

CHAPTER 1: INTRODUCTION

Lead Authors:

Fiona J. Warren and **Donald S. Lemmen** (*Natural Resources Canada*)

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In 2008, Canada completed its second national science assessment on climate change impacts and adaptation – *From Impacts to Adaptation: Canada in a Changing Climate* (Lemmen et al., 2008). From a regional perspective, this assessment covered climate change risks and opportunities, and actions being taken to address them, highlighting key vulnerabilities and the potential for adaptation within human and managed systems. The current report, *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, is an update to the 2008 assessment. It focuses on research and knowledge developments made over the past 6 years in Canada’s economic, social and environmental sectors.

Since 2008, there has been significant progress on both adaptation research and practice, in Canada and internationally. Our understanding of impacts, both observed and projected, has also improved. Increased attention is being paid to climate-related risks, particularly those associated with extreme rainfall and flooding events. At the same time, confidence relating to observed changes in the climate system and the drivers behind these changes has increased (see Box 1), and the associated social, economic and environmental impacts have become more apparent. Many consider climate change to be one of the most pressing challenges we are facing today.

Adaptation is now recognized as an essential response to climate change that complements efforts to reduce greenhouse gas emissions. Adaptation involves making adjustments in our decisions, activities and ways of thinking in response to observed or expected changes in climate, with the goals of (a) reducing harm and (b) taking advantage of potential opportunities. Adaptation can include behavioural changes, operational modifications, technological interventions, planning changes and revised investment practices, regulations and legislation. While adaptation in the natural environment occurs spontaneously, adaptation in human systems often benefits from careful planning that is guided by both scientific research and detailed understanding of the systems involved. Some examples of adaptation discussed in this report include: 1) the application of deeper pile foundations and adjustable foundations to protect northern mining infrastructure from damage caused by permafrost warming; and 2) the development of heat alert and response systems to protect communities from the health impacts of extreme heat events.

The volume of scientific publications focused on impacts and adaptation has risen substantially over the past 10 years, with the subject areas becoming increasingly diverse. At the same time, the focus in the research has expanded beyond

WHAT ARE SCIENCE ASSESSMENTS?

Science assessments (Figure 1) are reports that assess, critically analyze and synthesize a growing knowledge base, drawing from published and grey literature. They are generally broad in scope, and are typically undertaken at global, regional, national and sometimes subnational scales. The Intergovernmental Panel on Climate Change (IPCC), for example, produces climate change assessments at the global scale (e.g. IPCC, 2012, 2013). As part of Canada’s Adaptation Platform, the Climate Change Impacts and Adaptation Division (CCIAD) of Natural Resources Canada works with other experts in governments, universities and non-government organizations to produce science assessments on climate change impacts and adaptation that provide current, relevant and accessible sources of information to help inform the planning of programs, policies and actions. In addition to this report, CCIAD is leading or co-leading targeted assessments on climate change impacts and adaptation in Canada’s a) coastal regions, b) transportation sector, and c) mining sector.



FIGURE 1: Examples of past assessments.

BOX 1

THE CHANGING CLIMATE

It is evident that our climate is changing. On a global scale, average air and ocean temperatures are increasing (Figure 2), snow and ice coverage is decreasing, and sea level is rising. These trends have been clearly documented by a strong and growing body of scientific evidence (e.g. IPCC, 2013). In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change concluded that “warming of the climate system is unequivocal” (IPCC, 2007), which it expanded upon in the recently released Fifth Assessment Report, noting that recent changes are without precedent over the scale of decades to millennia (IPCC, 2013). In addition to the trends cited above, there have been observed changes in precipitation, wind patterns, and some aspects of extreme weather events (e.g. droughts, heat waves and cyclones) (IPCC, 2012, 2013).

It is also evident that changes in the global climate result from a combination of natural and anthropogenic factors. The changes observed over the 20th century have been primarily attributed to human activity, such as the burning of fossil fuels and shifts in land-use patterns. This dominant anthropogenic influence is expected to persist throughout the present century and beyond (IPCC, 2013). While reducing greenhouse gas emissions is vital to reducing the rate and magnitude of climate change, further warming of the climate system is inevitable. Due to the nature of the Earth’s climate system, warming would continue even with aggressive mitigation measures (IPCC, 2013).

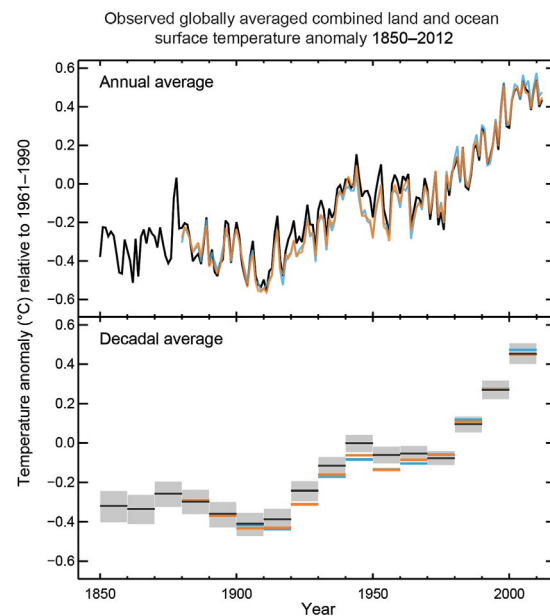


FIGURE 2: Observed global mean land and ocean surface temperature anomalies (from 1850–2012) from three data sets. Top panel shows annual mean values, bottom panel shows decadal mean values (Source: IPCC, 2013).

biophysical impacts accompanied by lists of potential adaptation options, to studies that examine the process of adaptation (the drivers and barriers) from a variety of perspectives. There are also growing examples of adaptation uptake and implementation – by governments, industry and non-governmental organizations.

This update report focuses on these recent developments in adaptation, as well as our improved understanding of the impacts of climate change. It builds upon the both the concepts and content of the 2008 assessment, and readers seeking additional information are directed to the previous report, in particular the chapter on concepts, overviews and approaches (Warren and Egginton, 2008) and the glossary. The current report assesses and synthesizes existing literature (including peer-reviewed, published and grey literature) on climate change impacts and adaptation in Canada, to discuss what we have learned since the publication of the last assessment. The sectoral/thematic approach was chosen to best present new knowledge available, and to better reach new audiences. These chapters highlight key developments in the sectors discussed, rather than presenting a comprehensive compilation of all relevant impacts and adaptation issues.

REPORT FORMAT

This report – *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* – contains nine chapters and a synthesis. This Introduction (Chapter 1) is followed by a supporting chapter, An Overview of Canada’s Changing Climate (Chapter 2), which presents observed and projected changes in climate (temperature, precipitation, extreme events) and discusses first-order impacts (including changes in sea level, sea ice, ocean climate, freshwater levels and flow, and lake ice). While some global scale results are included, Chapter 2 focuses on Canada, and provides supporting background information that will help provide context to assist readers in their interpretation of the impacts and adaptation discussions in the thematic chapters. It does not represent a comprehensive assessment of the state of knowledge on the changing climate system, but rather is intended to provide non-climate science specialists with an overview of key observed and projected changes.

Chapters 3 to 8 constitute the main body of the assessment and are structured according to the following sectors and themes: Natural Resources; Food Production; Industry;

Biodiversity and Protected Areas; Human Health; and Water and Transportation Infrastructure. These chapters address current sensitivities to climate, as well as the risks and opportunities presented by climate change. Adaptation options, approaches and planning are also discussed. Case studies are used to provide more detail on selected issues, to highlight examples of effective adaptation initiatives and to identify transferable lessons learned. Each of these chapters begins with key findings and a summary of relevant findings from the 2008 assessment report. However, in recognition of the significant differences between the sectors and the volume of new information available, they do not follow a common template.

The concluding chapter of this report, Adaptation: Linking Research and Practice (Chapter 9), examines adaptation in Canada in terms of both research and practice. It examines how research, engagement, practical adaptation action and understanding of the barriers and enablers of adaptation have progressed since the 2008 assessment report.

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