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ADAPTATION AND IMPACTS RESEARCH GROUP (AIRG)
Meteorological Service of Canada, Environment Canada

MAINSTREAMING ADAPTATION AND IMPACTS SCIENCE INTO SOLUTIONS

By:
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OCCASIONAL PAPER 2

January 2005

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INTRODUCTION

Over the past decade, the Adaptation and Impacts Research Group (AIRG) of the Meteorological Service of Canada, Environment Canada, has developed scientifically sound knowledge, information, data, models, maps and policy strategies ranging from the global to the community levels. The adaptation process is best viewed as an iterative, non-linear cycle that involves multi-disciplines, multi-agencies and all Canadians. The adaptation outcomes may occur at any stage in this knowledge creation and sharing process and may involve scientific, technological, institutional, behavioral, political, financial, regulatory, and/or individual adjustments to the changing climate.

Climate change, based on past and current observed data and scenarios of the future climates, creates a picture of a warming climate along with other changes in variability and extremes. The concern facing the impacts and adaptation science community is the determination of the frequency and magnitude of extreme events in the future. The associated mitigation actions to reduce greenhouse gases will have a minimal effect on the global mean temperature change and hence a much greater acceleration and commitment to adaptation solutions is needed now. Within this context, the AIRG has evolved significantly from its early focus on the science of impacts to that of adaptation options. Today, the AIRG has refined its concepts, methodologies, partnering and delivery of adaptation science (AIRG Newsletter, 2004) to help Canadians prosper by making adjustments in their social, environmental and economic activities. This includes the co-development of solutions in partnership with more than 200 clients and partners across Canada and worldwide.

Generally, the thematic areas of study include climate change and socio-economic scenarios; climate variability and change; natural and human-induced hazards; water resources; adaptation modeling;

This paper is an extract from the Book "Climate Change: Building the Adaptive Capacity", 2004, (eds. A. Fenech, R. Bing Rong, D. MacIver and H. Auld), Meteorological Service of Canada, Environment Canada, 400 pgs.

human health and biodiversity. Specific topics include, for example, regional climates and adaptation baselines; climate change scenarios and downscaling methodologies; high impact weather and hazards; weather warnings for behavioral adaptations; water resources and participatory impact assessments; climate change and energy modeling; transportation and weather extremes; safety and security; human health (e.g., water-borne diseases, infectious diseases) and biodiversity conservation (e.g., forestry, agriculture, parks).

The Mainstreaming Framework, utilized by the AIRG in many projects, is illustrated in Figure 1, where the top-left circle represents the top-down approach and the top-right circle represents the bottom-up approach and the bottom circle yields unified solutions.

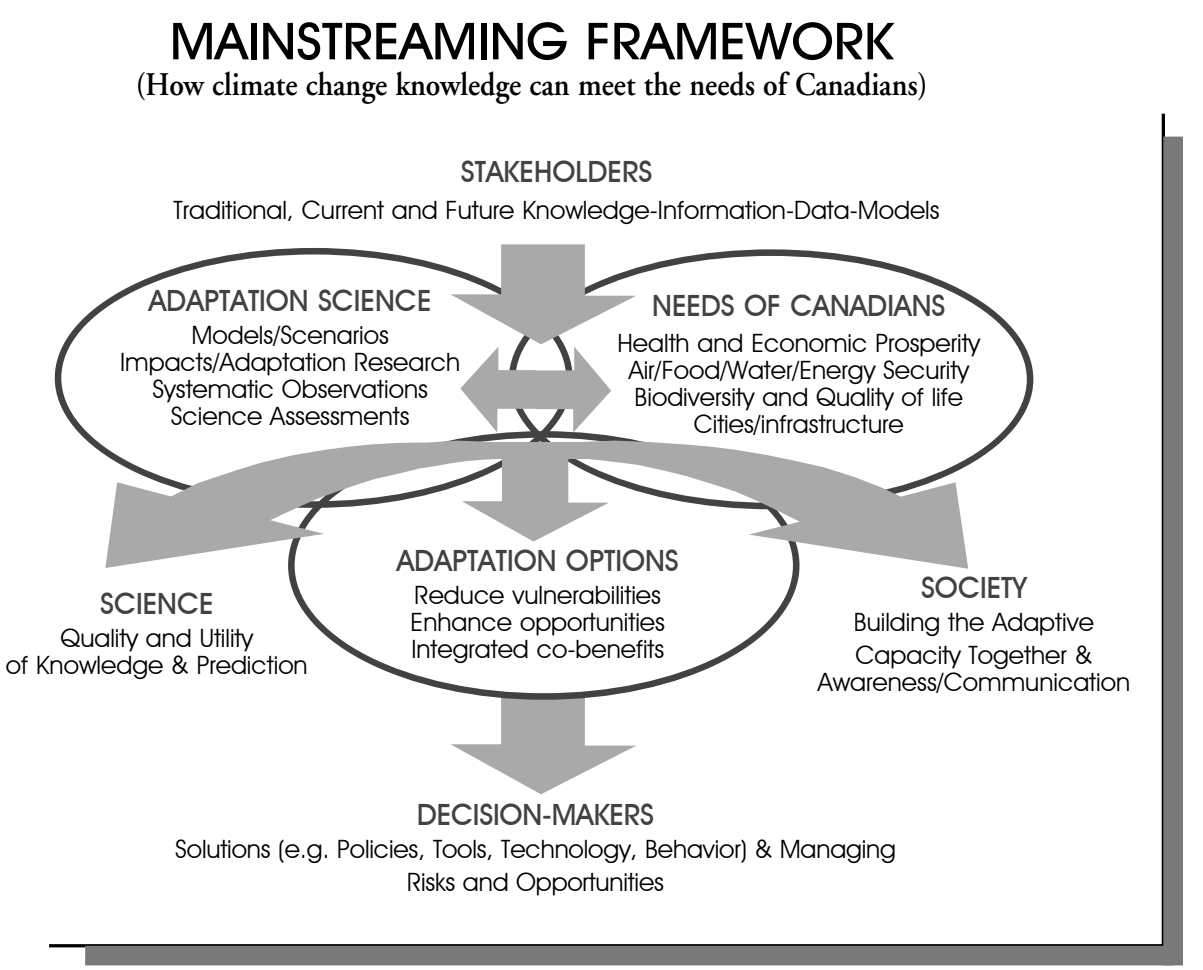

Figure 1: The Mainstreaming Framework where the upper left circle represents the top-down approach, the upper right circle represents the bottom-up approach and the lower circle represents the unified solutions (adapted from Wheaton and MacIver, 1999).

THE AIRG ADAPTATION VISION AND MISSION STATEMENT

Vision
Canadians become well-adapted to current and future changes in the climate and weather systems and prosper by making adjustments in their social, economic and environmental activities.

Mission Statement
To provide scientific expertise and leadership to Canadians on the environmental, social and economic risks, vulnerabilities, impacts and adaptations associated with climate variability, extremes and change.

ADAPTATION SCIENCE CAPACITY (THE WHERE):

The location of adaptation scientists is fundamental to the successful development and delivery of their science into solutions. Building the adaptive capacity of Canadians begins with developing sound science, increasing confidence in the certainty and resolution of climate change scenarios, understanding adaptation lessons and trends from the past, integrating adaptation into decision-making models and participatory dialogue with partners/stakeholders to effectively implement adaptation solutions.

The AIRG scientists, a core group of twelve plus many project-based researchers, are distributed and embedded in Universities across Canada to help increase the intellectual collaboration and to provide a portal for the transfer of new scientific developments into policy and practice. The benefits to both participating agencies are significant. The University community gains from greater scientific collaboration, intellectual advances, teaching and graduate student supervision and employment opportunities for students, post-doctoral fellows and staff. On the other hand, government scientists lead and/or participate in the development of new science, new research partnerships, new funding opportunities and the effective transfer of knowledge from many regions across Canada and worldwide into policies and solutions for decision-makers.

Building the adaptive capacity in Canada has been a long-term investment strategy to strengthen science and technology, education, training and communication. Adaptation solutions can take many forms ranging from pro-active and preventive changes to reactive and responsive changes.

The organizational structure of the AIRG is illustrated in Figure 2:

ADAPTATION SCIENCE (THE HOW):

Enhancing the well-being of Canadians, preserving our natural environment and advancing our long-term competitiveness will require environmental predictions at ever-increasing resolutions and certainties. To achieve these goals, impacts and adaptation research needs better regional climate models and downscaling methodologies, improved earth observing systems information, strengthened electronic

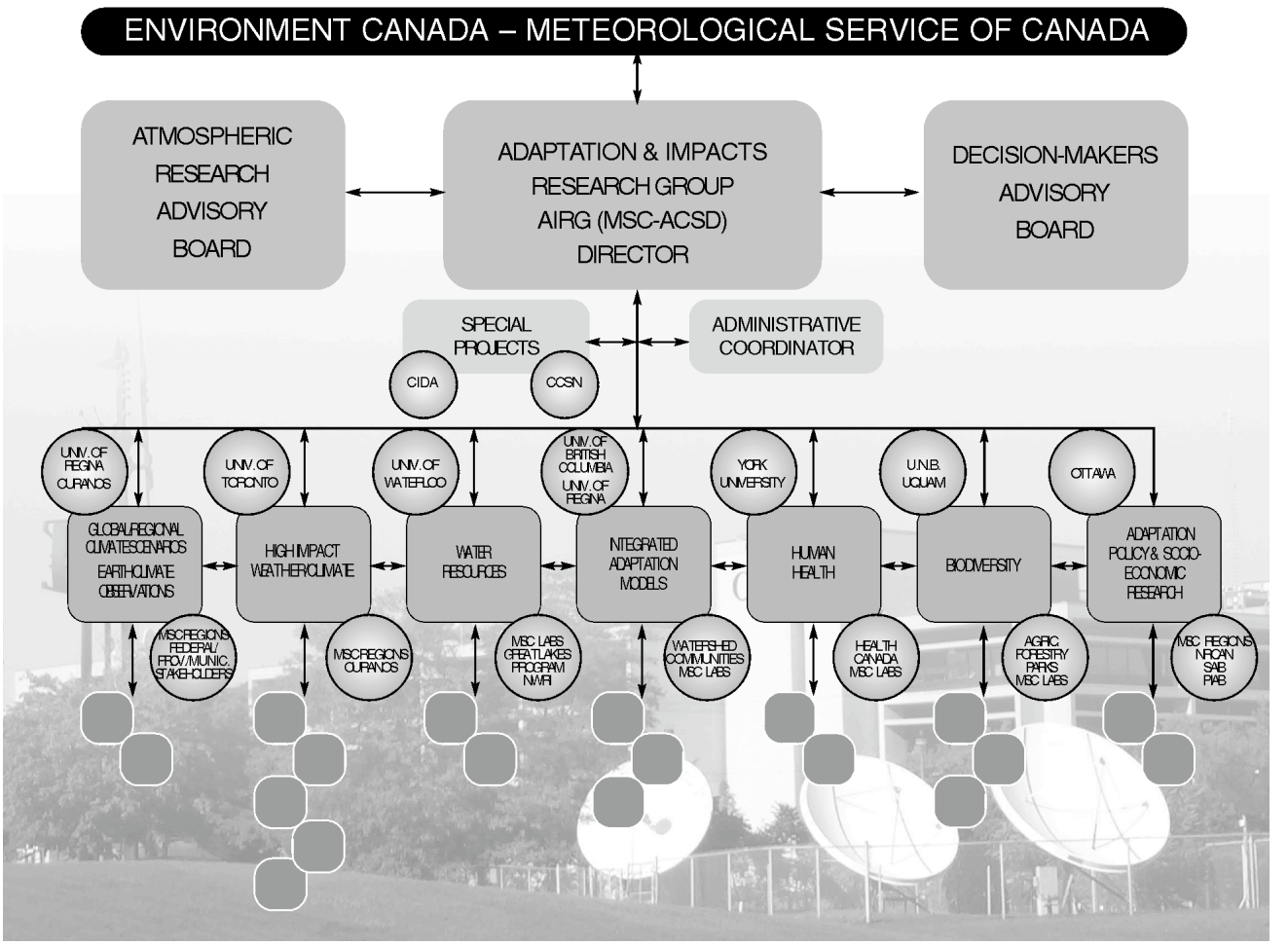

Figure 2: Organizational Structure of the AIRG at various Universities across Canada (top circles) with direct interlinkages to the applied science and forecasting parts of the Meteorological Service of Canada (MSC) regions, economic sectors, and other agencies (the bottom circles) and the various adaptation issues are illustrated in the square boxes

infrastructure, greater participatory engagement by the public and private sectors and dynamic modeling capabilities for the timely dissemination of knowledge into policy and adaptive management decisions. Climate change and associated sea level rise; frequent extreme weather events and increasing losses from them; pollution of land, water and air; threats to freshwater and groundwater resources availability; increasing energy demand; rapid urbanization and pressures on natural capital have become the most pressing environmental and economic problems facing Canada in the 21st century. These problems are further compounded due to increased human interventions on the natural systems and by changes in natural and human-induced climate variability and extremes. Collectively, these impacts have already become a major challenge to human health, safety and security, well-being and quality of life, long-term competitiveness and the protection of our ecosystem and planetary health.

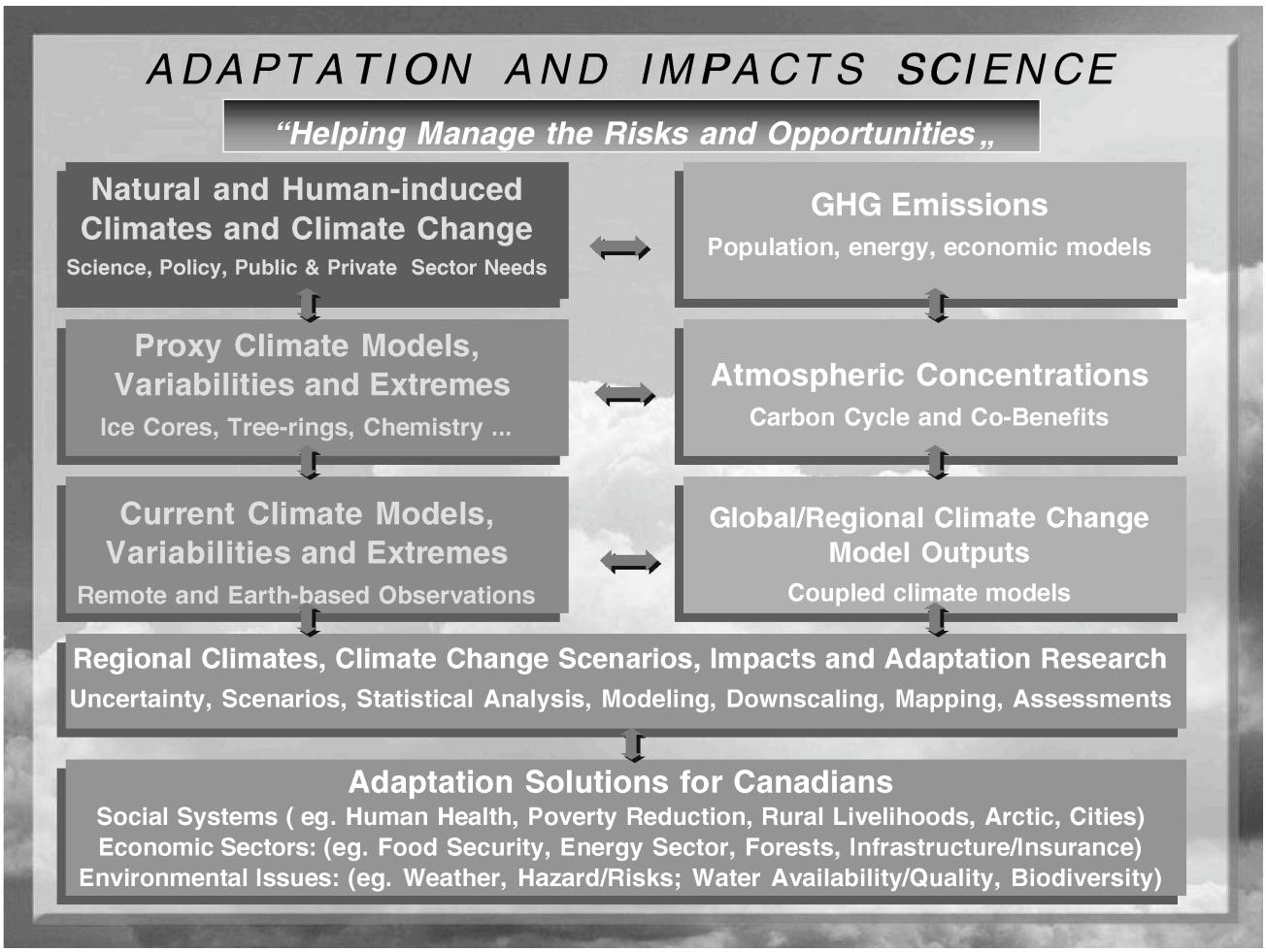

Figure 3: This analytical framework illustrates the adaptation science approach leading to solutions that are embedded within the social, economic and environmental framework of sustainable development.

The adaptation science analytical approach begins with either a science, policy or private sector need expressed in the form of a question or a problem worthy of further scientific investigation. In some cases, proxy and current climate models, based on systematic observations of the earth's climate system, can provide answers. In other cases, both historical data and future climate model scenarios at the global and regional scales are needed to help answer the problems. This type of analytical framework is illustrated in Figure 3:

THE OUTCOMES (THE WHY):

The outcomes or solutions are further defined beyond the sustainable development framework of social, economic and environmental issues into specific outcomes. This table is illustrated in Figure 4, where the first level matrix recognizes the following four outcome levels:

- **Improving Human Health, Safety and Security:** This section focuses on near-term *Environmental Prediction,* indices and warnings to reduce the vulnerability of Canadians.

- **Enhancing Well-Being and Quality of Life:** This section focuses on enhancing *Environmental Quality,* especially from 2010 and beyond (e.g., climate change).

- **Strengthening Long-Term Competitiveness:** This section focuses on *Sustainable Use* in order to strengthen our long-term competitiveness.

- **Protecting Ecosystem and Planetary Health:** This section focuses on *Environmental Conservation* in order to help protect ecosystem health and planetary health.

The left column of the matrix recognizes the scale-dependency of adaptation solutions. Specific adaptation projects form the body of the matrix with considerable interlinkages between projects, outcomes and spatial/time scales. For example, projects that address adaptation solutions for coastal zone management will have international, national and community applications as well as human health, well-being, economic competitiveness and ecosystem health interconnections.

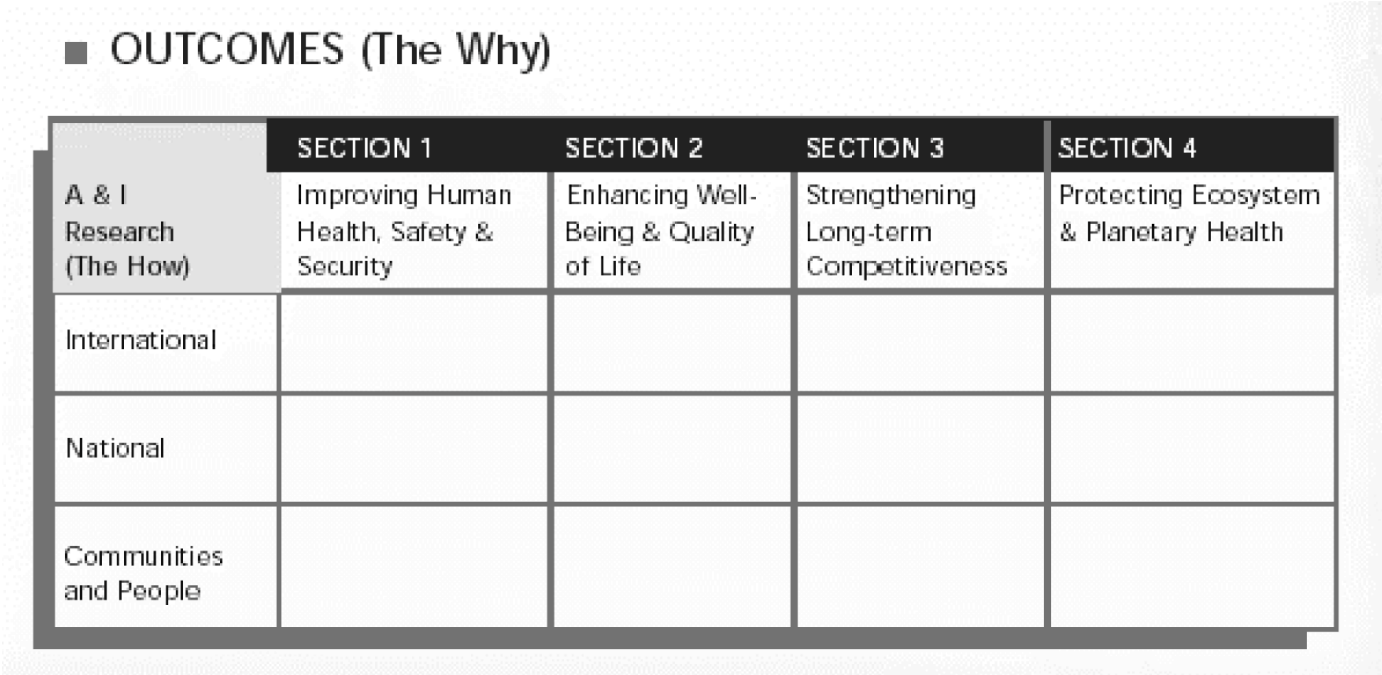

Figure 4: Outcome matrix with adaptation projects organized by outcome and scale.

Internally, the second level of stratification focuses on the individual projects that are then further clustered into five adaptation pillars – science and technology; information, prediction and reporting; performance policies and tools; governance; and education. This helps considerably in further identifying the partners, clients and outcomes of each project and the efficient development of solutions. In order to attain the objectives of numerous adaptation and impacts research projects, the formation of multi-disciplinary and multi-agency teams has long been an effective mechanism to deliver results in a timely manner. Since its establishment, the Adaptation and Impacts Research Group has been working very closely with the relevant government agencies, non-government organizations and citizens groups and aboriginal people. Our activities have expanded beyond Canada and the AIRG is providing scientific and technical support to many regions of the world to share our adaptation science and knowledge (eg. UNFCCC, IPCC, CBD, UNESCO, WMO, IJC, FAO, ISB, World bank, UNEP, UNDP, Smithsonian Institution, Canada-China, Canada-Caribbean, Canada-Africa, Canada-SE Asia).

Without a highly organized Mainstreaming Framework of this type, there would be little hope of integrating adaptation science into the decision-making processes. Within the overall matrix approach, this internal assessment of projects is further illustrated in Table 1.

WHO	SCALE	ADAPTATION PILLARS	TIMING	ENGAGEMENT
Scientists	Site	S &Technology	Anticipatory	Forecast and Preventive
Canadians	Local	Information	(pro-active)	
Communitie s	Regional	Governance		Natural and
Government s	National	Performance	Responsive	Autonomous
Private Sector	International	Educatio n	(reactive)	

Table 1: Internal identification of projects by who, scale, adaptation pillars, timing and engagement with partners, clients and decision-makers, internationally, nationally and locally.

SUMMARY COMMENTS:

The challenge facing many countries will be the identification of their international/national/community adaptation priorities and managing the risks and opportunities. The Mainstreaming Framework identified in this paper has been effective at bringing together the adaptation science communities; the communities that need to adapt and decision-makers. In other words, the definition of the problem, the effective creation of knowledge, the mobilization of the adaptation science capacity; the translation of knowledge into solutions, all requires an enabling Mainstreaming Framework that interlinks the science, policy, public and private sectors.

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