



MERIDIAN

IN THIS ISSUE

Respiratory Viruses in the Arctic: Treatment or Prevention?	1
Understanding and Planning for Climate Change in Nunavut	4
The Ittaq Heritage and Research Centre: Inuit Led Research in Nunavut	12
IPY 2007–2008: An Unfolding Legacy	16
A Tale of Two Cities: Washington, Ottawa, and Arctic Governance	22
Book Review: Smiling Bears	28
New Books	30

RESPIRATORY VIRUSES IN THE ARCTIC: TREATMENT OR PREVENTION?

Anna Banerji

It is ironic that, as a tropical-disease specialist, I have spent almost a decade and a half doing research in the Arctic. In 1995, while training as an infectious-disease paediatrician in Iqaluit, Nunavut, I noticed the pervasive impact of respiratory infections in Inuit children. Alarmed and curious, I conducted a chart review, which eventually led to a small study. Inevitably, the more answers I sought the more questions I had. Little did I know this would be the beginning of a 15-year quest chasing answers to one key question: what causes severe lower respiratory tract infections (LRTI) in very young Inuit?

In 2000, I met Dr. Ann Roberts, who was then the Chief Medical Officer of Health for Nunavut and was also committed to understanding and reducing the rates of LRTI there. In 2002 she commissioned the first ever case-control study on this topic in the Canadian Arctic. The study compared children under two years old who were hospitalized with LRTI (cases) with healthy children (controls). Controls were enrolled from Iqaluit as well as Pond Inlet and Pangnirtung, communities that had expressed interest in participating. We arrived in each community, met the hamlet council, and announced over the radio that we were in town. To our surprise, every eligible child in both communities was brought in to take part! This was indeed a testament to the impact of LRTI in the communities. The lo-

cal people were taking action just by participating, and, I believe, felt confident that they could make a difference.

S T U D I E S D O N E
I N T H E S O U T H
C A N N O T B E
G E N E R A L I Z E D
T O R E M O T E A R C T I C
C O M M U N I T I E S

The study identified several risk factors associated with hospital admission for LRTI: smoking during pregnancy; residing in the smaller communities; being of full Inuit race, as opposed to mixed or non-Inuit; overcrowding; and a lack of breastfeeding. There was an additional risk in adopted children who were not breastfed. Of particular importance was that prematurity was *not* identified as a significant risk factor.

This implies that all Inuit infants are at risk for LRTI, and not just premature Inuit infants. The implication is in direct contrast with studies conducted in other parts of the world, mostly in more southern communities. Another study result was equally striking: all of the children who were admitted to the intensive care unit and required life support were from communities *other than Iqaluit*. In fact, determining where a child lived appeared more useful than his or her prematurity status when predicting the child's risk of LRTI hospital admission. This only reinforces what

many northern medical researchers and practitioners already know: studies in the south, done primarily in large urban centres, simply cannot be generalized to remote Arctic communities.

Respiratory syncytial virus (RSV), the most common cause for LRTI hospital admissions globally, was identified in the majority of admissions. Many children, however, had two or more infections – even the common cold virus (rhinovirus) resulted in hospitalization. RSV is noteworthy as it can actually be prevented in about 80% of premature infants, by an antibody called *palivizumab*. Because this antibody is very expensive, its use is currently restricted to populations perceived as “high risk”. The primary Canadian criteria for this designation are prematurity and significant cardiac or respiratory disease.

ONE IN TWENTY
INFANTS UNDER
SIX MONTHS
NEEDED
LIFE SUPPORT

We published a second study which analysed the costs of different RSV prevention strategies with palivizumab using the northern demography. We assessed the impact of both place of residence and age (less than six months and less than one year) on the rates of RSV, and the costs of hospitalization versus prevention. We found that the rates of RSV admissions were not merely just as high as in any “high risk” population – they were actually higher. During the RSV season one in twenty infants under six months of age in the Baffin Island communities ended up on life support because of the disease. These numbers are almost inconceivable. Would this be tolerated in Toronto or anywhere else in southern Canada?

The high rate of hospitalization coupled with the immense costs of hospitalization, including medical evacuation by air, means that treating the disease is astronomically expensive – and in fact far more expensive than preventing it with palivizumab. We demonstrated that by administering palivizumab to Inuit infants in these communities, the governments would actually save money for each hospital admission avoided. This contrasts with studies from other areas, including Australia and Europe, where immunization was found to cost from \$20,000 to \$200,000 per admission avoided!

It is not only the cost of hospitalization that is troubling. Lower respiratory tract infections cause tremendous suffering for the child and tremendous anguish for the family. They also increase the risk of recurrent respiratory infections, and can lead to chronic respiratory problems.

NEW GUIDELINES
FOR PALIVIZUMAB
ANTIBODY

Restricting palivizumab use in Inuit children to premature infants and those with significant cardiac or respiratory disease can no longer be justified. The Canadian Paediatric Society (CPS) has reviewed our studies and has recognized that this situation needs to change. The CPS has recently issued new guidelines that will entitle all young Inuit infants in remote communities to palivizumab prophylaxis¹. I believe this will cause the rates and severity of RSV in the Canadian Arctic to plummet and its devastating effects to fade into history. The resulting improvement in the health of Inuit children will be a testament to the power research can have when it is relevant to the target population.

1. Samson, L. Canadian Paediatric Society. Prevention of respiratory syncytial virus infection. *Paediatrics & Child Health*, 2009;14(8):521–6.

HOW
GOVERNMENTS,
COMMUNITIES, AND
INDIVIDUALS
CAN SUPPORT
MATERNAL
CHILD HEALTH

What else do these studies mean? How can the burden of respiratory illness for the Inuit be reduced through prevention? After 15 years of studying the risks I have some suggestions for action.

If a mother wants to reduce the risk of admission for LRTI, she can stop smoking in pregnancy, and reduce the infant’s exposure to cigarette smoke. Breastfeeding should be encouraged and supported. We need to understand why adoption poses an additional risk. Although poor nutrition was not addressed by the studies described above, it is also a risk factor for severe LRTI. Studies have found Vitamin A, D, and iron deficiencies in Inuit populations; and a mother who is malnourished will have breast milk that is deficient in micronutrients. Mothers should try to maximize their nutrition during pregnancy, and their access to traditional foods should be supported where possible. Healthy foods must be affordable and price subsidies should be in place. Expecting mothers should take prenatal vitamins, and all infants should be given a multivitamin such as trivisol with iron in the first six months of life. Community wellness centres could provide accessible and relevant education about smoking and good nutrition. They could also offer nutritious meals for women and young children on a regular basis.

THE IMPORTANCE OF SAFE HOUSING

The recent UNICEF report *Aboriginal children's health: Leaving no child behind* stated that “our country is being called to a greater consciousness” and made the point that health disparity is one of the most significant children’s rights challenges Canada must address². One such disparity is housing. The case-control study showed a *direct association* with overcrowding and the risk of admission for LRTI.

The recent impact of H1N1 (swine flu) on aboriginal communities across Canada again demonstrates that poverty, overcrowding, and lack of basic sanitation boosts the risk of LRTI. Canada has ratified the Convention on the Rights of the Child and the UN declaration on Human Rights, which state that health is a human right. This includes the right to safe housing. We need a legal framework to ensure a minimum standard for housing, so that inadequate or substandard social housing is eliminated across Canada. Governments need to be held accountable: individuals should question political leaders about this issue, and lobby for legislation towards adequate housing.

WHAT CAN BE DONE TO SUPPORT POWERFUL RESEARCH AND ACTION?

Working in the Arctic has been one of the most positive experiences in my life, but at times it has been very challenging. The biggest barriers I have encountered have been complacency and inertia. I have met many committed, dedicated people in the north. I have also met individuals so used to the high rates of LRTI,

2. UNICEF. “Aboriginal children’s health: Leaving no child behind”. Canadian Supplement to the State of the World’s Children 2009. Canadian UNICEF Committee, 2009.

endemic diseases, poverty, overcrowding, and sub-standard housing that they have little motivation to lobby for change. The Tunngavik Federation of Nunavut’s 2007–2008 *Annual Report on the State of Inuit Culture and Society* states that the Nunavut and federal governments “must communicate with and involve Inuit in the design and delivery of health care” as a legal requirement under the Nunavut Land Claims Agreement Article 32. We have experienced situations when our research, though endorsed by the numerous Inuit organizations that we consulted for input and advice, and approved by the Nunavut Research Institute, has nonetheless encountered obstacles from the territorial government. We are still trying to negotiate and overcome these difficulties. I have recently been leading a team of experts from multiple health disciplines conducting a circumpolar surveillance of admissions for respiratory viruses including RSV and H1N1 in infants admitted to hospital in Canada and Greenland. It is our hope that the territorial government will support our efforts to improve the health of Inuit children – for if LRTIs are to be consigned to history, then individuals, communities, and governments must work together.

RESEARCH BIAS LIMITS UNDERSTANDING OF CANADIAN HEALTH LANDSCAPE

I believe that there is a “research bias” against medical research with remote aboriginal populations. Journals seem to prefer randomized placebo trials (RCT), which are usually conducted in large urban populations. However, these study designs are simply not appropriate in many aboriginal communities, which is perhaps why very few RCTs focus on Canadian aboriginal populations. This ranking of a study’s design above its potential impact in-

evitably contributes to the under-representation of research on Canadian aboriginal populations. Most unfortunately, it ultimately decreases our understanding of causes and risk factors for those who have the greatest health disparities. Because of this bias the published research is not actually representative of the true Canadian landscape.

This further complicates matters for prospective arctic researchers, who already contend with logistical and financial challenges. In an era where “evidence” guides policy, aboriginal peoples suffer from the lack of policy-driven research. Although Canadian Inuit children have the highest rates of LRTI in the world, our study is the first (and only) case-controlled study of its kind published – and we submitted the papers five times before they were accepted for publication. One reviewer from a major pediatric journal actually wrote that, “remote arctic communities are not of interest to the general reader”. To ameliorate the situation, Canadian journals should make it a part of their mission to include papers on aboriginal health and under-represented populations, especially because very little data exists.

I do believe that Canadian consciousness of the disparities faced by Inuit and other aboriginal peoples is rising. Our many voices can unite to fight complacency and advocate for better health for indigenous people in Canada, and I am confident that the education and mentoring of indigenous researchers and leaders will empower communities. I may or may not continue to do research in the Arctic, but I will always remain committed to the North. Over the past 15 years, I now have extended family and friends in the Arctic and I know that the North will always be a part of my life – and although I am a tropical-disease specialist, my heart will always be north of 60.

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Further Reading

Banerji, Anna, *et al.* "Comparison of the cost of hospitalization for respiratory syncytial virus disease versus palivizumab prophylaxis in Canadian Inuit infants". *The Pediatric Infectious Disease Journal*, 2009, vol. 28, no. 8, pp. 702–6.

Banerji, Anna. "Respiratory Tract Infections in Inuit Children". *Meridian* (Fall-Winter 2002), pp. 4–6.

UNDERSTANDING AND PLANNING FOR CLIMATE CHANGE IN NUNAVUT

Hadi Dowlatabadi, Michelle Boyle and Susan Rowley

Adaptation to climate change has three prerequisites: one, that we know what will happen; two, that we know what to do to minimize its impacts and even reap some rewards if possible; and finally, that we have the resources and autonomy to act on what we know. In this article we explore just the last question for Arctic Canada, where marginalised communities are experiencing extreme climate change as well as contending with many other external and internal stresses. Our collaborations with a number of communities in Nunavut revealed that while concern about climate change is prevalent, even more damaging pre-existing concerns remain to be addressed and should take precedence. Furthermore, the communities lack the resources, institutional capacity and expertise to employ long-term strategic planning processes to plan and execute effective climate change adaptation measures. In light of these challenges, we recommend that efforts to mainstream climate change adaptation rely on frameworks that can (a) respect community priorities and introduce resilience to climate change as one part of meeting other critical development goals, (b) more realistically assess the costs of adaptation given limited local resources and the investment required in

capacity building, and (c) accommodate key cultural differences in decision-making, values, and the use of information.

INTRODUCTION

The Inuit are legendary for having established a sustainable livelihood in one of Earth's harshest climates. They achieved this by developing their lifestyle and demand for resources to fit the natural rhythm of the arctic ecosystem (Berkes and Jolly, 2000; Bennett and Rowley, 2004). For millennia they adapted to seasonal and inter-annual variability in their environment by pursuing a nomadic lifestyle. This harmony was fundamentally altered by the socio-economic changes of the past century – most notably by sedentarization. Today, reliance on the local ecosystem is far from total. Dog-teams, for example, have been largely replaced by skidoos, and these run on petroleum, not fish and walrus; petroleum, not seal oil or caribou fat, provides heat and light.

Hunting and fishing, however, remain central to the Inuit social economy. Accurately reading the land, sea and sky in order to know where to hunt and which path to take requires knowledge derived from a pattern of past observations and experiences – the long-respected traditional knowledge. Climate change alters these patterns, and threatens to

push the Inuit even further from their ancestral experience.

Inuit succeeded for millennia because much of the time they were able to adapt to changing circumstances. Adaptability and flexibility are central themes in Inuit traditional knowledge. The challenges Inuit face today – rapid social change coupled with rapid environmental change – are likely unprecedented. Inuit society will need all the resourcefulness and resources it can command to adapt.

Established theories of adaptation describe the introduction of a new stress, emerging awareness of its impacts, consideration of options for relief, and implementation of a chosen option (Smithers and Smit, 1997). Further refinement may classify responses according to whether they strengthen community resilience and robustness against similar future stresses (Tompkins and Adger, 2004). A community's ability to achieve these responses has been used to characterise its adaptive capacity (Adger, 2003).

Anticipatory adaptation is a structured decision process aimed at responding strategically to different stresses at a defined scale. This situation requires foreknowledge of both climate change and how it is likely to manifest, and recognition of the challenges and uncertainties associated with predicting im-

pacts and adaptations through time. The process therefore must allow for strategies to be adjusted as development goals and ecological changes co-evolve (Dowlatabadi *et al.*, 1994). (See chart for one such process.)

The only thing that can assure the long-term prosperity of the Inuit is their capacity to understand and plan their response to the changes occurring in their homeland.

Ever since the federal government centralised basic services, drawing Inuit off the land and into sedentary life, arctic hamlets have depended largely on resource transfers from higher levels of government. Yet the health, housing, and education challenges first outlined by Jenness (1961) persist (Bergner, 2006). Successful adaptation today requires knowing the routes that lead to influence in federal and territorial decision-making on program design and delegation of responsibility – and how to bring home the grants hiding beneath a sea of red tape.

Adaptation in arctic communities faces these challenges:

- *Agenda*: How is it defined? Where is climate change in the hierarchy of imperatives?
- *Resources*: Who controls these? Are funds earmarked for specific uses? Does climate change present opportunities for communities to access resources?
- *Information*: Is there sufficient information about climate change, baseline conditions, and potential local impacts? How do communities use this information?
- *Values*: How should different options be ranked? Might Inuit cultural values render conventional adaptation frameworks unworkable?
- *Decision-making*: Can existent institutions and planning processes adopt anticipatory adaptation? What support is needed?

A G E N D A

Early and significant climate changes are already occurring in the Arctic (including sea ice reduction, permafrost degradation, more hazardous weather, and alterations in bio-

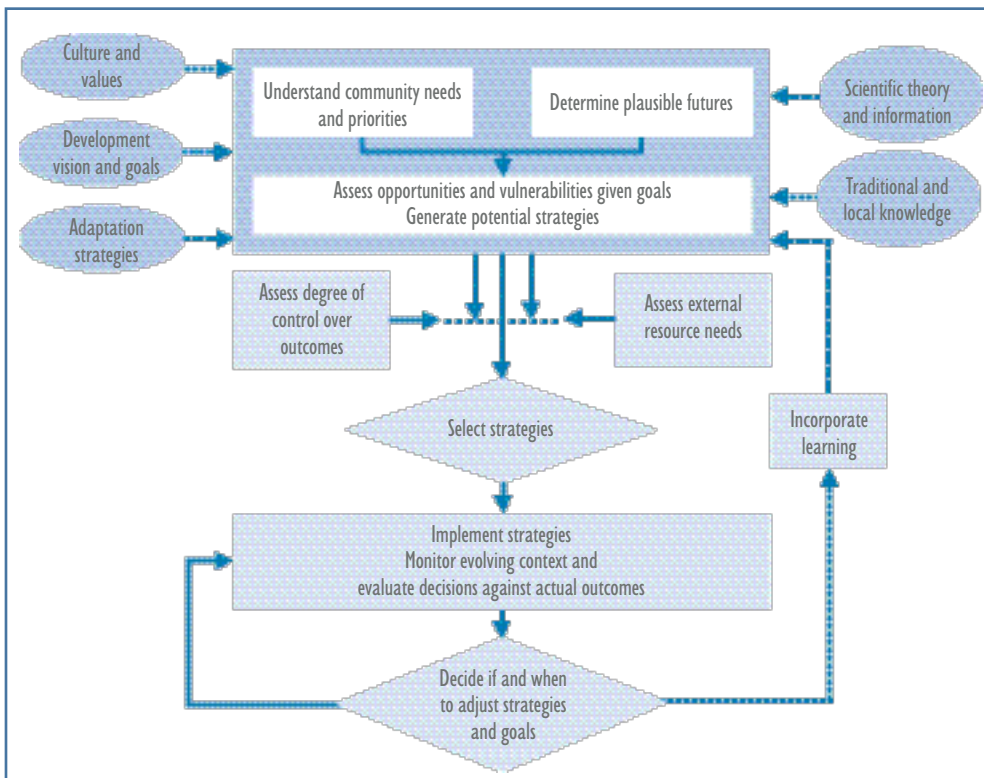
logical systems), with disproportionate impacts to indigenous populations who depend upon climate-sensitive resources (ACIA, 2005; IPCC, 2007; Furgal and Prowes, 2008). Awareness of these issues is strong in Nunavut. For decades, researchers have been travelling to high latitudes to study climate change phenomena. Local Inuit, embodying the oral history of generations, have offered their observations of climatic abnormalities to numerous studies from Fox (1998) to Laidler (2008). Inuit leaders, including Sheila Watt-Cloutier and Mary Simon, have brought regional concerns of climate change and cultural impacts to international attention.

Climate change also figures prominently in the political rhetoric. Nunavut was the first of the provinces and territories in Canada to sign on to the federal climate change program and develop its own climate change strategy, in 2003 (George, 2003). Conforming to international and national agendas, the policy's main objectives are to: control and reduce greenhouse gas emissions, identify and monitor climate change impacts, and to develop adaptation strategies (GN, 2003).

These objectives are beginning to penetrate territorial policies and sector strategies, but attention to planning and adaptation at the community level in Nunavut is in its infancy. There are some modest initiatives to reduce risks within the capital city of Iqaluit. A workshop and a conference were held to share knowledge of impacts and adaptation options, and to identify planning needs. As well, an associated pilot project engaged volunteer consultants to develop community climate adaptation plans for two communities (see www.planningforclimatechange.ca, Arvai and Gregory, 2007; Baksh and Render, 2008).

Most Inuit perceive that climate change impacts are greatest on harvesting activities,

A Process for Anticipatory Adaptation at the Community Level



as they have to adjust hunting patterns and equipment to accommodate seasonal and ice abnormalities (Ford, 2006). Elders feel deeply the erosion of traditional knowledge, spiritual wellbeing and identity that occurs as the familiar “cultural landscape” changes (Nelson, 2003; see Ehrlich and Sian, 2006:6 for definition). Nothing short of a reversal of climate change and immediate halt to emissions of chemicals that are transported to the polar region will restore this loss. Here, all that communities can do is to continue closely observing and studying the environment – as they have always done – and keep their knowledge current.

In the larger picture, however, climate change ranks behind much more critical challenges facing communities. Sixty years of development pressures and lagging investment in the needs of growing communities have resulted in dire economic and social conditions. As Justice Berger (2006:vi) put it:

Imagine the odds faced by a student attempting to do homework with 12 or 13 other people in the house... [V]irtually every home has at least one resident smoker; oil heating may produce carbon monoxide and other pollutants. The fact that even one quarter of Inuit students graduate from high school is, under the circumstances, a testament to the tenacity of those students, their parents, and their communities.

Our own efforts to understand local perspectives also indicate that, although notable improvements have been made, the overriding priority remains meeting basic needs (health, housing, and education/training). The imperative to expand job opportunities for the burgeoning population of youth is evident to all. The challenge is how to maintain a mixed economy that retains a distinct cultural identity while creating the economic

means to support a growing population (GN, 2004).

Climate change remains important to Nunavut communities – but is eclipsed by more immediate concerns. The fact that climate change may provide opportunity (e.g., easier access for resource exploitation) as well as adversity (e.g., amplifying pressures on traditional livelihoods and culture) highlights the need for measured and strategic responses that allow communities to capitalize on benefits and reduce risks.

The ability of communities to act on their priorities is restricted however. In addition to the fact that many forces of change lie outside local control (e.g., climate, long-range pollutants, globalization), hamlet governments are constrained by insufficient jurisdictional authority. As a case in point, key local actors ranked social and economic development action items as part of the Nunavut Economic Development Strategy implementation (see SEDS, 2003). The exercise illustrated that community control over priorities, whether sensitive to climate change or not, was inversely related to their perceived importance (Boyle and Dowlatabadi, 2005). Furthermore, several generations of top-down control and government intervention have undermined efforts to build the capacity of communities to manage their own affairs.

R E S O U R C E S

Communities are entirely dependent on external financial resource flows. Local governments in Nunavut (except Iqaluit) are not tax-based and generate almost no revenue. There are few economic development opportunities, and most of these (e.g., fur products, tourism, Inuit art) are tied to international markets that can be fickle in demand. The most lucrative opportunity by far is mining, which, historically, has not left communities with enduring benefits.

Both cause and consequence of the above, nearly all of the essential public services and programs delivered in communities are funded, or directly provided, by the government or Inuit organizations. Public housing, for instance, constitutes over half of all housing units in the territory (OAG, 2008). Resources are allocated among communities according to territorial funding cycles and central assessments of relative need. Nunavut itself relies on federal transfers, amounting to 92 percent of the territorial government’s yearly budget, and a total of more than a billion dollars, paid out to Inuit organizations over 15 years starting in 1999 in accordance with the Nunavut Land Claim Agreement (Canada, 1993; GN, 2008).

Theoretically, Inuit communities could access an enormous number of funding programs from all levels of government and other sources. Yet, there is a perpetual shortage of resources for local initiatives. The problem here is that governmental change is even faster than climate change. Criteria for eligibility and allocation of funds change frequently. Multi-year or seed funding is rare; usually community initiatives must demonstrate success and reapply each year for money to run programs and pay staff. With each change in government comes the risk that expected funds will be reallocated to other programs or discontinued altogether. Just as it does with hunting, success here requires a stable and relatively predictable environment.

Experience increases knowledge and competence. The best hunters have spent years studying the areas and the animals they use; the best hamlet staff have spent years researching potential sources, writing proposals, and managing finances. Unfortunately,

there is a very high turnover in hamlet personnel, so that this knowledge is never developed to the point of successful and sustained use. We collaborated with three hamlets for five years. Over this period, only one employee involved in planning and development was still working for the hamlet in *any* capacity.

So, imagine we do have grant hunters, ready to pounce on resources that can be used to address adaptation to climate change. How big are the resources available in the territorial budget? In a word: tiny.

The new Nunavut Climate Centre, supported by one employee, occupies a corner of the Department of Environment – which itself receives only two percent of the government budget (GN, 2008). If climate change is perceived as the key environmental stress, how can such small budgets adequately serve the needs of 26 communities?

Clearly, this small budget reflects the tension between immediate needs in Nunavut and national climate change programs. A recent energy-efficient public housing project (a partnership between the Nunavut Housing Corporation, Infrastructure Canada and the Canadian Mortgage and Housing Corporation) constructed 70 units in 2005, its inaugural year, and was considered successful (CMHC, 2006). Yet a 2004 report estimated that 3,300 units were needed immediately to alleviate critical shortages – and, 250 new units are needed annually to replace a largely dilapidated housing stock thereafter (ITK, 2004). Only a large-scale deployment of new housing would simultaneously address overcrowding and unemployment, as well as reduce energy use and greenhouse gas emissions.

Finally, we have to consider the grant-hunting strategy that has been shown to succeed in the past. Because the government does not have a prospective plan of development, it only reacts to situations of dire need. This reactive form of government means that communities must first suffer terribly before they can be the beneficiaries of government investment. This promotes a moral hazard hindering local adaptation to climate change – the worst affected communities are singled out for remedial measures. If we continue to ignore strategic planning and investment for development in Inuit communities, hamlets will be placed in a catch-22 situation where failing to adapt to climate change will be the most effective means of accessing the resources needed to adapt.

I N F O R M A T I O N

Availability of information on climate, impacts, and adaptations in Nunavut has increased dramatically in recent years. Qualitative studies on local observations of climate change are easily accessible and relevant to people in communities. This information documents past norms and benchmarks future climate change. When climate anomalies fall within recorded variability (oral history or formal records), traditional knowledge provides insights into possible impacts and how to respond. But estimating the impacts and effective responses to climate change beyond past experiences requires better understanding of local ecosystems and biogeochemistry than currently exists.

Predictions of future climate from global and arctic regional climate models are obtainable now that all Nunavut communities have broadband satellite Internet. However, there is insufficient local historical and geographical data for calibrating the models, which means that climate projections in the

Arctic are less precise. The projections available to the public have coarse spatial and temporal scales, covering a vast area and an extended period. Difficult for non-scientists to interpret, they are rarely if ever accessed or used in decision-making by local governments.

Qualitative descriptions about the range of possible climate effects may be sufficient, but the uncertainties regarding if, when, and how impacts may manifest can render the information too abstract for local planning purposes.

While the apparent availability of climate information has increased, data on social and economic conditions is scarce – but is nonetheless vital to assessment of local vulnerabilities and opportunities in communities. There are four potential sources for data, but each is currently hampered in collecting usable data:

- The Nunavut Bureau of Statistics currently lacks the capacity to collect data (though this may be improving).
- Government departments collect data, but these may not be publicly available, or of sufficient quality or consistency for decision-making by communities.
- Hamlet governments do not systematically gather data on residents.
- Periodic local level studies (*e.g.*, academic research, project environmental assessments) do not usually relate to community needs, and are rarely repeated to examine trends.

Climate change adaptation researchers depend mainly on external sources for quantitative information. While Statistics Canada produces valid and consistent data, it may not report on topics or indicators relevant to

Nunavut communities. For example, the definition of a census “family” fits poorly with the Inuit notion of shared households and extended kin, and confounds interpretation of related statistics. Data on land-based activities, pertinent to Inuit, is collected only at 10-year intervals and reported only at the territorial scale (see Boyle and Dowlatabadi, 2006).

Perhaps more important than the issues outlined above are the underlying reasons for Inuit mistrust of data and statistics. There are many theories for why Inuit have grown mistrustful of “scientific information” – including conflict with or dismissal of local expertise and the belief that authorities and researchers have used past surveys to harm Inuit. Whatever the reasons, until trust can be re-established the capacity of any entity to collect systematic socio-economic data in Nunavut will be severely compromised. By extension, adaptation planning based on such data will not have stakeholder support and cannot be implemented successfully.

C O M M U N I C A T I O N , T R U S T A N D V A L U E S

Western and Inuit cultures differ in their frameworks for understanding the world. Where Western science has pursued deconstruction and atomistic explanations, Inuit have holistic concepts and a highly contextual language for conveying their cosmology. For example, the Inuktitut word *sila* means weather; the spiritual force controlling the weather; outside; the great outdoors (the great beyond). It is also the root for the word for the universe (*silarjuaq*) and also is the root of the word for wisdom (*silatuniq*), which implies that the wise have taken something of the great outdoors into themselves

(*pers. comm.* J. Bennett, 2009). In contrast, Western science strives to differentiate weather from climate, emphasizing weather as events that take place in the context of climate. It is not surprising then to find that shared understanding of scientific concepts and methods used in decision-making and in translating scientific terminology meaningfully or consistently into aboriginal languages is challenging at best (Ellis, 2005; Schuegraf and Fast, 2005; Laidler, 2006; Myers and Furgal, 2006). Furgal *et al.* (2005), in attempting to communicate ideas related to contaminants in the arctic food chain, noted difficulties in communicating concepts such as “risk”, “probabilities of risk”, and “levels of safety”. Productive discussions of priorities, values, and trade-offs, necessary for anticipatory adaptation, are problematic within this cross-cultural context.

For long-term strategic planning, communities need to identify their objectives and priorities for the short-, medium- and long-term. Achieving these objectives may necessitate tradeoffs. We found it difficult to introduce such a framework into consideration of long-term strategic problems. Often, our collaborators simply called these too abstract and not a useful approach to long-term strategic planning.

We were often reminded that when travelling on the land, Inuit make decisions critical to survival by observing subtle signs and evaluating them against personal experience and multi-generational oral history (Bennett and Rowley, 2004; Parlee *et al.*, 2005). From the perspective of this knowledge system, scientific methods that remove data from their context and apply abstract analyses seem to produce little useful information.

Assessing discounted benefits and costs and negotiating trade-offs are critical to strategic decisions, but over-simplification, common in the atomistic approach, leads to a lack of trust. For example, in considering whether

or not to hunt a caribou, a hunter may consider many factors, ranging from immediate need, to productivity of the land this year, to health of land and the herd in future years (Bennett and Rowley, 2004). When we tried to introduce a simple discounting approach it was rightfully criticised for being too simplistic. Unfortunately, examples we tried to use to explain discounting only added fuel to the pyre on which we were burning. For example, we said: “imagine you have some money: would you keep it at home or save it in a bank, which can offer you three percent interest?” In this example we were hoping to share the concept of opportunity cost. But we were shown how context matters because the immediate reply was, “why would I have money at home or in a bank? My brother is unemployed and I should share my money with him so he can eat.”

Our problems persisted when, in a group exercise with hamlet Economic Development Officers (EDOs), we tried to help them consider how to choose between two development opportunities: one with low cost and risk, and the other with high cost and risk (a pier to moor tourist cruise ships or a hotel for guests arriving by plane). The EDOS uniformly chose both. We were surprised that they argued there was urgent need for development and nothing should be passed up. We had forgotten that, in their context, the resources that spur development come from outside.

In summary, a major weakness of the atomistic approach to the world is that it can omit key factors and hence forge ahead with a “solution” that would eventually reveal the initial assumptions as flawed. The notable weakness of the holistic approach is that it could involve such a breadth of issues and concerns as to defeat systematic deliberation of available options and the development of a strategy.

I N S T I T U T I O N S A N D
E F F E C T I V E
D E C I S I O N - M A K I N G

We have listed many critical community needs pre-dating concerns about climate change. Climate change may exacerbate or alleviate some of these needs. We have also indicated how few of these needs are under the direct control of hamlets. This leads hamlets to look to government and external sources to resolve many local concerns. Given, also, gaps in information, cultural differences, and planning mechanisms that mimic those in southern Canada, it is not at all surprising that the prerequisites for conventional strategic planning are not present in community planning processes (see table for examples). Effective adaptation to climate change is unlikely before these pre-existing challenges have been addressed.

Thus higher-level government support warrants examination. In Nunavut, nascent territorial government departments also suffer from significant shortages in financial and human resources, expertise, and relevant data. Communication and coordination among departments is minimal. Although the importance of reducing risks and adapting to climate change is recognized, the current situation is at odds with the comprehensive and systematic planning and analysis that is required (Arvai and Gregory, 2007; Baksh and Render, 2008; Ford *et al.*, 2007). Sustained support and efforts at effective capacity building by agencies dedicated to adaptation planning (*e.g.*, Natural Resources Canada, Canadian Institute of Planners, Inuit Circumpolar Council, research institutes) are necessary for the time being.

Challenges to Implementing Anticipatory Adaptation into Existing Planning Processes in Nunavut Communities

<i>Challenge</i>	<i>Examples</i>
The need to constantly respond to crises and immediate concerns	<ul style="list-style-type: none"> ● Keeping the community running smoothly, and the health and safety of residents takes priority ● Even basic services may not be easily available (<i>e.g.</i>, electricians flown in for community repairs) ● Events affect the whole community (<i>e.g.</i>, flu epidemics, the passing of an elder)
High turnover rates and lack of institutional memory	<ul style="list-style-type: none"> ● People in key planning positions change often. In our project, only one of five original contacts remained after 18 months (one position turned over twice) ● Annual elections for Hamlet Council (for a two-year position). Committees are reshuffled annually ● Average retention of employees for the Government of Nunavut is about 18 months
Limited human resources	<ul style="list-style-type: none"> ● Few people to carry out all the tasks required in running the community ● Skilled people become overwhelmed with participation in too many committees and initiatives ● Planning tasks are usually extraneous or marginal to full-time job responsibilities
Use of information and analytical skills	<ul style="list-style-type: none"> ● Preference for traditional knowledge and forms of decision-making ● Mistrust of data analysis and interpretation done by distant governments and external consultants/researchers ● Understanding/interpretation of key concepts (<i>e.g.</i>, trade-off analysis, discounting, risk) is not shared
External planning structures and plans	<ul style="list-style-type: none"> ● Most plans are tied to funding requirements from the government. Plans usually are written by external consultants; less than 50% of these plans are ever implemented. ● The existing structure of governance is relatively new to communities. “southern” planning models may be inconsistent with local culture and ways of decision-making
Short planning horizons	<ul style="list-style-type: none"> ● Budget allocations cover one to three years; community economic development plans usually look ahead five years ● In comparison, mining companies plan 10 to 50 years ahead; the time horizon for climate change impacts stretches to 100 years

CONCLUSIONS

Communities respond to the multiple stressors and factors with a sense of urgency to resolve current issues. Hamlet governments do not have sufficient control over agenda and resources to act on local priorities, nor to implement long-term planning over reactive decision-making. Furthermore, communities struggle with institutional and human resource issues that severely challenge their ability to engage in anticipatory adaptation.

Using characteristic resourcefulness, Inuit and Nunavut as a whole may capture new resources invested in climate change action to address long-standing priorities; cultural preservation and infrastructure improvements are prime examples. This approach reveals overall resilience but also highlights the indispensable role currently played by higher levels of government and external sources in supporting communities with funding, human resources, and expertise.

If anticipatory adaptation were to succeed in the future, significant investment would be necessary to build capacity and skills for planning in general, and for long-term strategic decision-making in particular. Changes to planning mechanisms and repair of jurisdictional fragmentation by the territorial government would be required to allow a more coordinated perspective at the local level. Adaptive capacity for communities in the future, however, depends on their ability to regain control and become empowered to implement local initiatives and adaptation strategies in order to realize their own development goals.

We have attempted to show that concepts and values underlying anticipatory adaptation frameworks do not fit the context and culture of Nunavut communities. This has several implications for climate change action in developed countries. Adaptation poli-

cies and programs that purport to assist marginalised communities should respect local priorities and introduce resilience to climate change into efforts aimed at meeting pre-existing critical development goals.

Given these observations it is difficult to sustain a belief that anticipatory adaptation will succeed in reducing the risk of damage to individuals and communities from climate change impacts. This vulnerability will probably be more acute in regions with pre-existing and unmet needs. Furthermore, it is likely to be amplified in marginalised communities dependent on resource flows from higher levels of government. These conditions stifle the capacity to act locally to alleviate needs. We suspect that our findings also hold elsewhere for communities in similar circumstances.

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THE ITTAQ HERITAGE AND RESEARCH CENTRE: INUIT LED RESEARCH IN NUNAVUT

Shari Gearheard and Nicodemus Illauq

Research in the Canadian Arctic is on the rise. Issues like climate change, wildlife management, and human and environmental health have been bringing researchers in increasing numbers to Nunavut. The 2007–2008 International Polar Year (IPY) saw a surge of research in Nunavut with over 150 research activities going on in the Territory with over 450 researchers arriving each year*.

Until recently, communities were usually left out of research activities. Communities would simply observe while researchers arrived, headed off to field sites, then departed without explaining what they did or what they found out. Sometimes they were never heard from again. The situation has improved today, where communities have an opportunity to review and comment on proposed research activities (Science License Applications via the Nunavut Research Institute), and the current research paradigm in the North is shifting more toward participatory work and community-based research programs. At the same time, communities are exploring new ways to diversify their economic opportunities. Finding employment in research projects and programs has become one new area of skills development and income.

This article describes what our community is doing to take community involvement in research to the next level. We introduce the Ittaq Heritage and Research Centre and some of our current activities. We hope it will encourage researchers to collaborate more with local communities and inspire other communities to establish their own research initiatives.

* Nunavut Research Institute. "IPY Research Activity in Nunavut in 2008" (information pamphlet).

ESTABLISHING ITTAQ

During a conversation in 2005, we (Shari, a University of Colorado researcher living full time in Clyde River, and Nick, a hamlet councillor at the time and currently Clyde River's Deputy Mayor) got talking about the different research projects going on in and around our community. It occurred to both of us that the many activities we saw, like interviewing, collecting samples, taking observations, and monitoring various instruments, might be easily and more efficiently done by local people. We talked about the amount of money that had to be spent to get researchers to the North and how perhaps that money could be put to better use by training and hiring local people to do the research. We talked about the environmental impact of so many researchers travelling long distances to the North and how perhaps research could be improved by having local researchers work on the project all year, rather than a campaign by scientists in only a few weeks or months. We thought this approach could provide more and more consistent data, and data that could be augmented by local knowledge and expertise. We agreed that it was worth looking into how coordinated local research might be able to complement scientific activities, provide new opportunities for our community members, and produce more meaningful research results.

We started by establishing the Clyde River Research Committee in that same year. We approached the different organizations in town and asked each of them to appoint a representative to the Research Committee so that we could hear perspectives from different lo-



WHAT DOES ITTAQ MEAN?

An *ittaq* is a skin tent. Inuit used to live in skin tents during the summer months. The term also refers to ancient times or something from a long time ago. After a community naming contest, "Ittaq" was chosen as the name of Clyde River's new heritage and research centre. Ittaq's research mission is to increase local participation in, and direction of, research in the Clyde River area, simultaneously creating local job opportunities and better research projects. Ittaq supports diverse research projects, whether local, government, industry, or university-led, by providing quality services: researchers and research assistants, logistics support, guiding, traditional knowledge input, environmental monitoring, sample/data collection and processing, interpreting/translating, outreach design and facilitation, and consultation/liaison work with local individuals and community organizations.

cal groups, and make sure our ideas got back to those organizations and their membership. We ended up with a group of nine people with representation from the Elders Committee, Hunters and Trappers Organization, Justice Committee, Housing, Hamlet Council, Ilisaqsivik Society (local wellness organization), and the Health Committee.

It didn't take long before our group proposed the idea of a research centre of our own, that would also include heritage activities and a support centre for our growing tourism industry. Clyde has always had a welcoming attitude toward visitors and researchers and it was in this spirit that we developed our ideas for the kind of encompassing centre we needed. At the heart of the research component of the centre would be the active pursuit of collaborative projects between the community and researchers (whether those researchers were local, from government, university, or industry) as well as encouraging locally-designed and led independent projects. To encourage collaborations, we would develop an array of services that would provide mutual benefits so that:

Researchers gain through i) more data and more consistent data collected by trained local people year-round; ii) potential for significant cost savings since researchers do not have to visit the community as often, or as long (or at all), or the number of visiting researchers can be reduced; iii) input from local experts on research topics (*e.g.*, access to traditional knowledge and local expertise); iv) greater support and project momentum from local people for the project because they are invested in the work and project leadership themselves.

Local people gain through i) jobs in research (*e.g.*, environmental monitoring, traditional knowledge collection, surveys, sample collection, sample processing, etc.);



Photo 1

Teema Qillaq is Clyde River's sea ice monitor. Here Teema gets ready to measure sea ice temperature at one of the monitoring stations. Photo: Nina Qillaq.

ii) training (working with researchers to learn skills for various projects, which can then be applied to other projects and enhanced with more experience and training; training also through formal courses in areas such as Workplace Hazardous Materials Information System (WHMIS) training, aquatic biomonitoring, etc.); iii) local input

Photo 2

Members of the sikulirijit working group in Clyde River discuss sea ice terminology and photographs of ice types (from left: Jacopie Panipak, Ilkoo Angutikjuak, David Iqaqrialu, Laimikie Palluq, and Joeline Sanguya). Photo: Shari Gearheard.



T H E I T T A Q A N D N R C A N
P A R T N E R S H I P

by David Mate

Project Leader, Earth Sciences Sector, Natural Resources Canada

The Earth Science Sector of Natural Resources Canada (NRCAN) began a new climate change adaptation program in 2006. One of its projects was focused on developing earth science information at the community level that could be used to identify climate change impacts and develop adaptation options. It had a particular interest in conducting a multi-disciplinary study in a Nunavut community that could demonstrate how scientists and communities could work together to build adaptive capacity. At a December 2006 Nunavut climate change workshop in Iqaluit, NRCAN project researchers were introduced to representatives from Clyde River who were keen on partnering as well as developing a community-based research and heritage centre called Ittaq. This partnership opportunity was exciting. The chance to work with a nascent community research and heritage centre was truly exhilarating! This first encounter set the stage for what has turned out to be a very pioneering and stimulating partnership.

To date, 19 project scientists from NRCAN and Canadian universities have collaborated with Ittaq staff and over 30 Clyde River residents on climate change adaptation research in the community. This has helped the science team conduct focused and applied research and at the same time build the capacity

of Ittaq. Research areas in and around the community have included studies of sea-level rise and coastal erosion, permafrost and terrain hazards, and drinking water supply. The project team was able to access and work with boat operators capable of conducting marine surveys, field experts capable of collecting data such as snow thickness, and logistical experts able to coordinate community meetings and input. The expertise of Ittaq has also laid the foundation for longer-term monitoring activities. For example, a permafrost monitoring station has been installed in the hamlet that will be maintained by Ittaq.

Ittaq has provided a valuable opportunity for NRCAN to learn how to work with a Nunavut community. No two communities are the same, however, the science team has learned how to work with a different culture, learn about the pace at which things move in communities, and ways to present research findings back to residents. This learning has helped the research team expand to other communities across the territory.

The Ittaq and NRCAN partnership has been a positive one and has set an example for how communities and science teams can work together for the benefit of all. It has also clearly demonstrated that local research centres in the Arctic enable important economic and training opportunities.

into project design, execution, analysis, reporting, and outreach since residents are actively involved in collaborative projects, increasing the likelihood that research results and products will be useful locally; iv) inspiration for youth to seek jobs in science and re-

search through exposure to diverse research projects.

In 2006 and 2007 we were able to obtain funding from the Government of Nunavut to buy a building in town and begin renovations for our new centre called the Ittaq Her-

itage and Research Centre. Renovations are still under way, but when the centre is complete we will have research workspace, meeting space, a library, a functioning science laboratory, warm and cold secure storage, map storage, a skinning area (to help teach and process animal skins), a media centre (film editing, audio recording (including a sound booth), and space for heritage displays, activities, and teaching.

I T T A Q R E S E A R C H
A C T I V I T I E S

With a new building underway, Ittaq has developed several research programs in the community. For example, Ittaq is collaborating with Natural Resources Canada to study climate change impacts in and around our community and help contribute to a territorial strategy for climate change in Nunavut. Other projects include:

*Sea Ice Monitoring and
Sikulirijiit Working Group*

Since 2006, a trained local resident, Teema Qillaq, has been the community's sea ice monitor (photo 1). Each sea ice season Teema installs ice monitoring stations at three significant locations chosen by the community, and checks them weekly, recording sea ice thickness, snow thickness, and ice temperature. Established as part of a larger research project called Siku-Inuit-Hila (Sea ice-People-Weather) launched during IPY, the monitoring program helps to provide local and regional sea ice information.

To complement the scientific measurements, local sea ice experts (*sikulirijiit*) in Clyde River have met regularly over the last three years to discuss and share their own observations and knowledge of sea ice. The group discusses and documents many aspects of sea ice including Inuktitut terminology of

sea ice, changes observed in sea ice over time, recent observations in animals, sea ice conditions, or other aspects of the environment (photo 2). The meetings help local experts to share knowledge and experiences that inform their hunting and travel and contribute to the overall research program (which includes a knowledge exchange with sea ice scientists and other *sikulirijiit* in other communities) that is compiling a book on Inuit sea ice knowledge and use.

Clyde River Family Tree Project

Our family tree project has set out to trace the histories of Clyde River families, including creating kinship charts and mapping where families originally camped and travelled before settling into the community. In 2008 we launched our project with one extended family and in the coming years we will work with other families (photo 3). The project also includes a photo project where we worked to take a photo of every resident of Clyde River (as of March 2009) and we will use those photos to create visual displays in our heritage centre that help connect families to the land (photo illustrated maps).

Media Centre

Ittaq is proud to host Clyde River's media centre, which includes a professional sound booth, video editing suite, and a collection of media including photos, videos, and oral histories (video, audio, and text). We have worked to digitize and catalogue our holdings so that these materials can be used by our community and others. Our audio tapes are often played on the radio, so that oral histories and the knowledge of elders can be shared. The technical resources and skills we house have been used for documentary films, TV programs, and museum projects.

THE FUTURE OF RESEARCH IN ARCTIC COMMUNITIES

More and more, Arctic communities are taking a stronger role in research. In Nunavut, there are many examples of local residents and community organizations partnering with southern universities and researchers to conduct projects that have meaningful results for people who live in the North. By taking this community participation to the next level and creating local research centres, communities can play an even stronger role by having the capacity and resources not only to participate in projects, but develop and lead them. This allows communities access to training opportunities and funding so that research also becomes a creative way to diversify local economies. Jobs in research and science in Nunavut communities would not only add to local economies, but improve research projects by providing research support and services year-round. As Arctic science and Arctic nations seek to establish programs like international observing networks (e.g., the Arctic Observing Network) and research networks, local communities should be considered and in-

cluded as integral partners. This full-time engagement in research has the potential to build strong working relationships with researchers from all sectors (university, industry, government, etc.) and empower local residents to work on and find solutions for many diverse questions and challenges facing their own communities. Having dedicated facilities, staff, and resources for communities to engage in research will inspire northern youth about science, about traditional knowledge, and about learning, with the knowledge that they can be researchers and do research all over the world, including close to home.

Shari Gearheard and Nick Illauq are co-founders of the Ittaq Heritage and Research Centre in Clyde River, Nunavut. Nick is Deputy Mayor of Clyde River and Shari is a research scientist with the National Snow and Ice Data Center, University of Colorado at Boulder. She lives full time in Clyde River.

Photo 3

Members of the Clyde River Family Tree Project work on kinship charts (from left: Sivugat Palluq, Attakalik Palluq, Philip Iqalukjuak, Aisa Piungituq, Raygilee Piungituq, Ilkoo Angutikjuak). Photo: Shari Gearheard.



IPY 2007 – 2008 : AN UNFOLDING LEGACY

Ian Church

International Polar Year 2007–2008 (IPY) has officially ended, but in a very real sense it is still going on. Some research projects are multi-year investigations, and will be producing new data for the next few years. Like previous International Polar Years, IPY 2007–2008 will no doubt influence polar research, government policy, and public perceptions of the polar regions for decades.

International Polar Year 2007–2008 was founded on the original principles developed by Austrian polar explorer Karl Weyprecht, who inspired the first International Polar Year (1882–83). Access and sharing of data, standardized data collection protocols and instrumentation, synchronized measurements within global networks, and appreciating the polar regions as key components of the global system were principles that he championed.

Planning for the fourth IPY began in the early part of this decade. The International Council for Science (ICSU) and the World Meteorological Organization (WMO), after first working independently on plans for an IPY, came together as the co-sponsors and in 2004 published *A Framework for the International Polar Year 2007–2008* as the blueprint¹. In it they set out the six IPY research themes:

1. Status: to determine the present environmental status of the polar regions;
2. Change: to quantify, and understand, past and present natural environmental and social change in the polar regions, and to improve projections of future change;

1. *A Framework for the International Polar Year 2007–2008*, <http://classic.ipy.org/development/framework/framework.pdf>.

3. Global Linkages: to advance understanding on all scales of the links and interactions between polar regions and the rest of the globe, and of the processes controlling these;
4. New Frontiers: to investigate the frontiers of science in the polar regions;
5. Vantage Point: to use the unique vantage point of the polar regions to develop and enhance observatories from the interior of the Earth to the Sun and the cosmos beyond;
6. Human Dimension: to investigate the cultural, historical, and social processes that shape the sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship.

Canadian Gérard Duhaime of Université Laval participated in the original planning group that developed the Framework and was influential in having the innovative sixth theme, the Human Dimension, added. Previous IPY programs had previously focused exclusively on the physical sciences.

The Canadian Polar Commission (CPC), under the leadership of then chairperson Peter Johnson, led the early involvement of Canada in the IPY planning, establishing the initial Canadian Steering Committee and explaining the Polar Year to academics, government agencies, the public, and political leaders. Once the IPY Framework had been endorsed, the CPC appointed the members to the Canadian IPY National Committee, the official lead for Canadian involvement as per the Framework, and helped coordinate funding for the Canadian IPY Secretariat, which was established at the University of Alberta. The national committee was structured to represent the diverse

interests in the IPY – northern and southern based academics, governments, including northern aboriginal governments or organizations, and educators.

Instead of top down research agendas developed by governments or others, the research programs and research projects were developed from the bottom up, a concept that originally overwhelmed the organizers when the first call for proposals brought in over 1200 submissions, when only 100 had been expected. The model encouraged those that best understood the science questions – the scientists, the stakeholders and in many cases northern residents and communities – to submit proposals.

THE IPY SCIENCE PROGRAM

International Polar Year comprised over 220 programs. Over 170 were science programs, while the others involved education and outreach, or data management. Canada's leadership in the human dimension of polar science resulted in projects that spanned the breadth of disciplines such as engineering and economics to social and health sciences. Some science programs, like the Arctic Health Initiative, included over 100 projects. Roughly 50,000 people from 63 nations took part in IPY.

Canadians participated in a wide range of projects, many funded from outside Canada, an indication of the high regard the international polar research community has for our polar scientists. One of the most exciting developments was the participation of northern-

based scientists and northern communities. In direct contrast to past IPYs, several research projects and a couple of fully endorsed programs were led by northern based individuals or aboriginal organizations. This participation has spurred increased interest in the north for continued development of scientific capacity, education, and research collaborations.

The total investment in IPY will never be fully known, as many of the projects and activities were embedded in the base budgets of participating organizations such as national space agencies, and government and university research programs. A wide variety of organizations, industry partners, academic institutions, foundations and government organizations provided funding, logistics, equipment, and materials and personnel support. Many volunteers dedicated substantial time to the IPY, spending countless hours preparing proposals or reviewing and adjudicating submissions. They deserve special credit.

In Canada the largest single financial contribution was the special \$150 million federal IPY allocation. Many other organizations also contributed: universities and colleges; the base programs of all levels of government, including those of northern aboriginal governments and organizations; independent funders such as the Canadian Foundation for Climate and Atmospheric Science, which invested almost \$30 million into IPY science; other polar research programs such as ArcticNet; as well as various research stations, industries, educators, museums, artists, and the media. In total Canada's contribution to the IPY may have exceeded \$700 million.

A number of projects which were not originally part of the IPY are providing new information to many of the other programs, and in so doing make a significant contribution. Canada is extensively involved in several of these. Two of the largest include the project

to chart the Arctic Ocean seabed in preparation for the various national territorial claims under the *Law of the Sea*, and the consolidation of the circumpolar *Geological Map of the Arctic*, which looks at the circumpolar Arctic from 60° north to the Pole². The National Round Table on the Environment and the Economy has looked at policy needs for helping northerners adapt to climate change, and the Canadian Standards Association is preparing guidelines for foundations built on permafrost.

Many art and media products not part of the original IPY outreach and education program have made significant contributions and continue to do so.

While IPY included large projects such as the Circumpolar Flaw Lead Study and the international THEMIS project that launched five special satellites and established northern circumpolar aurora observatories, there were also many smaller, equally important projects looking at individual species or the genetic links to various diseases in northern populations.

D A T A M A N A G E M E N T

A founding principle of the International Polar Years has been open access to data. The need to make IPY data available was a particular challenge. Science often operates within a cloak of secrecy until results are published, a practice that protects the intellectual property rights of the individual researchers. Data not published is often lost. IPY and many of its collaborating programs have tried to break this culture. Mechanisms were developed to protect the rights of the researchers and to protect the privacy and traditional knowledge of many northerners. Linked national and interna-

tional searchable metadata systems were established that described the data repositories set up by the program teams³.

Other publications, data collections, and specimen collections have been established and the entire record of the IPY as recorded on the International Program Office web site is being archived⁴. In Canada unique collections have been established in repositories such as the Arctic Institute of North America and the Yukon Government Archives to give future users access to the IPY legacy.⁵

O U T R E A C H , E D U C A T I O N , A N D T H E N E X T G E N E R A T I O N O F P O L A R S C I E N T I S T S

Education and outreach to the public, northerners and school children, and attracting and developing the next generation of polar scientists were major objectives of IPY, and each research program was required to address these objectives. Several organizations including the British Council (Cape Farewell Project), Students on Ice (a Canadian educational tour operator) and ArcticNet (Schools on Board) provided opportunities for Canadian and international high school students to experience the Arctic and Antarctic. Unique projects included special art and museum exhibits, film and media events, and books. The Canadian Youth Steering Committee ran an international science fiction short-story contest for young people and the resulting book, *Polaris: A Celebration of Polar Science*, won a youth science book award from the Canadian Science Writers Association.

2. "The New Geological Map of the Arctic: Canada Leads the Way", www.nrcan-rncan.gc.ca/com/elements/issues/39/arctic-eng.php.
3. IPY Data and Information Service, ipydis.org/, and Canadian polar data catalogue, polardata.ca/login.ccin.
4. International Polar Year website, www.ipy.org.
5. Arctic Institute of North America, www.aina.ucalgary.ca/astis; Yukon Government Archives, www.tc.gov.yk.ca/75.html.

Communication and education specialists accompanied many IPY researchers to meet and engage communities in the science activities, often by involving community members as part of science teams.

IPY 2007–2008 held quarterly educational “International Polar Days” with themes such as Sea Ice, Land and Life, Above the Poles, and People of the Poles. Online multilingual information packages for schools included activities such as simple experiments, and often mechanisms were established so classes could connect with scientists in the field via the Internet and media. The most unusual of these were Yellowknife based CKLB radio’s day long global radio and internet broadcasts focused on polar science.

An initiative begun by two young Yukon scientists under the banner of the IPY Youth Steering Committee quickly went international and became the Association of Polar Early Career Scientists (APECS), with a membership of over 1400 of the world’s next generation of polar researchers – a significant IPY legacy. These organizations supported mentoring and training programs for young polar scientists, conferences where they can present their findings, speaking tours in schools and larger public forums, and photo and essay contests to engage younger students.

The Polar Resource Book, which is being developed by the international education working group and members of APECS will help educators and scientists wishing to raise awareness about the importance of polar science during a time of rapid global climate

change. The book will be both a celebration of engagement with IPY and a practical handbook on how to conduct polar related science activities in schools.

T H E A R T S

IPY engaged the arts. The Arctic Institute of North America along with Calgary Opera celebrated the launch of the IPY by unveiling a new opera, *Frobisher*. Major art exhibitions of northern works have been featuring the environments, the peoples, and the science of the polar regions, as have television and film specials, and IPY film festivals. Many of the participating countries released IPY stamps and coins, and for the first time these were coordinated so that collectors could acquire consolidated packages. The newly established International Polar Artists Group, which helps organize and showcase the work of all polar themed arts, is another IPY legacy that will continue.

S C I E N C E I N F R A S T R U C T U R E S U P P O R T S R E S E A R C H , M O N I T O R I N G C H A N G E A N D E D U C A T I O N

IPY set out to improve polar research capacity by championing new and upgraded research and education infrastructure and new or enhanced polar monitoring programs. Generally infrastructure, like polar science itself, had begun to deteriorate over the previous two decades.

Innovation is the hallmark of recent infrastructure in Antarctica. The British Antarctic Survey (BAS) has begun construction of its new Halley Station VI, which sits on a

floating ice shelf that slowly moves out to sea. BAS has been operating in this location since the last International Polar Year – International Geophysical Year 1957–58 – and to protect the value of the 50-year data set Halley’s sensors must remain in a fixed geostationary position. The new Halley VI station sits on adjustable ski-mounted legs so the entire structure can be moved “upstream” as necessary. Belgium’s new Princess Elisabeth Station is probably the greenest station yet installed anywhere in the polar regions. It is totally dependent on renewable energy sources, something others could learn from. In the Antarctic interior the recently built Italian-French Concordia station, which was in full operation during IPY, is being used to test solar and Stirling engine power systems.

In the southern polar region efforts were made to formalize an ongoing monitoring network under the Pan-Antarctic Observations System (PANTOS). The IPY provided a boost for the newly formed International Antarctic Institute which is a consortium of organizations that provide university-level education and conduct research in Antarctica.⁶

In the Arctic, several countries such as China and India that had previously not had a physical arctic research presence joined others by establishing stations at Ny-Ålesund, Svalbard. Russia, the European Union, Canada and South Korea either launched or began planning for new polar class research vessels. With the urging and support of the Arctic Council a consortium of nations and organizations came together to initiate the Sustained Arctic Observing Network (SAON), an initiative endorsed and supported by both the European Union and the USA in their arctic strategies. The Arctic Council, with the assistance of IASC, continues to lead the initiative. The vi-

6. International Antarctic Institute, www.iai.utas.edu.au.

sion is that SAON and PANTOS will both contribute to the growing number of networks coordinated under the umbrella of the Global Earth Observation System of Systems (GEOS), designed both to detect environmental change and to provide ongoing information to organizations responsible for environmental management at all levels.

The Canadian Polar Commission and the Canadian IPY National Committee agreed that the Commission would take the lead in defining Canada's arctic science infrastructure needs. This project, which involved extensive consultation, resulted in the report *Beacons of the North: Research Infrastructure in Canada's Arctic and Subarctic*. The report made several recommendations regarding upgrading and replacement of Canada's aging arctic research fleet and establishing a network of facilities across the Canadian Arctic to support interdisciplinary research and monitoring and, when appropriate, education and community needs.

Since then the Council of Canadian Academies, the federal and territorial governments, and several universities and institutions that currently operate research stations have begun to address this need. The federal government has made commitments to a High Arctic research station and has provided \$85 million to assist many of the existing stations upgrade their ageing physical plants.

The three northern colleges have begun to work together with other University of the Arctic partners towards the objective of establishing a Canadian Arctic University. They have also been actively looking at opportunities to host and become more active partners or leaders in research through their respective research institutes. Recently Canada and the United Kingdom signed a memorandum of

understanding to cooperate and provide access for scientists to each others' research infrastructure, an initiative that other countries have expressed interest in and which would represent a lasting legacy of international collaboration from the IPY. In August a group of Canadians and American government, aboriginal, and university scientists and administrators met at the Kluane Lake Research station and agreed to collaborate on a terrestrial based research program and network in the western North American Arctic and Subarctic that would develop closer links with other circum-arctic networks such as SCAN Net.

H A S I P Y B E E N A S U C C E S S ?

Improved awareness of the polar regions and the "citizenship" that all peoples hold for Earth's high latitude regions was probably the highlight of the IPY. There is no doubt that the large numbers of observers in the field, documenting what was occurring and reporting back, helped focus public attention. Dramatic changes in both regions became front page news and their prominence – especially the Arctic – was reflected on political agendas. Environmental changes in the polar regions and globally are now much better appreciated.

New knowledge is already being put to use. In 2004, for instance, the Arctic Council's *Arctic Climate Impact Assessment* recognized unpredictable weather was a danger to the public.⁷ The report recommended that better, higher resolution weather forecasting models be developed for the Arctic. These were developed during IPY and now await better monitoring networks to be fully implemented.

"Polar citizenship" extended well beyond the Arctic as people came to appreciate the critical role that the polar regions play in global systems. The IPY organizations were

amazed for instance, when the people of Portugal, a nation with no territorial interests in either polar region and a very limited polar science program saw active engagement throughout the country. One event which focused on the poles, led by two young polar researchers, became notable as the best attended event ever staged at Portugal's National Museum.

W H A T N E X T ?

As the IPY science programs wrap up over the next year or two we will probably see more media attention to the findings. The IPY final results conference will be held in Oslo in June 2010. Other conferences will continue either to carry the IPY banner or feature a significant amount of IPY content. The ACUNS International Student Conference hosted by Yukon College this fall and the upcoming APECS/ArcticNet conferences in Victoria are examples that focus on the work of the next generation.

IPY has stressed from day one the importance of incorporating new knowledge into decision making at the personal, corporate, and government levels. A conference on this topic, currently being called the IPY Science and Policy Conference, is scheduled to take place in Canada in April or May 2012.

In Canada the developing federal Northern Strategy and the Northern Vision of the territorial premiers have already been influenced by IPY. There is no doubt that political agendas will continue to be shaped as new research results emerge.

7. Arctic Climate Impact Assessment, www.acia.uaf.edu.

The capacity to conduct research in the North and then to apply the results will probably continue to expand. A future Canadian Arctic University, an enhanced network of science stations that host research and educational activities, and a greatly enhanced monitoring network to detect change are already starting to become a reality. In the future, we will also be seeing more participation by northerners in science, both as participants and consumers – and because of their involvement in IPY northerners will be linked to the broader international science community. What is happening in Canada is being duplicated internationally. The United States has a new arctic policy and the nations of the European Union are also developing one. Global environmental change is driving more research. While there is public perception of political tension around the northern polar regions the level of international polar scientific collaboration has never been stronger – after all, the processes at work in the polar regions do have a global reach.

Similar to the period after the previous International Polar Year, when significant developments in polar science continued for several decades – there will be an “afterglow” of scientific activity in the polar regions that will carry on for some time. Many have actually given this a name, the Polar Decade – an idea originally championed by Russia and the World Meteorological Organization.

Are there threats to achieving this vision? Very much so. In the past fiscal constraints greatly hampered and often eliminated vital polar science programs and its expen-

sive logistical support. But the lessons of this and the previous three IPYs have shown that the polar regions are not only large parts of the Earth, but also drivers of global systems crucial to all humankind. The way to make polar science more affordable and effective is through international collaboration. The other lesson of this IPY is that if we allow polar science to deteriorate there is a higher probability that critical earth science signals often first detectable in the polar regions will be missed, and it becomes extremely difficult and expensive to remobilize a polar science community later.

A T H I R D P O L E ?

Early in the planning of IPY there was talk of four poles. The Mars Lander was scheduled to set down and begin exploring a Martian pole during International Polar Year. IPY grew so rapidly that those of us involved lost track of this amusing idea as we focused on Earth.

Some scientists and political leaders, however, are suggesting the major mountain spines of all the continents constitute the Earth’s “third pole”. The polar regions, especially the cryosphere, share many similarities with the other cold regions of Earth, most notably the high alpine and subalpine environments. They all pose challenges for science. Many of the terrestrial polar research techniques resemble alpine methods. Both have regions with frozen soils and create unique challenges for living organisms. Both store water as ice, affect weather, and are undergoing dramatic changes which in turn affect more temperate ecosystems and human populations. They all have continental and global implications. As an example IPY glaciology studies have recently documented that the Cordilleran glaciers and ice fields of the Pacific Northwest – Alaska, the Yukon and British

Columbia – are losing ice at a much higher rate than either Greenland or the Antarctic and in turn also contributing to global sea level change. The effects of the loss of this hydrological resource on ecosystems and on human social and economic activity in the future will be dramatic. Similar effects are being witnessed on all continents. Just as Arctic and Antarctic scientists are now working more closely together, maybe we need to also formally bring the alpine scientists into the club during and after a Polar Decade.

The legacies of International Polar Year 2007–2008 will be fueled by new knowledge. Looking back on past IPYs we realize that the importance of any individual project or assemblage of knowledge is not always obvious at the time. As an example Alfred Wegener’s theory of continental drift was dismissed for almost half a century by the science community after it was first proposed in 1912. It is now seen to have been insightful for its time. A large number of seemingly unrelated geophysical surveys during the 1GY resulted in, not just confirming what we now know as plate tectonics but provided the data to explain the mechanisms that drive it. This process is not only fundamental to understanding Earth Science but provides valuable insights in fields as diverse as the evolution of the ocean/atmospheric climate system and the evolution of life. Looking back, it is interesting to realize Germany now celebrates Wegener, having named their polar research institute in his honour.

Again during this IPY, it will not necessarily be the high profile, well funded projects

that will produce the most revealing new insights. It is too early to judge what the “eureka!” advances will be. What we do know is that based on the nature and spirit of IPY, they will probably result from interdisciplinary and international collaboration and the assembled results of several different and, when first conceived, unrelated projects.

We are, however, beginning to perceive what some of those insights may be. A first guess is that they will in some way relate to the many ways in which ice in the various environments of the polar regions influence environmental processes, on and in the land, on water, and in the atmosphere.

The 2004 *Arctic Climate Impact Assessment* focused on the impacts of changing climate primarily on the circumarctic world, and projected the future direction of this change. It noted that changes in the Arctic would have consequences globally. In September of this year the World Wildlife Fund (WWF) released a new assessment *Arctic Climate Feedbacks: Global Implications*⁸ which has been partially informed by the results coming out of IPY research programs. This report documents how warming of the Arctic will affect global systems. It will:

1. impact the climate and weather of the entire northern hemisphere;
2. drive changes to the global ocean circulation system;
3. drive ocean thermal loss as well as glacial ice and ice sheet loss. Glacial ice loss is accelerating and will be the major contributor to sea level rise during and beyond this century. Sea level increase is now projected to exceed one metre by the end of the century;

8. World Wildlife Fund, www.panda.org/what_we_do/where_we_work/arctic.

4. result in physical changes to the waters of the Arctic Ocean that lessen its current ability to absorb 5–15 percent of the total carbon dioxide taken up by the global ocean. Over the next few centuries the Arctic marine systems may become a net contributor to global atmospheric carbon dioxide levels;
5. accelerate uptake by arctic terrestrial vegetation of carbon dioxide; but this will be offset and eclipsed by greenhouse gas emissions from thawing organic materials stored in arctic soils; and
6. lead to the degradation of sub-sea permafrost, especially on continental shelves, resulting in the destabilization and release of massive, undersea carbon pools stored in the form of methane hydrates.

These are not surprises and have been talked about for some time. They were all referred to in the IPY *State of Polar Research* report released in February 2009.⁹ While the WWF report dealt mostly with the Arctic, similar processes occurring in the Antarctic are now being documented. What has changed is that increasingly, people from all nations are beginning to appreciate these challenges and recognize that the polar regions are not just places we learn about in geography or biology, in books describing the exploits of explorers, on television specials or at zoos and aquariums. Instead these are parts of the global system that impact peoples’ homes and therefore their lives. These regions matter to them. These people now recognize they are global

9. State of Polar Research, www.polar.se/state_of_polar_research.pdf.

citizens and polar citizens and with citizenship comes the responsibility for stewardship.

Karl Weyprecht, the father of IPY, would certainly approve – as do the polar and cold regions scientists and the residents of the circumpolar north who will be on the front lines of the changes in the polar regions and the research to better understand them over the next half century.

And in a half century’s time, if not before, these are the people who will lead humankind as we again mobilize our science capacity to take another snapshot of the polar regions during the 5th International Polar Year. I personally think we can’t wait that long.

A W O R D O F T H A N K S

As the Chair of the Canadian IPY National Committee I want to thank all IPY participants and contributors for their support of cold regions science. It was an amazing experience which is already showing signs of serving humankind well. I would also like to thank the many who provided me with the opportunity to make my very small contribution to this endeavour – it was the chance of a lifetime.

Ian Church is Chair of the Canadian National Committee, International Polar Year, and Senior Science Advisor (retired), Yukon Government.

A TALE OF TWO CITIES: WASHINGTON, OTTAWA, AND ARCTIC GOVERNANCE

Ron Macnab

THE US ARCTIC POLICY AND CANADA'S NORTHERN STRATEGY

In recent months, both Canada and the US have issued documents that focus on their respective national priorities in the Arctic region, and which outline actions that are being taken or considered to achieve those priorities. Not unexpectedly, the two countries address a number of common concerns in those documents; by advocating similar approaches for some issues and different approaches for others, the documents offer an interesting juxtaposition of outlooks and concepts that currently underpin the theory and practice of Arctic governance on either side of the Canada-US border.

This article reviews the two documents, comparing their contents and gauging their effectiveness in articulating national priorities for responding to the many issues that affect the management and administration of northern regions.

THE 2009 US NATIONAL ARCTIC POLICY: AN EMPHASIS ON SECURITY

Issued in January 2009 by President George W. Bush during the waning days of his administration, this document was at least two years in the making and entailed a comprehensive process of consultation with government, academia, industry, and northern indigenous groups.¹

The new policy succeeds one issued in 1994 during the Clinton administration.

Table A

US Arctic Policy Objectives in 1994 and in 2009

1994	2009
Protecting the Arctic environment and conserving its biological resources	National Security and Homeland Security
Assuring that natural resource management and economic development in the region are environmentally sustainable	International Governance
Strengthening institutions for cooperation among the eight Arctic nations	Extended Continental Shelf and Boundary Issues
Involving the Arctic's indigenous people in decisions that affect them	Promoting International Scientific Cooperation
Enhancing scientific monitoring and research on local, regional, and global environmental issues	Maritime Transportation
Meeting post-Cold War national security and defense needs	Economic Issues, Including Energy
	Environmental Protection and Conservation of Natural Resources

Though never publicly circulated, its six primary objectives appeared in a US Department of State Dispatch dated Dec 26, 1994². These objectives appear in Table A, along with those of the 2009 Policy.

Table A reveals a carry-over, in one form or another, of most 1994 objectives into the 2009 document. At least one, involvement of indigenous people, does not appear explicitly in the 2009 objectives, although it is mentioned in the body of the new policy. Two new

objectives appear in the 2009 policy: *extended continental shelf and boundary issues*; and *maritime transportation*. There can be little doubt that the inclusion of these new objectives reflects recent developments in the Arctic that have been prompted by the continental shelf provisions of the UN Convention on the Law of the Sea (UNCLOS), and by the melting of the permanent polar ice pack.

Assuming that the 1994 and 2009 objectives appear in order of importance, the most significant changes between the two lists are the reversed positions of the first and last items in each list: whereas in 1994 *protecting the Arctic environment and conserving its biological resources* was at the top, in 2009 it reappears at the bottom as *environmental protection and conservation of natural re-*

1. The Policy was issued both as National Security Presidential Directive (NSPD-66), and as Homeland Security Presidential Directive (HSPD-25). It is available online at <http://www.fas.org/irp/offdocs/nspd/nspd-66.htm>.
2. Available online at http://findarticles.com/p/articles/mi_m1584/is_n52_v5/ai_16709524/?tag=content;coll.

sources. The item at the bottom of the 1994 list, *meeting post-cold war national security and defense needs*, has been transferred to the top of the 2009 list as *national security and homeland security*. In a post 9/11 world, it is hardly surprising to see this inversion as an expression of US determination to seal its boundaries against unfriendly incursions.

Objectives and Implementation of the 2009 US Arctic Policy

The following paragraphs highlight the primary objectives of the new policy and their implementation goals. The objectives appear in Table B along with the departments and agencies charged with their implementation. The text below summarizes and paraphrases information from the original.³

National Security and Homeland Security

Objectives: The US will take necessary measures to safeguard its security interests in the Arctic region. It will maintain an “active and influential presence” in the region through sea power and by exercising national authority within its zones of sovereignty. Central to its maritime policy will be freedom of the seas, championing the principle of unfettered access to the Northwest Passage and to the Northern Sea Route as a way of bolstering similar claims for access to restricted waterways in other parts of the world.

Implementation: Develop greater capabilities to protect US borders in the Arctic. Increase domain awareness to protect maritime commerce, critical infrastructure, and key resources. Preserve mobility of US military and civilian vessels and aircraft throughout the Arctic while projecting a sovereign US maritime presence in support of US interests. Encourage the peaceful resolution of disputes.

3. Paragraphs III.B to III.H of Presidential Directive NSPD-66/HSPD-25.

Table B

2009 US Arctic Policy: Objectives and Implementing Departments and Agencies

<i>Objectives</i>	<i>Sub-objectives</i>	<i>Implementing departments and agencies⁴</i>
National Security and Homeland Security	Safeguard security interests Maintain active and influential presence Exercise authority within zones of sovereignty Pursue Freedom of Navigation	State, Defense, Homeland Security
International Governance	Participate in international fora Maintain contacts that promote US interests Support Arctic Council Recognize benefits of ratifying UNCLOS	State
Extended Continental Shelf and Boundary Issues	Develop Extended Continental Shelf limits Claim sovereign rights in ECS Acknowledge unresolved boundary with Canada Honour US-Russia boundary agreement	State
Promoting International Scientific Cooperation	Recognize value of research to US interests Seek research access throughout Arctic Promote partnerships and collaboration Coordinate mobilization of facilities & platforms	State, Interior, Commerce, National Science Foundation
Maritime Transportation	Focus on safety of navigation, protection of maritime commerce, protection of environment Help develop infrastructure for the above Work with IMO to improve transportation safety and security, and environmental protection	State, Defense, Transportation, Commerce, Homeland Security
Economic Issues, Including Energy	Seek stakeholder input for key decisions Balance resource development against indigenous interests Participate in international fora	State, Interior, Commerce, Energy
Environmental Protection and Conservation of Natural Resources	Improve knowledge of environmental change Manage resources effectively with minimal socioeconomic impact Base critical decisions on best data Safeguard living marine resources Recognize emerging pollution prospects	State, Interior, Commerce, Homeland Security, Environmental Protection Agency

4. Implementing organizations are expected to coordinate policy initiatives with other departments and agencies as appropriate.

International Governance

Objectives: The US will continue to participate in international fora and will maintain bilateral contacts that promote its interests in the Arctic; moreover, it recognizes that changing circumstances may require new or enhanced arrangements. The US supports the role and the accomplishments of the Arctic Council; while it would be amenable to appropriate restructuring of the Council, it would not favour its transformation into a formal international organization such as the Antarctic Treaty. The US recognizes that ratification of UNCLOS would serve its interests not only in the Arctic, but also worldwide.

Implementation: Cooperate with other countries on Arctic issues. Consider new or enhanced international arrangements to deal with ongoing developments. Review Arctic Council policy recommendations and ensure that other Arctic governments do likewise. Seek US Senate approval to ratify UNCLOS.

Extended Continental Shelf and Boundary Issues

Objectives: The US intends to develop its extended continental shelf and to claim sovereign rights over seabed resources within that zone; it recognizes that UNCLOS provides a legitimate mechanism for so doing. The US acknowledges its unresolved boundary with Canada in the Beaufort Sea, and is ready to honour the 1990 US-Russia agreement for maritime boundary in the Chukchi Sea, once the Russian Parliament ratifies the agreement.

Implementation: Take necessary action to establish the outer limit of the US outer continental shelf (OCS). Consider conservation and management of OCS resources. Urge the Russian Federation to ratify the 1990 maritime boundary agreement.

Promoting International Scientific Cooperation

Objectives: Scientific research is vital to US northern interests. Northern research requires access throughout the Arctic Ocean and mechanisms for sharing research platforms and data exchange. The US promotes collaboration with international consortia and individual states, and supports development of broad-based partnerships that advance understanding of changes that affect climate and the environment. The US supports the joint and coordinated mobilizations of research facilities and platforms.

Implementation: Play a leadership role in research. Promote full access to research sites. Partner with other nations to establish a circumpolar observing network. Encourage at high levels the international sharing of information concerning research opportunities and the coordination of research programs. Promote an internal domestic dialogue to enable and facilitate research linked to US policies. Strengthen partnerships with academic and research institutions and build upon their relationships with counterparts in other countries.

Maritime Transportation

Objectives: US priorities in the region focus on navigation, protection of maritime commerce, and environmental protection. The US recognizes a need for substantial infrastructure development in support of safe, secure, and environmentally sound maritime commerce. Working through the International Maritime Organization, the US promotes new or strengthened measures to improve the safety and security of maritime transportation and to protect the maritime environment.

Implementation: In cooperation with other nations, address issues arising from increased shipping in the Arctic. Establish a risk-based capability to deal with hazards in the arctic environment. Develop waterways management schemes that conform to international standards. Evaluate feasibility of channelling strategic sealift, humanitarian aid, and disaster relief through the Arctic.

Economic Issues, Including Energy

Objectives: The US will incorporate stakeholder input in decisions related to economic and energy security, and to the adaptation of Arctic communities to climate change. The US anticipates a demand for northern energy resources and will seek to balance their development with the interests of indigenous communities and environmental protection. The US recognizes the value and effectiveness of existing international fora.

Implementation: Increase the study of climate change with a view to preserving and enhancing economic opportunity. Ensure that best practices and international standards are followed in hydrocarbon and other development. Consult with other states concerning development and management of shared resources. Protect US environmental and economic interests with respect to hydrocarbon reservoirs that straddle national boundaries. Identify opportunities for international cooperation in methane hydrate and other issues. Explore need for additional fora to review hydrocarbon issues and shared infrastructure projects. Emphasize cooperative mechanisms to address common concerns.

Table C

Canada's Northern Strategy: Objectives, Themes, and Sub-objectives

<i>Objectives</i>	<i>Sub-objectives</i>	<i>Themes</i>
Exercising Arctic Sovereignty	Strengthening Arctic presence Enhancing stewardship Defining domain, advancing Arctic knowledge The human dimension	Assert sovereignty as long-standing, well-established, and based on historic title
Promoting Social and Economic Development	Supporting exploration and development Addressing critical infrastructure needs Supporting Northerners' well-being	Realize potential of the Arctic region in a sustainable way that is beneficial to Northerners
Protecting the North's Environmental Heritage	Being a global leader in Arctic science Protecting Northern lands and waters	Safeguard ecosystems for future generations
Improving and Developing Northern Governance	Made-in-the-North policies and strategies Providing the right tools	Devolve to territories control over lands and resource management

Environmental Protection and Conservation of Natural Resources
Objectives: Recognizing the impact of increased human activity on northern communities and ecosystems, the US assigns a high priority to the development of better knowledge concerning changes in the environment, in order to ensure effective long-term resource management and to address socioeconomic impacts of resource usage. Decisions relating to environmental protection and to resource conservation will be based on the best available information. The US adheres to the 1995 Fisheries Agreement on Straddling Stocks and endorses the protection of vulnerable marine ecosystems to safeguard living marine resources. It recognizes that warming in the Arctic region will likely precipitate the release of ice- and soil-bound contaminants that will add to existing sources of pollution.

Implementation: Cooperate with other nations in responding to environmental

challenges. Conserve, protect, and sustainably manage Arctic species and ensure adequate enforcement to safeguard living marine resources. Address changing and expanding commercial fisheries, with consideration of international agreements or organizations to govern future operations. Pursue ecosystem-based management. Develop more scientific information on adverse effects of pollutants on human health and the environment, working with other nations to reduce the introduction of key pollutants.

Resources and Assets

The implementation of certain policy elements will require appropriate resources and assets. Implementers must respect applicable laws and regulations and consider budgetary and other constraints. Heads of responsible departments and agencies are instructed to identify future budget, administrative, personnel, or legislative proposal requirements.

CANADA'S NORTHERN STRATEGY: AN EMPHASIS ON SOVEREIGNTY

Canada's Northern Strategy was formally introduced at a July 2009 news conference in Gatineau, Quebec hosted by the federal ministers of Foreign Affairs; Indian Affairs and Northern Development, and Science and Technology.⁵

Buttressed with sidebars containing several earnest ministerial declarations (two apiece from the Prime Minister and the Minister of Indian Affairs and Northern development; one each from the Ministers of Health and of Foreign Affairs), the Strategy is a compendium of current and proposed initiatives, most of which have been presented to the Canadian public previously.

The methodology applied in developing the Strategy is not revealed – however the prominence of Government ministers within its pages and during its public release suggests the document is part of a political action plan. Indeed, much of its contents appear to have been culled from recent ministerial declarations, policy and program pronouncements, and existing departmental work plans.

There is little evidence of extensive consultation to gather non-governmental input from northern stakeholders, although at least one initiative – upgrading key research facilities across the North – appears related to the outcome of an independent consultation process conducted recently by the Canadian Polar Commission to assess the research community's needs and priorities.

Written in English, French, and Inuktitut and profusely illustrated with iconic images of Canada's north, the document's fifty pages concentrate on four priority areas (Table C).

5. The Strategy is available at <http://northernstrategy.gc.ca/index-eng.asp>.

ACTIVITIES AND
PROPOSALS LISTED
IN CANADA'S
NORTHERN
STRATEGY

The paragraphs below outline the primary objectives and sub-objectives of the Strategy, along with the steps that have been taken or proposed to achieve those goals.

Exercising Arctic Sovereignty

Strengthening Arctic presence: Canada will enhance its northern presence by increasing military capability there by mobilizing more patrols, monitoring activities through RADAR-SAT II, and through continued participation in NORAD. Proposed new patrol ships and a polar icebreaker remain cornerstones of the Strategy, as does a deep-water berthing and fuelling facility in Nanisivik, Nunavut.

Enhancing stewardship: Canada will tighten its regulatory authority over maritime zones by instituting new regulations for ballast water control, and by extending the reach of the Arctic Waters Pollution Prevention Act (AWPPA) to 200 nautical miles. Vessels entering Canadian waters will be obligated to report their presence and intentions to Canadian authorities under a strengthened Northern Canada Traffic Regulation System (NORDREG). Search and Rescue capacity will be bolstered to deal with expected emergencies.

Defining domain and advancing knowledge of the Arctic: Canada will continue its work to define the outer limit of the extended continental shelf beyond 200 nautical miles. Exchanges with Denmark will consider options for resolving the issue of Hans Island. Maritime boundary disagreements with the US in the Beaufort Sea and with Denmark in the Lincoln Sea will be addressed. Disagreements over international shipping in the Northwest Passage will be managed.

The human dimension: Canada will continue to promote the involvement of northerners in the work of international indigenous peoples' groups.

**Promoting Social and Economic
Development**

Supporting exploration and development: Canada will establish new or improve existing regulatory, financial, and institutional arrangements that enable sustainable natural resource development. Aboriginal participation in resource development will be sought, and measures will be taken to protect the northern environment. Increased funding will be available for tourism promotion, along with support for local and community cultural and heritage institutions.

Addressing critical infrastructure needs: Canada will support infrastructure programs tailored to local needs, for example a commercial fishing harbour in Pangnirtung, Nunavut.

Supporting northerners' well-being: Canada is committed to programs to help develop and improve community and regional infrastructures for health care, nutrition, education, housing, and labour training. Opportunities will be pursued for sustainable employment for Aboriginal people in major industries. Air quality and climate change issues will be investigated, and socio-economic research will focus on such areas as industrial innovation, economic development, and Arctic human health from an international perspective.

**Protecting the North's
Environmental Heritage**

Being a global leader in Arctic science: Canada's IPY program has supported research on climate change impacts and adaptation, and in the improvement of northerners' health and welfare. A baseline of Arctic environmen-

tal knowledge is under development. A new world-class research station is being planned in the High Arctic, and key research facilities across the North are being upgraded.

Protecting northern lands and waters:

Canada will protect environmentally sensitive lands and waters and is considering the establishment of new National Wildlife Areas and at least one National Park. Ecosystems-based ocean management will be employed to protect the marine environment, including fish and fish habitat. Equipment and emergency response systems will be developed to deal with marine pollution and to remediate contaminated sites. New regulatory requirements will be introduced for safe and environmentally sound industrial development.

**Improving and Devolving Northern
Governance**

Made-in-the-North policies and strategies: More self-government agreements will be negotiated, enabling local management of lands and resources.

Providing the right tools: Outstanding land claims will be resolved, with funding for northern governments to deal with regional issues. Practical, innovative, and efficient governance models will be developed and applied.

**The International Dimension of
Canada's Northern Strategy**

The Strategy refers to Canada's record of working with northern neighbours to advance Canadian priorities, achieving common goals in the region, and address emerging issues – through cooperation, diplomacy, and adherence to international law.

The document asserts that Canada must demonstrate effective stewardship of its Arctic territory while promoting its national interests. Canada has developed bi- and multilateral partnerships with Arctic and non-

Arctic nations for dealing cooperatively with such matters as indigenous issues, environmental stewardship, sustainable resource development, safety and security, trading relationships, and transportation routes. In continuing to support the Arctic Council and other significant fora, Canada will promote improved worldwide understanding of the Arctic and international cooperation toward addressing the Arctic implications of major global challenges.

THE US POLICY AND CANADA'S STRATEGY: COMPARISONS

Tables B and C illustrate the clear contrast between the US Arctic Policy and Canada's Northern Strategy. Perhaps most striking is the assertive US stance on protection of its national interests across the region partly through increased military presence and use of sea power to support the Freedom of Navigation program. This contrasts with Canada's determination to safeguard its territorial sovereignty through military surveillance, regulatory measures, and maritime boundary initiatives.

On the military front the US can exercise Arctic sovereign rights over significantly less area than Canada, but is ready to use its substantial military resources to defend those rights. In contrast, while Canada's concerns apply over a much larger area, it is unlikely to increase its military capacity beyond a token amount.

Access to northern waterways is likely to remain a contentious issue: the US asserts its right to follow sea routes throughout most of the Arctic, while Canada vows to defend its waterways against unrestricted international traffic.

The US Policy and the Canadian Strategy also differ significantly in overall form and content: the US Policy, tightly scripted as an action plan, specifically defines main objectives, implementation goals, and responsible parties; the Canadian strategy features a vague wordiness that strives to showcase in the best possible light the full range of current initiatives and proposals, but without outlining areas of responsibility and accountability, and with little in the way of completion dates. Indeed, the Canadian document should more properly be labelled a *manifesto* (dictionary definition: a public declaration of intentions, opinions, objectives, or motives), rather than a strategy; this contrasts with a *policy* (a definite course of action adopted for the sake of expediency or facility).

A significant focus of the US policy is on international issues where national interests need to be advanced and defended; it is not surprising therefore, that the US State Department, the nation's primary channel for international communications and relations, appears to have been designated as the lead implementing organization for all aspects of the Policy. The Canadian Strategy, in contrast, is characterized by a heavy domestic agenda that addresses a wide range of urgent socioeconomic conditions, from the health and welfare of individual northerners (particularly the indigenous population) to the development of an efficient infrastructure that can meet a plethora of administrative, social, and industrial challenges; in this context, it is not at all clear where the overall federal leadership is coming from – nor where final accountability rests.

As already pointed out, the US policy and the Canadian Strategy went through two very different gestation processes: preparation of the US policy entailed an extensive two-year consultation with a broad community of northern stakeholders. With its mix of broad pursuits and specific initiatives, the

Canadian strategy reads generally as a re-packaging of government information that has been in the public eye for some time: there is little evidence that its authors sought new views and opinions through extensive dialogue with individuals and organizations outside of Government circles – although at least one element of the Strategy closely echoes (without attribution) the findings of a consultation process conducted by the Canadian Polar Commission concerning upgrades to northern research facilities.

Neither document includes information on projected costs of its initiatives. The US policy recognizes that appropriate “resources and assets” will be required to achieve its stated objectives, and it instructs implementing organizations to take the necessary steps to obtain those resources and assets. Despite the fact that the Canadian Strategy describes a suite of programs and activities that are now or will soon be operational, the document offers few specifics concerning the financial commitments that have been made in support of those initiatives – nor does it identify the departments responsible for the commitments.

C O N C L U S I O N S

The US Arctic Policy and Canada's Northern Strategy both seem to spring from the recognition that change in the Arctic region is making it necessary to develop coherent approaches to problems that occupy a wide spectrum of issues. To name a few, these issues relate to: social development; northerners' quality of life; infrastructure expansion and improvement; regional policing and national security; environmental protection; sustainable resource exploitation; marine transportation; local and international governance models; and maritime boundaries.

While many of the problems listed above are common to both countries, they

may reside at different levels of importance on each side of the Canada-US border. Clearly each country views the Arctic through the prisms of its self-interest and of prevailing circumstances on the domestic and global stages. Unsurprisingly, the US Arctic Policy and Canada's Northern Strategy reflect their originating countries' responses to these factors.

In Canada, recent history would suggest additionally that the Arctic is periodically used as a football to score political points by announcing – or reaffirming – northern commitments that all too often disappear from the agenda when they are determined subsequently to be impractical or too costly. An illustration of this cycle of commitment and retrenchment is the recent deferral of plans to construct northern patrol vessels for

the Navy, along with a polar class icebreaker for the Coast Guard. Ironically, these deferrals were announced at about the same time that Canada's Northern Strategy was released with great fanfare.

In this light, Canada's Northern Strategy is written in a tone that verges on the self-congratulatory: a cynical reader could be forgiven for concluding that its main purpose is to reiterate current actions and policies in order to paint a picture of an administration that is earnest in purpose and effective in execution. It remains to be seen whether Canada's Northern Strategy will turn out to be comparable to the US Arctic Policy, which is a blueprint for progress – or whether it will wind up as yet another catalogue of unfulfilled Arctic ambitions.

Acknowledgements

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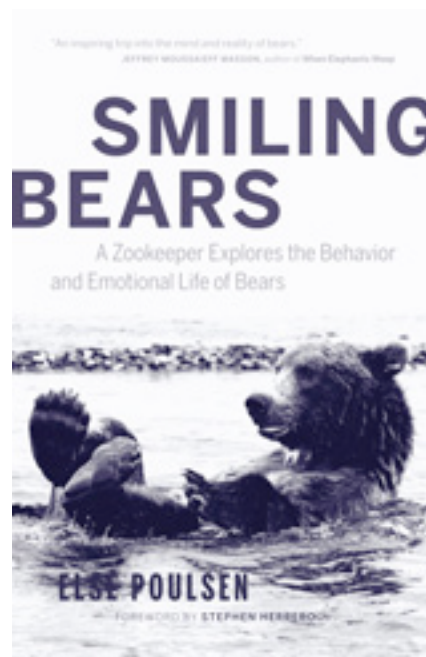
BOOK REVIEW

Gregory Thiemann

Smiling Bears: A Zookeeper Explores the Behavior and Emotional Life of Bears, by Else Poulsen. Greystone Books, 2009. 272 pp. \$29.95 CDN. ISBN: 978-1-55365-387-5.

In *Smiling Bears* Else Poulsen documents the behaviour and emotional lives of bears and presents them as intelligent, sensitive, sentient creatures. A specialist in captive bear husbandry and rehabilitation, Poulsen draws on her experience working with five different species to provide a unique perspective on how bears think, act and feel. She describes her one-on-one interactions with the animals and her writing conveys a vivid sense of the everyday lives of individual bears.

The book opens with a foreword by Stephen Herrero, a leading bear biologist and pioneer researcher on the causes and consequences of bear-human conflict. Herrero sets the stage through his work in Jasper National



Park and frames bears as distinct individuals with their own character strengths and flaws. He adds that *Smiling Bears* contains an unprecedented level of detail into the behaviour of individual bears and hints at some of the ethical complexities associated with keeping large carnivores in captivity.

Each chapter describes a set of Poulsen's experiences caring for particular bears. In the first we are introduced to a number of individual bears as Poulsen outlines her approach to integrating animal biology and behaviour into husbandry routines. She summarizes her philosophy as approaching each bear with two questions: Who are you? and What can I do for you? The second and third chapters focus on Poulsen's experience with a group of grizzly bears at the Calgary Zoo. She describes the relationships among the bears and how they communicate with each other and with their keepers. The intimate and perhaps unorthodox relationship between bear

and keeper is exemplified in an anecdote in which Poulsen believes she has passed on a cold virus to one of the bears and then treats the bear's symptoms with dozens of cough drops. Chapters 4–6 discuss the challenges of housing polar bears, including the problem of stereotypic behaviours such as pacing that can develop if captive bears are not challenged with novel items and activities. Here Poulsen describes some of her innovations in bear husbandry, including the use of pharmaceuticals to treat polar bear pacing and the link between pacing and human affective disorders.

Chapter 7 begins with a good introduction to the ecology of spectacled bears and touches on the serious conservation concerns surrounding this species. Chapter 8 describes Poulsen's experiences raising a black bear cub that had been found injured in the wild and then placed in the Detroit Zoo. Here, as in other places, the book's focus on detailed behavioural observations may leave readers wanting a broader interpretation of Poulsen's data. Without greater ecological or biological context, the significance of her observations is not always clear.

Chapters 9 and 10 describe the rehabilitation of an adult polar bear named Bärle, who was rescued from a circus in Mexico. Poulsen's account of her relationship with Bärle is touching as we learn how Bärle was gently introduced to new foods and activities. In one account, Poulsen stocks Bärle's water tank with live trout. But it is not until one of the fish inadvertently flops itself onto the floor that Bärle recognizes it as potential food. Gradually, we see Bärle develop from a traumatized victim into an engaged, outgoing individual. However, when she is added (successfully) to a group of seven other polar bears at the zoo, some readers may wonder why so many bears were housed in the same enclosure.

Although Poulsen could undoubtedly offer fascinating insight into the operation of zoos, the book provides little information on how these institutions strive to balance education, conservation, entertainment, research, and animal welfare. Poulsen mentions that Bärle was expected to breed in captivity but she does not explain why. Given that loss of sea ice habitat is the primary conservation concern for polar bears, the rationale for captive breeding is not obvious.

Although the book deals exclusively with captive bears, it conspicuously avoids some controversial issues relating to bears in captivity. For instance, if a mother with dependent cubs is killed by poaching or by accident, should her orphaned cubs be sent to a zoo? Should an adult bear, already accustomed to life in the wild, be sent to a zoo after becoming habituated to anthropogenic food? Should a severely injured or abused bear be given medical treatment only to be placed in captivity? These are difficult decisions that wildlife managers routinely face and these are all ways in which the bears in *Smiling Bears* came to be in captivity. Poulsen clearly feels that under the care of a dedicated and capable zookeeper, a bear in captivity will lead a rich and fulfilling life. But some readers may not share that belief and Poulsen never explicitly addresses those issues.

Overall, *Smiling Bears* sticks to a description of how captive bears interact with each other and their keepers. Where the book delves into broader ecological issues, it generally gets them right. However, in chapter 10 Poulsen suggests that some polar bear hunters intentionally shoot mothers to "generate cubs for captivity", a practice that she says is "less common today". This statement could give the mistaken impression that current polar bear harvesters are intentionally taking mothers and implies that zoos are benefiting from this alleged criminal activity. Poulsen offers no

SUBMISSION GUIDELINES

Meridian, the newsletter of the Canadian Polar Commission, publishes articles by Canadian arctic researchers. Submissions are welcome.

Meridian has a diverse readership including researchers, politicians, public servants, and students.

Articles usually run from 1500–4000 words in length; charts, maps, diagrams, photographs, and other images are welcome. Submissions may be addressed to:

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elaboration or supporting evidence for this provocative claim.

The epilogue is the highlight of the book and nicely summarizes some of the ecology, conservation concerns, and ongoing research efforts related to bears. Although Poulsen's emphasis on breeding polar bears in captivity for "eventual reintroduction into wild areas" does not address the primary concerns of habitat loss and climate warming, the epilogue is a nice review of some important issues and a passionate call for readers to get involved.

Poulsen's writing is concise and effective and captures the nuance of subtle behaviour. It gives a glimpse into the fascinating relationship between animals and their human keepers and reveals the depth of commitment and dedication that zoo professionals have for the animals under their care.

Gregory Thiemann is a polar bear biologist and Assistant Professor of Environmental Studies at York University.

NEW BOOKS

Northern Exposure: Peoples, Powers and Prospects in Canada's North,

Frances Abele, Thomas J. Courchene, F. Leslie Seidle and France St-Hilaire, eds. McGill-Queens University Press. \$49.95. 500pp., colour maps and illustrations. ISBN: 978-0-886452-05-6.

Public policy specialists review the implications of the unprecedented changes in governance that have taken place in the three territories and in aboriginal communities in northern Quebec and Labrador over the past three decades and analyze challenges that must be faced in order to strengthen economic development and quality of life for northern residents. Contributions from Inuit and First Nations leaders, former territorial premiers, and aboriginal youth activists add further depth and perspective.

Inuit, Polar Bears, and Sustainable Use, Milton M.R. Freeman and Lee Foote, eds. CCI Press. \$50.00. 252 pp. ISBN: 978-1-896445-45-8.

This book addresses the practice of conservation hunting of polar bears, Inuit understanding of polar bears and their changing

habitat, public perceptions of polar bears and climate changes that appear to influence polar bear management decisions, and analysis of existing polar bear management and governance programs. The aim of this book is to contribute to culturally-inclusive, equitable and effective wildlife conservation and management in the Northern regions. It presents the generally underreported perspectives of Arctic residents that reflect an experiential understanding of events taking place in the region, and of some others whose views also augment assessments being used to develop polar bear conservation initiatives.

Finding Dahshaa: Self-Government, Social Suffering, and Aboriginal Policy in Canada, by Stephanie Irlbacher-Fox. University of British Columbia Press. \$85.00. Hardcover, 216 pp. ISBN: 978-0-7748-1624.

Finding Dahshaa describes self-government negotiations as they have unfolded between Canada and the Dehcho, Délîné, and Inuvialuit and Gwich'in peoples. By contrasting accounts of negotiating sessions in city boardrooms with descriptions of Dene moosehide-tanning camps on the land and community meetings in small northern communities, it shows why Canada's aboriginal policy has failed to alleviate the causes of social suf-

fering in the north. Social suffering is not a relic of the past, it has become part of the process as government negotiators have dismissed it as irrelevant to self-government or used it as a rationale to minimize indigenous authority. Ethnographic descriptions of tanning practices, which embody principles and values central to the project of self-determination, by contrast, offer an alternative model for negotiations.

Stephanie Irlbacher-Fox holds a doctorate in polar studies from Cambridge University and for the past decade has worked for indigenous peoples on self-government and related political development processes in Canada's Northwest Territories.

Inuktitut Qaujimajjutit – Inuktitut Essentials: a phrasebook, by Chris Douglas, Leena Evic, Myna Ishulutak, Gavin Nesbitt and Jeela Palluq. Iqaluit, Pirurvik Press, 2009. \$39.95. Paperback, 161 pp. ISBN: 978-0-973217-82-7.

The authors are with the Pirurvik Centre, a firm that offers Inuit-language instruction and cultural education in Iqaluit.

This phrasebook contains over 1000 words and expressions, a key to the syllabic script, a pronunciation guide, and background on the language and its Nunavut dialects.

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