeast Asia which has created a larger demand for grain that is putting more pressure on the Prairies and the Great Plains areas to drain more wetlands. Climate change in these areas would add another stress to these ecosystems.

After speaking about the NAWMP, Cox noted that there were no particular policies in Canada in place regarding wetland communities and global climate change. This is partly due to the fact that much of the natural environment is either privately-owned or government-controlled and there are not many incentives or programs in place to encourage landowners to manage their resources more effectively. Governments should consider how they can best encourage the private landowner to be more actively engaged in the issue of climate change.

Cox said that the NAWCC was attempting to work towards stabilizing wetlands and watershed systems. He emphasized that while professionals were aware of global warming, increased education on a local level needed to be addressed. Cox suggested that all partners across North America should be brought together to formally indicate there is a major problem and to see what can be done to mitigate landscape impacts in the immediate short term.

In synthesizing the key messages that arose from the discussion following the panel presentations, **Bob Stewart** noted that one of the main considerations for the natural environment was its extreme sensitivity. This is complicated by the extent of that sensitivity as all of its components will react to different stimuli and be affected by climate change in different ways. Modifications within ecosystems will depend upon many factors including the magnitude and rate of change (which is generally unknown) and which may overpower the resilience of certain systems. Resistance levels of some systems are just now being reached and we are only beginning to see the effects. Part of the knowledge gaps result from incomplete ecological data sets, which, if they even exist, tend to go back no further than 30 years. Such data sets were not designed to deal with the global issues of today and thus may not help us to determine when

changes occurred, what was the actual change, what the current variability is, and so on. Monitoring networks, currently being reduced to meet fiscal requirements, must be made more effective. Another method that may help address uncertainties in how systems may react would be to consider other scenarios apart from the traditional 2xCO₂ scenario. We need to increase the breadth of our climate change studies, perhaps focussing on the impacts of climate variability, as well as looking more in depth at traditional climate change scenarios.

It is also apparent that while many of the ecosystems are seemingly independent, they are, in fact, also interdependent. The challenge, therefore, is to first try to understand what is happening between systems and then attempt to comprehend the synergistic effects when alterations are made to one or more systems. While much more work needs to be done to understand biological processes, there is also a need to get away from exclusively conducting single sector studies and move into multisector studies designed to consider interrelations between species, systems and various impacts.

Quite possibly the clearest and strongest (and most challenging) message that emerged from this panel session was the idea that human beings must adopt a more conservationist point of view. It will be necessary to consider the natural environment not as a resource but rather understand the intrinsic value that the natural environment has, in addition to the role it plays in supporting human systems. We can no longer approach it as being “out there” but rather in the loop of the human cycle, and that our activities are the single most forceful influencing power on ecosystems, particularly where land use is concerned. Falling under this outlook, current ecosystem management practices must be revised to become more wildlife friendly. We must realize that parks programs and selected case studies will not be enough to protect Canada’s biodiversity. Landowner incentives to preserve endangered and threatened species need to be put in place. Finally, Stewart acknowledged that none of these goals could be accomplished without a concentrated effort to move beyond targeting those persons and groups that are already actively involved and engaging stakeholders to pick up the gauntlet and join in the challenge.

Sustaining Food and Fibre Production - Panel 2

Moderator: Barry Smit, **Speaker:** Brian Shuter

Panelists: Mike Brklacich, Dave Martell, Ross Herrington, Beth Chalecki, Sheila Forsyth

Brian Shuter identified the primary impacts of climate change on fisheries. Water temperatures are expected to be warmer which will change the supply of fish. It is expected that there will be less inland and marine fisheries while there will be a growth in more coastal fisheries.

The warmer climate will have other effects. Freshwater supplies will decline due to increased evaporation, which will result in a decline in feeder streams, causing a drop in lake levels that will have a negative effect on fish and fisheries. Freshwater in Canada is also at risk due to rising sea levels, which in turn will cause coastal wetlands to disappear and salt water to invade freshwater areas.

The effects on Canada’s freshwater supply are not limited to these, however. The shallower and slower streams will cause a reduction in the fertilization of coastal systems. These will then cause a change in ecosystem production, population production and populations and species distributions which could mean net gains or losses depending on the fish species.

As far as trying to adapt to the changing conditions is concerned, it may be necessary to refocus the harvesting of species where production may increase under climate change. Currently unused and

underused species may have future value. It is important to reduce other stresses as best as we can to maintain aquatic ecosystems, such as reducing acid rain or other toxic deposition into habitats. Another adaptive measure is to actively accelerate the northward shift of southern fish species.

Shuter suggested that empirical demonstrations of likely climate change impacts with a comparison across space and time should be developed and that studies should focus on salmonoids which have a key sensitivity to climate change.

Mike Brklacich discussed agriculture and climate change, stressing a synthesized approach between the science and farming community. This approach would assist in identifying vulnerabilities, indicators and better identify possibilities for adaptation for farmers.

Dave Martell noted that climate change will have an incredibly diverse impact in British Columbia, likely resulting in the Boreal Forest being pushed farther northward. Although the consequences of such a move are unclear, it is anticipated that fires, tree diseases and pests will increase. A number of questions such as how to sustain ecosystem processes during the transition phase and how the forest industry will adapt rely on the development of an understanding of dynamic landscape management for answers.

As lead for the Prairies regional report, **Ross Herrington** discussed climate sensitivities, particularly in the southern parts of the region. It is expected that higher temperatures will offset increases in precipitation in the region. Agriculture, traditionally susceptible to climate change, will see decreases of 10-30% in wheat yields. Other terrain changes may see grasslands affected by a loss of soil organic material, a decrease in forage quality and increased fire frequency. More extensive irrigation, better pest management, and diversification of farming are areas that will require more attention.

Beth Chalecki reported on extraterritorial issues that examined the effects on Canada's interests outside the country including international trade, security (both food and military security) and environmental refugees. Much more work in these areas, along with attention to economic evaluation, is necessary.

Sheila Forsyth of the National Agriculture and Environment Committee (NAEC) explained that the Committee is a forum for farm leaders to work on environmental issues across the country. The NAEC has 22 different members covering all commodities, and in general farm organizations and other natural organizations dealing with forages, entitlement, etc. Their four priorities are: 1) biodiversity, 2) biotechnology, 3) climate change and 4) nutrient management and water resources.

The NAEC focuses on sustainability and takes into account the social, economic and environmental aspects of a holistic approach. In terms of climate change, the NAEC conducts work on vulnerabilities and opportunities. Because the farming community focuses less on adaptability and more on emissions reduction, this is a priority for the NAEC. Forsyth noted that there have been changes in crop regimes, with changes in fuel efficiencies which is of interest to a lot of farmers. They anticipate an increase in forages which will likely contribute to a reduction in greenhouse gas emissions in the future. A further interest of NAEC is in collaborating with Environment Canada and Agriculture Canada to produce an inventory of the technologies that farmers can use to reduce greenhouse gases which also have additional economic and environmental benefits, such as reductions in soil erosion.

As far as biodiversity is concerned, NAEC is looking at incentives and measures for private land owners to conserve habitats. As far as water resources are implicated, farmers see there are important pressures in ensuring water quality and water use. Potato farmers in Prince Edward Island have begun irrigating for

the first time over the last few years. Rights to water are likely to become an issue. Biotechnology has a focus right now on herbicide tolerant plants, although cold tolerant plants are being tested in the Niagara region this winter to see if they survive the winter.

Among the issues that worry farmers at the moment are the changing attitudes of insurance companies in providing a safety net and carbon taxes. More work needs to be done on how best to reduce greenhouse gas emissions, continuing research which will permit adaptation, maintaining soil quality and resources, and using a holistic approach to the issues. Education and awareness of climate change and its impacts are cited as the most important issue that NAEC is commencing to handle under its project ATMOSFARM, a joint project with Environment Canada and Agriculture and Agri-Food Canada.

Social and Economic Well-being - Panel 3

Moderator: Barry Smit, **Speaker:** Helen Fast

Panelists: Kirsty Duncan, Geoff Wall, Jim Abraham, Bob Bailey, Abdel Maarouf

Helen Fast discussed climate change and its implications for subsistence societies, focusing on Arctic and sub-Arctic communities. Fast found that while subsistence harvesting practices have traditionally sustained Northern communities, this way of life is becoming more difficult to pursue due to the influences of climate change. As a result, many aboriginal people are being forced to work in a wage economy to survive. For many aboriginals, the movement from a subsistence economy to a wage economy is not a viable option, largely due to the fact that there are no jobs in the relatively isolated circumstances in which the non-urban aboriginal chooses to live.

Fast noted that the wage economy and subsistence economy were not interchangeable as having equal value to aboriginal people. Pointing to the complex social structure of aboriginal communities based on kinship systems and close relationships with nature, their lifestyles are limited by the extent to which they are willing and can adopt the values of the majority of Canadian society. Attempting to quantify the economic value and the edible food waste of current land use patterns has proved to be a challenge.

The continuation of the aboriginal economy will be severely challenged by the anticipated effects of climate change on wildlife, vegetation, water and habitats. Such changes will also have more serious implications for the general well-being of these societies. The impacts of climate change on subsistence and land based economies falls into three categories: the distribution of animals and other resources, the use of traditional knowledge and the health of the northern population.

The loss of permafrost will disrupt drainage patterns, damage will occur to forests, and travel by hunters and wildlife will become more difficult and unpredictable. Fish and marine mammals, which comprise an important component of the subsistence economy, will be affected by changes in water temperature and circulation. With changes in forests, wildlife and waterfowl, as well as changes in animal distributions and behaviour becoming erratic and unpredictable, climate change will affect the use of traditional ecological knowledge (TEK) and will be an important social loss.

Finally, there are health implications for the native populations in terms of dietary dislocations and epidemiological changes. The loss of country foods, the possible transport of various contaminants to northern regions via a warmer climate (e.g., waste bacteria to move through sod soil) will contribute to an increase in cardio-vascular disorders, dietary problems, diabetes and vitamin deficiencies. Latent conditions have been shown to become acute or chronic when individuals are exposed to stress. These,

combined with the increased medical costs, suggest that serious study should be given to the implications for the health of northern populations.

Kirsty Duncan pointed to the direct and indirect effects on human health that climate change could cause in Canada. Duncan noted that the areas most susceptible will be large urban areas, particularly in southeastern Ontario and Quebec. Among the infectious diseases that are likely to become endemic due to an expansion northward of mosquito-bearing diseases are: malaria, yellow fever, tick-borne diseases and Rocky Mountain Spotted Fever. Extreme weather events such as heat waves will take their toll on the elderly and the very young. Duncan stated that regional climate impact studies on health are required, as are empirical research and urged that Health Canada consider climate change in its top 50 priority issues.

Speaking about tourism and recreation, **Geoff Wall** noted that this particular sector involves more dollars than other sectors in Canada such as forestry and mining, and that many factors are involved since tourism and recreation spans a variety of mountain, coastal, and wetland areas. Winter activities in the south may become limited as snow availability is reduced; however, this may create tourism and recreational opportunities for other locations further north. Recreationalists are generally very flexible in terms of adapting activities, but little is known as to the way people substitute activities, times and places. Wall noted that, to date, the tourism industry has shown little involvement and little interest in the climate change issue.

Jim Abraham considered the socioeconomic impacts of climate change in the Atlantic Region. Abraham suggested that very little research has been done on socioeconomic well-being in Atlantic Canada, although the region is very vulnerable, particularly where health issues are concerned. The economy of the area is highly dependent on natural resources, recreation and tourism, with a great deal of coastline vulnerability.

Bob Bailey of the Recreational Fisheries Institute of Canada (RFI), called for more research on exotic species as the ones that have arrived in Canada (e.g., sea lamprey, zebra mussels) have already caused some problems. Bailey also noted that studies should be conducted on the long-term impacts of climate change, especially on warm water fish species which are said to benefit in the short run. It is necessary to look at the long-term impacts to see whether the benefits will be lasting, reduced, enhanced or eliminated altogether.

The RFI has had success with its recreational national survey, which has shown that almost one in five Canadians pursued recreational fishing in 1990. RFI is a young organization (begun in 1993) but is interested in cultivating partnerships. Three years ago, the RFI began bringing provincial fisheries people together on a national level, resulting in a secondary meeting outside the Fisheries Ministers' Conference. Bailey suggested that Environment Canada would find support from both the private and public sector members of the RFI in attempts to address climate change, particularly with respect to fish and stream rehabilitation projects and preventative mitigation of the potential impacts of climate change.

Abdel Maarouf reminded participants of other integrated atmospheric issues such as stratospheric ozone depletion, acidic deposition, smog, air toxics/pollutants, and suspended particulate matter are related to climate change. As an example, Maarouf pointed to the IPCC 1995 assessment that indicated the depletion of stratospheric ozone is responsible for some climatic cooling. One information gap that could benefit from more research is on the net synergistic effects of climate change and other atmospheric issues on various systems.

In identifying the issues that arose from the panels on sustaining food and fibre production and social and economic well-being, moderator Barry Smit identified four issues that he heard recurring through the session presentations.

The first issue was that of climate impact assessment. While quite a lot of information had been discussed that dealt with resource-based activities such as fisheries, forestry, agriculture, etc., there seemed to be a real need to extend these to look at the sensitivities of the communities which rely on the activities. For example, instead of looking only at fish stocks, it is necessary to look at the Atlantic communities, Pacific communities, Great Lakes, etc., and identify the sensitivities or vulnerabilities of these communities to changes.

It is important to extend the Canada Country Study to look at longer term effects alongside the current problems, awareness of year-to-year variabilities that will prompt considerations of the extremes and sensitivities of systems, making climate impact assessments more rigorous and concrete.

There are a lot of uncertainties, and Smit noted that the word “uncertainty” is used in the media to inspire a “do nothing until things are more certain” approach in the general public. A better approach would be not to try to remove the scientific uncertainty, but to attempt to characterize it, and recognize it. Smit urged that scientists consider risks and begin to employ a language that better reflects what we do know in order to gain more support.

Finally, adaptation was used in two distinct ways in the panel presentations. The first is the more traditional use that we do something differently to avoid future problems. The other interpretation of adaptation is to include it as part of climate impact assessments. That is, if you are trying to estimate the consequences of changes and variations, you need to recognize how the system of interest would adjust or adapt autonomously. This is a type of adaptation that farmers use, and the result is that because they are used to climate variability, the perception is that there are no problems. Smit suggested that identifying these changes will be significant in convincing the public that there has already been adaptation to climate, particularly because of the costs involved. There are costs to climate adaptation, and it will be important to define, document, measure and articulate these costs. If we begin to take a rigorous and conscious approach to climate adaptation in preparing for climate change, on an ongoing basis, we will be much more successful.

Protecting Infrastructure - Panel 4

Moderator: Joan Masterton **Speaker:** Alan Dalgliesh

Panelists: Mark Baker, Angus Ross, Gérald Vigeant, William Hogg

Alan Dalgliesh spoke on the subject of the built environment. The construction industry accounts for 15% of the gross domestic product, employing about 900,000 people in Canada. A building’s lifespan is only about 15-20 years. The industry has very tight connections with the issue of climate and climate change as both a contributor to, and having to be prepared for, climate change impacts. For example, the industry plays a large role in greenhouse gas emissions as 30% of the fuel that is burned is used to heat and cool buildings. In Toronto, for example, cooling buildings now costs more than heating.

Dalgliesh noted that the industry relies heavily on the Canada’s National Building Code and that climate data from Environment Canada is helping to redesign the Code. In fact, the National Building Code

governs design regulations to include extreme events such as tornadoes, thunderstorms, hurricanes and other extreme events based on Environment Canada climate data and buildings must take into consideration wind-loads, snow-loads, and rain-loads. With these types of information, it is hoped that building lifespans can be increased. Dalglish said that demolition can also take large tolls on the environment, specifically with respect to landfills. Dalglish suggested that proper design, climate data, and the careful assessment of questioning “how long am I going to need this resource?” will help the industry prepare for climate change and reduce the need for constant renovations to existing buildings.

Mark Baker discussed the insurance industry’s perspective on climate change, noting that this issue, particularly with respect to extreme weather events, could destroy the industry as repeated events leave insurance companies no time to recover from previous losses. Other factors that influence the industry are the growth of cities, especially in areas deemed vulnerable due to extreme weather events, inadequately constructed or poor enforcement of the National Building Code and the broadening of insurance coverage by policies.

Gérald Vigeant provided highlights of the findings from the Quebec Regional report. Vigeant suggested that it will be necessary to adopt a “common” methodology to detect, compile and analyze the social, environmental and economic consequences of adapting to climate change, noting that coping with extreme weather events is the main source of concern. Vigeant also identified the research gap of trying to find methods of incorporating incremental or reduced risks into the planning and maintenance of existing infrastructure.

William Hogg noted that arguments concerning climate change are shifting from discussing *whether* humans are affecting the climate to *how* we are affecting the climate. As far as expectations of extreme weather events are concerned, it is most likely that the amplitude of the hydrologic cycle will increase, and the probability of heavy rainfall events is also increasing in some areas of Canada, while decreasing in others. It is not yet certain as to whether there will be an increase in wind storms. Hogg stressed the importance of maintaining monitoring capabilities for preparation for extreme weather events.

Angus Ross, Director of the Insurance Bureau of Canada and Chairman of the Reinsurance Research Council, provided more information on the insurance industry’s interests in climate change. Ross identified other factors impacting losses in the industry as being post-loss gauging, fraud, maintenance losses, and the ability of insurers to respond to repeated extreme weather events. These concerns are also detectable on a global basis. Ross showed numbers produced by Munich Reinsurance on great natural catastrophes. The definition of a great natural catastrophe is one which has an economic impact outside the country in which the catastrophe occurs. Although this includes earthquakes, such as the Kobe earthquake in the 1990s, they are generally infrequent and thus most of the list is composed of extreme weather events.

In the last seven years of the 1980s, eleven losses were reported through the Insurance Bureau of Canada that cost the insurance industry roughly \$423 million. Most of these events were precipitation events, with losses spent on general sewer back-ups, and failed infrastructures. In the first seven years of the 1990’s there was a five-fold increase in the cost and a four-fold increase in the frequency of extreme weather events, not including 1997. Included in this increase were: Quebec snow load losses (one February cost around \$30 million), a hailstorm in British Columbia cost \$18 million, and the Manitoba flood cost approximately \$20 million. The insurance industry accepts the IPCC findings that there will be more frequent and severe storms, floods, droughts and tornadoes. Heat waves and cold waves are not likely to cause serious problems for the industry.

Ross said that one way in which the industry is protecting itself is through reinsuring energy savings guarantees, financed by third party financiers with projected savings that will be attained by the owner. One such example is through the major school boards in Toronto, with another being undertaken in the First Canadian Place. Ross also noted that Emergency Preparedness Canada should be expanding its role to include mitigation investment that is used in other countries, including the United States.

Safer building techniques, safety partnerships, better coordination with government insurers, researchers, engineers, etc., along with a stronger research base with better data and targeted research will all assist in securing better insurance against extreme weather events. Community awareness is being promoted, insurance loss data needs to be made available and more programs such as the hail seeding program begun in 1996 in Alberta will all help to secure safety nets, as well as promote the industry.

Maintaining Vibrant Industry - Panel 5

Moderator: Joan Masterton, **Speaker:** Gilles Mercier

Panelists: Tim Bullock, Dale Rothman, Jean Andrey, Philippe Crabbé, Malcolm Wilson

Gilles Mercier gave an overview of the energy sectoral report for the Canada Country Study. Mercier focused on the major components of this sector (energy production, energy use), noting that he also addressed issues such as energy transportation and transmission in the report.

With respect to climate change impacts on energy production in the next century, Mercier stated that warmer temperatures in Atlantic Canada could have both negative and positive impacts for offshore production, although iceberg analyses are not consistent. It is possible that positive impacts could come from longer open water seasons allowing exploration and production activities in Atlantic Canada, although these benefits could be partially offset by more extreme weather events such as storms, more wave action and higher sea levels. Coal mining in the Rockies could be negatively affected due to increased erosion and occurrence of landslides.

Electricity production in Canada is very important and GCMs predict higher precipitation in certain regions, with lower precipitation in others. This leaves the question of what would be the overall impact for Canada. Northern regions of Quebec, Ontario, and possibly Manitoba and Labrador could see higher hydropower capacities due to increases in runoff. For example, facilities in James Bay estimated an increase of about 15%. How British Columbia hydro power would be affected, however, is unclear as the region might suffer due to glacier melt (which would decrease the flow rate) although increased river flows would be of benefit. There are many factors besides precipitation that govern energy production, making estimates of overall impacts for Canada even more complicated. Changes in climatic variables such as wind, cloud cover, etc. could affect the frequency and severity of major extreme weather events. This, in turn, would affect energy production from these renewable energy sources.

Mercier noted four examples of possible adaptation measures that might be adopted in energy production. He cited new construction and safety measures being implemented. However, the petroleum industry would not be willing to reduce their standards in the short-term because of the degree of uncertainty regarding the potential impacts of climate change, and would most likely adopt a conservative approach. There would be need for better management of water resources to prevent floods and to optimize water use. A potential water management conflict may occur in the Prairies with the need for irrigation increasing due to dry growing seasons. Thermal power plants will need to use more advanced technologies like a combined cycle system which requires less cooling water. Wind and solar energy

systems will need to be made more robust. As far as energy demand goes, it is expected that increased warming will result in the need for less energy for winter heating while summer cooling energy needs will increase. Based on rough estimates, a net energy savings in the residential and commercial sectors is anticipated for Canada, although the industrial sectors, specifically energy intensive industries, could be more vulnerable due to the decline of hydro power capacity. The transportation sector, a big user of energy, may see a decrease in fuel demands with global warming, but this may be offset by the greater need for air conditioning and food refrigeration in the trucking industry.

Adaptation options for these impacts include: new building codes that would incorporate the reduced demand for heating in the residential and commercial sectors. We could also see a modification of the fuel mix across Canada and an increased use of renewable energy sources.

Mercier noted that information on climate change impacts in the energy sector is scarce, and felt that the next step for the Canada Country Study should be to adopt a better integrated approach.

Tim Bullock discussed some of the concerns regarding energy, industry and transportation from the Ontario Regional Report. He noted that water will be one of the biggest issues for Ontario, particularly in the Great Lakes region, with demands on cooling processes in homes, transportation, aviation, ships and industry. Bullock identified a major data gap regarding climate change impacts in Northern Ontario. Also, apart from recent climate change research conducted for the Great Lakes region, many studies for the rest of Ontario are out-of-date. As far as second order impacts of climate change are concerned, the explicit realization of the Great Lakes as water bodies in GCMs is needed. It will also be necessary to maintain a climate monitoring network in Ontario to prepare for extreme weather events.

Jean Andrey recognized that transportation is very important to the well being of Canada. While the transportation industry accounts for only 4% of Canada's GDP, it is part of our social structure. Andrey noted that while there are a few specific studies on climate change impacts related to transportation, the big industries and growth sectors such as trucking, air, roads, passenger vehicle, etc. have not been adequately studied. Andrey dispelled the myths that heat stress would lead to road buckling and that there would be significant damages to rail beds because of permafrost thaw. Andrey encouraged more studies be conducted related to climate change impacts on aviation, and also how to incorporate planning for extreme weather events. In addition, Andrey suggested that there is a need to break away from the artificial separation between adaptation and mitigation work as it relates to transport and start talking about developing transport systems that reduce vulnerability to climate today and in the future.

Philippe Crabbé considered the interprovincial trade issue, noting that the data and its reliability were sometimes questionable, although Statistics Canada is remedying the situation with a project to improve provincial economies data by the year 2000. About 16% of trade in Canada is interprovincial, with the territories having the largest component. The benefits of climate change, from an economic point of view, are likely to be reaped in the north of Canada with the costs likely to be borne by the south. Water is anticipated to be a large issue, with needs increasing in the south of the country. Crabbé noted that the "precautionary principle" should be enforced, as well as the "irreversibility principle" in approaching the climate change issue.

Malcolm Wilson, Director of Energy Development with the Saskatchewan Energy Department, focused on the regional aspects of energy and how the energy sector is looking towards adaptation. Climate change has the potential to change peak energy usage. While we currently have a winter peak usage, due to heating requirements, this could change with a warmer climate to having greater cooling demands and thus a summer energy peak.

Wilson noted that the energy sector relies to a large extent on decisions made in other sectors, therefore adaptation decisions made by these sectors will have impacts on the energy industry. For example, changing agricultural patterns and a changing rural landscape in Saskatchewan will have impacts on the energy distribution network and infrastructure that is currently in place. Wilson noted that there is a great deal of emphasis placed on mitigation rather than adaptation as it is hard to engage the decision-makers within the energy sector in the issue of adaptation, much less its benefits and pitfalls. Energy facilities generally have a life time in the order of 50-60 years, making it important to engage consideration of adaptation now in order to ensure they are capable of coping with climate change throughout the facilities' life span instead of it being incapable or out-of-date too soon.

Dale Rothman presented the findings from the “Costing Climate Change: The Economics of Adaptations and Residual Impacts for Canada” paper. Rothman noted that it is virtually impossible to guess at what the costs of climate change will be to Canadians. He offered the challenge of questioning whether economic numbers provided actually capture enough of the impacts, particularly since many sectors simply adapt instead of assigning a specific cost to what they see as necessary changes.

In identifying the issues that arose from panel sessions four and five, moderator **Joan Masterton** emphasized how very important it is to have reliable climate and other data, not only for Canada, but also on an international level. The scientific community is being asked to reduce uncertainty, but we are given less data, fewer facts and less information as governments and budgets are being downsized. We cannot properly begin to understand the extent of climate change, nor begin to adapt to it in the best manner possible, without better information.

There seem to be a number of opportunities for action that can be undertaken now which, moreover, appear to have little or no cost. Among these are renovations, relating to the capital turn-over issue that is significant when talking about mitigation and timing for mitigation activities, etc., upgrading and enforcing the National Building Code, and extending this to land use, planning, local zoning issues and so on. Other opportunities for action can be found in the examples of hard dollars saved in cloud seeding, and other insurance industry projects. There are some benefits to be had if we begin to take an integrated approach to the issues.

The most important opportunity, however, is that people are motivated to action now. We have to begin to dispel some of the myths surrounding climate change impacts for Canada. Communication, talking clearly to the public, being realistic in predictions and expectations is an on-going process, and a vital tool for climate adaptation that can be extended to the politicians and policy makers and hopefully will make actions come together more quickly.

Finally, the panels addressed the value of things and how people, the environment, GDP etc. are defined. These issues all require much more than traditional thinking and also require a collective effort if we are to look forward to the future, learn the language of other disciplines and break out from overly specific unrelated studies to address the new issues and reflect new values and economics.

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BREAK-OUT GROUPS SYNTHESIS

The Break-Out Session

A two-to three hour session of break-out groups was held on the afternoon of the second day of the Canada Country Study Symposium. The groups were charged with:

- addressing both the communications and research gaps arising from the Initial Assessment Phase (formerly Phase I) of the CCS
- sketching a generic outline identifying the important components that should be addressed in the Response Phase (formerly Phase II)

The make-up of the groups was based on sectors or communities - in this case, government, academic, and stakeholder. In total, nine groups were planned with approximately a dozen people from the total list of symposium attendees assigned to each. As it turned out, two of the groups merged with others so that seven break-out groups resulted.

Synthesis of the Content of the Break-Out Reports

All seven groups touched on both of the issues with which they were charged. The degree to which they addressed the two issues differed from one to another, but there was substantial agreement on the main points which were highlighted by each group.

Initial Assessment Phase (IAP)

Introduction

It was generally felt that the Initial Assessment Phase (IAP) met its objective of synthesizing existing knowledge of climate change impacts and adaptation for Canada. A growing network of climate change researchers has also developed out of this Phase, which provides a solid foundation from which to begin the Response Phase. It was, however, noted that stakeholder participation was limited during the IAP and should be broadened in the next.

Research

From the research included in the IAP, it was felt that the first order impacts were well documented and better understood than the second and third order impacts. These second and third order impacts include the social and economic ramifications of climate change, many of which are at the earliest stages of study. As well, the details of impacts at regional and local scales are still rather uncertain and improvements are needed before specific policies can be tailored. Included in the need for future research is the role of adaptation, as the strategies in the IAP remain vague and very general. Since that Phase was a culmination of existing research, gaps such as second order impacts, local scale impacts and adaptation strategies are all areas to be considered in the Response Phase. It was thought that the IAP results could have been more integrated through increased coordination between the research activities.

It was also thought that mitigation and adaptation need to be clarified and linkages between these two similar but different areas must be established. Also the need for cumulative and integrated impact assessments involving issues other than climate change should be the next step.

Communications

The IAP provides solid information from which to develop a communication plan to include the general public, NGOs and stakeholders in industry and governments. This communication initiative should be carefully tailored to specific target audiences. It is important to communicate the climate change issue as well as to discuss possible adaptation strategies to change. Care must be taken that identification of impacts winners and losers does not become divisive.

Response Phase

Organization

The response phase of the CCS should focus on early involvement of government at all levels, business and industry associations, NGOs, academics (both natural and social), and religious groups. Particularly important will be engagement of stakeholders, locally impacted communities, and young Canadians.

The approach to implementing this Phase would be contingent on the outcome of the CoPIII meeting in Kyoto and a lead coordination role was suggested for Environment Canada (EC), possibly the CCS Secretariat. Other coordinating bodies could be the Royal Society of Canada, the Canadian Climate Program Board, or a university research chair or centre of excellence. The Response Phase would not be EC-driven but depend upon a wider spectrum of interests for impetus, including the 4 federal natural resource departments as well as those communities of interest expected to be directly affected by the impacts of climate change and variability. Thus it would be more independent of government than was the IAP.

Both research and communications are seen as vital components of the CCS Response Phase and both need to have involvement of stakeholders and regional groups as partners. Incentives may be needed to ensure this. The exact make-up of these components should reflect how their results are expected to be used at the end of the Phase. The general philosophy should be to promote an integrative approach, possibly following watersheds or even political boundaries. Thus, single sector work may be de-emphasized except where lack of knowledge would compromise integrative work. In general, priorities to be addressed should possibly be determined on the basis of three criteria: (a) aspects where decisions made in the short term would have long-term consequences, (b) aspects where threshold values for damage would be exceeded much more often due to climate change, and (c) areas where a difference can be made over the next few years.

It was suggested that in the Response Phase, both adaptation and mitigation should be considered as part of a broader response framework, with emphasis on doing what is sustainable and appropriate in any case. The term “adaptigation” was coined by one of the break-out groups as indicative of this broader response.

Research Component

The research component of the Response Phase should take a systematic approach and define a set of working rules or guidelines so that all participants are clear as to expectations and as to the “big picture” into which their work fits. For participation, priority should be considered for both those who were involved in the IAP or related climate change efforts, and activities which meet certain criteria such as significant stakeholder involvement. The latter is a reflection of the need to determine priorities for research by a carefully planned process involving both stakeholders and researchers and emphasizing a regional approach which builds on existing structures and engages people who will be affected in actual research projects. A major concern is the desirability of directing research to the provision of more useful information for Canadians - in other words, answering the “what can we do now?” question.

Important bases for Response Phase research will be data and scenarios. There is a need to facilitate greater access to existing climatic, ecosystem and socio-economic data, and in some cases network restoration is warranted. Realistic scenarios should be used (e.g., not EERE - Everything Else Remains Equal) and should focus on a continuum of 10-year periods.

Research should address both the impacts of and response to climate variability and change. In terms of the impacts area, there is a general need to look across the whole time scale from the historic to present to the short term (next decade or two) to the longer term (next 100 years); this is partly related to distinguishing between climate variability and climate change. With respect to response options, evaluation of the social acceptability and economic viability of potential response options and strategies for implementing them will be an important aspect of the needed work.

The following lists some of the priority areas for research:

- water
- ecosystem sensitivity, response and associated socio-economic effects
- urban issues
- human health
- integrated air issues
- costing (both overall and broken down to regions and sectors) and then developing a framework that balances costs, benefits, risks and uncertainties
- TEK (traditional ecological knowledge)
- adaptation process

Case studies focussing on extreme events were favoured as an important tool for addressing some of the needed research. One case study approach of potential value would involve tracking one commodity from cradle to grave in relation to climate change impacts on production, distribution, consumption and recycling.

Although little time was devoted to identifying specific research deliverables, the following suggestions were made:

- Research results that can be presented with a high enough level of confidence for decisions to be made. (This may mean looking further at areas where a lot of work has already been done, to the detriment of areas where substantial gaps exist.)
- A set of indicators that the public can use to define climate change.

- By the end of 2000, a set of climate scenarios for each decade with a focus on the distribution of extreme events.

Communications Component

The communications component of the Response Phase should be aimed at both improving public education on the climate change impacts issue as well as engaging all stakeholders (governments, industry, general public) in active response options. A comprehensive strategy for this component is needed and may involve partnerships and varied educational approaches, emphasizing strongly message content and style. There should be a marked local or regional flavour to such a strategy. A clear determination of who the messengers are should be made.

Partnerships with all levels of governments and with private sector stakeholders should be promoted through delivery of targeted messages based on the results of the IAP. Unorganized stakeholders such as the poor and elderly need to be remembered.

Varied educational approaches could include reports and information pamphlets based on them, technical fora or seminar series focussed on the IAP results, an updated CCS website, information expressed in terms of risk management rather than levels of uncertainty, and the piggy-backing of CCS messages on other local environmental initiatives/activities.

CCS NATIONAL SYMPOSIUM

BREAK-OUT GROUPS REPORTS

REPORT OF BREAK-OUT GROUP 1 (GOVERNMENT)

Chair: Paul Egginton, Natural Resources Canada
Rapporteur: Roderick Shaw, Rodshaw Environmental Consulting Inc.

Note: the opinions expressed in this report are those of the break-out group as a whole.

1. Matters addressed by Break-out Group 1

As in the case of the other groups, Break-out Group 1 addressed the following two main issues:

1. The communication and research gaps in Phase I of the Canada Country Study.
2. A generic outline describing the important components that should be addressed in Phase II of the Canada Country Study.

2. Break-out Group 1's Understanding of Phases I and II of the CCS

The Group spent some time making clear in their own minds the differences between Phases I and II of the CCS, and the difference between “adaptation” and “mitigation”. Phase I was understood to be a synthesis of existing knowledge on climate change in Canada (particularly impacts on and sensitivities of various ecosystems), while Phase II was understood to involve a prioritization of the various issues related to climate change that might require adaptive action, and the research that would be required to support the adaptive action. It is obvious that there are many potential impacts of climate change in Canada; lack of resources will therefore require us to concentrate on adaptive actions applied to those ecosystems that are most vulnerable to climate change.

Although it was not meant as a criticism, Phase I was seen by the Group to be relatively unsystematic (perhaps because it was a synthesis of information over a broad range of ecosystems), while Phase II affords us to be more systematic in that it will require us to be more focused through the prioritization of ecosystems and sectors requiring adaptive research and measures, and to combine the efforts of government, academia and stakeholders in the community at large.

There was some discussion among the Group about the meanings of “adaptation” and “mitigation”. It was agreed that there was a fuzzy boundary between the two concepts. Mitigation was actually seen by the Group to be a general term applying to all actions intended to reduce the effects of increasing greenhouse gasses in the atmosphere. In the relatively long term, “pre-emptive” mitigation is the reduction of greenhouse gas concentrations through reductions in emissions. This appeared to be the meaning of “mitigation” used at the Symposium. “Adaptive” mitigation, or “adaptation” as used at the Symposium, is the reduction not of greenhouse concentrations, but the adverse effects of these increased concentrations on ecosystems. In any event, the Group agreed that it was important to establish the linkages between mitigation and adaptation; the public’s interest in adaptation would be increased through these linkages.

3. Perceived Gaps in Phase I of the CCS

Communication was seen by the Group as a obvious gap in Phase I; it was agreed that Phase II of the CCS must be open and transparent to the public. Because adaptation will involve the public at large, Phase II will not be a success unless the correct imagery is used to “grab” the public’s attention. One possible area of research in Phase II would be to answer the question; “ *What means of communication will make climate change meaningful to Canadians and will expand their consciousness in order to make adaptation more acceptable?* There are many everyday actions such as purchasing of outer clothing and the planning of vacations that Joe and Jane Public may not realize are climate-driven.

Some possible approaches to communication in Phase II that were brought up within the Group were:

- studying the examples of NGOs who have been successful in increasing public awareness and mobilizing action
- using the approach of case studies and scenarios to educate the public.

4. Some Priorities for Phase II of the CCS

The Group agreed that the priority issues for Phase II would satisfy at least two criteria:

- 1) They would be aspects where decisions made in the short run would have long-term consequences.
- 2) They would be aspects where threshold values for damage would be exceeded much more often because of climate change.

With respect to the latter criterion, changes in climate variability may require more adaptive action than changes in mean climate values. Canadians are accustomed to dealing with climate variability up to certain thresholds (it is part of the Canadian identity!), it is when these threshold values are exceeded that public concern will be raised. For example, spring flooding is not uncommon and is even expected; an increase due to climate change in extreme flooding such as that experienced in the Red River Valley in the spring of 1997 is a cause of great public concern. Adaptive measures such as those undertaken by the City of Winnipeg did much to prevent even more damage that actually occurred.

Other examples of threshold values that were brought up within the Group were the possible disappearance of winter ice cover in northern Canadian waters (perhaps bringing on a problem with sovereignty), and the melting of permafrost in the Arctic (requiring the re-construction of buildings presently supported by the permafrost).

5. The Need for an Integrative Approach in Phase II

It was recognized by the Group that climate change was only one of many stressors on the human and natural environments. There are many sectors of the environment, each of which may be linked to several others and each of which may be stressed by different atmospheric conditions such as acidic deposition or tropospheric ozone, in addition to climate change. The Group agreed that work in Phase II would be best served by sectoral integration in meaningful geographical areas such as watersheds or even political units. It makes more sense to integrate various components of physical and biological research than to carry out each component separately. In Phase II, research in a single sector such as transportation or agriculture should be de-emphasized unless there is a lack of knowledge in a particular sector that would retard the

integrated work. A multi-sectoral approach would promote interaction among interested stakeholders, including those in the public-at-large, because the work may be seen as being more useful for a variety of particular interests.

Integrated modelling or other systems approaches may be useful in Phase II, although the Group realized that the use of overly complicated models and analytical tools could be counter-productive, especially to effective communication.

6. Who should be Involved in Phase II?

The Group agreed that the following should be involved in Phase II:

- Governments at the federal, provincial, territorial and municipal level. Climate change will manifest itself on the national, regional and local scales; adaptive measures will have to be undertaken by governments at all three of these scales.
- Business and industry associations. These should be represented by senior officers capable of making commitments.
- Non-government organizations. Advantage could be taken of NGOs' experience in communicating with the public.
- Religious groups.
- Teachers. This group would be useful in developing educational material.
- Academia. This group would include not only natural scientists but social scientists as well. Especially important would be the inclusion of economists whose input into Phase I was limited.

7. Who Should Lead Phase II?

It was the consensus of the Break-out Group that Phase II should be led by the four federal natural resource departments: Environment Canada; Natural Resources Canada; Fisheries and Oceans Canada; and Agriculture Canada. Advantage should be taken of experience in the United States with their Global Change Research Programme. Phase II should also be linked in Canada with the National Round Table on Sustainable Development whose members are at the CEO level. The National Round Table is concerned mainly with mitigation; it is essential to link adaptive measures with mitigative measures.

Respectfully submitted,

Roderick Shaw
Rapporteur
Break-out Group 1

REPORT OF BREAK-OUT GROUP 2 (GOVERNMENT)

Chair: Eric Taylor, Environment Canada, Pacific and Yukon Region
Rapporteur: Jacinthe Lacroix, ACLIQ

Goal 1: Communication and research gaps

At the beginning of the discussion, it was decided to separate the point into two: one for the research aspects and one for the communication.

Research gaps:

Since many of the persons present didn't have the chance or the time to read all the regional reports, it was agreed that we should not lose too much time on that issue. After all, the research gaps are supposed to have been clearly identified in the different regional reports. Nevertheless, it was mentioned that because of severe time restraints on phase 1, some information was not included in the reports and should be taken into account in phase 2.

Communication gaps:

A lot of discussions focussed on that issue, mainly because people agreed that the tremendous amount of work done in phase 1 should be broadly disclosed by any means, but clearly, simply and effectively. Showing around the results contained in the phase 1 reports is a prerequisite to engage more partners in phase 2. In summary, the two main communication gaps that were identified are the following:

- There was a misrepresentation of phase 1 in media: they reported essentially on “what’s going to happen” and, most of the time on the bad side of things and never realized that the reports were a summary of the actual state of our knowledge on climate change.

To correct that situation it was proposed that the media, in every region, be invited to a special presentation where the objectives and the results of the Canada Country Study could be explained properly. The regional authors should lead those presentations, joined by sectoral authors if need be.

- Phase 1 of the Canada Country Study (CCS) must not end with the National Symposium. A communication strategy must be put into place in every region to communicate the phase 1 results to different groups, from senior managers and stakeholders to the general public. The information about GHG and the trends and impacts of climate change, variability and extremes should be tailored to the different audiences. After all, to engage in the debate, people have to understand the actual state of knowledge and what are the trends.

To do so it was proposed to use every means available, like:

- forums and meetings
- Web site - on that point it is suggested to remove the password from the current web site and to update that site

- wide distribution of the plain language summaries to libraries, research centers and of the full reports to federal, provincial and municipal agencies and major private stakeholders. All this should occur at no charge!

Again, regional authors should lead those initiatives, helped by the sectoral authors and Environment Canada, the latest with some funding. Even if time and resources are tight, a special effort must be done in the next weeks and months to get the results of the CCS out.

Goal 2: Outline of CCS phase 2

For that second part of the discussion, most of the sayings pointed in one direction: phase 2 of the CCS must be attractive to other groups of interest in addition to the ones implicated in phase 1. To attain this objective, the following steps are proposed:

Step 1:

In every region, along with the distribution of the full reports, a letter of invitation to forums and/or meetings must be sent and, when possible, personal contact must be established with the targeted people. In those forums/meetings, regional and sectoral authors will present and explain the results of the study; all the explanations must be tailored to the targeted audiences. The aim of those meetings is to sensitize the people in such a way that they will be interested to participate (in-kind and financially) in the design and realization of phase 2. They must clearly understand what is at stake, in their own sector, in terms of impacts related to climate change, variability and extremes.

Phase 2 of the CCS cannot be done by the same small group of persons that worked on the Phase 1. Also, all the recommendations made in the sectoral and regional reports cannot be answered in a short period of time or even in a longer one. So, the approach for phase 2 must consider reasonable objectives within a time frame of about 2 to 5 years, no more. We should consider how the results of phase 2 could be needed for “Kyoto 2” (COP4) and for the IPCC 3rd assessment. A goal like Kyoto 2 (COP4) could be a reason for manager involvement.

Step 2:

With the people that demonstrated an interest at the forums/meetings, another forum or a workshop, leaded by the regional and sectoral authors could be launched to:

- identify and clarify regional and sectoral priorities for climate change research (including variability and extremes) with multi-stakeholder involvement, on the sectors where adaptation is possible and taking into account the time scale of the sector (e.g., agriculture can move fast, forestry not so much, so here you have two sectors with different priorities considering the rate of climate change).

At that point, it is important to focus on realistic issues where something can be done within a 2 to 5 years time frame. Also, the efforts must be put on adaptation tools that can be built in a short time, which means flexibility. We have to make a list of the things we expect, reasonably, to be done and concentrate on things that will be useful and usable for the stakeholders. And, never forget the resources limitations (\$ and people) to do the work.

- address the question of “values”, monetary and non-monetary, to identify how to get a more serious idea of the total costs of impacts and adaptation strategies; this must be done for all sectors and regions to see if its worth adapting.

NOTE:

- economists and scientific researchers must work together on that aspect.
- ask the different sectors: what kind of adaptation strategy is already in place in their sector and how can those strategies also be used in a climate change context (e.g., water issue). This is a way to ensure that existing or planned studies (e.g., irrigation project in Alberta) incorporate the climate change issue.

Recommended research goals for Phase 2

Even if the group did not want to address the research gaps of phase 1, many suggestions about what should be done in phase 2 were made. Thus:

- large integrative strategies that include climate change in their plans should be put in place (e.g., freshwater strategy, food resource plan, coastal zone management plan). Environment Canada should be an important player (like provide for free data), but not necessarily the leader; those are multi-partnership initiatives and responsible agencies should take lead on their sector.
- more detailed research of climate change, variability and extremes, in terms of impacts and adaptation for:
 - ❖ water resources (very important for many sectors and regions)
 - ❖ built environment
 - ❖ extreme events (partners: CMHC, EPC, Provincial Emergency dept., insurance and reinsurance companies).
- better regional climate models that use “climatic indicators” and can forecast climate at different time scales.
- in the different sectors, more impact models that incorporate climate (e.g., fisheries - fish assessment models incorporating climate, oceanographic and hydrological variability; forestry, ecosystems); we need a better understanding for better adaptation. Agencies with these responsibilities need to take this on phase 2.

REPORT OF BREAK-OUT GROUP 3/4 (GOVERNMENT)

Chair: Elaine Wheaton, Saskatchewan Research Council
Rapporteur: Dave Broadhurst, Environment Canada, Ontario Region

Report summary prepared by: Lorraine Craig, Environment Canada, Environmental Adaptation Research Group

The break-out groups were directed to address two primary goals: (1) determine the research and communication gaps of the Canada Country Study and (2) identify the main research and implementation components of Phase II of the Canada Country Study. This break-out group was the product of the amalgamation of the original groups 3 and 4.

The break-out group began by assessing the present situation surrounding the Canada Country Study (CCS). These discussions were used as the basis for exploring the gaps from Phase I, and the key components and associated implementation strategy for Phase II. The discussions were structured according five major areas (1) taking stock (2) desired outcomes of Phase II of the CCS (3) research gaps (4) communication gaps and (5) implementation strategy for Phase II.

1. Canada Country Study: Taking Stock

a) Strengths of the Canada Country Study

The participants were generally quite positive about what had been accomplished through the Canada Country Study thus far. One major strength of the CCS was its capacity-building function, as participating individuals and organizations are now more knowledgeable about the impacts of climate change on Canadians and our adaptive capabilities. In addition, through collaboration on the various regional and sectoral studies, a network of diverse climate change impacts and adaptation researchers was formed. This provided a research team and results for building our knowledge base and communication efforts on Canadian climate change issues. The release of the results was well-timed, just prior to the Kyoto Framework Convention on Climate Change (FCCC) negotiations and provided a focus for Ministerial attention on the climate change issue from a Canadian perspective.

The reports and symposium served as a credible addition to the national discussion concerning climate change and adaptation. In addition, the CCS has also strengthened Canada's contribution to the IPCC assessment process. The Canada Country Study was viewed as a comprehensive and thorough review of Canadian climate change impacts and adaptation research, particularly given the time and resource limitations. The Study results provide a solid foundation for drawing conclusions about what is currently known and what questions remain to be answered. The results indicate that we know enough to be concerned about current and future impacts and that adaptation efforts are necessary. The Study identified knowledge gaps which provide research priorities for the second phase of the CCS.

b) Weaknesses of the Canada Country Study

While the CCS was praised for its comprehensiveness, some group members felt that further work needs to be done integrating the results of the various studies and communicating clear messages to the media, public and decision-makers. A number of documents were released over a short period of time which may have been overwhelming to those primarily interested in the key results and findings. It was suggested

that there is a need for another set of products (factsheets) containing only our key messages. Communication efforts should continue after the symposium is concluded.

The tight time frame for completion of the study was seen to impose a restriction on the extent of peer review of the results. A further weakness identified was regarding the limited extent of stakeholder participation in the study. The need for broader public participation, including climate change skeptics, was recognized as a way of building stakeholder issues into the research agenda and improving the credibility of results. While it was recognized that the overall intent of the CCS was to review existing literature, some members of the group argued that the results confirmed what was already known about climate change and did not reduce scientific uncertainties.

c) Opportunities surrounding the Canada Country Study

The CCS has helped to elevate the profile of climate change among the Canadian public, decision-makers and stakeholders. This provides the momentum for communication activities and scoping the next phase of the study. The results clearly indicate that all sectors of society are likely to be affected by climate change. The study provides a platform for information sharing among sectors and indicates that further work is required to develop an equivalent knowledge base among all sectors. There is an opportunity to continue research on impacts and adaptation from an integrated, ecosystem perspective. A solid information base now exists from which to move forward and communicate results in ways which are meaningful to specific groups of Canadians.

d) Potential threats to further progress

As the CCS was structured to examine impacts and adaptation to climate change on regional and sectoral bases, the potential exists to identify "winners" and "losers". It is likely that certain regions or sectors will benefit from climate change while others will largely suffer negative impacts. While the possibility exists for the results to be divisive, the group felt that communications should focus on identifying the overall net implications of climate change on Canada as a country.

A further potential threat relates to ongoing reductions in government funding. In order to understand climate change impacts, integration and coordination among various jurisdictions is critical. This becomes more of a challenge as government funding, and its associated ability to coordinate these activities is reduced. A framework for integration is necessary for Phase II of the research program.

The CCS was instrumental in developing a comprehensive information base on Canadian climate change impacts and adaptation. What is now required is a clearly defined action plan to map out the critical research needs for Phase II. Some members felt that strong action is needed to ensure that the research agenda moves forward and does not revisit the areas addressed in Phase I. Others however, viewed a periodic review process, similar to that undertaken by IPCC, as a valuable activity.

2. Identification of Phase II Outcomes

The next step for the break-out group was to attempt to establish a set of key outcomes for Phase II of the Canada Country Study. The group found it very difficult to define these outcomes and our discussion seemed to naturally gravitate towards examining the gaps from Phase I. The general discussion of the vision for the second phase of the Canada Country Study resulted in the identification of the following key remaining questions:

- We have a clear vision of the long-term effects of climate change, but what impacts are we seeing now and what responses can be expected over the next 5 to 10 years?
- How do we distinguish between climate change and climate variability? Are the ecosystem responses that we are currently seeing consistent with global warming?
- Over the past 100 years there has been seven periods during which the average national temperature has changed by at least 2 degrees Celsius. What impact has this had on ecosystems?

Some specific deliverables for Phase II were identified:

- A set of indicators (qualitative and quantitative) that the public can use to define climate change.
- By the end of the year 2000, produce a set of climate scenarios for each decade with a focus on the distribution of extreme events.

3. Research Gaps

A group brainstorming exercise to identify research and communication needs was undertaken both to ensure active participation by all group members and to identify priority research areas. Each group member was asked to record at least two research gaps on post-it notes and display them on a board where the group responses were discussed and arranged according to theme.

Several common research and communication themes were identified, resulting in a bottom-up approach to the identification of the key components of Phase II of the CCS. Research gaps were identified in 6 key areas (see Table 1):

Table 1. Summary of Research Needs for Canada Country Study II

| Research Area | Subthemes |
|--|---|
| Scenarios (5) ¹ | <ul style="list-style-type: none"> • regional climate change scenarios • more complete understanding of climate in 10 year periods with research on extreme events at a regional level |
| Ecosystems responses to climate change (7) | <ul style="list-style-type: none"> • review of ecosystem responses to historical temperature shifts • impacts of hydrological changes on wetlands (prairie wetlands) • ecosystem succession models that include natural disturbances • air quality • water quality and water quantity responses • quantification of resources/sectors at risk |
| Adaptation/Impacts assessment (6) | <ul style="list-style-type: none"> • adaptation processes, adaptation testing through impacts assessment • implications of climate change for urban systems and municipal governments |
| Human health (4) | <ul style="list-style-type: none"> • better understanding of impacts of changes in air quality and water quality and supply on human health (morbidity, mortality and social response) |
| Information for policy-making (2) | <ul style="list-style-type: none"> • scientific information on environmental, social and economic factors • framework for balancing costs/benefits/risks/uncertainties |

1. Numbers in parentheses refer to the number of group submissions that identified gaps in this area

a) Scenarios

The development of more regional climate change scenarios was identified as a research priority. There is also a need for a more thorough understanding of climate change and variability in 10 year periods (i.e. 10-year time slices or less), identifying extreme events at a regional level was identified.

b) Ecosystems responses to climate change

The need to assess impacts and adaptation from an ecosystem perspective was the most frequently identified area requiring further research. The need for quantitative data on specific resources at risk was expressed. Several specific projects were identified under this theme including: a review of ecosystem responses to historical temperature shifts; a study of the impacts of hydrological changes on wetlands and fisheries (Prairies was a suggested location); development of ecosystem succession models that include natural disturbances; and further assessment of air quality and water quality and quantity responses to climate change.

c) Adaptation/impact assessment

The need for more extensive impacts assessments to build our knowledge of the adaptation process was identified as a research priority. The need for regional impacts assessments was identified in order to inform municipal governments on the implications of climate change for urban systems

d) Human health

The lack of data concerning the effect of climate change impacts on morbidity, mortality and social impacts was identified. There needs to be a better understanding of impacts of changes in air quality and water quality resulting from climate change on human health.

e) Information for policy-making

The need for scientific support for public policy decision making, including environmental, social and economic factors was identified. In addition an overall framework for balancing costs/benefits/risks and uncertainties regarding climate change impacts and adaptation was identified as a research requirement.

4. Communications Gaps

Communications gaps were addressed separately using the same brainstorming technique. The need for a comprehensive planning process as a precursor to developing a communications strategy was identified. This includes developing an information base for identifying target groups, communication channels and key messages. A needs assessment to identify current public knowledge, attitudes and behaviours, information needs and trusted information sources, should form the basis of communication initiatives. A plan for evaluating the effectiveness of communication efforts should be built into the overall communication strategy. Regular communication of key messages targeted towards specific audiences was identified as a way of maintaining climate change on the public agenda.

Public education on climate change should provide information and clarification on fundamental scientific concepts such as the greenhouse effect and El Nino. Community adaptation success stories should be identified and conveyed to other communities. A variety of target audiences were identified for communication efforts including primary school age children, high school students, other educational and community groups, MPs, stakeholders and other influential politicians. Training for scientists in communicating with the public and the media was suggested. Specific messages to address arguments put forward by those who are skeptical of the scientific evidence for climate change should be developed as part of the overall communication strategy.

Climate change messages should be concise, clear and simple. It was suggested that CCS co-authors prepare a one-page summary of consensus statements on what is known conclusively about climate change. This summary would form the basis for messages conveyed to the media. The need to separate high confidence messages from low confidence messages was identified.

Table 2. Summary of climate change communications needs

| | |
|---|---|
| Comprehensive Strategy (5) ¹ | <ul style="list-style-type: none"> • communications needs assessment to determine messages and approach for specific target groups • strategy for evaluating effectiveness • early interaction with stakeholders • partner with existing groups • integrate climate change with regional issues |
| Partnerships (5) | |
| Education Approaches (9) | |
| Message Content (10) | |

1. Numbers in parentheses refer to the number of group submissions that identified gaps in this area

5. Implementation Strategy

While the implementation strategy for Canada Country Study Phase II was discussed, the group concluded that the approach to be taken is contingent on the outcome of the Kyoto conference. While the Canada Country Study Secretariat was identified as the preferred group to provide the lead co-ordinating role, other options were identified such as the Royal Society of Canada, Climate Program Board, the four natural resource departments, or through the University community by establishing a research chair or Centre of Excellence.

Some members felt that the regional leadership model of CCS Phase I was successful and should be extended in Phase II. Specific examples that were discussed included demonstration projects in regions such as Northern Ontario, involvement in regional action plans, or Environment Canada's flagship projects (St. Lawrence Action Plan (SLAP), Fraser River Action Plan (FRAP) and Great Lakes 2000) and a water resource study in the Prairies. The involvement of stakeholders and existing regional groups (such as the Prairies Adaptation Network) as partners in defining the research agenda was viewed as critical to the success of CCS II. CCS II should strive to seek broader partnerships and involve small to medium sized communities.

Existing stakeholder networks could help both to communicate the results of Phase I and shape the direction of Phase II of the CCS. Results could also be communicated through the Remedial Action Plan public advisory committees and other groups already engaged in environmental issues.

REPORT OF BREAK-OUT GROUP 5 (ACADEMIC)**Chair:** Kirsty Duncan, University of Windsor**Rapporteur:** Abdel Maarouf, Environmental Adaptation Research Group, University of Toronto*Introduction*

This Break-out Group consisted of 7 participants from various universities across Canada. The group met for about 2 hours and discussed the outcome of Phase I of the Canada Country Study (CCS), made a number of recommendations for Phase II, and considered CCS's potential contribution to the IPCC Third Assessment Report (TAR) to be expected around the year 2000.

Phase I

Workshop participants recognized that the CCS is the first national assessment of current knowledge and understanding of the impacts of climate change and variability on Canadians, their ecosystems and socio-economic systems. Workshop participants also recognized that Phase I of the study was not intended to gather new data or conduct new research. Therefore, scientists across Canada who participated in the CCS should be proud of their effort and the achievements made in a relatively short period of time, and of their success in informing the media, the Canadian public, and policy-makers, thus advancing forward the climate change issue.

Key Results

- First-order impacts of climate change have been well documented and understood. Examples include longer growing season for agriculture, northward shift of forests, more heat-waves in summer, lower energy demand in winter, rising sea-level, etc.
- The study established that since Canada is a very large country with variety of climatic and ecological zones and socio-economic systems, there will be a pronounced regional variability in terms of sensitivity and vulnerability to the impacts of climate change.
- The current assessment provides little information, however, on second-order impacts of climate change. There is a great deal of uncertainty about the socio-economic impacts. For example, how will people, farmers, fishing and forestry industry, and Canada's international trade be affected by climate change? It is also uncertain how climate change will affect other air issues such as acid rain and air pollution emissions and concentration.
- Currently, there are no reliable models on how society, the economy and the environment interact in a changing climate. Therefore suggested societal adaptive strategies remain vague and very general.
- Climate impacts are better understood for some socio-economic sectors than others. For example, warmer temperatures would lengthen the season for summer tourism and recreation, while outdoor winter sports such as skiing would suffer from a shorter season. In the energy sector, however, It is difficult to assess with confidence the impacts of climate change due to several unpredictable and interacting factors.
- The results remain very general and do not provide sufficient details at the regional and local scales. These are the scales that will be mostly impacted by a variety of climatic variables and future weather extremes.

National Symposium Proceedings

- Due to the short time span of Phase I, the results of the various components of the study appear to be somewhat fragmented and lack adequate coherence.

Policy

- Climate change impacts at the regional and local scales are still not adequately understood. Therefore, specific policies cannot be tailored to specific regions, sectors or communities.
- At present, over-arching policies such as “no-regrets” policies can be suggested.
- In light of the above, Canada should maintain flexibility in developing and implementing policies, especially in international negotiations.

Research Gaps

- There is a great concern that extreme events (floods, droughts, heat-waves, severe storms, etc.) could increase in frequency and severity as climate changes. Since these events could have the largest impacts on society and economy, much more knowledge is needed on the costs of impacts of and adaptation to severe climatic events.
- The value of qualitative research cannot be ignored, and more rigorous research of this type is needed. Quantitative research on climate change impacts is also needed and it was lacking in the first phase of the study.
- The current lack of good socio-economic data banks has contributed to a poor understanding of societal impacts of climate variability and change at the regional and local scales.
- Most Canadians live in urban areas, suggesting a greater need for understanding climate change impacts and adaptation in those areas. One such example is the Toronto-Niagara region, which is currently the subject of a collaborative research study involving Environment Canada, University of Toronto and several other stakeholders.
- Current research efforts tend to focus on either mitigation of or adaptation to climate change, while the integration of the two approaches makes more sense and is currently lacking in research agendas.
- It has become evident that “climate” is only one driver in a much bigger “environmental change” or “global change” issue. Current research continues to be narrowly focused on “climate change” rather than taking a more general “Cumulative Impact Assessment” or “Integrated Assessment” frameworks.

Communication

- It is evident that many industrial sectors and other stakeholders were not adequately represented in Phase I, with the exception of the insurance industry.
- Some key players are totally missing, e.g. Health Canada and the health sector in general, in spite of several key findings raising concern about serious health impacts of climate change.
- Plain language summaries are very useful in communicating knowledge to a wide range of users. Caution should be taken, however, when translating science into policies. Some key findings often get lost when summaries are made for policy-makers.
- Academics are not usually trained on how to communicate scientific findings to the media, which are often interested in key “sound bites”.
- Phase I did not do well enough in communicating the uncertainties of climate change impacts.

Recommendations for Phase II of CCS

Audience and collaborators

- Special attention should be given in addressing and involving locally impacted communities.
- Future research should be undertaken much more closely with stakeholders.
- There are other groups (e.g., Canadian University Program on Global Change) and many scientists in academic institutions who receive research grants (e.g., NSERC grants) to conduct climate change studies. These groups should be contacted and encouraged to get involved in the second phase.
- University students and other young Canadians have a valuable role to play in research activities and in communicating adaptive strategies among future generations. Incentives should be given to encourage their participation.

Additional sectors, communities and research

- A wide-range of industrial communities and associations and resource managers were not represented in Phase I, e.g., Canadian Association of Petroleum Producers.
- Some “voiceless” groups and other not-well-organized communities may be severely impacted by climate change. An outreach effort should be made to involve them in future studies.
- Policy analysis and policy research should be conducted to evaluate various options and strategies which would be most socially accepted and economically viable.
- In order to understand and implement a process of social adaptation, knowledge must be gained on public perception of climate change. Public forums and focus groups should be organized and encouraged to participate in identifying the issues to be addressed in the next phase.
- There is a need for realistic “what-if” scenarios; there is NO need for “everything-else-being-equal” scenarios.
- Detailed analysis of “case studies” such as floods, droughts, forest fires, etc. Is also needed.
- Canada is heavily dependent on international trade and is involved in various international partnerships; therefore, Phase II should maintain both “global” and “local” interest in the climate change issue.
- There is a perception that Phase I was not independent and that the peer-review process was not rigorous. Phase II should be at arms-length, independent from government, and be subject to a rigorous peer-review process.

IPCC TAR (Year 2000)

- Workshop participants believe that research findings of Phase II of the Canada Country Study can make significant contributions to the Third Assessment Report (TAR) of the IPCC. However, the group recognizes that there is a trade-off between IPCC TAR deadline and developing a sound research plan, conducted in a realistic time frame.
- The group also draws attention that in the first assessment of the IPCC, much greater emphasis was placed on mitigation than on adaptation. Adaptation strategies were viewed then as failure or lack of commitment to reduce greenhouse gas emissions. Now, the international community has accepted adaptation as an important and viable measure in reducing the risk and vulnerability of climate change. The group, therefore, recommends that more integration of the two response strategies (mitigation and adaptation) be considered in the next phase of the CCS.

REPORT OF BREAK-OUT GROUP 6 (ACADEMIC)

Chair: Roger Hansell, University of Toronto

Rapporteur: Brian Mills, Environment Canada, Environmental Adaptation Research Group

Introduction

Each break-out group was charged with two general tasks:

- to address both the communication and research gaps in Phase I of the Canada Country Study (CCS), and
- to sketch a generic outline identifying the important components that should be addressed in Phase II of the Canada Country Study.

Session facilitators had some liberty in choosing the manner in which they addressed each task. Break-out Group #6 selected a less structured path than that followed by most groups with the resulting discussion focused around three themes:

1. Context for discussing the Canada Country Study
2. Considerations in designing Phase II
3. Priority research areas, approaches and ideas

Context

The first part of the session was used to learn about the various backgrounds and interests of participants as well as to exchange initial views on the Canada Country Study.

As expected in an academic break-out group, most of the participants represented universities or were members of research organizations. Some of the disciplines and backgrounds of participants included applied engineering, ecology, forestry, economics and geography. Participants had varying degrees of involvement in the Canada Country Study and nobody had read the entire series of regional, sectoral and cross-cutting reports.

Concern was expressed early and often in the session about the level of involvement of stakeholders in the Canada Country Study. It was generally felt that consultations with and the engagement of stakeholders are vitally important to the long term success of a second phase and were not reflected in the attendance of the Phase I symposium.

Prior to entering into a second phase, one member of the group suggested explicitly defining the rationale for continued work. A cost/benefit evaluation of Phase I results that considered more than just traditional economic measures was proposed to assess whether climate change would have a net positive or negative effect on Canada. If a positive balance resulted then it could be argued that additional research is not warranted. Other participants responded by noting that the CCS was not established for this purpose; that key local and regional impacts might be overlooked or averaged out; and that even after synthesizing all of the research, insufficient information exists to complete such an analysis. After some debate on the subject, the general need for a Phase II was supported by everyone.



Considerations in Designing Phase II

A number of fundamental considerations for Phase II were identified and explored during the session. They are listed below. Each consideration addresses one or more communication and research gaps revealed during Phase I activities and should be construed as important components of Phase II.

1. Mitigation must be considered in Phase II as part of a broader adaptation (response) framework

There was agreement among participants that it does not make sense to separate mitigation from adaptation either conceptually or practically when designing and implementing Phase II. Adaptive management provides a broad enough framework to incorporate responses designed to reduce emissions as well as those intended to reduce vulnerability to the possible impacts of climate change. There was some debate as to whether or not the purpose of Phase II should be to recommend and implement specific actions in addition to identifying and evaluating impacts and adaptation strategies.

2. Adopt a systemic approach and a set of working rules/guidelines

In designing Phase II, most participants felt that it was necessary to define the “big picture”, at least qualitatively, in order to systematically organize information from various contributors. This could be accomplished by developing a soft model or series of box diagrams representing study components that should be accompanied by a set of working rules to bound the research and ensure some degree of integration. Such an approach would allow all stakeholders to see their place within the study and could be used to establish priorities for research and targets for policy.

3. Target stakeholders with the results of Phase I and engage them in Phase II

Much of the break-out group discussion was devoted to the subject of communication and stakeholder involvement. It was felt that, with a few exceptions, research on climate change had been poorly reflected in the popular media, partly a function of the general unwillingness of scientists to communicate the results of their research and associated uncertainties. One participant encouraged everyone to challenge editorials and columns that undermine global warming theory and the need for actions to address the issue. Everyone wanted to see that the results documented in Phase I get converted into literature for public (and media) consumption.

All participants rallied behind the notion of devoting more effort towards educating stakeholders about the implications of climate change and possible response strategies. However, it was stressed that education alone was insufficient and that stakeholders must be consulted and engaged in the process of designing and implementing Phase II. Furthermore, it was suggested that certain stakeholders should be targeted first based on whether or not they were sympathetic to climate change concerns, actively involved in addressing the issue, or could influence other key stakeholders to participate. The group established a short list of key allies (in bold) that should be approached first and a larger working list of important stakeholder groups that should eventually be consulted:

- alternative fuels sector
- architects/planners
- automobile manufacturers
- Canadian Association of Petroleum Producers (CAPP)
- construction industry
- driving public
- **educational institutions**

- future generations
- general public
- health agencies
- **hydro power agencies**
- **insurance**
- new technology (entrepreneurs?)
- **NGOs**
- NRCan (and other fed. departments)
- other energy industry
- **petroleum industry**
- public works
- steel manufacturers
- students
- timber producers
- transport industry (trucking, rail, airlines)

Participants briefly discussed the types of messages and information that should be communicated to the public and stakeholders. Positive reinforcement of stakeholder actions that are successfully addressing climate change should be encouraged and used to demonstrate the benefits of such actions to other stakeholders. A cautionary flag was raised concerning the potential for mixed messages where Phase II portrays climate change as both a positive “good” and negative “bad” thing.

4. Facilitate greater access to existing climatic, ecosystem, and socio-economic data and promote restoration of data collection networks/infrastructure

Participants emphasized that data is a fundamental resource needed to identify links between climate change and its causes, and to determine the rates of ecosystem change. Without data it is impossible to identify key climate-sensitive variables let alone model impacts. Data gathering units in government should be restored and current restrictions on the access to information should be lifted. Where possible, data should be made available to all interested researchers through a common web site. Efforts to improve access and availability should be focused on the following three data types (ordered from highest to lowest priority, with a primary source identified in parentheses):

- climate, including transient change scenarios (Atmospheric Environment Service, Environment Canada)
- ecosystem (Ecological Monitoring and Assessment Network, Environment Canada)
- socio-economic (Statistics Canada)

5. Incentives will be an essential component of any strategy designed to encourage individuals to take adaptive and mitigative actions

This specific consideration evolved as part of a broader group discussion on the purpose of Phase II, the incorporation of both adaptation and mitigation perspectives, and the role of individuals in addressing climate change. If Phase II is designed to recommend and begin implementing specific strategies, one can't rely upon individuals to take adaptive/mitigative actions for the common good. Incentives are required since an individual doesn't always benefit from adopting measures. If incentives not provided, then a regulatory framework, essentially a set of disincentives may be required.

6. *Adopt a 'model community' or set of regional/sectoral case studies to make more efficient use of resources*

The break-out group participants noted that Phase II will likely be launched in an era of limited financial resources. Participants suggested focusing research efforts on a demonstration community or initiating a series of regional or sectoral case studies to obtain the best return on limited funds.

7. *Involve Phase I authors in Phase II activities*

There was agreement among break-out group members that additional cost-savings in designing Phase II could be achieved by involving Phase I authors and contributors in the research. Even if individual authors cannot commit to Phase II, they are in the best position to identify other experts who may be able to participate.

8. *Hold a series of technical sessions to provide contributing scientists a forum to present Phase I results*

Phase I contributors among the break-out group expressed a desire to present the results of their research as part of a technical forum or seminar series. This mechanism would promote discussions about methods and results, and could also be used to advertise the value of interdisciplinary work, something not recognized within the narrow disciplines of many academic institutions. Collaboration during such events would stimulate ideas and generate enthusiasm for participating in Phase II. The sessions need not be extravagant or single-purpose. The sessions could be attached to larger workshops, like the annual Ecological Monitoring and Assessment Network meetings.

9. *Environment Canada should provide leadership for Phase II, but Phase II should not be Environment Canada-driven*

The participants briefly debated the question of Phase II leadership and responsibility. Strong support was received for a bottom-up approach but it was generally accepted that Environment Canada should provide leadership and coordinate a second phase but that its mandate should not be the sole reason for conducting Phase II. In particular, a few participants commented that Environment Canada could play a strong role in establishing interdisciplinary case studies.

Priority Research Areas/Ideas

After establishing Phase II considerations, break-out group members were asked to identify a few key priority research areas or ideas based on their perceptions of research gaps in the Canada Country Study. These are listed below:

- 1. *Preserve and strengthen climatological data base***
- 2. *Obtain a better sense of costs associated with climate change impacts and adaptive or mitigation responses (e.g. construction savings by avoiding mistakes)***
- 3. *Research on the sensitivity of ecosystems to climate and associated socio-economic effects with emphasis on highly sensitive systems (arctic); ecosystems with extremely important economic value (boreal forest); or small regions (Saint John River Valley)***
- 4. *More economic research (e.g. valuation, cost estimation) that includes an evaluation of potential mitigation and adaptation measures***

5. *Incorporation of traditional and local knowledge into the research*
6. *Track one commodity from 'cradle to grave' through a life cycle analysis in order to demonstrate various climate change impacts associated with stages of production, distribution, consumption and recycling.*

REPORT OF BREAK-OUT GROUP 7/8 (STAKEHOLDERS)

Chair: Rick Findlay, Environment Canada, Global Air Issues Branch
Rapporteur: Jamie Smith, Smith and Lavendar Consultants

Introduction

This break-out group was designed to provide a perspective on the Canada Country Study distinct from the one presented by the other break-out groups, since it included “stakeholders” from outside government and academic institutions. Because of the limited number of “stakeholder” attendees, groups 7 and 8 were combined to form one group, which raised the question: why were there not many “stakeholders” in attendance? The primary message from the break-out group to the symposium unfolded from this: the CCS was not providing or distributing information that was useful to “stakeholders”, and as a result they were not attending the symposium. For example, the CCS was not appealing to the “bottom line” for industry. To attract more “stakeholders” in the future, the CCS needs to more fully engage “stakeholders” by providing more “useful” information on the impact of climate change, and by ensuring that their needs and concerns are incorporated in the CCS work. Stakeholder groups should be included in providing direction for research and possibly even for providing resources (financial or otherwise) to the study.

During the presentations of the break-out group reports, it was pointed out that the perspectives presented here should be considered as reflecting primarily the opinions and viewpoints of the recreational fisheries and the insurance industry. Other groups with perhaps fewer resources, such as the poor and elderly who are most vulnerable to climate change, were not represented by this break-out group and they may have different perspectives on the CCS.

Fortunately, the discussion of the group concentrated on developing a communications plan for “engaging all Canadians” in the CCS which would presumably include all groups most concerned and affected by climate change in Canada.

Another important message suggested during the break-out group was that local initiatives/activities on environmental issues could be used to “piggy back” our message. Finally, institutional arrangements of government departments were recognized as major barriers to taking action and conducting research on climate impacts and adaptation. For example, the federal departments of environment and fisheries will not cooperate to conduct climate change research.

This report summarizes the perspectives of the break-out group members (organized into “stakeholder” categories), group comments regarding gaps in the first phase of the study, group recommendations for future activities, and some after-thoughts from the rapporteur.

Individual group member perspectives

The recreational fisheries members expressed a need for better communications by researchers to Canadians of both what the impacts of climate change will be, and the adaptation actions that need to be taken. Future research, it was suggested, should be focused on what is at stake addressing values outside of economics. For example, fishing is a family activity with cultural and environmental education aspects

that cannot be accounted for in dollar terms. The need for better cooperation between government departments was also expressed as an area for future research.

The insurance industry representative suggested the development of an office that could provide monitoring and detailed information for current weather-related disasters. It was suggested that this was the best solution if we cannot provide detailed predictions of disasters and extremes using climate models. An improved baseline is the first step towards understanding extremes and it is most useful for the industry.

One federal government representative was most interested in future alliances and partnerships with “stakeholders” and other government departments to facilitate taking action on climate impacts, limiting emissions, and adapting to climate change. Developing partnerships is particularly important given the limited resources of governments for communicating their message. It was noted that the symposium lacked communication with other government departments and “stakeholders”. The second government representative emphasized the need to conduct more socio-economic research on impacts and adaptations because there are many sectors that have not been addressed, and the research needs to be better coordinated in order to fill these gaps. This member also suggested that by combining the issue of limiting emissions with climate impacts and adaptation in the next phase of the CCS might be a mistake because discussions of how to limit emissions always tend to overwhelm the impacts side as it is more politically sensitive.

The tourism and recreation consultant suggested that the information produced by the CCS is inadequate for their needs as the level of uncertainty is too high for decision-making. It was suggested that since the Atmospheric Environment Service’s responsibility is for climate information only, other sectors and government departments should take over research on the impact of climate change on their sectors. Phase 2 of the CCS should focus on disseminating information on how important climatic change is to each sector in order to induce the individual sectors to become involved in the issue. The science/technology writing consultant was concerned about the separation of “stakeholders” from government and academics in the break-out groups - it was recognized that everyone is a “stakeholder” just for different reasons and we need to work more closely together. Emphasis was put on how we can all work more in our communities, and to act as examples of how to adapt and survive as there are benefits to taking action now.

The member of a global change organization expressed the need to increase awareness of the issue to Canadians. A cross country tour of a series of forums was suggested with the intent of “moving the public forward” towards action on climate change. The forums should present a balanced view of the issue since the current understanding of Canadians is based upon only small parts of the issue making it more difficult for them to understand the implications of climatic change. It was suggested that future activities of the CCS should be well planned and coordinated, should integrate limiting emissions with impacts and adaptation, and should involve the provincial and federal research councils.

Gaps in climate and adaptation literature

Overall the group seemed to feel that phase 1 of the CCS met its goals successfully which they defined as a review of the current literature on the impacts of and adaptations to climatic change. The group did not focus on specific research activities, although some comments were made about some specific gaps. Gaps were identified in baseline information on climate extremes and socio-economic sectors, as well as detailed information on health (of interest to the public) and fisheries (salt and freshwater) impacts.

Specifically, the impact of the introduction of exotic species (such as zebra mussels) on ecosystems under climate change are not well understood. Poor integration of the natural environment and socio-economic studies was also identified by the group as an obvious weakness in the current literature, a problem that also leads to a poor understanding of the cumulative effects of climatic change. In general, a common concern in the group was that a lack of coordination of the research activities to date has led to poor integration of results. This was felt by some members of the group to be a result of institutional barriers. Sister departments in government do not work together, resulting in poor cooperation and poor integration of research. Most of the discussion in the group concentrated on future directions for the CCS.

Recommendations for future CCS activities

Given the limited resources for future CCS activities, the group felt future research should focus on areas of research where a difference could be made such that “solid” statements without using words such as “maybe, may, might” could be made about impacts. This may mean concentrating on areas/sectors either where gaps exist or where much work has already been done. The goal should be to obtain results that can be presented with a high enough level of confidence for decisions to be made. Concentrating research on these areas could reduce uncertainty, but may be achieved at the expense of research into areas that have not yet been studied and have been identified as “gaps”, such as health. Specific comments regarding a communications plan and research areas were made with more general comments for future consideration in planning the future direction of the CCS.

Communications Planning: Engaging Canadians

The group felt that a well planned and strategic communications plan was essential for the next phase of the CCS. The result of the next phase, it was suggested, should produce more than a report, it should sensitize, or make aware, Canadians to all aspects of the issue. By doing this “stakeholder” involvement will increase as their needs and concerns will be incorporated into future work. Government was criticized for doing a poor job at communicating information in the past with many different agencies providing conflicting messages about global warming. The plan must first determine what the message should be, and then cater it to specific constituencies making use of existing associations as suggested below. Some of the components of the plan may include:

- engaging “stakeholder” groups such as: provinces/territories/municipalities; 20% club of cities which have an annual meeting; Business Council on National Issues (BCNI), Canadian Petroleum Producers, etc.
- a series of forums to determine the needs for “stakeholders”, such as a municipality speaking tour
- the information should be expressed in terms of “risk management” rather than speaking of high levels of uncertainty (people will not commit action to arguments made using “maybe”), since high levels of certainty may not be possible given the state of climate models

Research Activities: Potential Areas of Concern

The group was somewhat reluctant to identify specific areas or issues that should be the focus of further research. This reluctance was likely as a result of the concern that such priorities for research should be determined by a process which involved many “stakeholders” and researchers and careful planning, rather than by a handful of people over a two hour period. Nevertheless, some areas of concern were raised by the group as a start. The areas of concern included:

- specific sectors of fisheries (fresh and salt), health, water
- the cross cutting issue of integration of air issues including acid rain, smog, hazardous air pollutants, stratospheric ozone depletion, and suspended particulates
- vulnerable regions and vulnerable sectors
- areas where a difference can be made over the next few years

General Comments: Considerations/Directions

Some more general recommendations were:

- adopt the “adaptive management paradigm” which programs learning into the decision making process
- seek partnerships with “stakeholders” who have a stake in the work and who can contribute important perspectives and/or resources to the CCS
- coordinate and integrate the whole national agenda on climate change
- get other government departments to have climate change on their agendas

Summary: Rapporteur’s point of view

Given the time restraints of the break-out group sessions, and the bias of the group towards “stakeholder” involvement, it was not surprising that this group felt a need for improved engagement of people and organizations outside government and academia. One of the few industries committed to the global warming issue is the insurance industry because it is feeling the effects of current climatic trends. As a result, this industry needs and is asking for better information now. Clearly, other industries are not feeling the pinch on their “bottom line”, and are not likely to until they are convinced that current climate and future climatic change will affect their business. Many groups and regions that are most vulnerable to climatic change do not have the resources that industry has, and their needs must also be addressed in future studies. Government has played a major leadership role with the CCS and has successfully conveyed information on climate impacts and adaptations to the media (although perhaps it has been less successful in reaching the general public). If the government is to provide future leadership, and if the future CCS will be led in part by Environment Canada, those sectors and regions without sufficient resources must be supported by government initiatives. Perhaps the strongest message of the “stakeholder” group was that we need to have more involvement by a wider range of groups, and we need to direct research towards providing more useful information to Canadians, information that helps answer “what can we do now?”

REPORT OF BREAK-OUT GROUP 9 (NGO/STAKEHOLDER)

Chair: Claude Lefrançois, Canadian Global Change Program
Rapporteur: Peter Timmerman, University of Toronto

The Break-out Group numbered 6-8 persons. It was noted at the outset that there were only 2 NGO representatives in the room, and this was a cause of concern, which led into the discussion of background issues, specifically with regard to communications.

1. Background Issues Concerning Phase I and Transition to Phase II

There was general agreement that communication was a significant issue, and that the fact that there was perceived to be a "communications problem" at the end of the process indicated that perhaps there should have been a more fully thought through strategy at the outset of Phase I. It was suggested that one of the reasons why there was less NGO participation than expected (apart from scheduling difficulties) was that there was a perception that this Symposium was really about delivering a "product" to be broadcast or sold, and that the NGO's were to be recruited to carry out that task, along with the stakeholders. Phase II would provide an opportunity to rethink the "signals" being given by the Study. This is addressed further in section 2 of this report.

Given that Phase I had provided the information base for Phase II, the relationship between the scientists and the stakeholders needed to be rethought for Phase II. Although Phase I had involved a number of stakeholders, it was not clear to the group how much of a role the stakeholders had in identifying research tasks for the scientists involved in the Study. This was part of the larger issue of the role of science in general in an area which has become so politicized: an initiative to discuss this role would we welcome. Phase II should generally be much more stakeholder-led, although (as noted in section III) there was discussion of the role of the Federal government (including Environment Canada) in that upcoming Phase.

Phase II would obviously be carried out within (it is expected) the framework of a Kyoto accord, and there are significant questions about what kind of a plan is to be developed to meet the proposed targets. Would it be possible to have a mini-Kyoto in Canada, that would use the Phase I outcomes as input?

2. Communication Issues

There were a number of suggestions concerning communicating the results of Phase I, and by implication, beginning to think about Phase II. It was emphasized that the transition period between Phase I and II, as well as Phase II, needs to have an iterative communications process. There also needs to be clarification about the communication "signals" and goals: are these studies designed to improve general climate change literacy, target specific Phase I results, begin a further consultative process, etc.?

Next, there needs to be clarification (and identification) of the appropriate messengers and the appropriate targets, including and beyond the direct stakeholders. It was generally agreed that the messages for citizens should be tied to personal, individual concerns related to climate change, though this should not be done at the expense of a wider community concern. Either in this Phase or in Phase II, some of the less obvious issues that needed to be highlighted were:

- The role and limits of scientific evidence and certainty
- The cost/benefit issues including examples (e.g. The U.S. EPA Study (1997) of the benefits of the Clean Air Act) of areas where commitments to reductions in pollutants had brought social benefits
- The linkages among and between issues, especially issues with a shorter time horizon than climate change
- The critical need to maintain and strengthen the working data base upon which public and private decisions are to be made.

3. Key Design Issues for Phase II

Phase II should take into consideration what we call "adaptigation" - mitigation and adaptation as a mix of options. The benefits of doing what is sustainable and appropriate in any case should be stressed, since that will enhance our capacity to adapt, while at the same time mitigating our contributions to the problem. There should be emphasis on mitigation as an insurance against risk.

Phase II should take a regional approach, and we took special note of the model provided by the Saskatchewan Research Council (The Prairie Adaptation Network) as an already existing adaptation network, and the need to build on existing structures where they exist. Where there are funds available, priority should go to supporting those groups that have already been participating in Phase I or in general climate change efforts, and who meet generally appropriate criteria (e.g. Significant stakeholder involvement). This would also enhance the chance of leveraging significant additional funds from other sources.

The group identified three elements of Phase I that could be usefully studied in more detail in Phase II:

- Water was seen as a "glue" uniting a number of physical and socio-economic forces. Although there was a special report from Phase I on water to be released, the group wanted to ensure that water was seen not so much as an individual issue, but as a possible "groundplan" or common language for Phase II.
- Urban issues were noted by many people as a significant concern that had been underresearched. The initiative by Toronto and other localities were noted; as was the proposed Toronto-Niagara Region Study.
- There was need for further study on the impact of climate change on air quality.

It was lastly suggested that a number of Federal government ministries should be involved in Phase II; and it was further noted that part of the Federal role should be in monitoring and assessing the benchmark mitigation and adaptation results of our Kyoto commitments as the progress, which should affect the planning of Phase II. Another role of the Federal government was to clarify and coordinate the elements of the study, including the role of the expected various players and partners.

The group adjourned, and a presentation of its results was made to the plenary on the following day by the Rapporteur.

CCS NATIONAL SYMPOSIUM

FINAL PLENARY SESSION

The final session, held during the third morning of the Symposium, was used to allow the chairs and rapporteurs of the breakout sessions to present to the plenary the results of their group's deliberations the previous afternoon. In addition to these reports, this session provided the plenary with the opportunity to comment on the rapporteurs' summaries and to provide additional points related to their perspectives of the next phase of work that should be undertaken through the Canada Country Study and, in particular the communications and research gaps.

The rapporteurs' reports are detailed in a previous section of this proceedings. The following is a synthesis of additional points raised during the discussion of the break-out group reports.

Stakeholder Engagement

- need to look at strengthening the role of municipalities in understanding the impacts and the viability of adaptation options, possibly by building on some of the successes in and by municipalities.
- the regional focus of the Canada Country Study should be continued with efforts and resources directed at building on the enthusiasm generated in the regions by this initial assessment; increasing the awareness of the results of this Initial Assessment Phase; and supporting a consistent effort of engaging more and a broader spectrum of the stakeholder community.
- to engage more stakeholders, particularly those from within the business community, requires identification of how the climate change impacts and adaptive responses will affect their bottom line.

Communications Focus

- the focus of communications activities should be on building the awareness of citizens and other key stakeholders of the issues surrounding their sensitivities to climate change and the need for both mitigation and adaptation responses - rather than raising political awareness raise the awareness of politicians' constituencies.
- one of the reasons that stakeholders are not becoming engaged in the climate change issue is skepticism about the basic science – need to link communication on impacts and adaptation to the basic science of climate change.
- rather than communicating knowledge we should be communicating ideas and images on climate change - this is what the people want and understand.
- need more flexibility, particularly in terms of time frames, to bring in new information and make it available to Canadians - when resources are limited, the communications schedule should allow for the different timetables of when new information becomes available and not force the fit to a predetermined schedule.
- concern that the current Canada Country Study reports are throwing a lot of material out to the public, some of which could be lost because of the sheer volume of material. It may be more effective to have a series of two-pagers, released periodically, that focus on a particular aspect of climate change impacts and adaptation options.

Research Gaps

- need to raise the question of the effectiveness of the climate impacts and adaptation research community identifying climate change impacts and adaptation strategies without the full engagement of the specific area/sector stakeholders and specialists. To what extent should the climate impacts and adaptation research community be driving the agenda and trying to affect the mandates of other groups for which climate change is not currently seen as part of their agenda.
- need to raise our understanding and increase awareness of what the interdependence of Canada's social and economic well-being is with that of the rest of the global community means in terms of the impacts of climate change and the viability of adaptation options. Climate change impacts and adaptation options outside of Canada may have significant implications for Canada.

APPENDIX A: CCS NATIONAL SYMPOSIUM PROGRAMME

The Canada Country Study: Climate Impacts and Adaptation National Symposium

November 24-26, 1997, Toronto, Ontario, Canada

MONDAY, NOVEMBER 24, 1997, Hart House, University of Toronto, 7 Hart House Circle

| | | |
|----------------|--|---|
| 8:00 - 9:00 am | Symposium Registration | |
| 9:00 - 9:30 | Welcome | Gordon McBean |
| | Minister's Address | Environment Minister Christine Stewart |
| 9:30 - 10:00 | Registration continues, <i>Health break</i> | |
| 10:00 - 11:00 | The Science of Climate Change <ul style="list-style-type: none"> • The Changing Climate • The Canada Country Study: Climate Impacts and Adaptation | Chair: Richard Haworth Gordon McBean Roger Street |
| 11:00 - 12:00 | Climate Change, Canada and International Linkages <ul style="list-style-type: none"> • IPCC Impacts and Adaptation • U.S. National Impact and Adaptation Assessment | Chair: John Stone Richard Moss Paul Dresler |
| 12:30 - 14:00 | <i>Lunch</i> | |
| 14:00 - 14:20 | Introduction to the Panel Sessions | Barrie Maxwell |
| 14:20 - 16:15 | Perspectives on Impacts and Adaptation <ul style="list-style-type: none"> • Natural Environment (water resources, wetlands, terrestrial and aquatic ecosystems) | Moderator: Bob Stewart Speaker: Richard Roberts Panel: Linda Mortsch Ken Cox Hague Vaughan Eric Taylor Tom Brydges |
| 16:30 | Identifying the Issues <i>Buses take participants to Crowne Plaza Hotel</i> | Bob Stewart |
| 17:30 - 18:15 | Chairs and Rapporteurs meeting, <i>The Boardroom, Crowne Plaza, Lobby Level</i> | |
| 18:30 - 20:00 | Acknowledging the CCS Reception, Crowne Plaza Hotel, 225 Front St. West | |

National Symposium Proceedings

TUESDAY, NOVEMBER 25, 1997, Metro Toronto Convention Centre, 225 Front St. West, adjoining lobby with the Crowne Plaza, Room 205

| | | |
|---------------|--|---|
| 8:30 - 12:30 | <p>Perspectives on Impacts and Adaptation</p> <ul style="list-style-type: none"> • Sustaining Food and Fibre Production (agriculture, fisheries and forestry) • Social and Economic Well-being (human health, tourism and recreation) <p>Identifying the Issues</p> <ul style="list-style-type: none"> • Protecting Infrastructure (built environment and insurance) | <p>Moderator: Barry Smit</p> <p>Speaker: Brian Shuter Panel: Mike Brklacich Dave Martell Ross Herrington Beth Chalecki Sheila Forsyth</p> <p>Speaker: Helen Fast Panel: Kirsty Duncan Geoff Wall Jim Abraham Bob Bailey Abdel Maarouf</p> <p>Barry Smit</p> <p>Moderator: Joan Masterton Speaker: Alan Dalglish Panel: Mark Baker Angus Ross Gérald Vigeant Bill Hogg</p> |
| 12:00 - 13:15 | <i>Lunch</i> | |
| 13:15 - 14:15 | <ul style="list-style-type: none"> • Maintaining Vibrant Industry (energy, industry and transportation) | <p>Speaker: Gilles Mercier Panel: Tim Bullock Dale Rothman Jean Andrey Philippe Crabbé</p> |
| 14:15 - 14:30 | Identifying the Issues | Joan Masterton |
| 14:30 - 14:45 | Charge to Break Out Groups | Roger Street |
| 14:45 - 17:30 | Break Out Sessions (<i>various rooms</i>) | |
| 17:30 - 18:30 | Chairs and Rapporteurs Meeting Room 206F | |

WEDNESDAY, NOVEMBER 26, 1997, Crowne Plaza Hotel, 225 Front St. West, Ballroom B

| | | |
|---------------|--|----------------------------|
| 9:00 - 12:00 | Rapporteurs' Reports/Developing the Science Plenary | Chair: Rodney White |
| 12:00 - 13:00 | Closing of the Symposium | Roger Street |



APPENDIX B:

PARTICIPANTS AT THE CANADA COUNTRY STUDY NATIONAL SYMPOSIUM

| Name | Affiliation |
|---------------------|---|
| Abraham, Jim | Environment Canada - Atlantic Region |
| Adler, Andy | Stelco Inc./Canadian Steel Producers Association |
| Allsopp, Terry | Environment Canada - Ontario Region |
| Ambrosini, Anna | Environment Canada, EARG, Downsview |
| Andrey, Jean | University of Waterloo, Dept. of Geography |
| Auld, Heather | Environment Canada – Ontario Region, AES |
| Averill, Nancy | National Round Table on the Environment and Economy (NRTEE) |
| Bailey Robert | President, Recreational Fisheries Inst. of Canada |
| Baker, Mark | State Farm Insurance |
| Baker, W.B. | Recreation consultant |
| Baltacioglu, Yaprak | Environment Canada, Policy and Communications |
| Bass, Brad | Environment Canada, EARG, University of Toronto |
| Baxter, Deborah | Environment Canada - Ontario Region |
| Beauroy, Daphne | Interpreter |
| Blackall, Alana | Int'l Council for Local Environmental Initiatives (ICLEI) |
| Bradley, Brenda | Environment Canada, EARG, University of Waterloo |
| Brklacich, Michael | Department of Geography, Carleton University |
| Broadhurst, Dave | Environment Canada – Ontario Region |
| Bruce, Jim | Canadian Climate Program Board |
| Bubelis, Paul | Toronto Atmospheric Fund |
| Bullock, Tim | Environment Canada - Ontario Region |
| Cartmale, Lara | Environment Canada, EARG, Downsview |
| Chiotti, Quentin | Environment Canada, EARG, University of Toronto |
| Clarke, Dianne | Environment Canada, AES Communications |
| Cox, Ken | North American Wetlands Conservation Council |
| Crabbé, Philippe | Inst. for Research on Environment and Economy, University of Ottawa |
| Craig, Lorraine | Environment Canada, EARG, University of Waterloo |
| Craine, Ian | University of Toronto, Department of Zoology |
| Cuthbert, Doug | Environment Canada – Ontario Region |
| D'Amours, Denis | Department of Fisheries and Oceans |
| Dalglish, Alan | Building Engineering Specialist |
| De Kimpe, Christian | Agriculture and Agri-Food Canada |
| Del Col, Claudia | Environment Canada, AES Communications |
| Diamond, Tony | University of New Brunswick |
| Dresler, Paul | U.S. National Assessment Working Group |
| Duncan, Kirsty | University of Windsor |
| Edgett, Ruth | Environment Canada, Policy and Communications |
| Edwards, Susan | Environment Canada – Ontario Region, AES |
| Egginton, Paul | Natural Resources Canada |
| Everell, Marc Denis | Natural Resources Canada |

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|---------------------|--|
| Fenech, Adam | Environment Canada, EMAN |
| Fenech, Guy | Environment Canada, AES |
| Findlay, Rick | Environment Canada, Global Air Issues Branch |
| Fraser, John | Ambassador for the Environment |
| Forsyth, Sheila | National Agriculture Environment Committee |
| Fung Fook, Indra | Environment Canada, EARG, Downsview |
| Goos, Tim | Environment Canada, PNR |
| Hansell, Roger | University of Toronto, IES |
| Haworth, Richard | Natural Resources Canada |
| Hengeveld, Henry | Environment Canada, AES |
| Herrington, Ross | Environment Canada, PNR |
| Hewson, Mike | Environment Canada, AES |
| Hornung, Robert | Pembina Institute |
| Kerr-Upal, Manjit | Recreational Fisheries Institute of Canada |
| Kertland, Pamela | Environment Canada, AES |
| Kovacs, Paul | Insurance Bureau of Canada |
| Kozlovic, Dan | University of Toronto, Dept. of Zoology |
| Kulshrestha, S.N. | University of Saskatchewan |
| Lacroix, Jacinthe | Association de Climatologie du Québec (ACLIQ) |
| Laughton, David | University of Alberta |
| Lavigne, Jacque | Environment Canada |
| Lefrancois, Claude | CGCP, RSC |
| Legg, John | Natural Resources Canada |
| Lewchuk, Shirley | Senior Advisor, Office of the Ambassador for the Environment |
| Lizotte, Irene | Environment Canada, AES |
| Llewellyn, Simon | Environment Canada - Ontario Region |
| Lorde, Verne | Environment Canada - Ontario Region |
| Lynch, Sean | Environment Canada, Global Air Issues Branch |
| Maarouf, Abdel | Environment Canada, EARG, University of Toronto |
| Madill, Keith | Canadian Vehicle Manufacturers Association |
| Malcolm, Jay | University of Toronto |
| Malucha, Paul | |
| Martel, Nicole | Environment Canada, Policy and Communications |
| Martire, Carm | Environment Canada - Ontario Region |
| Masterton, Joan | Environment Canada, AES |
| Maxwell, Barrie | Environment Canada, EARG |
| Mayer, Nicola | Environment Canada, EARG |
| McKeown, David | City of Toronto Public Health |
| McMillan, Ann | Environment Canada, AES |
| McMullen, Catherine | Allophilia |
| Mercier, Gilles | Natural Resources Canada |
| Mills, Brian | Environment Canada, EARG, University of Waterloo |
| Mills, John | Environment Canada – Ontario Region |
| Moore, Jennifer | Environment Canada, EPS |
| Mortsch, Linda | Environment Canada, EARG, University of Waterloo |
| Moss, Richard | IPCC Working Group II Technical Support Unit |
| Munn, R. E. (Ted) | University of Toronto, IES |



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|-----------------------|---|
| Myslik, Robert | Environment Canada - Ontario Region |
| O'Brien, E.G. (Ted) | Agriculture and Agri-Food Canada |
| Ogilvie, Ken | Pollution Probe |
| Passmore, Jeff | Canadian Wind Energy Association |
| Perrotta, Kim | City of Toronto, EPO |
| Rai, Lovleen | Environment Canada, EARG |
| Reid, Neville | Ontario Ministry of the Environment |
| Richer, Nicole | Federation of Canadian Municipalities |
| Robarts, Richard | National Hydrology Research Inst. |
| Ross, Angus | SOREMA Mgt. Inc/IBC |
| Rothman, Dale | Environment Canada, EARG |
| Sahi, Ram | Natural Resources Canada |
| Sanderson, Marie | University of Waterloo, Dept. of Geography |
| Schutze, Caroline | Interpreter |
| Shimizu, Ron | Environment Canada - Ontario Region |
| Shiomi, Mike | Environment Canada - Ontario Region |
| Shriner, Dave | Oak Ridge National Laboratory |
| Shuter, Brian | Ontario Ministry of Natural Resources |
| Slivitzky, Michel | INRS-Eau, Université du Québec |
| Smart, Anne-Marie | Environment Canada, Policy and Communications |
| Smith, Jamie | Smith and Lavender Environmental Consultants |
| Smit, Barry | University of Guelph |
| Srivastava, Bhartendu | OCAC member |
| Stocks, Brian | Canadian Forest Service |
| Stone, John | Environment Canada, AES, PPID |
| Timmerman, Peter | University of Toronto, IES |
| Tyrer, Victor | Ontario Science Centre |
| Vaughan, Hague | Environment Canada, NWRI |
| Vigeant, Gérald | Environment Canada – Québec Region |
| Vodden, Christy | Natural Resources Canada |
| Watson, Jeffrey | Canadian Global Change Program, RSC |
| Wheaton, Elaine | Saskatchewan Research Council |
| Whelpdale, Doug | Environment Canada, AES |
| White, Rodney | University of Toronto, IES |
| Wickham, Marianne | Environment Canada, Policy and Communications |
| Wilson, Malcolm | Saskatchewan. Energy and Mines |
| Wittrock, Virginia | Saskatchewan Research Council |
| Yap, David | Ontario Ministry of the Environment, EMRB. |