

C-CIARN NORTH

Canadian Climate Change Impacts and Adaptation Assessment Northern Regions Chapter

Northern Consultation Meeting #3

Iqaluit, Nunavut

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Notes

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Morning – Plenary Session

Overview: Canadian Climate Change Impacts and Adaptation Assessment

Presented by Tanuja Kulkarni, National Assessment Coordinator, Natural Resources Canada

The Climate Change Impacts and Adaptation Assessment is a scientifically objective assessment of existing knowledge of the risks and opportunities that climate change presents to Canadians. The assessment will cover what we already know as well as identifying knowledge gaps. Important goals are to understand Canada's ability to adapt and the limits to adaptation, and to understand the significance of the rate of change. This national assessment will complement and contribute to the global perspective of the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), which is currently under development.

The Impacts and Adaptation Assessment differs from previous national studies in that climate science is not the subject of the assessment but one of the contributing sources of information, along with such things as information about biophysical and socioeconomic impacts. The goal of the assessment is to provide and integrate information that will assist Canadians in developing policy related to adaptation.

The assessment will draw on a variety of knowledge sources, including peer-reviewed scientific publications, grey literature such as government reports, traditional knowledge, local knowledge, and the expertise of people working in affected fields and locations. Among the cross-cutting themes that will be addressed are public safety and security, economic sustainability and development, human health, cultural impacts, security and sovereignty, and ecosystem and species sustainability.

The primary focus is on the regions of Canada, although international and transboundary issues will also be addressed. Taking a regional approach will raise the profile of the issue within political jurisdictions, highlight relationships among sectors, and emphasize collaboration within and between jurisdictions. Case studies will provide examples of local approaches. Ultimately, the assessment should tell us what climate change means for Canada.

A number of different products will be developed, aimed at several different audiences. These include a synthesis report, a full scientific report, regional impacts and adaptation posters, and highlights documents. Other potential products have not yet been determined. Target date for release of the assessment is the spring of 2007.

The Northern Regions chapter should make a strong contribution to the assessment. It has the advantage of building on the information gathered for the Arctic Climate Impact Assessment and our knowledge of existing climate change impacts. Now we want to concentrate on the human dimension of climate change – an important contribution the North can make to the national picture.

Overview: Northern Regions Chapter

Presented by Chris Furgal, co-lead author

Lead authors for the Northern Regions Chapter are Christopher Furgal, Université Laval, and Terry Prowse, Environment Canada, University of Victoria. Contributing authors are B. Bonsal, C.

Dickson, H. Melling, D. Milburn, R. Chouinard, F. Jackson, S. Nickels, M. Nuttall, A. Ogden, J. Reist, W. Savigny, N. Snow, and T. Edwards. The contributing authors will be calling on others to assist in developing their chapters. All contributions are welcome and all will be acknowledged.

The chapter is divided into six principal sections: introduction; current and future conditions; implications of climate change for the Arctic environment; implications and adaptation for key areas and issues; regional centres and small communities; and conclusions. The various contributing authors are working on specific sections, with the lead authors pulling the sections together into a coherent whole. For purposes of the report, the northern region is considered to be the area encompassed by the Yukon, the Northwest Territories, and Nunavut.

The introduction will provide a brief overview of the region, its population, and current climatic, demographic, and socioeconomic conditions. The second section will survey past climate in the region through the instrumental records and reconstructions of climate before such records, current climate conditions, and projections for the region's future climate. It will also summarize current and future socioeconomic and demographic conditions and trends.

The third section of the chapter will examine the implications of climate change for the arctic environment: how key components of the natural environment have changed in the recent past and are forecast to change, and the importance of those changes for other parts of the physical system, people, and ecosystems. Section three provides important background information for understanding the changes in various sectors discussed in the next section.

The fourth section, the largest part of the chapter, discusses vulnerabilities, projected changes, and adaptation within key areas of northern experience. Currently, ten subject areas are proposed: hydroelectric development, oil and gas, mining, linear infrastructure, shipping and transport, forestry, fisheries, wildlife, aesthetic and recreation aspects of northern environments, and human health. In each of these sectors, discussion will address: current status and key vulnerabilities; projected changes and changes in relation to climate; and sensitivity, adaptive capacity, and options for adaptation.

The fifth section of the chapter will look at the different perspectives, vulnerabilities, and potentials for adaptation in several groupings of northern communities: regional centres, small communities, and indigenous peoples. Finally, the chapter conclusion will offer a brief summary for the region of key vulnerabilities, implications for northern adaptive capacity, and the key gaps and needs for further research and action.

The first draft of the northern chapter is due at the end of March 2006. It will be reviewed over the summer and the authors will respond to the comments in the fall. The final version is due in December, with release of the full report scheduled for spring 2007.

Discussion

Comments/Questions following the morning's initial overview presentations

- Will cultural issues be singled out from socioeconomic impacts?

- This is up to the authors, and will be based on data and interest.

- At the most recent NTI elders workshop on climate change adaptation, it was made clear that individual hunters are adapting to climate change, but wildlife management agencies and other resource management boards and government agencies are not necessarily focusing on adaptation. Thus, it is critical to work with these groups to ensure their perspectives and needs related to adaptation are included in the assessment.

- The Nunavut Economic Outlook (Conference Board of Canada, 2003), which serves as Nunavut's primary economic development policy and planning document, highlighted the importance of the traditional (non-wage) economy in Nunavut. Implications of climate change for the traditional economy should be addressed in the assessment.
- In addition to addressing climate change impacts on large-scale commercial shipping and transportation, the section on transportation and shipping should also consider the vulnerability and adaptive capacity of small-scale non-commercial transportation activities by Inuit (e.g., inter-settlement transportation by small boat, sea ice transport by snowmobile, etc.).
- From the Inuit Circumpolar Conference perspective, the likely destruction of hunting culture should be a major theme in the assessment, and should also be handled directly as a section unto itself and throughout the chapter.
- By compartmentalizing vulnerability into sectors, the assessment does not address key linkages and fails to provide a holistic perspective.
- The overall lack of capacity (technical and financial) in Nunavut (and Canada) to develop policy for adaptation needs to be addressed in the assessment.
- What about catastrophic weather events, how are these going to be addressed? Perhaps these are more important to local populations than changes in average precipitation and temperature.
- The assessment needs to address variations between and within northern regions with respect to community vulnerability and adaptive capacity.
- Also, communities cannot be viewed as static; their socioeconomic and demographic make-up and vulnerability are constantly evolving in the North. This needs to be addressed.
- Section 3.1: Implications of climate change for the environment – wind needs to be addressed, from an Inuit point of view.
- Section 4.5: Shipping in the north – we are talking about transport within Nunavut that needs to be addressed, beyond international transport.
- Section 4.6: Northern forestry sector – tree line advance is a huge factor for Nunavut; also include kelp forests and peat.
- Section 4.7.1: Linkages to outside – focus on delta areas of the world. We need to focus on these areas, and linkages need to be focused in a real context, not a political context.
- Another important issue, aside from extreme weather, is the accelerated rate of change and the ability of the ecology of the North to adapt. Large issues of co-dependency and the linkages associated with the rates of change from an ecological perspective.
- The overall structure – the assessment must integrate southern academic perspective with northern aboriginal perspectives.
- Section 4.4: What is meant by linear infrastructure?
 - Roads and engineered infrastructure for major industry.
- Municipal infrastructure needs to be dealt with explicitly in a separate section rather than indirectly through other sections.
- Assessment must address the fact that much of the socioeconomic data necessary to develop community vulnerability assessments is lacking.
- Will there be any identification of financial costs related to adaptations in Nunavut, in the Canadian Arctic?

- Is your work set up to sponsor research?
 - Response: No, beyond these meeting and several key projects there is nothing. However, this should be included in the section on research and data needs for the territory.

Conclusions and Steps Forward - Communications Plan and Strategy

- The Lancaster Sound Green Paper: tried to get the key parts of the document translated into Inuktitut, so that key points are put across, and then send this information out to radio.
- Community radio: very functional in many communities and brings the information to residents in many communities, which avoids an Iqaluit-based bias.
- Try APTN who are “starving” for good materials they can replay.
- This is an issue where one size does not fit all; need to balance community needs with territorial needs and the needs of the North as a whole.
- Pan-northern synthesis report that compares and contrasts vulnerability and adaptation across the three northern regions will an essential output; however, there will also be a need for stand-alone highlights reports for each territory, highlighting unique challenges and opportunities in each region.
- Policy implications: Look at developing assessment summary reports and briefing materials specifically for northern policy makers.
 - Response – What would be the most useful products in terms of policy-friendly materials, and also how do we develop a policy document alongside the technical document? What could be recommended as a policy-friendly document for Nunavut?
- A dilemma is to reflect visually the differences amongst territories and within territories.
- Perhaps a DVD with information above and beyond what is included in the chapter.
- Presentation side of involving communities: perhaps a PowerPoint presentation or something with audiovisual aspects to be sent out to communities – in multiple languages.
- Policy implications – briefing notes, or something of similar length, would be useful. Anything longer possibly not useful. Having a policy focus in the chapter would be useful.
- Achieving outreach into educational realms: Build links to educational materials to make this information available to younger cohorts.
- What would younger individuals be interested in making use of? How could this lend itself to communication type materials?
- Need to find contact for Nunavut-based curriculum development.
- Trying to reach the general public is an much different issue than reaching school children or politicians – need to define the audience more clearly.
- There is a will to work with what the regions suggest for communication materials. Based on their suggestions, work will continue.
- After publication of the book, there will be approximately one year of support, by NRCan, for communications. This will include a website, CD package, posters.
- There is talk of one poster for the entire northern section.
- Large scientific posters might not be the best communication tool for Nunavut since they reach a very small portion of Nunavummiut.

- Is it possible to integrate Nunavut and Labrador in the communication products and in their linkages to the communication process?
- There is a question that requires clarification: In the one-year time frame allocated for communications, what communications products are realistically feasible and what resources will NRCAN commit to developing communication materials beyond those already committed to (poster, CDs)?
- NRCAN should identify key communicators, radio/media, on science and work with them on these issues, particularly with a northern contact person who can bring out more of the northern focus.
- Don't forget that communities have their own seasonal cycles. That will affect the timing of communication efforts. For example, it wouldn't make sense to report the assessment result over community radio in June when everyone is out camping.

Breakout Groups

Group A

Comments are grouped according to the sections in the draft outline of the Northern Regions chapter.

General Remarks and Suggestions

- Turbot fishermen in Pangnirtung have lost fishing equipment and have been forced to close the fishing season early in several seasons due to poor ice conditions and unpredictable, severe weather.
- An elder recently lost his snow machine in water and survived by grabbing onto the qamutik. This normally would not happen. Climate changes are increasing the hazards in traditional harvesting activities and could result in fewer people harvesting. If people in Pangnirtung are on income support instead of fishing, that has a large effect on their own and their family's wellbeing and the economy.
- Case study: Pangnirtung turbot fish plant – a good candidate for a location-based case study due to the availability of socioeconomic data to assess the impact of poor ice conditions.
- Assessments often give the impression that climate change will benefit Arctic fisheries in the short term by increasing their productivity, but this isn't the case for the small-scale ice-based or long-line fishing by Inuit. Just because there could be more places for fisheries doesn't mean that the fish will be there, or that the fish will be what people want (e.g., turbot, rather than char or invasive species).
- The assessment needs to examine who will benefit and who will suffer due to changes in fishery opportunities resulting from a changing climate.
- Gap in section 3 on components of the environment that will be impacted by climate change: I don't see a specific bullet for the marine system in this section.
- General productivity of marine ecosystems is changing. What other changes are having an influence (e.g., PH , temperature, circulation, salinity)?

1.0 Introduction

- The Assessment introduction should provide an overview of northern governance structures (land claims bodies, regulatory institutions, territorial governments) and processes such as devolution that will determine northern institutional capacity to assess and respond to climate change impacts.
- The unique social and economic importance of the environment to northern residents (as the basis for both way of life and the wage and non-wage economies) should be acknowledged.

2.0 Current and Future Conditions

- Inuit observations are not quantifiable but must be included. Traditional knowledge is a source of important insight into pre-instrumental climate conditions (e.g., historic position of glacier margins).

- Assessment must describe the location of Nunavut communities (e.g., elevation, proximity to coast) and physical geographic characteristics (e.g., soil type) that affect their vulnerability.
- Extreme weather events are more important than changes in average temperature and precipitation. These must be accounted for in developing scenarios of future climate conditions. The uncertainty inherent in regional climate models must be clearly and openly addressed in the assessment.
- Isolation of communities means people are dependent on air travel, have less capacity to react to changes than they had in the past, and are stuck in certain areas.
- Iqaluit has been promoted as a cold-weather testing site, but that could change under warmer climate scenarios. Need to assess the implications of change for future long-term viability of cold weather testing and other economic opportunities that are built on Nunavut's current climate realities.
- Lack of roads in Canada in general makes it difficult for many areas; both fuel and food resources are impacted.
- How do you prepare contingency plans for northern communities?
- The assessment should include some discussion of current and future trends in hazardous weather conditions (e.g., blowing snow, wind shear, blizzards, fog, freezing rain, rain on snow, high winds) that are most problematic to Inuit communities. Simply focusing on precipitation and temperature trends will not allow a meaningful assessment of community vulnerability.
- Vulnerabilities of wildlife to changes – bird diseases have become more prevalent; sea cucumbers and ptarmigans have been dying off, but the specific causes are unknown.
- The Nunavut Department of Community Government and Services has completed “community planning reviews” for several Nunavut communities. These reviews include current local socioeconomic data and trend analysis (otherwise not available), and should be incorporated into the assessment.

3.0 Implications of Climate Change for the Arctic Environment

- In addition to documenting changes in the extent and distribution of sea ice, changes in ice structure and quality (from the Inuit perspective) should be addressed in the assessment. Some ice-covered areas may not necessarily be usable for travel due to poor ice conditions (too thin, too rough).
- Isostatic rebound of the land should be addressed in addition to sea level rise. Some Nunavut communities are actually experiencing marine access problems associated with a declining sea level due to rebound. Rebound is usually overlooked, but it's important for infrastructure development.
- Need to discuss the broader socioeconomic context (e.g., how climate change impacts in the North affect socioeconomic interests outside of the North and, vice versa, how impacts in the South have ramifications in the North).

4.0 Implications and Adaptation for Key Areas / Issues

4.1 Hydroelectric Development

- The hydroelectric section should be renamed “renewable energy” so other developments can be included.
- Qullik Energy Corp. is looking at small-scale hydro development for the Iqaluit region.

4.2 Oil and Gas

- Finnish and Norwegian supertankers carrying natural gas could become a problem.
- The Assessment should also consider how fossil fuel demand (e.g., home heating requirements) in the North may change as a result of changing climate conditions.

4.3 Mining

- Life cycles of mines in the North could be longer, but containing the tailings and contamination from mine sites might become more challenging. Tailing encapsulation in permafrost containment may become less viable as the permafrost table drops, and wind dispersal of tailings becomes more problematic as winds become stronger, more erratic.
- Roads and infrastructure related to mines are impacted by climate; they are dependent on cold.

4.4 Linear Infrastructure

- Waste drop dumps, frozen core dams, some sewage lagoons also rely on cold.
- Plans for Iqaluit's future landfill site (and presumably other locations) assume current permafrost conditions will exist in the long-term future; the possibility of future permafrost loss is apparently not considered in design. These sorts of issues need to be examined.

4.5 Shipping and Transport

- Section should be renamed “shipping/transportation” to include consideration of non-commercial transportation issues.
- Air travel is important in the transport section. Plane travel releases large amounts of greenhouse gases. Also, changes in wind conditions could affect the safety and reliability of air travel, especially to communities on Baffin Island in mountainous terrain.
- Implications of longer open-ice season and the effects on the environment haven't been studied enough.
- No discussion of shipping technology, and the implications of increased shipping speed are unknown – possible implications for hunter safety.
- 4.5.2 (vulnerabilities and climate change impacts) would be the section to include the changes happening to the Northwest Passage.
- It would be useful to have a study that looks at past and current shipping trends in the Arctic, not just the future.
- Improved sealift capacity (longer transport window due to longer open-ice period) could prove economically beneficial and create the impetus for more local development. This facet of change should be examined in more detail in the assessment.
- 4.5.2, sub-bullet three (sovereignty, security, and safety issues...) should perhaps become a main bullet.
- 4.5.6 (vulnerability of environment to marine transport): Some communities may want a moratorium on shipping or restriction to just the open-water season.
- Regional land use plans developed by the Nunavut Planning Commission as required under the Nunavut Land Claim could be useful in determining potential impacts on shipping (e.g., existing

land use plans contain restrictions on winter shipping to protect community sea ice access). North Baffin and Kivalliq regions have completed plans.

- Case study: Stephen Harper's possible plan to build military base and deep water port in Iqaluit could provide a basis for a study.
- Case study: Baker Lake proposal currently underway for changes to transportation regulations due to new mining developments (Meadowbank Gold Project).
- Case Study: impacts of climate change research on Nunavut communities that host large volumes of projects and researchers (e.g., Resolute Bay, Arviat).

4.6 Implications and Adaptation for the Northern Forestry Sector

- Kelp forests in Hudson Bay are vulnerable and have been proposed to be harvested.
- 4.6.1 (profile of Canada's northern forest sector): Movement of treeline isn't of immediate concern, but it could be very significant down the road.
- Expansion of boreal forest into Nunavut will create the need for new forest management institutions and policy in Nunavut.
- Movement of treeline could introduce new bird, mammal and insect species, and could have political implications (by reducing the size of the Arctic tundra, and potentially giving the basis for sub-Arctic First Nations to claim more access to Inuit territory).

4.7 Fisheries

- How will fishing quotas be affected by climate change?
- The fisheries section is missing a bullet specifically dealing with adaptation, which sounds critical for Nunavut.
- The section needs an overview of fisheries management practices and institutions currently in place in the North to give a sense of how adaptable the northern management regimes are, and who would be responsible for developing, implementing, and monitoring adaptation policy.
- 4.7.3 (linkages outside): Linkages outside could perhaps be put under another section.
- There should be better identification of food webs and what key species are.
- What key species indicators should be used for this section could be examined.
- Need to examine marine food webs to document current species composition, trophic structure, and to assess how ecosystem integrity (and sensitivity to harvesting pressure) may change in the future due to climate change.

4.8 Wildlife

- Due to the profound importance of wildlife and wildlife harvesting as the basis for cultural identity and subsistence in all three territories, this section will be a vital component for the assessment.
- Need to address both the impacts on wildlife due to reduced food supply and habitat caused by changing environmental conditions and impacts of harvesting pressures.
- Case study: Peary caribou and Hudson Bay polar bears would be good case studies.
- The Nunavut Wildlife Harvest Study dataset should be incorporated into the assessment (to determine current harvesting levels by Nunavut communities and basic needs).

- The traditional economy could fall under wildlife section, but might be better off under its own section.
- Should harvesting be looked at as an economic or a cultural issue?
- Hidden costs of transporting harvested food (e.g., inter-settlement transfer of country food to communities experiencing scarcities as a result of restricted access to hunting areas due to poor ice conditions).
- It looks like harvesting should get its own section in the assessment.
- Over the past three summers, the Nunavut Research Institute has collected benthic macro-invertebrates from several rivers in the vicinity of Iqaluit, Nunavut, to establish benchmarks against which future changes in species composition can be assessed. This is one small study - the lack of information on current invertebrate and other species assemblages will make assessing climate change impacts on biota a challenge.

4.9 Aesthetic and Recreational Aspects of Northern Environments

- Accessing traditional trails for camping or hunting is becoming more difficult.
- The Parks Canada Nunavut field office could have useful data relating to this field.
- Introduction of new predator species could pose new dangers for campers (e.g., grizzlies are being sighted and encountered more frequently in the Kivalliq).
- Many undocumented archaeological sites in coastal areas are being lost to erosion and storm surge.

4.10 Human Health

- Need to define health in a northern context and to evaluate northern-specific indicators of health status.
- Case study: ArcticNet Inuit health research survey in Northern Quebec in 2003-04 (the Qanuipitaa project).
- People are worried about exposure to West Nile virus and other mosquito-borne diseases. Public concern is heightened by the lack of information about the prevalence and risk of West Nile and other potential northward-advancing disease vectors.
- New protozoa have been found in mosquitoes.
- How will not being able to get out on the land affect people's health?
- Fresh water supplies are at risk from contaminants and potentially due to new species of insect and plant.
- Impacts on Inuit health of dietary shift away from country food to store-bought foods should be considered.
- More eye illnesses in hunters resulting from UV radiation.
- Will this assessment include changes on UV exposure as in the ACIA?
- Health risks due to travel should perhaps be under 4.10.4 (direct impacts of climate change on human health), not 4.10.5 (potential indirect impacts of climate change on human health).
- Overworking of the health system due to climate change.

➤ Where should health care infrastructure be covered? Under 4.10.5 (potential indirect impacts of climate change on human health)?

5.0 Regional Centres and Small Communities

➤ All Nunavut communities face the same core infrastructure issues and planning challenges, regardless of size.

➤ Nunavut development issues are different from those of the Yukon and NWT. All Nunavut communities deal with the same issues and all but one of Nunavut's communities are coastal.

➤ Adaptive capacity changes with the size and social composition of community. In many communities there are local champions who lead the way by example in developing and adopting adaptive techniques and technology.

➤ Small communities possibly adapt more quickly than larger communities as word of mouth and sharing of technologies are more prevalent. Inuit seem to adapt to new technologies much quicker than some other indigenous groups.

➤ Sometimes people misinterpret cultural changes. Some changes are not due to environmental change (e.g., change from dogsleds to skidoos). Socioeconomic changes are caused by complex factors; it is difficult to anticipate changes that will result from changing environmental conditions.

➤ 5.4.2 (critical climate change issues for Inuit): Consistent, reliable data over the long term is needed.

➤ 5.4.2 (critical climate change issues for Inuit): Governments must start programs that may extend past their terms.

➤ 5.4.2 (critical climate change issues for Inuit): Knowledge transfer capacity may not be as great in the North as elsewhere.

➤ 5.4.2 (critical climate change issues for Inuit): This is a national assessment that includes the North, but not really a region-specific recommendation document. This can inform policies, but can't really be a policy document as it may compromise the scientific nature of the document.

➤ 5.4.2 (critical climate change issues for Inuit): Northerners are cautious about being "poster boys" for climate change.

➤ 5.4.2 (critical climate change issues for Inuit): How should policy people get in contact with scientists over these issues?

- C-CIARN a good place to help connect people, as long as it is in place.

6.0 Conclusions

➤ 6.3 (key gaps and needs for research and action) should focus on action more than research.

➤ The conclusion needs a more explicit policy link.

➤ Youth concern about climate change is a big gap that needs to be examined.

➤ Conclusion points are key as they are what politicians will look at most.

➤ 6.2 (implications for northern adaptive capacity): Change to "ability to adapt."

Communications Products and Approaches

- The Lancaster Sound Green Paper could be used as an example: Translate key parts of document and issue them to community radio programs.
- Include all data but make sure territories are separated.
- Is there a possibility of having a policy document to go along with the scientific document?
- Design of the document is important. Formatting and separation of information is key. Possibly a digital version of the document or its bibliography would be good.
- Getting communities involved: PowerPoint presentation of the meaning of the studies?
- Policy implications: Briefing-note-length document would be useful; an executive summary could be most effective.
- Outreach into educational worlds to connect with young people?
- Reaching the general public: Something is needed to reach the “stay-at-home mom” as well.
- During the year after the report is released, a poster will be developed and a website will have downloadable chapters.
- Some don’t think posters work at all.
- Possibly integrate Nunavik into the communication of information?
- Make sure information is divided between Iqaluit and the rest of the communities as information is processed differently in different regions. The focus on radio stations is a good idea.
- Interviews on Quirks and Quarks are a good way to get arctic results to the rest of Canada. Find the key people in Canada that report on science and try to work with them.

Group B

Comments are grouped according to the sections in the draft outline of the Northern Regions chapter.

General Remarks and Suggestions

1.0 Introduction

- Key issues for Nunavut include: fragility of the ecosystem; seasonal cycles and the inter-relatedness and cascading effects in the Arctic ecosystem. There are so few species that the food chain is fragile, and easily broken. The difference in one week in a normal seasonal cycle can mean severe decimation to a herd of caribou, for example.
 - One of the challenges is to recognize the uniqueness of each territory while drawing a common conclusion.
 - What is being used as a baseline for impacts?
 - This raises the argument that systems have already been impacted, so where do you start with respect to discussing changes.
 - Then one must relate past changes to the current accelerated change.
 - Discussions are always framed around changes from today, but past trends also need to be addressed.
 - The definition of baseline leads to what you are using as your indicators, how these issues are being discussed, and how indicators are defined.
 - Demographic and socioeconomic data for this chapter are being drawn from census data as other sources are scarce.
 - Traditional knowledge studies go back to 1998 or prior, depending on what past assessments have done. This time there are going to be issues raised that have not been covered in past assessments; therefore, this chapter will want to look into previously uncovered information.
 - The size of Canada and the degree of variation by region, geography, and human experience is a key point that needs to be mentioned.
 - Mention anything related to the urgency of climate change in Nunavut – key examples specific to Nunavut. Linear infrastructure is not that large an issue for Nunavut. Perhaps permafrost is an area to focus on. The lack of connection between communities is important – all air-based transport between communities; examples of people being cut off from their major food sources when aircraft are not able to land due to weather.
 - This raised the issue of how dependent on southern foods Inuit are becoming. Thus what ways can Inuit adapt if their country foods are threatened by climate change?
 - What about the International Polar Year? And other large Arctic research projects? Don't just talk about what is being done, but by whom and how – and the IPY context.
 - The reality of the situation – e.g., two skidoos and sleds lost at the floe edge due to unpredictable ice conditions.

- Discussions of local knowledge related to observations of change.

2.0 Current and Future Conditions

➤ 2.2.1 (climate change trends and data): What needs to be looked at, the unpredictability of changes as they relate to arctic environments. How do the models function, what are their sensitivities, and how interrelated are their projections?

➤ 2.2.1 (climate change trends and data): This data could be used for better housing construction, i.e., very simple changes by adapting data for local applications – for example, constructing roofs for 100 km/hr winds rather than 30 km/hr winds.

➤ 2.2.1 (climate change trends and data): Need to discuss key variables and why these variables are key for northern communities – e.g., managing risk assessment in Iglulik (see James Ford’s study “Assessing Igloodik’s Vulnerability to Sea Ice Change: An example from Igloodik, Nunavut”).

➤ 2.2.2 (future climate projections): What about looking into wind related to wind power? Climate change is thought to improve wind as a resource for power, so there are both negative and positive impacts of climate change with respect to wind.

➤ 2.2.2 (future climate projections): Wind is a central environmental factor in the North that needs to be considered by the climate models. It has huge implications for Nunavut.

➤ 2.2.2 (future climate projections): Look into adaptation workshops where elders give their input into climate change.

➤ 2.3.1 (current socio-demographic profile of northern communities): The importance of key variables in terms of communities and their connection to surrounding areas.

➤ 2.3.1 (current socio-demographic profile of northern communities): Major factors are the accelerated birth rate, and demographics and the relationship between land-based knowledge and wage-based employment.

➤ 2.3.1 (current socio-demographic profile of northern communities): Perhaps more dangerous are the changes to human health amongst Inuit, which is coinciding with climate change. How can one view the relationship between diet preference and the source of food with respect to cultural and social impacts?

➤ 2.3.1 (current socio-demographic profile of northern communities): What are being used as indicators and how are these tailored to Nunavut? This is a major issue for data collection and how useful data is, short and long-term. There is a meeting in Yellowknife in several weeks on these issues.

➤ 2.3.1 (current socio-demographic profile of northern communities): This may all fit into future studies in order to develop Nunavut-specific indicators.

➤ 2.3.1 (current socio-demographic profile of northern communities): Communities and infrastructure – possible impacts on radio and television communication.

➤ 2.3.1 (current socio-demographic profile of northern communities): The definition of what communities are must reach beyond geography. Issues of climate change, mobility, and industry all cloud the discussion.

➤ 2.3.2 (trends in socioeconomic and demographic profiles/regions across North): Local access to carving stone and how this changes with access issues due to different environmental conditions, such as sea ice.

3.0 Implications of Climate Change for the Arctic Environment

- Vegetation: going back to baselines, there is a need for being able to interpret long-term monitoring. There is also a huge lack of resources in Nunavut to establish these baselines. Northerners should not be dependent on southerners for this research.
- Aquatic vegetation: changes and developments due to climate change. Possible complications with access to potable water.
- Sea ice should be focused on.
- Original arctic environment, and how Inuit were intimately in tune with environmental conditions and changes.
- What about data structures, how it is stored and what it is being used for? How is the data defined and located so that it can be assessed for gaps and needs and overall value?
- Ocean currents should be looked into – thermohaline, etc.
- Wind should be addressed unto itself.
- Insolation and albedo values: how are these changes leading to possible adaptations, e.g., solar cells? There is an Arctic College paper on photovoltaics. Contact is Jamal Shirley.
- Links between climate change, ozone, UV radiation. UV is a large issue due to skin cancer, burns and blisters. This can be discussed as an early indicator of change. What about seasonal changes in UV?
- Is there a holistic focus for communities rather than a compartmentalized approach to the various factors already discussed?
- Atmospheric effects: this should be a section unto itself; encompassing wind, albedo, UV.

4.0 Implications and Adaptation for Key Areas/Issues

- Human resources are a limiting factor for Nunavut. The people who are trained have extremely high skill levels, however compared to other areas there are far fewer numbers of skilled individuals.
- Looking at breaking down demographics with respect to community size. This lends itself well to adaptive capacity discussions. Therefore you eliminate the redundancy of territory wide discussions.
- Trades as they relate to mining. 3500 jobs projected in the near future, with 90% related to trades.
- National community profiling project, to break stats down so they are usable on a community level. There is also GIS interface component.

4.1 Hydroelectric Development

- In other regions this section was expanded to renewable energy. Same for Nunavut?
- Need to talk about the dynamics of energy in Nunavut with respect to development, housing demand, and population growth.

- Hydro and tidal energy are thought to be possible technologies for Nunavut.
- LNG from high Arctic, making use of local sources.
- Methyl hydrates in permafrost as another energy source.
- Energy efficiency: the mega watt concept – building design in the Arctic that allows buildings to run on zero net energy use. "Nega-Watt" (a concept first introduced over 30 yrs ago by Amory Lovins), and has to do with saving watts (through energy efficiency) rather than using them. This is being discussed in Nunavut, but not being understood.
 - Potential for geothermal in Nunavut is unknown.
 - Coal in Nunavut: there are sites in the high Arctic for coal prospecting, and Pond Inlet has a history of heating with coal. The type of coal is unknown.
 - There are also coal seams on Ellesmere Island. INAC would know about this and where it might develop further. Heat content is an issue; need a source of high heat for industry.
 - Local wind energy has not been successfully developed because of local issues, not because of the systems themselves. Maintenance issues are the largest barriers, leading to misinformation on wind and therefore limited use of this technology. Turbine design is also an issue; appropriate engineering and micro technologies.
 - Community energy planning: there are waste heat recovery projects territory-wide, but no set policy or plan linking them.
 - Malcolm Large of Island Technologies Inc., PEI worked in Iglulik and started discussions on how Nunavummiut could develop their own energy capacity to sell back to the grid.
 - Solar: one-million-dollar project for Nunavut was carried out in Iqaluit and Iglulik with limited results. The most successful endeavor was at Nunavut Arctic College in Iqaluit.
 - Nunavut Power Corp. may be looking into several key sites.

4.2 Oil and Gas

- Natural gas: waiting for climate to change so that reserves become available.
- Transportation of petroleum products: by sea, buried gas pipelines. Will there be expansion further north into more “secure” cold environments?
- Scales are shifting toward industrialized employment versus traditional employment and skills. Now one must look at the relationships between social, environmental and cultural relationships.
 - This is an aspect of modern demography; rural communities around the world have diminished. There is potential of de-population of the North. Look into demographics in Greenland, the industry change from cod to shrimp, and how that relates to population movements and ghost towns.
 - Movement of people within Nunavut to larger areas (Iqaluit, Rankin) as well as north-south migration (Ottawa).
 - Industry and the possibility of fly-in-fly-out communities.
 - The wild card is sovereignty: how many countries have claims to the Canadian North and the will of the Canadian government to maintain northern communities.
 - More large-scale decisions are being made down south with very large consequences for Nunavut, i.e. industry.

- History suggests that large issues need to be presented at a national level with the hope that territorial wishes are still reflected.
- Devolution, where the power is held and how this relates to adaptation projects remains to be seen.
- Adaptive capacity vs. economic advantage – often a zero-sum game in Nunavut

4.5 Shipping and Transport

- 4.5.1 (present status): Roads are being developed from Manitoba and Yellowknife. This has been accelerated by the collapse of winter ice roads. Route selection has taken place, but no development as of yet.
- 4.5.1 (present status): Other road information could be available from Community Government Services.
- 4.5.1 (present status): Mines in Kivalliq require major roads, e.g. north of Baker Lake.
- 4.5.1 (present status): There is a road in Arctic Bay (about 36km); look into details of costs associated with construction and maintenance.
- 4.5.1 (present status): Ice roads are also present – Kivalliq and Kitikmeot.
- 4.5.1 (present status): Problems to deal with snow on roads; generally means greater maintenance costs than construction costs.
- 4.5.4 (current status of marine transport): Sealift could become more important, but on different scales than present large sealifts from the south. This is more a focus for the eastern Arctic.
- 4.5.8 (needs for adaptation): Airships.

4.7 Fisheries

- Fisheries and what is included as a fish – i.e., fin fish versus seals and whales; Department of Fisheries and Oceans versus Environment Canada definitions.
- Devolution: what gets included in territorial responsibilities?
- Inshore fisheries as a possibility to sustain communities. The Fisheries and Sealing Division of the Nunavut Department of Environment (Wayne Lynch) is the appropriate contact for follow-up.
- As the climate changes, there is pressure between Nunavut and Labrador/Newfoundland to get agreements on resource ownership.

4.8 Wildlife

- Bird populations: changes due to freshwater inputs leading to desalinization of water and the embedded impacts to bird habitats as a result. Eider ducks, Mr. Grant Gilchrist
- Case study: Sanikiluaq becomes a very complicated terrestrial/marine environment – potential case study of a politically and environmentally unique setting. The GN is currently looking into monitoring some of these issues (environmental focus).

4.9 Aesthetic and Recreational Aspects of Northern Environments

- Potential for southerners to look further north for recreation and water sources. The question is what wildlife will be present of these purposes.

- Possibly longer seasons for cruises. The shipping industry is always in the lead for trends, thus it is interesting to see what happens. This type of tourism will give some insight into where things are headed.
- What about the types of tours and how this impacts communities, i.e. sales of carvings, etc.? What about Makivik owning the rights to tour boats? What about pressure on archaeological and historical sites due to large-scale tourism?
- Adaptive capacity is dependent on the human capacity to regulate these issues and also upon having the power to enforce these decisions.
- Parks and protected areas: some protected area strategy is needed; unsure where Parks Canada and Nunavut are with these issues.
- Relationship to the Land Claims Agreement: the Agreement was drawn up based on past and current land use. How does this change with impacts from climate change?
- Search and rescue, and emergency preparedness – will be addressed in the communities section.

4.10 Human Health

- Accidental death: no current understanding of trauma in Nunavut as it relates to types of activity.
- Water quality: a Walkerton-like issue, related to chlorinating local water supplies, has yet to emerge in Nunavut.
 - Public health infrastructure and the capacity to provide water that meets national standards.
 - In Igloolik, there are people who will go to great lengths to avoid drinking fluoridated and chlorinated water, preferring untreated lake ice, or naturally desalinated sea ice
 - What about boil water advisories? – not common in Nunavut.
 - Human impacts on the land due to cabin construction lead to possible pollution in waterways.
 - Salt water inundation of freshwater supply.
 - Grise Fiord, glacier-fed drinking water; long-term complications with water supply.

5.0 Regional Centres and Small Communities

- Need to talk about the connection between issues and key elements of adaptive capacity.
- Key issue is that this is a maintenance issue for these communities to survive. The only way around this dependence is through capacity building.
 - It is difficult to find ways of economically sustaining communities.
 - Helping communities is the key to sovereignty.
 - The government must provide the means for a community to be healthy; the communities should have ownership and direction of their own health and infrastructure.
 - Housing needs: if these were met, what about the demands on infrastructure?
 - What are you training people for? How do you address training within the context of artificial communities? What capacity do governments want to build and what leads to “healthy” communities? In the context of climate change, what does this mean when communities are currently trying to define themselves and now must do so again with respect to changes from climate?

- The present communities (physically) are based on services. This affects the dynamic of adaptability of communities.
- Storms are now viewed differently as town closures are dependent vehicular traffic safety.
- How do you design communities with respect to rising sea levels and discontinuous permafrost? The future of building needs to be assessed and investments made to improve the understanding of long-term construction.
- Again, resolving these questions relates to human capacity.
- Dump sites, the dynamics of contaminant management with permafrost changes.
- Mines and using permafrost to cap contaminants is now a long-term environmental issue.
- Case study: Water supply – Iqaluit story. Changes in dam structure require a great deal of technical expertise. Now berm construction is variable due to changes in permafrost.
- Variability is the only constant in construction; must design with the precautionary principal in mind. How realistic is this for Nunavut, and how often is it done?
- Look at community planning – communities are very interested and quite concerned about how they are going to adapt to a changing climate with regards to infrastructure. As mentioned in session CGS with NRCAN is submitting a proposal to create a Municipal Climate Change and Adaptation Strategy dealing with community infrastructure and planning issues as impacted by climate change. There is a lack of information and resources and concerted effort by governments, scientists and organizations to deal with issues at community infrastructure level.
- There is need for a centre for strategic planning to deal with adaptability with a Nunavut focus.

6.0 Conclusions

- 6.3 (key gaps and needs for research and action): Not just the what, but who how and where.
- 6.3 (key gaps and needs for research and action): Also information management and storage.