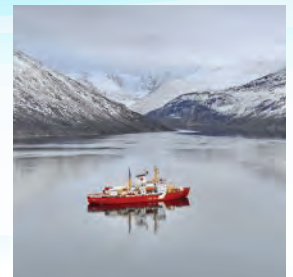
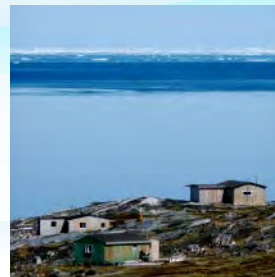
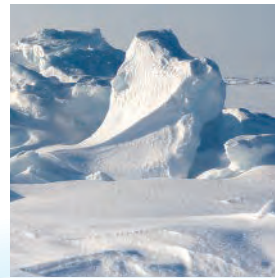


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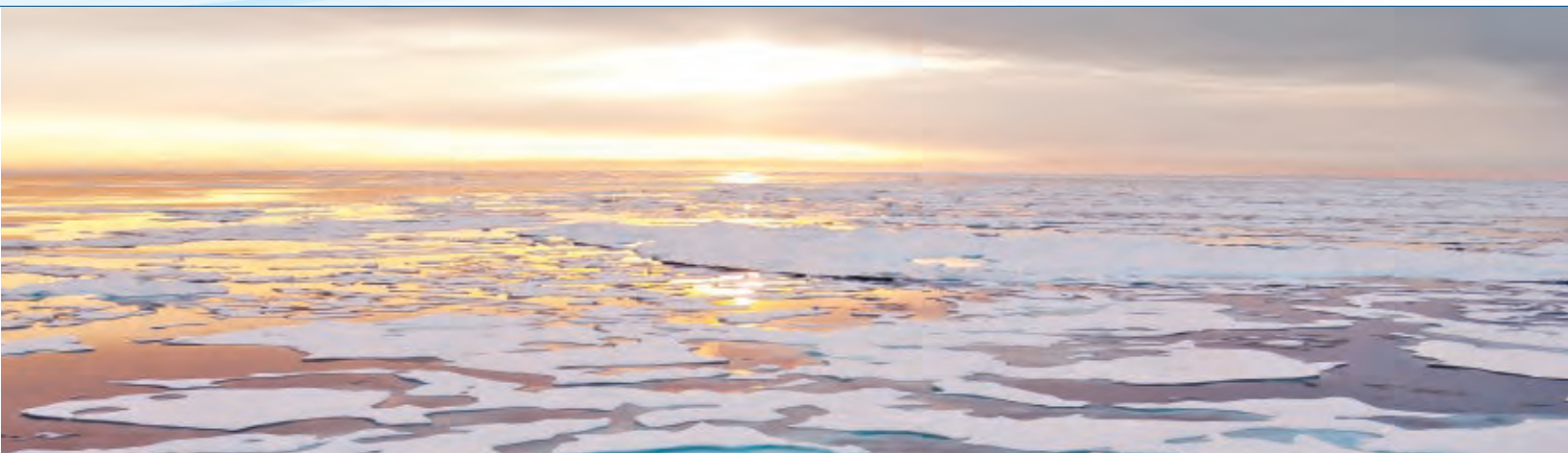
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FROM SCIENCE TO POLICY IN NUNAVIK AND NUNATSIAVUT: SYNTHESIS AND RECOMMENDATIONS

AN INTEGRATED REGIONAL IMPACT STUDY
OF CLIMATE CHANGE AND MODERNIZATION

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SCIENCE TO POLICY SYNTHESIS OF THE NUNAVIK-NUNATSIAVUT IRIS ASSESSMENT



AUTHORS

*This Chapter was written by the Steering Committee of the Nunavik-Nunatsiavut Integrated Regional Impact Study (IRIS), whose members are **Michael Barrett** (Kativik Regional Government), **Tom Sheldon** (Nunatsiavut Government), **Ross Brown** (climatologist from Ouranos/Environment Canada), **Michel Allard** (ArcticNet IRIS Leader for the Nunavik-Nunatsiavut region) and **Mickaël Lemay** (ArcticNet IRIS coordinator). Acknowledgment also goes to **Selena Whiteley** from Kativik Regional Government for her contribution to this chapter.*

REPORTING PROCESS

Priority adaptation issues were identified and discussed during a workshop held in Kuujuaq in November 2009. During this workshop, the IRIS assessment structure was defined and the IRIS Steering Committee designated. The IRIS chapters written by ArcticNet scientists and their co-authors were reviewed by the Steering Committee who then met in Nain in September 2011 to write the core of the Science to Policy Synthesis. The key findings of the scientific chapters were assessed, and a series of recommendations were then formulated and discussed with government officials from Nunavik and Nunatsiavut.

This IRIS assessment is principally based on research conducted through a series of scientific projects supported by ArcticNet. Since the funded projects do not cover all of the potential issues of concern for the regions, some major research gaps still exist and are highlighted both in the synthesis and in the IRIS chapters.

(Photo caption : Kuujuaq Town Hall): Scientists from various disciplines, regional government representatives, community members and stakeholders met in Kuujuaq (November 2009) for the first Nunavik-Nunatsiavut IRIS workshop.

INTRODUCTION

Globally, Inuit communities in Nunavik and Nunatsiavut are amongst the groups most affected by the impacts of climate change. Scientists and northern residents are witnessing increasing evidence of the direct impacts of the accelerated warming in this region, which is expected to continue well into the future. This warming, combined with changes in the natural and the socio-economic environment, is creating cascading effects on the ecosystem and society with significant impacts on human health and quality of life.

The Integrated Regional Impact Study (IRIS) framework was created to disseminate the results of ArcticNet's scientific research to the public. However, the goal is also to inform policy makers and to make policy-related recommendations. One of the main aims of the Canadian Eastern Subarctic IRIS region study (Figure 1)

is to transfer knowledge and assessments of predicted changes to communities, stakeholders and policy-makers to assist in the development of adaptation strategies. The underlying principle in developing policy-related recommendations is to maintain an environment capable of sustaining the health of Inuit and preserving the long-term productivity of ecosystems upon which they depend. This Science to Policy Synthesis summarizes the key findings and conclusions of the Nunavik and Nunatsiavut IRIS for the four priority issues that were identified in the region: 1- human health, 2- safety and security, 3- vulnerability of infrastructure and, 4- resource exploitation.



Figure 1. The Nunavik and Nunatsiavut IRIS region and the Inuit Communities.

CLIMATE CHANGE AND MODERNIZATION

Climate warming has been highlighted many times in recent scientific literature and reported in the media as the main driver of change in the Arctic regions. However, the Arctic is also undergoing “modernization”, a general term that is not defined clearly and covers socio-economic processes.

A broad range of changes (other than climate) affecting people in Nunavik and Nunatsiavut can be linked to several factors that were either non-existent or of low significance only three to four decades ago. Firstly, the negotiation of self governance over territories and empowerment over educational and administrative matters has raised Inuit empowerment and level of political leadership. Secondly, significant improvements in infrastructure and transportation in the North (e.g. internet and air transportation) make it much easier to connect with other cultures and stay informed of current issues. Another aspect of change is rapid population growth due to very high birth rates over recent years. Thanks to improved schooling (despite the need for more improvements) the new generation is more likely to take on wage gaining employment, take charge of community and regional affairs, protect the environment and their cultural heritage, and participate in business. These cultural, educational, political and socio-economic changes are occurring against a backdrop of increasing pressure for exploitation of mineral and other natural resources that has the potential to bring increased wealth to the North but also carries the potential to threaten the resources essential to maintaining the Inuit way of life.

This modernization occurs simultaneously with climate warming which greatly modifies ecosystems, which the Inuit rely on as a food source. Permafrost, lake, river and sea ice, vegetation, and animal populations are all affected.

Changed eating habits, more difficult access to traditional food sources and the impact of new southern lifestyles are all contributing to major health problems across the Arctic. Of particular concern to Nunavik and Nunatsiavut are declining key animal populations such as caribou and Arctic charr and maintaining access to high quality drinking water.

An important issue resulting from population growth and climate warming is the availability in communities of land suitable for new housing. In Salluit for example, new housing cannot be constructed in the existing community because of ice-rich frozen soils that settle in response to warming. This problem has required the development of a community expansion plan at a nearby location where soils are less sensitive to warming.

Another issue of concern that requires further study is the coastal environment of Nunavik and Nunatsiavut. Inuit are a coastal people who travel on water in summer and on ice and snow in winter. Fish and marine resources are part of their long survival history and are still an important source of healthy food today. Islands, bays, estuaries and fjords constitute the cultural landscape. The scientific research carried out in the Nunatsiavut fjords presented in this volume is a good example of a strategy that needs to be pursued. Inuit groups consulted during the Nunavik-Nunatsiavut IRIS process repeatedly emphasized that effective land conservation planning was essential to protecting their territories and ecosystems in light of increasing local population and industrial development.

The following key findings raise major issues for human health, safety and security, vulnerability of infrastructures and for the impacts of resource exploitation. They are followed by recommendations to address these issues and improve quality of life, protect the environment and facilitate sustainable development.

NUNAVIK AND NUNATSIAVUT ARE EXPERIENCING RAPID WARMING

RECOMMENDATION

- *Improvements are needed in weather forecasting and environmental prediction at regional and local scales.*

The vulnerability of the region to climate change has been highlighted in recent years due to an abrupt and unprecedented warming that began around 1993. This warming has contributed to wide-reaching and rapid environmental changes. For example, snow and ice cover duration are currently decreasing at a rate of about 1.0 day/year, ground temperatures have warmed by over 2°C with significant increases in active layer depth over permafrost. Glaciers in the Torngat Mountains lost approximately 20% of their total area between 2005 and 2007. Inuit knowledge indicates that these recent changes are outside the range of previous community experience. Together with more unpredictable weather, these changes are having wide-ranging impacts on human health, safety, municipal infrastructure and access to territory and resources. Climate model projections for the 2041-2070 period indicate a continuation of the observed warming trend as well as increased precipitation over the region (Figure 2).

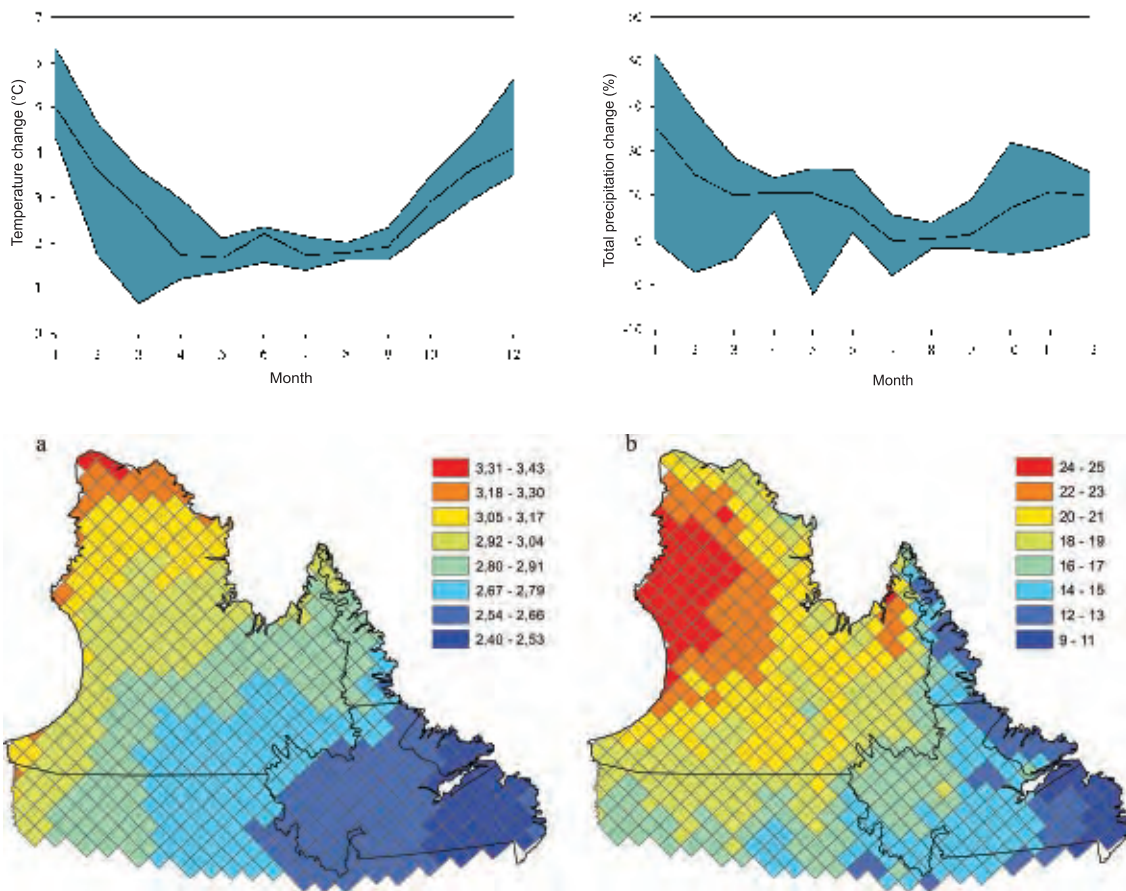
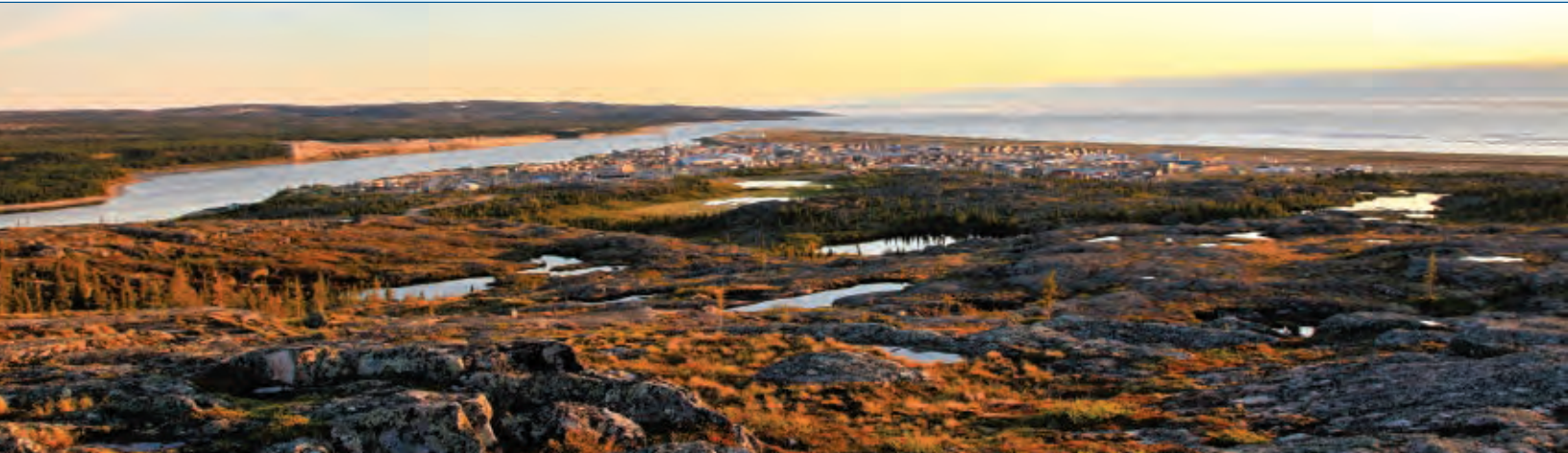


Figure 2. Top: Seasonal character of projected change in monthly mean temperature (left panel) and total precipitation (right panel) from six CRCM runs for 2050 period, averaged over all model grid cells in the study region. The outer lines represent the range in the six simulations. Bottom: Corresponding spatial pattern of projected change in (left) mean annual temperature (°C) and (right) mean annual total precipitation (%).

INUIT IN NUNAVIK AND NUNATSIAVUT HAVE A LIFE EXPECTANCY 10 YEARS SHORTER THAN MOST CANADIANS



RECOMMENDATIONS

- *Policies must be developed and adopted to address the current significant health inequality and lower life expectancy.*
- *Promotion of a healthy lifestyle must be encouraged; the negative impacts of drugs and alcohol cannot be ignored.*
- *Promotion of health and nutrition education in communities is also crucial.*
- *Research-driven interventions, such as those that were successful in the Inuit regions, must be pursued. For example: the study leading to the ban on trans-fats in Nunavik, the research that disclosed the substantial decline in persistent organic pollutants both in the environment and in people, and the research that revealed that marine fatty-acids provide protection against CVDs (Cardio-Vascular Diseases).*
- *An active lifestyle must be promoted to enhance quality of life.*

Nunavik and Nunatsiavut have the shortest life expectancy of the four Inuit regions and one that is substantially lower than the rest of Canada. Young males and older females are particularly vulnerable to premature death. Mortality profiles differ by sex with intentional and non-intentional injuries weighing most heavily for men and chronic diseases for women. Environmental changes together with changes in the socio-economic environment are contributing to this problem through negative impacts on human health and well-being. Recent health indicator data including food and nutrition, CVD (Cardio-Vascular Disease) risk factors, contaminants, infectious diseases from animals or drinking water, and injuries through travel, indicate that the people of Nunavik and Nunatsiavut are among the least healthy in the country with the situation apparently declining.

While significant declines in mean blood concentrations of mercury, lead and cadmium have been observed in Nunavik between 1992 and 2004, a significant proportion of individuals, particularly women of childbearing age, continue to have concentrations exceeding the acceptable level set by Health Canada. State-of-the-art research is identifying deleterious effects on the development of young Inuit with initial findings indicating long-lasting adverse effects of early contaminant exposure on cognitive functions. However, positive effects of fatty acids on sensory and memory function have been identified.

Obesity and cardiovascular disease levels are high and rising. However, for the same level of risk factors, Inuit are in better health than Caucasian populations. The consumption of marine fatty acids, the beneficial effects of which appear to be multiplying, is one of perhaps several protective factors that seem to be at play. However, these factors may be at risk due to dietary transition, environmental changes and the availability of quality country food.

A HIGH NUMBER OF INUIT FAMILIES WITH CHILDREN ARE FOOD INSECURE



RECOMMENDATIONS

- *Access to a sustainable supply of healthy country food is of paramount concern. Enhancing hunter support and community freezer programs, formalizing the support for country food sharing networks, and finding ways to increase the availability of country foods circulating in communities via commercial sale and distribution are recommended.*
- *Healthy store-bought foods need to be available and affordable.*
- *Initiatives such as ice monitoring, trail marking and access to survival equipment (such as spot tracking devices) must be encouraged.*
- *Search and rescue capacity at local and regional levels must continue to be improved and supported.*
- *Traditional and land skills knowledge transfer between generations must be encouraged.*

The transition away from the consumption of high amounts of country foods towards a more western diet as well as the rise in chronic diseases in the two regions is also associated with the status of food security. Food security exists when “all people at all times have access to sufficient, safe and nutritious foods to meet their dietary needs and food preferences for an active and healthy life” (FAO, 1999). Food security is influenced by food availability, accessibility and food quality. Depending on the way food security is classified, the rate ranges between 25% and 72% in Nunavik while in Nunatsiavut, 46% of households with children are reported to be food insecure, with about 16% reporting severe food insecurity. High food costs, availability of country foods, employment, low household income, the decrease in consumption of country foods, lifestyle choices and the lack of nutritious food options are factors affecting these high levels of food insecurity. People who are food insecure are at an increased risk of being overweight and having chronic health conditions, mental health challenges and a lower learning capacity.

Policy and program mechanisms for alleviating food insecurity in the two regions require greater attention as this public health problem grows. Enhancing hunter support or community freezer programs, formalizing the support for country food sharing networks, finding ways to increase the availability of country foods circulating in communities via commercial sale and distribution, and reorienting market food subsidies all show promise in addressing this issue. Promoting health and nutrition education in communities is also crucial for addressing this issue.

THE POPULATIONS OF THE LARGE CARIBOU HERDS ARE DECLINING



RECOMMENDATIONS

- *Caribou habitat, calving areas and migration routes must be conserved.*
- *Sport hunting, if it affects the health of the caribou herds or Inuit subsistence harvesting, should be curtailed or banned.*
- *An across-boundary partnership and coordination entity should be established for caribou management.*

The George River (GR) and Leaf River (LR) herds are two of the largest migratory caribou populations in the world. The available data indicate that the total number of caribou from both herds grew to in excess of 1 million animals during the 1990s but decreased dramatically to probably less than half this number by 2010.

The current decline in numbers is having negative social and economic implications, particularly for Inuit that rely extensively on caribou meat for subsistence. Changes in the distribution of caribou, for example a shift to Labrador for the GR herd (Sharma et al. 2009), as well as decreases in abundance, are expected in the near future and are unlikely to be offset by potential positive effects of an earlier and longer period of vegetation growth in a warmer climate.

Climate change will also bring additional stress to caribou for instance through prolonged exposure to insects. Communities, stakeholders and responsible entities should be prepared for a lower abundance of animals and perhaps a less predictable distribution affecting accessibility to the resource. Management efforts focusing on preserving high quality habitat, limiting anthropogenic landscape disturbances, and managing hunting in a sustainable manner, could alleviate stressors on migratory caribou of the Québec-Labrador peninsula.

ARCTIC CHARR IS AN IMPORTANT FOOD RESOURCE AT RISK



RECOMMENDATIONS

- *The sustainability of the Arctic charr harvest must continue to be assessed.*
- *Habitat enhancement and restocking for Arctic charr should be considered.*
- *Community-based monitoring of Arctic charr populations should be implemented.*

Arctic charr are considered vulnerable to the predicted impacts of climate change because of their preference for cold-water conditions. In a warming environment, lacustrine Arctic charr are the most likely to be impacted by predicted summer temperature increases, with effects being most acute at the southern edge of the distribution range where the warming will be greatest and competition from other salmonid fish species better able to cope with warmer temperatures will be most intense.

Arctic charr (migrating charr) may reduce their period of sea-residency as temperatures increase. Such changes will have profound impacts on Inuit who rely on Arctic charr as a significant source of healthy dietary protein and fatty-acids. To some extent, such impacts may be mitigated by pro-active environmental management as Inuit-led stream enhancement and population introductions have shown.

Key knowledge gaps concerning biology and population dynamics inhibit our abilities to accurately predict climate change impacts on Arctic charr and suggest there is considerable value in collecting long-term data sets specific to the species (e.g. through community based monitoring programs).

BERRY PRODUCTION IS PREDICTED TO DECLINE UNDER INCREASED SHRUB COVER



RECOMMENDATION

- *Important berry harvesting areas close to communities should be protected.*

Recent warming is promoting shrub growth as well as treeline expansion over Nunavik and Nunatsiavut, but not in a uniform way. Research has documented an increasing trend in dwarf birch and willow bush cover, as well as an altitudinal expansion of larch. With warmer and longer summers favouring increased viable seed production and seedling recruitment, trees are expected to gradually expand beyond current boundaries.

Changes in the distribution of shrubs are expected to alter snow distribution and its persistence on the land, affecting permafrost, feedbacks to the atmosphere and wildlife and human transportation routes. Warmer and longer growing seasons may not benefit the growth and productivity of all berry-producing plants. Berry species that have their highest productivity in full sun (especially partridgeberry/redberry and bog bilberry/blueberry) will most likely decline under an increased shrub cover, yet the patchy nature of arctic vegetation should enable other species more tolerant to partial shade such as black crowberry/blackberry/paurngaqutik and cloudberry/bakeapple/aqpiq to take advantage of the changing conditions.

Community-based monitoring is an important tool to enable the collection of long-term data crucial to understanding current uncertainties about berry productivity and other ecosystem changes. Such long-term, sustained monitoring will enable Northerners to track environmental changes in their communities and to tailor appropriate adaptation strategies for their region such as the development of protected areas to ensure easy access to high quality sites for this culturally important activity.

MAINTAINING GOOD QUALITY DRINKING WATER IN COMMUNITIES IS A CHALLENGE



RECOMMENDATIONS

- *Monitoring of water quality for both primary and secondary sources of drinking water in communities should be improved.*
- *Important sources of drinking water close to communities should be protected.*

Nunavik and Nunatsiavut have a rich natural heritage of lakes, rivers and wetlands that require ongoing stewardship and protection. Permafrost thaw lakes (thermokarst ponds) are a major classification of northern freshwater ecosystems, and they appear to be increasing in abundance and total surface area in parts of the circumpolar North, including Nunavik, as the permafrost continues to warm and degrade. The avoidance and mitigation of chemical pollution of northern aquatic ecosystems from both long-range and local sources requires ongoing vigilance.

Secondary water sources near communities are commonly used and are culturally important sources of drinking water. A variety of drinking water problems related to both supply and quality have been identified throughout Nunavik and Nunatsiavut. The monitoring of water quality of both treated and untreated secondary sources of water is currently deficient.

THE THAWING OF PERMAFROST MODIFIES THE NATURAL ENVIRONMENT AND REQUIRES ADEQUATE INFRASTRUCTURE



RECOMMENDATION

- *Improved urban planning and appropriate engineering practices should be applied to take into account local environmental conditions including permafrost and climate change effects for construction projects.*

Permafrost degradation is seriously affecting the natural environment. Thawing of the permafrost in the discontinuous zone creates new ponds and provokes landslides and changes to drainage patterns. The infrastructure of villages in both regions is particularly affected due to inappropriate practices or design flaws combined with climate change. A well-documented case is the community of Salluit, which is built on ice-rich clays where the active layer increased by 30-40 cm in the past twenty years.

The effects of these changes can be seen in the roads as well as in movement of some of the buildings. In many Nunavik communities, permafrost thawing has begun to occur along the sides of some runway sections. In most Nunatsiavut communities, community infrastructure development, including water supply and sewage system placement as well as land-use plans have failed to accommodate Subarctic environmental conditions including permafrost, freezing of active layer and seasonal hydrological conditions.

Great care must be taken in the development of adequate infrastructure and housing. Adaptation strategies are being developed to support improved land-use planning, respond to construction issues, and lessen the impacts of permafrost thaw through better maintenance practices.

SEA ICE COVER IS DIMINISHING IN ITS EXTENT AND DURATION AND FJORD ECOSYSTEMS ARE CHANGING



RECOMMENDATION

- *A better understanding of Nunavik and Nunatsiavut river and coastal systems is crucial.*

An ongoing biological and physical study of the fjords of Nunatsiavut is providing new insights into these critical areas in the face of changing climate and modernization. There has been a significant reduction in sea ice cover across the fjords in northern Labrador over the past 50 years with extreme, recent record lows in coverage, accompanied by reduced salinity in the fjords over this same time period. Generally, Inuit in Nunavik and Nunatsiavut have also reported a decrease in sea ice cover and duration over recent years.

On a shorter timescale, over the past 10 years, there has also been an increase in marine productivity along a north to south gradient in Labrador. Although the biological significance of these changes will vary, it is expected that if these changes continue, a general increase in species abundance as well as new species in these fjords will occur, which could alter food web systems including the harvesting practices of Inuit. More importantly, it has been found that high-energy marine ecosystems along the coast of Labrador can demonstrate substantial resilience and recovery from anthropogenic disturbances if managed in a sustainable and progressive manner.

However, the legacies of local sources of contamination continue to have an impact on coastal marine systems, as indicated by elevated levels of contaminants (PCBs) in some ringed seals (approximately 10-15%) captured from the coast of Labrador. Ringed seals still remain a healthy source of nutrition, and contaminant levels in Inuit from Nunatsiavut are generally lower than the rest of the Arctic due to overall diet choices.

NUNATSIAVUT AND NUNAVIK HAVE BEGUN IMPLEMENTING LAND USE PLANS



RECOMMENDATION

- *Parks, protected areas and land sheltered from development should continue to be identified for the conservation of valued ecosystems.*

The Master Plan for Land Use in the Kativik region was approved in 1998 and includes land identification and classification of: areas that are essential for harvesting, areas of interest to Inuit, caribou calving grounds and reserves for parks. The Nunatsiavut Government has recently approved a land use plan for the Labrador Inuit Settlement Area (LISA) which includes the following land designations (total percentage of LISA in designation): National Park (14.4%), General Use (52.3%), Traditional Use without George River Caribou Calving Area (13.4%), Special Policy - George River Caribou Calving Area (19.5%) and Other (0.5%). In Nunatsiavut, the creation of the Torngat Mountains National Park in 2005 by Parks Canada also resulted in the protection of 9 700 km² of the region's 72 500 km² of land from industrial development. In partnership with the Kativik Regional Government and Makivik Corporation, the Government of Quebec created the Parc national des Pingualuit (1 149 km²) in 2004 and the Parc national Kuururjuq (4 461 km²) in 2009.

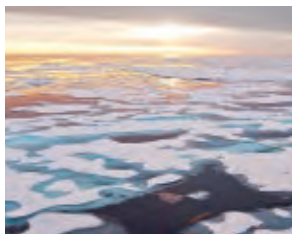
The proposed Parc national Tursujuq (26 000 km²) and the Parc national Ulittaniujalik (5 272 km²) should be created by 2013. No industrial activity is permitted in the parks of either region. There are four other areas in Nunavik, totalling 9 949 km² designated as park reserves. In Nunavik, community consultations are underway for 11 additional proposed protected areas. The objective is to protect at least 20% of Nunavik from Industrial development by 2020. The Government of Quebec has announced its objective to shelter 50% of the Plan Nord region, which includes Nunavik, from industrial development by 2035. Inuit harvesting areas overlap with some of the conservation areas and in other cases are within close proximity to the communities. All of these designated areas, in addition to their importance for conservation, will help cope with the impacts of climate change, while coexisting with areas of industrial development in both regions.



CONCLUSION

The key findings of this study indicate major issues in regard to human health, safety and security, vulnerability of infrastructure and the need to protect ecosystems from the impacts of resource exploitation. Numerous actions to improve quality of life, safeguard the environment and facilitate sustainable development need to be implemented. Many of these actions are presented here as recommendations.

SYNTHESIS OF FINDINGS AND RECOMMENDATIONS



NUNAVIK AND NUNATSIAVUT ARE EXPERIENCING RAPID WARMING

- Improvements are needed in weather forecasting and environmental prediction at regional and local scales.



INUIT IN NUNAVIK AND NUNATSIAVUT HAVE A LIFE EXPECTANCY 10 YEARS SHORTER THAN MOST CANADIANS

- Policies must be developed and adopted to address the current significant health inequality and lower life expectancy.
- Promotion of a healthy lifestyle must be encouraged; the negative impacts of drugs and alcohol cannot be ignored.
- Promotion of health and nutrition education in communities is also crucial.
- Research-driven interventions, such as those that were successful in the Inuit regions, must be pursued. For example: the study leading to the ban on trans-fats in Nunavik, the research that disclosed the substantial decline in persistent organic pollutants both in the environment and in people, and the research that revealed that marine fatty-acids provide protection against CVDs (Cardio-Vascular Diseases).
- An active lifestyle must be promoted to enhance quality of life.



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- Access to a sustainable supply of healthy country food is of paramount concern. Enhancing hunter support and community freezer programs, formalizing the support for country food sharing networks, and finding ways to increase the availability of country foods circulating in communities via commercial sale and distribution are recommended.
- Healthy store-bought foods need to be available and affordable.
- Initiatives such as ice monitoring, trail marking and access to survival equipment (such as spot tracking devices) must be encouraged.
- Search and rescue capacity at local and regional levels must continue to be improved and supported.
- Traditional and land skills knowledge transfer between generations must be encouraged.



THE POPULATIONS OF THE LARGE CARIBOU HERDS ARE DECLINING

- Caribou habitat, calving areas and migration routes must be conserved.
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