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Understanding Climate Change Adaptation and Adaptive Capacity

Synthesis Report

Canada

Understanding Climate Change Adaptation and Adaptive Capacity

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1. Background

In 2007-08, the Natural Resources Canada Climate Change Impacts and Adaptation Division (CCIAD) called for proposals to fund and promote research that contributed "to understanding and enhancing adaptation and **adaptive capacity**" and supported "climate change decision-making and policy development in Canada." Researchers were required to consult and work with decision makers or stakeholders at the earliest stages of the project and incorporate local or traditional knowledge where appropriate (NRCan, 2007). The CCIAD subsequently commissioned 20 research projects. Nineteen were available for this report.

> **Adaptive Capacity:** The ability of a system to adjust in response to projected or actual changes in climate. (greenlearning.ca)

The Policy Research Initiative (PRI), in partnership with NRCan, synthesized the main findings from the CCIAD commissioned research projects. This report presents common themes and key messages, and identifies policy and program considerations that support adaptive capacity to climate change in Canada. Authors of the CCIAD workshop in Ottawa on June 5, 2009 to discuss preliminary common themes and key messages from the research projects. The workshop also included discussion of the relevant processes and barriers to adaptation and adaptive capacity identified in the commissioned projects.

The research projects synthesized in this report identified five main themes and four common barriers to adaptation. The common themes to adaptation include:

- the need for **adaptive management**;
- **mainstreaming** climate change adaptation;
- emphasizing collaborative approaches;
- the need for a tailored approach to adaptation; and
- viewing mitigation and adaptation as complementary approaches.

> **Adaptive Management:** A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices. In active adaptive management, management is treated as a deliberate experiment for purposes of learning. (Millennium Ecosystem Assessment, 2005: 599)

> **Mainstreaming:** The integration of climate change considerations into a range of policies, programs, and decision-making processes.

The common barriers to adaptation include:

- the perceived lack of leadership by governments on climate change;
- existing governance and institutional arrangements;
- policy and regulatory issues; and
- the uncertainty and lack of understanding of climate change.

This report begins with an introduction to the research project reports and the workshop. A section follows on the variety of methods, tools, instruments, and venues to adaptation and adaptive capacity emerging from the research. Subsequent discussion

looks at common themes to adaptation emerging from the research and then the common challenges or barriers to adaptation and adaptive capacity. Finally, the link between is examined and conclusions drawn.

2. Introduction

The 20 projects commissioned by CCIAD reflected a variety of sectors (Table 1) with 89 authors, co-authors, contributors, and collaborators, who represented 12 Canadian universities, and 12 governmental and 9 non-governmental organizations. The references provide a complete list of research projects and authors. The agenda for the one-day workshop, Understanding Adaptation and Adaptive Capacity, held on June 5, 2009, in Ottawa can be found in Appendix 1. The 24 researchers attending the workshop represented 18 of the 20 commissioned projects. Sixteen federal government officials were also invited to participate in the workshop discussions. Appendix 2 provides a list of the workshop participants and their affiliations.

Table 1 - Research Projects by Sector

Sector	***Projects Included in Report (#)***	***Projects not Included in Report (#)***
Communities	4	
First Nations	2	
Agriculture	1	
Health	3	
Fisheries	2	
Water and infrastructure	3	
Forestry	2	
Prairie region		1
Ontario parks	1	
Coastal zone	1	

Workshop goals included the following:

- Share research experiences that contribute to the understanding of adaptation and the enhancement of adaptive capacity.
- Explore approaches and processes that contribute to enhancing adaptive capacity.
- Identify key principles for the federal government with respect to the development of adaptation policies and programs.

Organizers also asked workshop participants to identify knowledge gaps and explore opportunities for collaborative initiatives.

3. Methodologies used in the Research Projects

The commissioned research projects attempted to understand adaptation and how to enhance adaptive capacity by using various methods, tools, instruments, and venues. In addition, all research projects incorporated stakeholder perspectives to varying degrees.

The commissioned projects included interdisciplinary approaches that combined social and natural science methodologies. For example, in the agricultural sector, the one project used action research combined with more traditional research. The researchers combined the application of integrated assessment models (global climate models, regional circulation models, and crop growth models) with focus groups, questionnaires, interviews, and a multi-criteria analysis framework (Bryant et al., 2008). Research methods used in the fish and fisheries sector included instrumental data, stakeholder workshops, surveys, climate change scenarios, and water management stream flow modelling (Casselman et al., 2008). Research in the urban drainage infrastructure incorporated multi-model approaches to climate change scenarios, stakeholder workshops, questionnaires, and statistical modelling (Mailhot et al., 2008).

In addition, the commissioned research projects included stakeholder perspectives using a variety of participatory approaches and interviews. The methods were used for a number of purposes, ranging from eliciting information, to empowerment and a co-constructive research approach. Table 2 shows the combinations of methods, tools, instruments, and venues adopted by researchers.

Table 2 - Methods, Tools, Instruments, and Venues used in the Reports

	Reports (include 19 reports)																			Total
Action research approach										X										1
Participatory methods (e.g., focus groups, community forum, group discussions, community meetings, face-to-face communication, First Nations gatherings, workshops)	X		X	X		X	X		X	X	X	X	X	X		X	X	X		14
Web-based communication and collaboration interface/web site						X					X									2
Interviews (structured and semi-structured and questionnaires, including open ended)	X			X				X		X		X	X	X		X	X	X		10
Survey		X		X																2
Future climate change scenarios, downscaling, integrated impact/assessment model	X		X				X		X	X						X				6
Species assessment regarding climate warming (e.g., fish composition related to recorded water temperature)	X																			1
Economic assessment; cost-effective analysis; cost-benefit analysis							X		X						X					3
Statistical analysis; e.g., cluster analysis, multi-criteria analysis, others	X				X			X		X						X				5
Expert knowledge		X		X					X								X			4
Internet search		X																		1
Total	5	3	2	4	1	2	3	2	4	5	2	2	2	2	1	4	3	2		

4. Common Messages from the Research

Five common messages for enhancing adaptive capacity and understanding adaptation emerged from the research projects[1]:

- the need for adaptive management;
- mainstreaming climate change adaptation;
- emphasizing collaborative approaches;
- the need for a tailored approach to adaptation; and
- viewing mitigation and adaptation as complementary.

The Need for Adaptive Management

The commissioned research projects identified adaptive management as one way to deal with the uncertainty and knowledge gaps associated with the science of climate change. Permanent monitoring and re-assessment of adaptation policies and programs allow for necessary adjustments, and some workshop participants emphasized the need for this kind of ongoing evaluation. They saw adaptive management as a possible way to avoid the disadvantages associated with maladaptation. For example, research in the urban

drainage infrastructure sector recommended an adaptive management approach to deal with the prospects of more frequent and intense extreme climatic events, such as intense rain episodes. Considering a number of climate change scenarios and intervention plans that use alternative adaptation measures becomes important in any response to the long-term uncertainty associated with a changing climate. Hence, research called for a continuous re-examination of intervention plans in response to the evolving climatic projections and advances in climate science (Mailhot et al., 2008).

Mainstreaming Climate Change Adaptation

Some research projects emphasized the significance of a holistic, comprehensive, and integrated approach to climate change adaptation and adaptive capacity (Bizikova et al., 2008; Brklacich et al., 2008; Bryant et al., 2008). "Mainstreaming" refers to this integration of climate change considerations into a range of policies, programs, and decision-making processes.

In this regard, a changing climate represents one more factor that can exacerbate pre-existing stressors and constrain current adaptive capacity. Pre-existing stressors can be local or external, climatic or non-climatic. Because of the potential of climate change to impact (or be impacted by) these existing and interrelated stressors (e.g., demographic factors, macro-economic forces, deteriorated infrastructure, land use practices), many of the commissioned research projects recognized the need for a mainstreaming approach.

Some research also called for the institutionalization of climate change considerations within all aspects of the planning, policy, programs, and strategy processes and in developing the governance institutions involved with climate change adaptation. For example, research in the forestry sector recognized the need for institutionalizing approaches that consider climate change and identifying opportunities to develop long-term planning that integrates climate change within forest management plans (Johnston et al., 2008). Similarly, the watershed infrastructure sector tests alternative approaches and adaptation options in an effort to incorporate climate change considerations into existing management plans and policy processes (Christensen et al., 2008).

First Nations have traditionally recognized the importance of an integrated approach to the environment. The Migmag, for instance, identified climate change as one factor affecting the availability of traditional medicinal ingredients; other factors included land use practices, cultural changes, and lifestyles (Gagnon et al., 2008).

Mainstreaming also includes enhancing current adaptive capacities to cope with future climatic stress. The commissioned research projects used a range of methods to identify deficits in particular adaptive capacities and the venues needed to enhance required adaptive capacities. For example, researchers applied selected indicators to identify areas with adaptive capacity deficits in the Canadian boreal plains ecozone. The selected indicators included family income, incidence of low-income families, full-time employment change, unemployment rate, population change, and average family income (Johnston et al., 2008).

Workshop discussions recognized the importance of the interrelated nature of stressors in risk management processes and in a changing climate. Some participants argued for a systematic or multi-dimensional approach (*i.e.*, social, economic, and biophysical) to climate change. Acknowledging the multiple dimensions of climate change adaptation indicates an attempt at integrating sustainability across time scales and varied disciplines. In the context of planning, participants identified the need to find strategic areas for mainstreaming climate change to produce the most impact, with the understanding that this approach suits some policy domains more than others.

Emphasis on Collaborative Approaches

Collaboration in this report refers to a process that facilitates a wide range of social interaction initiatives, including participatory methods, focus groups, community forums, group discussions, community meetings, workshops, face-to-face communications, and First Nations elders circles. The actual process of collaboration facilitates social interaction and exposes those involved in the research to alternative perspectives as participants share information and knowledge. It also allows for combining methodologies and adopting integrative and multidisciplinary approaches. Some research projects explicitly recognized the benefits of a collaborative approach and called for such endeavours (Bizikova et al., 2008; Brklacich et al., 2008; Bryant et al., 2008).

The commissioned research projects covered a range of collaborative initiatives, from participatory action research and partnerships, to workshops and multidisciplinary initiatives (see Bryant et al., 2008; Gagnon et al., 2008; McLeman, 2008; Sauchyn et al., 2008). This collaborative process was also reflected in the authors, co-authors, collaborators, and participants involved in the commissioned projects. They included biophysical and social scientists, decision makers, managers, representatives of community organizations, and community members. By taking collaborators through the process of defining concepts and goals, identifying issues and objectives, developing methods and venues, transferring and sharing knowledge and information, a progressive learning process takes place that enhances **human capital**. This can potentially generate formal and informal institutions, such as legal agreements and memoranda of understanding, or become a component of the decision-making process.

> **Human Capital:** The training, skills, education, health, etc. of an individual or group of individuals collectively, viewed as a resource contributing to economic growth. (Oxford dictionary)

Collaboration can also enhance **social capital**. The commissioned research projects called for higher levels of social capital[2], including the development of social networks, trust, and co-operation to enhance adaptive capacity (PRI, 2005a,b). Rural community-based research referred to social capital as informal organizations and social networks, such as community groups and associations. Social networks have a strong sense of trust and co-operation that can be mobilized to achieve social and economic objectives (Brklacich et al., 2008). While local community

> **Social Capital:** Social networks that provide access to resources and support (PRI, 2005a: 1).

groups provide one foundation on which to build capacity to adapt to stress and climate change (McLeman, 2008), the need for higher levels of social capital in support of collective action was also highlighted in the forestry research (Johnston et al., 2008).

Workshop participants expanded on the importance of collaborative approaches, and encouraged better collaboration within the science community, and among sectors and disciplines. Participants recognized that collaborative approaches might help overcome barriers to adaptation and adaptive capacity. Collaboration in policy development was suggested as a best practice initiative, and identified as a suitable process to bring regional initiatives into the national dialogue. Collaborative endeavours were also seen as a way to help manage and connect multiple perspectives. "**Embedded science**," a collaborative model where scientists work with communities, managers, planners, and practitioners to incorporate scientific analyses into policy development and management plans. Collaboration, under the context of embedded science, starts at the beginning of the planning cycle to ensure that scientists support the objectives of the plan (Johnston et al., 2008).

Embedded Science: A collaborative model where scientists work with communities, managers, planners, and practitioners to incorporate scientific analyses into policy development and management plans.

During the plenary discussions at the workshop, social capital and enhancing understanding of social capital also gained attention. Participants acknowledged the importance of building networks to support the enhancement of adaptive capacity, because social networks allow communities to pursue a course of action in climate change adaptation. In addition, participants identified social capital as an important component for pulling different experiences and disciplines together.

Adaptation Requires a Tailored Approach

The need for connecting global climate change (e.g., global average temperature, global average precipitation) to stressors, needs, and priorities at the local (e.g., town, neighbourhood), sectoral (e.g., mining, transportation), and group (e.g., women, people with a disability) levels relates to the juxtaposition of the multiple stressors associated with climate change issues discussed earlier. Two important themes emerged from the research: the differential or contextual character of climate change impact and adaptation at the local, sectoral, and group levels; and the necessity for making climate change relevant to the local, sectoral, and group levels.

The interactions of global processes, such as climate change, with local processes, such as demographic stress, vary geographically and impact different groups in different ways. As a result, adaptation strategies need to be tailored to such variations. Research from both the agricultural and health sectors illustrated this need. Farmers experienced stressors and impacts differently, depending on their geographical location. Thus, crop selection should be tailored to the unique conditions of a given region (Bryant et al., 2008). With respect to health, adaptation efforts will require a focus on the most vulnerable groups of people – children, seniors, those with a disability, the homeless, the

isolated, the chronically ill (Berry et al., *in progress*; Gosselin et al., 2008; Kosatsky et al., 2008).

The research reports stressed the importance of applying lessons from the past to current and future adaptations. This approach is integral to First Nations research where elders seeked successful strategies by examining and learning from past community adaptations. Workshop participants also stressed the importance of increasing human capital by learning from the past, embracing both First Nations and non-Aboriginal experiences. An example of a maladaptation came from the James Smith First Nation where a dramatic die-off of cattle led to the collapse of the economic base in the community and the introduction of the welfare system. With welfare, came dependency, the loss of a work ethic, and lifestyle changes, including poor nutrition and the development of high levels of diabetes. Elders called for reconnecting the young population to cultural and spiritual resources to enhance the capacity of the people to negotiate the future (Ermine et al., 2008).

In this regard, the reports and workshop participants identified lessons from history and a better use of case examples as valuable resources. Some participants did caution about the usefulness of historical adaptation: past experiences might not provide much guidance in developing adaptation strategies, because of the unprecedented impacts expected in a changing climate.

At least five of the nineteen research projects mentioned economic diversification, as an adaptation strategy tailored to local or sectoral needs and priorities. Diversification might be a feasible alternative within the same economic sector or another economic sector. For example, researchers in the fish and fisheries sector analyzed fishery licences and the landed value of fish. They identified past interaction and diversification within British Columbia, as the fishery industry moved from capturing Pacific salmon to other fish species, such as halibut, sablefish, ground fish trawl, and crab (Hunter and Hyatt, 2008).

Economic diversification was also found in rural research. Some case studies identified the diversification of the economic base of rural communities as a top priority. Researchers did not suggest that a community should abandon its historic and traditional economic base, but leverage existing assets. Promoting tourism was mentioned as one way to build on the local resource base and history (Brklacich et al., 2008). Workshop participants also commented on the small number of studies focusing on alternative agriculture, the homeless, and specific vulnerable populations.

Participants at the workshop discussed the importance of making climate change adaptation relevant to Canadians by tailoring strategies to meet specific needs and priorities. Theme or place-based approaches were considered important as was the manner of communications with specific communities, sectors, and groups. Within that context, “place” was identified as the arena for addressing the disconnect between “where people live” and “where the policy is taken.” Climate change must be made relevant to community members.

Participatory approaches can aid rural community members in making the connections between global forces (e.g., climate change and economic globalization) and local stress (e.g., aging population, deteriorated infrastructure). Such connections allow community members to identify the potential of climate change to exacerbate existing local stresses (Brklacich et al., 2008; McLeman, 2008).

One study in the health sector assessed the effectiveness of communication targeting seniors that explained heat risk and protection measures. In addition, the study focused on seniors considered at high risk (e.g., those who are poor, isolated, or frail) in terms of adopting protection measures during heat wave events. The research revealed problems in the acceptance and feasibility of some proposed protection measures and offered recommendations to promote the effectiveness of the communication (Gosselin et al., 2008).

The importance of making climate change relevant to Canadians was discussed at the workshop. Some participants noted that climate change in general is an extremely broad issue that does not always resonate with the public; that is, people do not see it as relevant to their daily life. Participants suggested using visual means and real examples as one option to help people understand what climate change impacts and adaptations mean and what adaptation looks like.

Adaptation and Mitigation as Complementary

Several of the research projects viewed adaptation and mitigation as complementary activities. For example, the research in the forestry sector encouraged the integration of both adaptation and mitigation considerations into forest management plans (Johnston et al., 2008; Yamasaki et al., 2008). Another example was found in community research that embraced mitigation co-benefits to adaptation within the context of sustainable development. For example, increasing the number of trees and canopy coverage in an urban environment helps reduce the impact of hot days and heat waves, intense rainfall, storm water run-off, and pollution. At the same time, trees and canopy coverage support a decrease in the use of air conditioning, therefore reducing greenhouse gas emissions (Bizikova et al., 2008).

5. Common Barriers to Adaptation

The research identified four major barriers to adaptation and adaptive capacity. It was also noted that these barriers will likely constrain mitigation efforts as well[3]:

- the perceived lack of leadership and action by governments;
- existing governance and institutional arrangements;
- policy and regulatory issues; and
- uncertainty and lack of understanding.

Perceived Lack of Governments Leadership and Action

A few of the research projects mentioned the perceived lack of leadership and action by governments on climate change as reported by stakeholders. This hindered the

willingness of stakeholders to adopt anticipatory responses, and deprived them of a targeted and co-ordinated action plan to guide potential adaptation efforts. For example, research in the forestry sector referred to the risk in regulatory uncertainty around carbon pricing. This hindered forestry managers in pursuing adaptation initiatives (Johnston et al., 2008). Researchers in the fish and fisheries sector reported on outcomes of various outreach and science transfer workshops. They referred to the public perception of a lack of leadership and governments' inaction on climate change (Casselman et al., 2008). Research in the agricultural sector also identified stakeholder concerns regarding the lack of vision, both in terms of agriculture and climate change, and the slow implementation of existing policies and programs (Bryant et al., 2008).

Existing Governance and Institutional Arrangements

The identification of governance and institutional arrangements as a barrier relates to the need for a better understanding of, and response to, local needs and priorities. For example, researchers in the forestry sector called for greater local authority and autonomy in decision making. The recognition of the varying effects of climate change from place to place and the call for adaptations tailored to local needs and priorities led to an interesting dimension in terms of transferring authority and autonomy to the local level. The research cautioned that actual trends may be in the opposite direction, toward more centralized institutions (Johnston et al., 2008). As a result, the need to minimize local impacts and tailor adaptations to local climate change risks gets lost. Rural community research called on policy makers to engage with the local community level in an effort to remove barriers to adaptation (McLeman, 2008).

The lack of co-ordination among governments became another barrier. Research in rural communities recognized the multiple interactions occurring among planning and governance structures, and many other agencies. These interactions happened at the municipal level and with more senior levels of government. The co-ordination among governments has the potential to either support or hinder a community's capacity to adapt to an uncertain future. For example, the rural community of Change Islands, Newfoundland and Labrador, relied on local informal institutions. However, provincial legislation governing the tourism sector was designed to regulate year-round facilities in Change Islands, making it difficult for seasonal tourism facilities to have complied with provincial regulations (Brklacich et al., 2008).

Workshop participants also referred to a disconnect in research time frames. For example, research highlighted the need to provide sufficient time to engage different stakeholders, build trust, and share knowledge (Searle et al., 2008). Another example was found in the agricultural sector research, which noted that time constraints can restrict research methodologies and reduce the number of localities included in the research (Bryant et al., 2008). First Nations' research identified time lines imposed by funding agencies as limits on the ability to address cultural sensitivities and argued for adequate time to build relations with Aboriginal people (Gagnon et al., 2008).

Policy and Regulatory Issues

The commissioned research projects recognized some policy and regulatory issues as barriers to adaptation and adaptive capacity. For instance, protected areas in Ontario are designed and selected based on the principle of ecological representation. The idea is to create a system of protected areas that captures ecosystems that are representative of the province. In this regard, the purpose of a protected area is to preserve over time the particular ecosystem (or ecosystems) contained within its boundary. However, ecosystems within protected areas are expected to change as a result of climate change. This means that current ecological representation signifies an unsustainable target under a changing climate (Lemieux et al., 2008).

In Addington Highlands, Ontario, most small business are subject to the same provincial regulations and reporting requirements as large corporations. The overhead costs associated with these constantly increasing reporting requirements, which come directly out of the net incomes of families, stress the local economy and leave community members with fewer resources to dedicate to adaptation efforts. For instance, a timber-harvesting company is required to employ licensed foresters and pursue extensive pre- and post-cutting reports. However, family-owned annual logging operations are frequently very small, and meeting reporting requirements can be disproportionately burdensome. The research suggested the requirements favour large corporations and punish small family businesses (McLeman, 2008).

Uncertainty and Lack of Understanding

Some research projects identified the need to educate the public and stakeholders about climate change science and the uncertainty associated with climate change. Scenarios that present a range of future possibilities have been suggested to address that uncertainty. This provides flexible rather than fixed-static responses. Such knowledge plays an important role in reducing resistance toward climate change adaptation initiatives, thus enhancing the willingness to adapt.

For example, researchers in the water resource sector argued that the lack of understanding of climate change scenarios, paleo-data, and future uncertainty all hinder the capacity to adapt. Strategic approaches and risk assessments are usually based on direct observation, that is, a relatively short period of data and observations. But, under potential climate change impacts and the threat of more frequent and intense climatic extremes, such as intense rainfalls and storms, a stationary approach to strategic and risk assessments further constrains the range of future possibilities (Sauchyn et al., 2008).

Researchers noted that discussing the benefits of considering non-traditional sources of knowledge enhances the capacity of water managers and practitioners to plan for climate change. For example, including an analysis of tree rings and climate change scenarios enhances existing hydro-climatic measurement data (Sauchyn et al., 2008).

Another example was found in the watershed infrastructure sector. Researchers evaluated two potential climate change adaptation options by pursuing an integrated

assessment in the Rural Municipality of Corman Park, Saskatchewan.The researchers explicitly acknowledged the importance of incorporating uncertainty in the assessment process. They encouraged results to reflect uncertainty to produce a range of probable future results for each option under study (Christensen et al., 2008).

6. Linking Science and Policy

This report presents collective learning's from the CCIAD commissioned research projects to inform decision making and assist policy makers in their efforts to create and implement effective adaptation policies and programs. More generally, the synthesis attempts to facilitate the linkage between science and policy. This is an ongoing challenge for both the research and policy communities. Members from both were brought together in the workshop forum to discuss such challenges. This section presents some of the outcomes of the workshop discussions in the context of linking science and policy.

Participants considered communication, awareness, and the development of communication strategies as important elements in linking research and policy development. While participants acknowledged the range of players involved in climate change adaptation, including diverse disciplines and multiple perspectives, they also recognized the need to encourage dialogue among different sectors of society. In addition, participants noted the diversity of terms and concepts involved in climate change, such as adaptation, adaptive capacity, and mitigation, and emphasized the need for a common understanding of what these terms mean. Efforts to communicate the terms clearly could help develop a community of practice among scientists and policy makers.

Participants identified data and information issues regarding science and policy. In addition to the lack of data standardization, accessibility to data and information were identified as important challenges constantly faced by policy analysts. Participants also acknowledged the requirement for adequate data that supports efforts to persuade the public of the need to act. While recognizing that data needs to be local to be meaningful and credible, that same data should also be positioned within a broader context and at different scales to inform policy.

Workshop participants had a lively discussion about quantifying values and perceptions, and related adaptation as part of sustainability and quality of life. Quantification was discussed as a useful tool in decision making, for example, in evaluating trade-offs, and measuring adaptation targets and progress. However, the importance of qualitative research results was equally emphasized as a valid and meaningful source of information. Many participants noted that it is not a question of one or the other; ideally, both quantitative and qualitative methods are used.

Participants at the workshop provided some simple and useful guidelines for researchers, aimed at facilitating the incorporation of research findings in policy considerations.

- Clearly identify the relevant policy makers, and understand their readiness for adopting new ideas.
- Identify windows of opportunity to have influence as researchers. Communicate succinctly and clearly.
- Take steps to develop trust between research and policy makers.
- Ensure the science is rigorous and prepare for meaningful use.

The issue of "proactive inertia" also received attention during the workshop discussion. Researchers were encouraged to anticipate policy needs and be ready when the adaptation imperative became broadly recognized. Participants also identified the limited funding available to pursue adaptation initiatives. In this regard, they acknowledged the necessity of making the case to secure funds for adaptation when the opportunity arrives, while learning from existing research.

Finally, participants called for research involving cultural diversity and urban–rural differences to further inform policy and program development. Participants also encouraged the sharing of information among sectors regarding climate change adaptation initiatives under way in private industry. Mitigation and **adaptation co-benefits** (measures that simultaneously reduce vulnerability to climate change and decrease greenhouse gas emissions) were identified as a topic deserving further exploration, including how to make the most out of funding by achieving co-benefits.

Adaptation Co-Benefits: Measures that simultaneously reduce vulnerability to climate change and decrease greenhouse gas emissions.

7. Conclusion

This report synthesizes 19 of the 20 CCIAD commissioned research projects, 2007-08, and integrates discussions drawn from the workshop, Understanding Adaptation and Adaptive Capacity, held June 5, 2009, in Ottawa. This report has found a number of common themes and key messages, covering a wide range of sectors, institutions, disciplines, and authors involved in the research projects and workshop discussions.

- Mainstreaming climate change adaptation is recommended. It refers to the integration of climate change consideration throughout the planning and decision-making processes of diverse sectors.

- The need for an adaptive management approach emerges as a response to deal with the inherent uncertainty and knowledge gaps involved in the climate change science. An adaptive management approach allows for necessary adjustments to adaptation policies and programs when necessary.

- Uncertainty in climate change can be addressed by accommodating a range of possible future climate scenarios, providing flexible rather than fixed-static responses.

- Adaptation requires a tailored approach to respond to the differential or contextual character of climate change impact and adaptation at the local, sectoral, and group levels.

- Existing governance and institutional arrangements need to be designed to respond to local needs and priorities for adaptation.

- There is a need for more flexible policy and regulatory instruments to respond to the particular adaptation needs and priorities of the local, sectoral, and group levels, while enhancing their capacity to cope with climate stress.

- Collaborative approaches strengthen adaptive capacity by supporting and enhancing social and human capital.

- Governments' leadership and action on climate change may enhance stakeholders' willingness to adopt an anticipatory response, while providing an action plan to guide stakeholders' potential adaptation efforts.

- Mitigation and adaptation are complementary approaches, as opposed to competing perspectives. The search for mitigation and adaptation co-benefits and synergies requires further exploration.

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Appendix 1 - Agenda: Understanding Adaptation and Adaptive Capacity to Climate Change Workshop

International Development and Research Centre (IDRC), 8th Floor (Meeting room: W. David Hopper A). 150 Kent St., Ottawa. June 5, 2009.

Objectives of the Workshop are to:

- Explore the key findings and common themes emerging from research conducted under NRCan's Understanding Adaptation and Adaptation Capacity call for proposals.
- Explore approaches/processes that contribute to enhancing adaptive capacity.
- Identify key principles with respect to the development of adaptation policies and programs.
- Identify knowledge gaps and encourage collaborative initiatives.

Agenda

8:30 Coffee and light refreshments

9:00 Welcome by NRCan and PRI
Judy Watling, Director General, Policy Research Initiative
Pamela Kertland, Manager, Tools for Adaptation Programming, NRCan

Introductions and objectives (Melissa Creede, facilitator)

9:50 Presentation - Synthesis of findings from 19 research papers, PRI – Lorena Patino

10:15 Health break

10:30 Exploring adaptation and enhancing adaptive capacity

Table Discussion - draw on individual experience and the synthesis presentation to reflect on common learnings for adaptation and enhancing adaptive capacity

Report back in plenary

12:15 Lunch

13:15 Linking science and policy

Presentation - Case Study: Policy and Science. Jim Frehs, Manager, Health Canada

13:45 Linking science and policy

Table discussion with report back to plenary - from our collective experience, identify key messages and lessons learned for adaptation policy and program development

14:30 Health break

15: 45 Wrap-up plenary on learnings and key findings

16:15 Closing remarks by NRCan and PRI

Judy Watling, Director General, Policy Research Initiative
Pamela Kertland, Manager, Tools for Adaptation Programming, NRCan

Appendix 2 - List of Participants and Affiliations at the Understanding Adaptation and Adaptive Capacity to Climate Change Workshop, IDRC, June 5, 2009

Name	**Organization**
Peter Berry	Health Canada
Livia Bizikova	International Institute of Sustainable Development
Heidi Braun	International Development Research Centre
Professor Mike Brklacich	Carleton University
Christopher Bryant	Université de Montréal
Bernard Cantin	Policy Research Initiative
Simon Carter	International Development Research Centre
John M. Casselman	Queen's University
Paul Christensen	University of Saskatchewan
Stewart J. Cohen	Environment Canada
Melissa Creede	Facilitator
Peter Croal	Canadian International Development Agency
Janice Festa	Transport Canada
Jim Frehs	Health Canada
Chantal Gagnon	Southern Gulf of St. Lawrence Coalition on Sustainability
Harvey Hill	Agriculture and Agri-Food Canada
Brian Horton	Natural Resources Canada
Kim Hyatt	Fisheries and Ocean Canada
Jane Inch	Environment Canada
Mark Johnston	Saskatchewan Research Council
Pamela Kertland	Natural Resources Canada
Norman King	Agence de la santé et des services sociaux de Montréal
Thomas Kosatsky	Regional Public Health Program - Montreal Center
Patrick	Human Resources and Skills Development Canada
Caroline Larrivée	OURANOS - Consortium on Regional Climatology and Adaptation to Climate Change

Name	Organization
Christopher Lemieux	University of Waterloo
Alain Mailhot	Institut national de la recherche scientifique
John McEwen	Indian and Northern Affairs Canada
Robert McLeman	University of Ottawa
Lisa McPhail	Infrastructure Canada
Anne Morin	Policy Research Initiative
Jennifer Mullane	Fisheries and Oceans Canada
Chad Nelson	Environment Canada
Lorena Patino	Policy Research Initiative
Jeremy Pittman	University of Regina
Claude Rioux	Université du Québec à Rimouski
Judy Roussel	Agriculture and Agri-Food Canada
Dave Sauchyn	University of Regina
Rick Searle	EKOS Communications Inc.
Doug Seeley	Deep Synergy
Ian Small	Foreign Affairs and International Trade
Catherine Ste-Marie	Natural Resources Canada
Stephanie B.	Policy Research Initiative
Amélie Tessier	Infrastructure Canada
David Thorne	Atlantic Canada Opportunities Agency
Henry David Venema	International Institute for Sustainable Development
Lucille Villasenor-Caron	Natural Resources Canada
Malcom Wakefield	Canada Mortgage and Housing Corporation
Judy Watling	Policy Research Initiative
Tim Williamson	Natural Resources Canada

Notes

[1] Common messages are found in at least three of the CCIAD-commissioned research initiatives, and were further identified at the Understanding Adaptation and Adaptive Capacity workshop.

[2] Social capital refers to "social networks that provide access to resources and support" (PRI, 2005a: 1).

[3] Barriers are not found in all research projects. However, they are identified in at least three of the CCIAD-commissioned research initiatives, and were further acknowledged at the workshop.