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Responding to Climate Change in Nunavut: Policy Recommendations

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Introduction

Climate change is considered to be a significant challenge for Inuit (Duerden 2004; ACIA 2005; Ford et al. 2006a). Communities, governments, and regional and national Inuit organizations have expressed their concern over the risks posed by climate change, and the urgency of taking action to address the problem (NTI 2001; GN 2003; Shirley 2005; Watt-Cloutier et al. 2005). Existing policy responses to climate change have largely focused on reducing greenhouse gas emissions, also referred to as climate change mitigation. Even under the most aggressive emission control measures, however, current greenhouse gas emissions commit the earth to continued climate change (Hansen et al. 2002; Wigley 2005). The likelihood of adverse impacts has created a growing urgency for measures to reduce or moderate the expected negative effects of climate change (known as adaptation). To identify adaptation needs and facilitate adaptation policy, we need to know the nature of community vulnerability, in terms of who and what are vulnerable to what stresses, in what way, why, and what capacity exists to cope with change (Burton et al. 2002; IISD 2003; Ford & Smit 2004; Schroter et al. 2005).

This paper outlines potential policy responses to reduce the vulnerability of Inuit communities to climate change, focusing on hunting livelihoods, which form the basis of Inuit living and culture. The paper begins by reviewing policy approaches to climate change at international, federal, and territorial levels, arguing for the development of adaptation policy. Drawing upon specific work conducted in partnership with the communities of Arctic Bay and Igloolik, Nunavut, and general research from Nunavut, we identify key drivers of climate change vulnerability. The paper concludes by identifying entry points for policy aimed at increasing adaptive capacity and/or reducing exposure to climate change.

Climate Change Policy

The United Nations Framework Convention on Climate Change (UNFCCC) and national governments have focused on two broad policy areas to address climate change: mitigation and adaptation (Ford & Smit 2004). Mitigation relates to efforts to reduce or stabilize greenhouse gas emissions to abate, moderate, or alleviate

changes in the climate. Adaptation refers to consciously planned adjustments in a system to reduce, moderate, or take advantage of the expected negative impacts of climate change (IPCC 2001). Academic and political attention has largely focused on mitigation as a response to climate change, evident in the UNFCCC and Kyoto Protocol (Burton et al. 2002; Huq & Reid 2004; Burton & Lim 2005). Adaptation is also recognized in the UNFCCC as a component of climate change policy, the importance of which is increasingly being recognized (EC 2002; Huq et al. 2003; Smith et al. 2003; C-CIARN 2004; Ford et al. 2006; Fussel & Klein 2006). In Canada, the federal government has supported research activities on adaptation, including the creation of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN). The Government of Nunavut has also indicated its intention to promote adaptation to climate change with the release of the Nunavut Climate Change Strategy, in which the development and promotion of adaptation are key goals (GN 2003).

The increasing importance of adaptation relates, in part, to the recognition that even under the most aggressive emission control measures, current greenhouse gas emissions commit the earth to continued climate change (Hansen et al. 2002). Furthermore, it is also recognized that climate change is already occurring in some regions where populations are vulnerable (Huq et al. 2003; ACIA 2005). This is particularly relevant in the Arctic, where evidence already points to the impact of climate change on local weather patterns and livelihoods (Ford 2005; Ford et al. 2006a, b). Regional organizations, governments, and communities in the Arctic have stressed the necessity and importance of developing adaptive options that address current and future climate-related vulnerabilities (Cohen 1997; DSD 2003; GN 2003; ICARP 2005; NTI 2005; Shirley 2005; Streicker 2005).

Adaptation Policy

Adaptation research has traditionally focused on identifying potential measures for adapting to climate change (O'Brien et al. 2004). Burton et al. (2002) term this "first generation" adaptation research, and it has formed the basis of several studies including the US Country Studies Program and UNEP Country Studies (Burton & Lim 2005). Identified adaptation options are predominantly technological and engineering based, including the construction of sea defences to provide protection from rising sea levels and development of irrigation schemes in areas predicted to experience increased drought occurrence (Smith & Lenhart 1996; O'Brien 2000; Stuczyinski et al. 2000). The focus of these studies is largely biophysical, using scenarios of climate change to model biophysical system responses, with corresponding adaptation options designed to reduce exposure to climate change impacts. In the Arctic too, adaptation research has focused on specifying technical adjustments required to reduce exposure to climate change (Maxwell 1997; Johnson et al. 2003; Instanes 2005).

Experience, however, indicates that policy targeting climate change alone may be neither optimal nor successfully incorporated into the decision-making process (O'Brien, 2000; Newton 2001; Dowlatabadi 2002; Handmer 2003; Huq et al. 2003; Smit & Pilifosova 2003; Niang-Diop & Bosch 2005). Climate change is one stress among many; social, cultural, and economic stresses are often considered more important to decision makers and communities. Policy aimed specifically at addressing climate change is further limited by its focus on future conditions—such approaches do not necessarily address immediate and pressing needs. In Nunavut, for example, policy priorities established by communities relate to other problems, including suicide prevention, cultural preservation, education and training, and employment creation (RT & Associates 2002; NEDS 2003; Boyle & Dowlatabadi 2005; Ford 2005; Shirley 2005).

Within the climate change adaptation field, there is growing consensus that enhancing adaptive capacity is as central to adaptation as the identification of particular adaptation measures specific to climate change (Smit & Pilifosova 2001, 2003; O'Brein et al. 2004; Burton & Lim 2005). Enhanced adaptive capacity can be achieved by addressing non-climatic determinants of vulnerability and integrating them into ongoing decision-making and policy processes, thereby serving immediate needs, providing immediate benefits, and reducing vulnerability to current climatic conditions (Agrawala 2004; Huq & Reid 2004). Enhancing capacity to deal with present conditions strengthens community resilience to longer-term climate change (IISD 2003; O'Brien et al. 2004; Pielke & Sarewitz 2005; Thomas & Twyman 2005). Known as "mainstreaming," this approach to climate change adaptation policy is increasingly well recognized and utilized in planning (Pouliotte 2005).

A Conceptual Approach for Adaptation Research

The identification and characterization of vulnerability in communities is crucial for identifying adaptation needs, opportunities, and constraints to adaptation, and for informing the development of policies that reduce risks associated with climate change (Burton et al. 2002; Ford & Smit 2004; Burton & Lim 2005; Schroter et al. 2005). Vulnerability refers to the susceptibility to harm in a system in response to a stimulus or stimuli (Smit & Pilifosova 2003). It is widely accepted that vulnerability is conditioned by the nature of biophysical conditions and the human system (Turner et al. 2003; Duerden 2004; Ford & Smit 2004; O'Brien et al. 2004; Robards & Alessa 2004). Ford et al. (2006a, b) conceptualize vulnerability as a function of exposure and adaptive capacity. Here, exposure reflects the susceptibility of people and communities to hazardous conditions, and adaptive capacity reflects a community's potential or ability to address, plan for, or adapt to exposure-sensitivity. In a similar manner, Turner et al. (2003), O'Brien et al. (2004), and ACIA (2005) frame vulnerability in terms of exposure, sensitivity, and resilience or capacity to adapt. Common to these approaches, vulnerability

at a local level is viewed as being affected by social, economic, cultural, political and biophysical conditions and processes operating at multiple scales over time and space. Adaptation policy must take into account cross-scale linkages which will influence success of policy and determine policy entry points.

Vulnerability analysis starts by examining past and present experience and response to climate variability, change, and extremes in order to characterize current levels of vulnerability. This addresses important concerns for adaptation policy, including:

1. Identification of those conditions that represent risks to community members;
2. Characterization of how communities manage and experience climatic risks;
3. Identification of those processes and conditions that influence exposure to climatic hazards and determine the efficacy, availability, and success of past and present adaptations;
4. Identification of opportunities and constraints to adapting to climate change; and
5. Identification of points of entry for adaptation policy.

Analysis of current vulnerability provides an empirical foundation for developing adaptation policy, identifying opportunities to reduce vulnerability by increasing adaptive capacity and/or reducing exposure-sensitivity. Future vulnerability is assessed by analyzing how climate change will alter the nature of the climate-related risks, and whether the communities' coping strategies will have the capacity to deal with these risks. This is used to set the context for adaptation policy and help assess policy options.

Nunavut

The Canadian territory of Nunavut, which became an official and independent territory in 1999, covers 1,994,000 square kilometres of Arctic Canada carved out of the Northwest Territories by the Nunavut Land claims Agreement. This agreement provided the territory's Inuit population—who make up 85% of Nunavut's population of 26,000—with control of more than 350,000 square kilometres of land, and set up a territorial government with wide ranging powers. Nunavut's 26 communities range in size from Bathurst Inlet (population 25) to the capital, Iqaluit (population 6,500). The economy is based on the harvesting of renewable resources, estimated to be worth at least $40–$60 million annually, which provides many families with an affordable and important source of food (Furgal et al. 2002; NEO 2002; Duhaime et al. 2004). Harvesting is supplemented by mineral exploration, extraction activities, tourism, sales of Inuit art, and government employment.

Communities in Nunavut have experienced rapid social, cultural, economic, and political changes over the last 50 years (see Wenzel 1991; Damas 2002), including the development of a wage-based economy alongside the informal harvesting economy, integration of and dependence on external markets, sedentarization of previously semi-nomadic hunting groups, imposition of southern education and cultural values, and changes to the technology used in hunting. Climate change is superimposed upon, and exacerbated by, these social changes (Krupnik & Jolly 2002; DSD 2003; ACIA 2005; Nickels et al. 2005; Ford et al. 2006a, b). Continued climatic change will contribute to background variability and community hazard, and can be expected to increasingly test the adaptive capacity of Inuit livelihoods in Nunavut (ACIA 2005).

Vulnerability to Climate Change in Nunavut

Current State of Vulnerability Research in Nunavut

Vulnerability assessments have only been conducted in a limited number of communities in Nunavut, especially assessments of the harvesting sector (Shirley 2005). There is need for more community case studies to identify how local geography, community history, and social, political, economic, and biophysical conditions shape vulnerability. However, completed climate change vulnerability analyses by Ford (2006 a, b) and Ford et al. (2006 a, b), in partnership with the communities of Igloolik and Arctic Bay, Nunavut, identify key trends and drivers of vulnerability. Emerging research indicates these key trends are comparable in small Inuit communities across the Canadian Arctic (Berkes & Jolly 2002; Gagnon 2005; Laidler 2005; Nickels et al. 2005; Pearce 2005a, 2005b). In absence of more detailed case studies, and in light of ongoing and predicted rapid climate change, these trends can identify key themes for targeted adaptation policy.

Key Vulnerability Trends

High Level of Adaptive Capacity

Analysis of past and present response to, and experience of, climate variability, change, and extremes indicates significant adaptability among Inuit in Nunavut (Ford et al. 2006 a, b). **Table 6.1** (page 116) shows how Nunavut communities are currently responding to climate change; responses are largely behavioural, and include risk minimization, risk avoidance, and the sharing of risk. The ability of Inuit in Nunavut to cope or deal with changing exposure is indicative of their adaptive capacity. This capacity is facilitated by traditional Inuit knowledge, strong social networks, flexibility in seasonal hunting cycles, and economic and institutional support.

From knowledge passed down through the generations—and from personal experience—hunters have knowledge of the dangers of hunting, how to evaluate risks, what preparations to make before hunting, and what to do in emergency

situations. As a repository of accumulated experience and knowledge of changing conditions and successful adaptations, this knowledge is drawn upon to minimize the risks of hunting and maximize the opportunities. It is a highly experiential form of knowledge, continually updated and revised in light of observations, trial and error experience, and incorporation of non-traditional knowledge alongside the traditional (Stevenson 1997; Berkes 1999; Ford et al. 2006). For example, increasing unpredictability of biophysical conditions, documented by community members in recent years, is now part of the collective social memory that frames individual practice and decision making (Ford et al. 2006). This ability to learn and combine new experiences with traditional knowledge confers significant adaptability.

In Igloolik and Arctic Bay, Nunavut, Ford et al. (2006 a, b) demonstrated the importance of social networks in facilitating adaptive capacity to environmental stress. These networks included a high level of interdependence within the extended family unit, and a strong sense of collective community responsibility and mutual aid. Sharing remains an affirmation of Inuit identity, and the responsibility is taken seriously. These networks facilitate the sharing of food, equipment, and knowledge, and ensure rapid response to crisis. The sharing of food in the extended family unit, for instance, underpins the food security of those who do not have the time, money, or knowledge to hunt in light of community documented climate change. The importance of social networks in community life and in dealing with stress has been demonstrated across Nunavut (Wenzel 1991, 1995; Oakes & Riewe 1997; Damas 2002; DSD 2002; NEO 2002).

Inuit hunting is opportunistic, a necessity given the inherent variability of Arctic environments. While there are preferred seasons and locations to hunt, hunters will harvest what is available, whenever and wherever it is available. In Arctic Bay, for instance, if the caribou hunt in August and September fails, other species, such as seal, will be harvested (Ford et al. 2006a). Substitution allows people to cope with variations in animal numbers, and also enables them to manage changes in the accessibility of hunting locations. Similar flexibility has been documented by Wenzel (1995) in Clyde River, Nunavut, and Nickels et al. (2005) throughout Nunavut.

Monetary transfers from the federal government, and emerging institutional support from the Nunavut government and Inuit institutions, play an important role in providing financing to cover the purchase of equipment to cope with the changing climatic conditions. This is particularly important in an Arctic context, where high levels of unemployment, and limited opportunities to earn money limit the extent to which hunters can purchase safety equipment.

Emerging Vulnerabilities.

Strategies by which Inuit deal with climate variability, change, and extremes are not without their costs, and the ability to respond is unequal (**Table 6.1** – page 116). Technological adaptations, for instance, are available only to those who can

afford them, and there is evidence that technological developments may increase inequalities within communities (DSD 2002; Ford et al. 2006). Quota systems on certain animal species restrict the flexibility with which hunters can respond to changing accessibility of hunting areas and abundance of animals. The effectiveness of adaptation also varies. Some adaptation technologies can increase exposure to climatic hazards by encouraging risk taking behaviour (Aporta & Higgs 2005; Ford et al. 2006 a, b).

In other areas, characteristics of Inuit society that traditionally facilitated adaptability have been altered as a result of changing livelihoods during the last half of the twentieth century. Over time, this has resulted in the emergence of vulnerable groups, specifically younger generation Inuit and those without access to economic resources. An erosion of traditional Inuit knowledge and land-based skills—through which hunting risks are managed—has been documented among younger generation Inuit in Nunavut (Rasing 1999; Aporta 2004; Takano 2004; Ford et al. 2006 a, b), and throughout the Canadian Arctic (Condon et al. 1995; Newton 1995; Collings et al. 1998). While subsistence activities remain important to younger generation Inuit, fewer are displaying the same degree of commitment or interest in harvesting. This has been attributed to: southern educational requirements that result in decreased time to participate in hunting, increased dependence on waged employment, a general shift in social norms, and intergenerational segregation between young and older generations (Condon et al. 1995; Kral 2003; Takano 2004; Ford et al. 2006). Consequently, certain skills necessary for safe and successful harvesting have been lost, including traditional forms of navigation and the ability to make snow shelters. Other skills have been inadequately developed, including how to dress appropriately, what equipment to take along on trips, and the ability to identify precursors to hazardous conditions. This has increased the vulnerability of young hunters when they travel and hunt without experienced hunters (Ford et al. 2006).

The functioning of social networks has been affected by a decrease in the importance of the extended family, the emergence of intergenerational segregation, decline in practice of traditional cultural values, concentration of resources in fewer hands, and the emergence of social tension (Oakes & Riewe 1997; Wenzel 1995; Kral. 2003; Kishigami 2004). The increasing importance of money has created division and social tension, and has entered into previously non-monetary sharing practices. The sharing of equipment, in particular, is practised less today, although traditional foods are still widely shared (Wenzel 1995; Ford et al. 2006). The increasing importance of money has also resulted in economic dependence on the volatility of external markets and government support. The recent closure of the Nanisivik mine near Arctic Bay, for example, forced many former employees to sell their hunting equipment, which they can no longer afford (DSD 2002). For young Inuit, in particular, the lack of monetary resources limits their opportunities to take part in harvesting activities, further reinforcing the decline in participation in and erosion of traditional skills (Collings et al. 1998; NEO 2002). Weakened

social networks compromise the capacity of individuals to cope with changing climatic conditions.

Institutional support and new technology have, to an extent, emerged to compensate for the weakening of social networks and erosion of traditional knowledge. GPS for instance, means that knowledge of traditional navigational skills is no longer required for safe travel. Snowmobiles permit hunters to travel long distances quickly, without the knowledge required to operate a dog team. New technology, however, has increased risk-taking behaviour and dependency on monetary resources (Aporta & Higgs 2005). Institutional support is also important: people no longer starve in years when there are no animals, as happened occasionally in the past. In addition, there is also evidence that such support has heightened some inequalities in the community, further reinforcing a weakening of social networks (Ford et al. 2006a, b).

Specific Adaptation Policy Options

Climate change vulnerability assessments were conducted by Ford (2006 a, b) and Ford et al. (2006 a, b) in partnership with the communities of Arctic Bay and Igloolik, Nunavut, using data gathered from 112 interviews in 2004/05. Specific measures to address current vulnerabilities were identified by community members during this research. These included: subsidies to cover the purchase of extra supplies and safety equipment necessary in light of more hazardous conditions; affordable insurance to cover equipment lost or damaged in climate-related hunting accidents; increased search-and-rescue capability in light of more dangerous hunting conditions; resources to help hunters learn how to properly use new hunting technology; the development of inter-community trade to help those with country food shortages; enhanced awareness and understanding of climate change so that people know how it might affect them; and construction of a bridge from Igloolik Island to the mainland to allow access to hunting areas on the mainland in light of changes in the sea ice.

> "[We need] more coast guard ships close by to the community so they can rescue stranded hunters."—Atagutak Ipeeleee, Arctic Bay

> "We need bigger boats in order to cope with [the stronger] winds [in the summer]."—Anonymous, Arctic Bay

> "We have to get insurance to help those people who [lose] equipment … because of [unusual] ice conditions or if they are stranded on the floe edge [due to unpredictable weather]."—Koonoo Muckpaloo, Arctic Bay

> "The Nunavut Government should supply [safety] equipment to the hunters [because it is now more dangerous to hunt]."—Elizabeth Awa, Igloolik

> "[With the ice freezing up later] it would be a lot easier if they put a bridge over [to] the mainland."—Elizabeth Awa, Igloolik

These measures are largely technological/financial, are specific to climate change, and address current climatic risks, the responsibility for which lie with the territorial government and Inuit organizations. While they are specific to Arctic Bay and Igloolik, research indicates similar recommendations elsewhere in Nunavut (DSD 2003; Nickels et al. 2005).

Mainstreaming Adaptation

Given the importance of competing priorities for the Government of Nunavut, policy targeting climate change alone may not be successfully incorporated into the decision-making process. This section identifies potential for adaptation "mainstreaming" in Nunavut, where policy addresses non-climatic determinants of climate change vulnerability, which can be included in the routine development of policy. Policy entry points include existing programs relating to cultural preservation, wildlife management, community well-being, education, and community economic development. While all these entry points are addressed, the discussion largely focuses on the preservation and promotion of cultural values.

Preservation and Promotion of Traditional Knowledge, Culture, and Values

Opportunities exist for actions to address social issues, which will also increase the adaptive capacity and reduce exposure of communities to cope with future climate change. Policies are needed to promote and preserve traditional Inuit knowledge, culture, and values, and increase safe hunting practices, especially among youth; many hunting accidents today are associated with a lack of land-based skills and knowledge of the environment.

> "It is more dangerous [for the younger generation] because they don't know the conditions, what to avoid."—Kautaq Joseph, Arctic Bay

> "I think we have lost the skills so much, I mean what would have not been dangerous for a man 50 years ago is now dangerous … because we have lost so many skills."—James Ungallak, Igloolik

> "If you don't know the traditional knowledge you won't last very long, you will freeze to death if you don't know how to survive."—David Kalluk, Arctic Bay

Reducing exposure and increasing adaptive capacity of youth today will reduce vulnerability to future climate change.

Traditional Inuit knowledge also forms the basis of Inuit cultural identity, spirituality, and values, the preservation and promotion of which can reinforce other factors relevant to climate change. Kral's (2003) work in Nunavut, for instance, indicated strong links between the promotion of traditional knowledge and cultural values, and suicide prevention. Similarly, Kirmayer et al (1998, 2000) in their work among small Inuit communities in Nunavik, northern Quebec, demonstrate that greater engagement with a community and family network reduces suicide

risks among youth aged 15–25. The work of Condon et al. (1995) and Collings et al. (1998) in the Inuit community of Holman, shows a strong relationship between subsistence activities and mental health and self-esteem.

> "My main concern is passing on traditional knowledge in terms of the weather, hunting, and so on, the social knowledge, the Inuit traditional knowledge."—Koonark Enoogoo, Arctic Bay

> "It is a real concern [to people in the community] that these general skills and ability to read the weather are not being passed on to the young as they should be."—John MacDonald, Igloolik

> "I wish that we could start teaching the traditional way of the Inuit … I would prefer that we used Inuit traditional knowledge to be utilized in the wellness teaching."—Anonymous, unspecified Nunavut community (from Kral 2003).

Efforts to promote traditional Inuit knowledge and values are ongoing in Nunavut. In Igloolik, the Inullariiat Society, a not-for-profit entity formed in 1993, promotes Inuit culture and heritage within the community. "Land Camps" whereby elders and experienced hunters take young Inuit on the land for weeks at a time are offered throughout the year by the Society. Teaching replicates the way in which knowledge and values were traditionally passed down: participants learn by doing, watching, and being on the land. This program has not only helped participants to develop essential survival and safety skills, but has also allowed young people to strengthen their relationships with each other, elders, and their cultural heritage (Wachowich 2001; Takano 2004). Other programs offered in Igloolik include classes that demonstrate preparation of animal skins, how to make traditional clothing, and how to build igloos. Kral (2003) identifies these activities as essential to community well-being, serving to strengthen community social networks and increase individual self-esteem. Lack of funding however, remains an issue constraining the development of such initiatives elsewhere in Nunavut, and has limited the programmes in Igloolik (Takano 2004). Residents in Arctic Bay, for instance, expressed the need for such a program in their community:

> "If they set up a camp here for young people, that could be used to revive the traditional skills"—Leah Kalluk, Arctic Bay

> "I think [they] should have more kids going out with older people. They should have more of those kinds of activities in the community." —Martha Attitaq, Arctic Bay

Strengthening of financial support from the Government of Nunavut and Inuit organizations is required to meet these needs. This falls within their mandate; maintaining and promoting Inuit knowledge and culture:

- Is established in the Nunavut Political Accord, the Nunavut Land Claims Agreement, and the Bathurst Mandate;
- Has been identified as a policy priority by communities throughout Nunavut and one that must be taken into account in community economic development;

- Forms a central objective of regional and national Inuit organizations (NEO 2002; NEDS 2003; Nickels et al. 2005; GN 2004; ITK 2006); and
- Is central to the current mandate of the Government of Nunavut.

Wildlife Management

Opportunities exist to address climate change vulnerability in policy development and programming in wildlife management. Quota systems, which limit the number of animals that can be caught (narwhal, polar bear) and, in some instances, the timing at which they can be caught (polar bear), have the potential to reduce the flexibility with which hunters can respond to climate change. Quota systems have also been linked to conflicts between community members with conflicting goals, with consequences for the strength of social networks.

> "[The quota] angers a lot people … old and young. They fight amongst each other, they divide families, because [of] disagreement how they should distribute the quotas."—James Ungallak, Igloolik

Emerging co-management agreements over the allocation of harvesting quotas, however, have significantly increased the flexibility of quota systems, creating an enabling framework where conflicts can be resolved. For example, since 1999, narwhal quotas have been determined in a co-management body composed of the local Hunters and Trappers Organization, the Nunavut Wildlife Management Board, Nunavut Tunngavik Incorporated, and the Federal Department of Fisheries and Oceans (DFO). Although the fixed level of the quota is set by the DFO, there is flexibility: the community has the opportunity to carry over the total allowable harvest from the previous year or borrow for the next years limit (Armitage 2005). Flexible, multi-level governance is important in facilitating the ability of management systems to deal with change, promoting the sharing of information between decision makers at different scales, linking scientific and traditional management systems, permitting greater opportunity to address conflicts over competing vision or goals, and providing an arena to solve conflict (Berkes et al. 2003; Armitage 2005; Diduck et al. 2005), which is important in light of predictions of changing migration and accessibility of narwhals. Similar co-management arrangements exist for polar bears (Diduck et al. 2005).

While existing experience of wildlife co-management in Nunavut is encouraging, technical, methodological and political differences between actors remain. Relationships between actors, for example, remain hierarchical with conflicts over the use of scientific and traditional knowledge. In 2000, in the community of Qikiqtarjuaq, Nunavut, the DFO decided to close the narwhal hunt on the basis of scientific stock assessments, creating significant conflict among partners in the co-management arrangement who were not consulted. If current co-management systems are to adapt to change, better coordination and communication across levels will be required (Armitage 2005; Diduck et al. 2005).

Economic Development

Sustainable economic development in the north includes community participation, equitable distribution of economic benefits within communities, and allocation of increased importance to land based economies in development decisions. Past experience with economic development in Arctic Canada, particularly resource development, has been mixed (Myers and Forest 1997; DSD 2002). For example, the operation of, and subsequent closure of, the Nanisivik mine near Arctic Bay. The mine acted as an important source of income during its operation, but created wage dependency in the community, contributed to social problems including drug and alcohol abuse, created inequities in income distribution, and contributed to the emergence of conflict in the community (DSD 2002; Ford et al. 2006). If future development increased disparities, this could increase vulnerability to climate change. Since the opening of the Nanisivik mine in the 1970s, however, significant advances have been made. Inuit in Nunavut now have a central role in setting economic priorities, power has been devolved to allow Inuit to have greater control over how development proceeds, and ensuring that benefits are spread equally is a major goal in development planning—these are enshrined in the Nunavut Economic Development Strategy, Nunavut Land Claims Agreement, and the mandate of the current Government of Nunavut. If economic development occurs within this context, then adaptive capacity can be strengthened. It is important therefore that these priorities are maintained in light of significant development pressure from mining and oil, and gas companies.

Conclusion

In light of competing policy priorities, if climate change adaptation policy is to be successful, it needs to serve immediate needs, bring immediate benefits, and enhance the ability to cope with current climatic conditions. Drawing upon the author's own work, and that of others' in Nunavut, this paper has demonstrated that adaptation policy can be informed and guided by the assessment of non-climatic determinants of vulnerability. These include an erosion of traditional Inuit knowledge, weakening of social networks, and reduced harvesting flexibility, which have increased exposure to climatic hazards and reduced adaptive capacity over time. Such measures will strengthen livelihoods and the ability to respond to current stressors, and increase capacity to adapt to climate change. These issues are key community concerns for which the Government of Nunavut has a mandate to address. Potential policy directions to reduce vulnerability to climate change include: expansion of cultural preservation programs, strengthening of wildlife co-management arrangements, and community-based economic development.

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Table 6.1: Adaptive Strategies Employed by Inuit in Nunavut to Deal with Climate Change and Associated Cost

Climate Change Related Risks	Adaptive Strategies	Adaptation Costs
Unpredictability of the weather, wind, ice	• Hunters are taking extra food, gas, and supplies in anticipation of potential dangers • Hunters are making sure that they travel with others when possible • Some hunters are being risk averse, avoiding travelling on the land or water if they have reason to believe the weather is going to be bad • Use of weather forecast on the TV and radio to complement traditional forecasts • New equipment taken along e.g. personal location beacons, immersion suits, satellite phones	• Costs of purchasing extra supplies prohibitive for many who have limited income • Avoiding travelling at certain times results in shortages of some traditional foods and need to purchase more store food • New equipment is often expensive
Waves/stormy weather for summer boating	• Identification of safe areas prior to travel where shelter can be found • Waiting in the community for adequate conditions	• Waiting results in reduced harvests and need to purchase more store food • Avoiding certain areas can result in higher gas costs and add more time onto hunting trips (a problem for those with full-time jobs)
Snow covered thin ice	• Avoidance of snow covered areas • Extra care while travelling	• Avoiding certain areas can result in higher gas costs and add more time onto hunting trips (a problem for those with full-time jobs)
Reduced accessibility to hunting areas	• Waiting in the community until hunting areas are accessible • Switch species and location • Sharing of country food • Development of new access routes – e.g. overland travel instead of ice travel	• Waiting results in reduced harvests and need to purchase more store food • Not all have the hunting skills to switch species • New routes can be more time consuming, have higher fuel costs, and be more damaging on equipment

Source: Adapted from Fox 2002; Thorpe et al. 2002; Nickels et al. 2002, 2005; DSD 2003; Ford 2005, 2006; Ford et al. 2006 a, b; Laidler 2005

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