

# EMERGING TRENDS IN CLIMATE CHANGE POLICY: THE ROLE OF ADAPTATION

James Ford<sup>‡</sup>

## ABSTRACT

*Until recently, public policy solutions to the global problem of climate change have been dominated by the concept of mitigation: reduction of the greenhouse gas emissions that cause global warming. This focus on prevention in both academic research and practical application of climate change policy has resulted in the neglect of an alternative conception, that of adaptation. Adaptation offers an alternate vision of climate change policy, one that recognises a certain degree of climatic alteration as inevitable, and offers solutions that can allow especially vulnerable populations to survive all climatic hazards, not just man-made climate change. This article discusses both why adaptation has traditionally been neglected in the international discourse on climate change, and also why it has come to have greater prominence in more recent studies and policy initiatives. It further analyses and breaks down the concept of adaptation into ‘impacts-driven’ and ‘vulnerability-based’ methods, to argue that only the latter truly takes account of the socio-economic determinants of climate vulnerability, and thus offers effective adaptive solutions to the challenges posed by climate change. A case study of the Inuit population in the Canadian Arctic is employed to demonstrate how a vulnerability-based approach works in practice, offering four possible adaptive solutions to the climatic hazards faced by the Inuit. It is concluded that the adaptation approach needs to be mainstreamed into general socio-economic policies, in order to ensure that vulnerable populations are able to face up to the challenges of man-made climate change and everyday climatic hazards.*

Keywords: climate change policy; mitigation; adaptation; anthropogenic emissions; climatic hazards; vulnerable populations; Canada; the Arctic; the Inuit; impacts-driven policy; vulnerability-based policy

## 1. INTRODUCTION

It is widely accepted that the climate is changing and will continue to change at rates unprecedented in recent human history.<sup>1</sup> Climate models project increasing temperatures and precipi-

---

<sup>‡</sup> Department of Geography, McGill University, Canada. For questions or comments, please contact: james.ford@mcgill.ca.

<sup>1</sup> IPCC, *Climate Change 2007: The Physical Science Basis. Summary for Policy Makers*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Geneva, 2007).

tation which will alter the frequency, magnitude, and geographic distribution of climate-related hazards including flooding, drought, and heat waves; create new patterns of extreme weather; shift the distribution, abundance, and migratory behaviour of wildlife species; and reduce the areal extent and thickness of the Arctic sea-ice.<sup>2-3</sup> Rising sea levels will threaten low-lying areas and accelerate coastal retreat.<sup>4</sup> On account of the potential wide ranging social, cultural, and economic implications, it has been argued that climate change is a major threat to global security in the coming century.<sup>5</sup>

The United Nations Framework Convention on Climate Change (FCCC) guides national and international efforts to respond to climate change. The FCCC is composed of 189 member countries and was opened for signature at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 (known by its popular title as The Earth Summit). The main focus of the Framework Convention has been on reducing or stabilising emissions responsible for climate change (known as mitigation). Adaptation – encompassing measures to reduce or moderate the negative effects of climate change – also figures prominently in the FCCC, although it has been overshadowed by mitigation in policy discussions. New perspectives on the role of adaptation, however, are beginning to emerge, driven in part by the realisation that some degree of climate change is inevitable and by the current effects of climate change in vulnerable regions.

This paper reviews the emergence of adaptation as a focus of climate change policy action and assesses current approaches to adaptation policy development and research. It begins by documenting how the problem of climate change has been addressed internationally, charting the evolution of mitigation and adaptation in policy debates. Examples from Canada are employed to illustrate how climate change policy at the national level reflects trends on the international stage. The paper then focuses on how adaptation has been approached, illustrating how the existing FCCC definition of adaptation – actions taken in response to climate change impacts *resulting from* anthropogenic emissions – is constraining the effectiveness of policy and its ability to address the needs of the vulnerable. It is argued that the concept of adaptation needs to be reframed to allow actions to reduce vulnerability to *climatic hazards in general* and not just the marginal impacts of human induced climate change. Such reframing is necessary to broaden the range of response options aimed at reducing the negative effects of climate change to include action to address socio-economic determinants of climate vulnerability. The paper finishes by demonstrating – using an example from Canada – how the integration of the management of climate change risks into broader policy goals can lead to ‘no-regrets’ adaptation, where policy reduces vulnerability to climatic risks while addressing other priorities.

## 2. CLIMATE CHANGE POLICY

Political and academic attention to climate change policy has largely focused on reducing the greenhouse gas emissions responsible for climate change.<sup>6-7</sup> Mitigation is the basis of the Frame-

---

<sup>2</sup> W. Chapman and J. Walsh, “Simulations of Arctic Temperature and Pressure by Global Coupled Models,” *Journal of Climate* vol. 20, no.4 (2007), pp. 609-632.

<sup>3</sup> IPCC, 2007.

<sup>4</sup> R. J. Nicholls and R. S. J. Tol, “Impacts and responses to sea-level rise: A global analysis of the SRES scenarios over the 21st Century,” *Philosophical Transaction of the Royal Society A – Mathematical, Physical and Engineering Sciences*, vol. 361 (2005), pp. 1073-1095.

<sup>5</sup> N. Stern, *The economics of climate change: The Stern Review* (Cambridge: Cambridge University Press, 2006).

<sup>6</sup> S. Huq, F. Yamin, A. Rahman, A. Chatterjee, X. Yang, S. Wade, V. Orindi, and J. Chigwada, “Linking climate adaptation and development: A synthesis of six case studies from Asia and Africa,” *IDS Bulletin* vol. 36 (2005), pp. 117-122.

<sup>7</sup> I. Burton, S. Huq, B. Lim, O. Pilifosova, and E.L. Schipper, “From impacts assessment to adaptation priorities: The shaping of adaptation policy,” *Climate Policy* vol. 2 (2002), pp. 145-159.

work Convention and its principle update, the Kyoto Protocol, which provides the legal basis within which many national and regional governments are responding to climate change. The protocol legally binds Annex 1 (industrialised) countries to reduce greenhouse gas emissions by an average of 5% by the first commitment period (2008-2012) compared to the baseline of 1990. Countries that have ratified the Protocol but are not able to achieve the necessary emissions reductions domestically are permitted to purchase carbon credits from nations who have exceeded their Kyoto reductions, or invest in green technologies or emission reduction programs in non-Annex 1 nations (mechanisms known as The Clean Development Mechanisms and Joint Implementation). Mitigation also figures prominently in discussions over what will replace Kyoto when the implementation period ends in 2012, with scientists and some governments (notably in the EU) arguing for stronger emission targets to avoid ‘dangerous climate change.’

Action on adaptation as a response to climate change has been limited and even discouraged, especially throughout the 1990s when there was considerable faith in the ability of mitigation to be effective in tackling climate change.<sup>8</sup> Former US Vice President Al Gore, for example, speaking in 1992, argued that adaptation represented “a kind of laziness, an arrogant faith in our ability to react in time to save our skins.”<sup>9</sup> In 2007 Gore re-affirmed his opposition to adaptation arguing “We really have to focus on prevention;”<sup>10</sup> a stance taken by many environmental activists who feel action on adaptation directs attention and resources away from reducing greenhouse gas emissions. The politics of climate negotiations, especially in the 1990s, also contributed to the neglect of adaptation, with many developed country governments viewing discussion of adaptation as tantamount to accepting human responsibility for climate change. Fears that responsibility would implicitly lead to discussions of liability and compensation naturally steered developed country negotiators away from adaptation.<sup>11</sup>

New perspectives on adaptation, however, have begun to emerge, captured in the Stern Review on the Economics of Climate Change,<sup>12</sup> reports produced by international scientific bodies including the Intergovernmental Panel on Climate Change and the Arctic Council,<sup>13-14</sup> and a proliferation of adaptation research by non-governmental organisations (NGOs) and academia. As many of these reports highlight, adaptation – despite being overlooked – has always been recognised by the Framework Convention as an important component of climate change policy. Article 4.1b, for example, commits parties to “formulate, implement... national and where appropriate, regional programmes containing measures to... facilitate adequate adaptation to climate change.”<sup>15</sup> Article 11 of the Kyoto Protocol also commits parties to promote and facilitate adaptation to address climate change. Moreover, the Intergovernmental Panel on Climate Change (IPCC) – whose assessments on the science, impacts, and economics of climate change have guided negotiations among

---

<sup>8</sup> R. Pielke, G. Prins, S. Raynor, and D. Sarewitz, “Climate change 2007: Lifting the taboo on adaptation,” *Nature* vol. 445 (2007), pp. 597-598.

<sup>9</sup> *Ibid.*

<sup>10</sup> M. Crenson, “Scientific debate on the wane, fight brews over how to address climate change,” *International Herald Tribune*, available online: <http://www.iht.com/articles/ap/2007/02/23/america/NA-FEA-GEN-Climate-Change-An-Update.php> (accessed 3 September 2007).

<sup>11</sup> E. L. Schipper, and M. Pelling, “Disaster risk, climate change and international development: scope for, and challenge to, integration,” *Disasters* vol. 30 (2006), pp. 19-38.

<sup>12</sup> Stern.

<sup>13</sup> ACIA, *Arctic Climate Impacts Assessment* (Cambridge: Cambridge University Press, 2005).

<sup>14</sup> IPCC (2007).

<sup>15</sup> UNFCCC, *United Nations Framework Convention on Climate Change - Convention Text* (Geneva: IUCC, 1992).

signatories to the FCCC – first stressed the importance of adaptation as “a very powerful option” for responding to climate change in its second assessment report.<sup>16</sup>

In light of this resurgence of interest, the FCCC has moved to re-affirm the importance of adaptation on the policy agenda alongside mitigation, establishing several programs to support adaptation following the signing of the 2001 Marrakech Accord to the Kyoto Protocol. These include the National Adaptation Programme of Action, the Kyoto Protocol Adaptation Fund, the Least Developed Countries Fund, the Strategic Priority on Adaptation, and the Special Climate Change Fund.<sup>17</sup> The increasing importance of adaptation in climate change policy is also evident in national climate change plans. In Canada, for example, the House of Commons Standing Committee on Environment and Sustainable Development noted the urgency of adaptation and recommended the development of a national adaptation strategy in 2005. A national adaptation assessment identifying opportunities for adaptation was completed by Natural Resources Canada in late 2007.

### 3. THE IMPORTANCE OF ADAPTATION

There are numerous explanations for the increasing interest in adaptation as a response to climate change. First, the experience of climate negotiations throughout the 1990s eroded confidence in the ability of mitigation to stabilise or moderate climate change.<sup>18</sup> The Kyoto protocol, for example, which legally binds Annex 1 (industrialised) countries to reduce greenhouse gas emissions by an average of 5%, is widely considered insufficient to have any real impact on climate change.<sup>19</sup> Confidence has been further eroded by the political difficulties of achieving mitigation: the emissions of Annex 2 (non-industrialised) countries are rapidly increasing and offsetting emission reductions in Annex 1 countries. Moreover, many Annex 1 countries are having difficulties meeting their Kyoto targets. In Canada, for example, the government of Stephen Harper has indicated that Canada will not purchase the carbon credits necessary to meet its Kyoto targets, in-effect defaulting on its Kyoto commitments. Decreasing confidence in mitigation has been compounded by recent scientific research which indicates that some degree of climate change is unavoidable due to historic emissions.<sup>20</sup> For instance, if atmospheric concentrations of greenhouse gases were capped at 2000 levels (considered unlikely), estimates indicate that temperatures would still increase by 0.4°C to 0.6°C over the next century.<sup>21</sup> Communities, regions, and economic sectors will therefore have to adapt to some degree of climate change.

Second, it is widely recognised that climate change is already occurring in some regions where populations are vulnerable.<sup>22</sup> This is particularly relevant in Arctic regions where evidence already points to the effect of climate change on local weather patterns, wildlife, sea ice, and livelihoods in northern regions.<sup>23</sup> Adaptation policy can bring immediate benefits in the form of reduced sensitivity to climatic risks and increased adaptability to future stresses. Developing nations who have limited capacity to deal with climate change are also demanding an international response to help them adapt to increasingly destructive climatic events. In 2002, for example, many developing

---

<sup>16</sup> IPCC, *Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change (Cambridge: Cambridge University Press, 1995).

<sup>17</sup> Huq et al.

<sup>18</sup> Pielke et al.

<sup>19</sup> G. Monbiot, *Heat: How to Stop the Planet Burning* (Toronto: Penguin Books, 2006).

<sup>20</sup> W. L. Hare and M. Meinshausen, “How much warming are we committed to and how much can be avoided?” *Climatic Change* vol. 75, no.1-2 (2006), pp. 111-149.

<sup>21</sup> T. M. L. Wigley, “The climate change commitment,” *Science* vol. 307 (2005): pp. 1766-1769.

<sup>22</sup> IPCC (2007).

<sup>23</sup> ACIA.

nations signed the Delhi Declaration calling for greater attention to adaptation in climate change policy negotiations.<sup>24</sup>

Finally, there is growing realisation among many developing nations, especially those with low populations, the absence of sizable industrial base, and limited consumption levels, that there is little they can do to slow or stop climate change because they contribute so little to global greenhouse gas emissions. In Canada too, organisations representing indigenous peoples in the Arctic – while recognising the importance of reducing emissions to prevent dangerous climate change – are realising that with only 100,000 people in the Arctic territories and with low levels of industrial development there are few opportunities to influence global greenhouse gas emissions.<sup>25</sup> Adaptation offers a tangible way in which the impacts of climate change can be reduced.

#### 4. ADAPTATION RESEARCH AND POLICY DEVELOPMENT

A growing community of policy makers and researchers is evolving to provide support to identify what adaptation policies are required to moderate or reduce the negative effects of climate change, and how they can be best developed, applied, and funded. Two approaches have shaped the adaptation research and policy agenda: impacts-driven and vulnerability-based approaches. It is argued here that the current framing of adaptation in the FCCC, and in policy debates in general, is largely impacts-driven and therefore constrains adaptation options to addressing the marginal negative impacts of human induced climate change. Thinking of adaptation using a vulnerability-based approach broadens the range of actions to reduce the effects of climatic hazards including, but not limited to, human induced climate change.

##### 4.1 Impacts-Driven Policy and Research

Most adaptation research and policy discussion has focused on modelling the impacts of climate change on natural and human systems using simulations produced by global climate models (GCMs), with adaptation options identified to reduce exposure to predicted climate change impacts.<sup>26-27</sup> Burton et al. term this ‘Type 1’ adaptation or ‘impacts driven research,’<sup>28</sup> and the approach has formed the basis of numerous studies including the US Country Studies Program and country reports prepared for the FCCC National Adaptation Programs for Action (NAPAs). Adaptive responses that have been proposed in this context are largely techno-engineering in nature, including the construction of sea defences to provide protection from rising sea levels, the development of irrigation systems in regions predicted to be affected by increasing drought, and construction of enhanced drainage systems in areas expected to be affected by increasing precipitation.<sup>29</sup>

The focus on reducing exposure to predicted climate change impacts is partly a reflection of the preponderance of physical scientists in the adaptation research community. It is also a reflection of how the FCCC (and many national governments) treats adaptation – as actions taken in response to climate change *resulting from* anthropogenic emissions. Adaptive responses under the FCCC

<sup>24</sup> UNFCCC, *The Delhi Declaration on Climate Change and Sustainable Development* (Geneva: IUCC, 2002).

<sup>25</sup> J. Ford, T. Pearce, B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusujurat, and K. Qrunnut, “Reducing vulnerability to climate change in the Arctic: the case of Nunavut, Canada,” *Arctic* vol. 60 (2007), pp. 150-166.

<sup>26</sup> B. Smit, and J. Wandel, “Adaptation, adaptive capacity, and vulnerability,” *Global Environmental Change* vol. 16 (2006), pp. 282-292.

<sup>27</sup> H. M. Fussel, and R.T.J. Klein, “Climate change vulnerability assessments: An evolution of conceptual thinking,” *Climatic Change* vol. 75, no.3 (2006), pp. 301-329.

<sup>28</sup> I. Burton, S. Huq, B. Lim, O. Pilifosova, and E.L. Schipper, “From impacts assessment to adaptation priorities: The shaping of adaptation policy,” *Climate Policy* vol. 2 (2002): pp. 145-159.

<sup>29</sup> Ford et al. (2007).

therefore have to demonstrate that they address the marginal impacts of future climate change, not existing climatic risks. Impacts-driven research with its focus on climate change projections and techno-engineering interventions to reduce exposure to climate change impacts naturally fit this definition.

Impact-driven or Type 1 adaptation research has provided vital information to policy makers on the potential impacts of climate change, and policy responses have been important in reducing climate change exposure. However, this approach to adaptation largely neglects the complex socio-economic dynamics that shape vulnerability to climate change.<sup>30-31</sup> The differential effects of current climate-related hazards, as Hurricane Katrina made clear, highlights the importance of non-climatic factors shaping vulnerability. Focusing attention on the marginal impacts of climate change in isolation from other conditions, as necessitated by the FCCC, distracts from other, often more important, societal drivers of climate vulnerability. If unaddressed these social determinants can make adaptive responses ineffective in reducing the negative impacts of climate change.

Moreover, focusing on reducing marginal future climate change impacts is often neither practical nor successfully incorporated into decision-making processes, and can direct attention away from the real needs of the vulnerable. Climate change is one source of stress on human systems; poverty, public health, economic development, infrastructure, and food security are often considered more pressing needs to policy makers and vulnerable populations than projections of long-term changes in average climatic conditions. As long as adaptation is treated separately from these concerns, its importance for society will be obscured.

Impacts-driven adaptation policy development is further constrained by its dependence upon climate change scenarios to identify the marginal impacts of climate change. Despite improvements over the years, climate change scenarios are subject to significant uncertainty. Uncertainty is multiplied as scenarios produced by GCMs drive biophysical impact models that have their own inherent uncertainties. Imperfect knowledge regarding the relationships between climate parameters and other variables complicates analyses,<sup>32</sup> and at a local level the distinctive geography of widely dispersed communities further reduces predictive capacity. This leads to a situation where policy makers are faced with the prospect of developing adaptive responses to cope with, for example, projections of sea level rise in the range of 0.11 - 0.77m by 2100 depending on the scenario and GCM used.<sup>33</sup> Experience highlights that policy makers are reluctant to develop policies based on uncertain results and uncertainty in climate projections is unlikely to be reduced in the near future.<sup>34</sup> Where policy interventions do occur, it can result in maladaptation and inefficient use of resources if uncertain projections do not materialize.

## 4.2 Vulnerability-Based Policy and Research

In the natural hazards and development literature, adaptation describes a much broader range of actions that can help reduce the negative effects of climate change than what is considered in the FCCC and by many national governments.<sup>35</sup> Increasingly, researchers and decision makers in the

---

<sup>30</sup> P. Tschakert, "Views from the vulnerable: Understanding climatic and other stressors in the Sahel," *Global Environmental Change* (in press).

<sup>31</sup> Ford et al. (2007).

<sup>32</sup> W. N. Adger and K. Vincent, "Uncertainty in adaptive capacity," *Comptes Rendus Geoscience* vol. 337 (2005), pp. 339-410.

<sup>33</sup> IPCC, *Climate Change 2001: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change (Cambridge: Cambridge University Press, 2001).

<sup>34</sup> A. H. Lynch and R. D. Brunner, "The importance of context in climate change impacts assessment: Lessons from Barrow, Alaska," *Climatic Change* (in press).

<sup>35</sup> Schipper and Pelling.

climate change field are viewing adaptation through this lens. For instance, the United Nations Development Program's Adaptation Policy Framework – designed to provide guidance for developing climate change adaptation initiatives – defines adaptation as “a process by which strategies to moderate, cope with, and take advantage of the consequences of *climatic events* are enhanced, developed, and implemented” (italics are in original).<sup>36</sup> The focus here on “climate events,” as opposed to anthropogenic climate change, is a key departure from the approach to adaptation within the FCCC and directs the focus of adaptation policy and research to address the root causes of climate vulnerability – what some commentators have termed second generation or Type 2 adaptation studies.<sup>37-38</sup>

Policies that address vulnerability differ in key respects from attempts to reduce impacts. Vulnerability has often been described as the ‘capacity to be wounded.’<sup>39</sup> It is a measure of the susceptibility to harm in a system in response to a stimulus or stimuli, and is related to both exposure and sensitivity to climatic risks and adaptive capacity to deal with those risks.<sup>40-41</sup> Vulnerability-based adaptation policy, therefore, focuses on measures that reduce both climate exposure and human sensitivity, *and* increase adaptive capacity. This may include the prescription of traditional techno-engineering adaptive responses designed to reduce exposure to climate change impacts. More often, however, vulnerability-based policy development advocates initiatives to strengthen adaptive capacity and/or reduce climate sensitivity, which are not normally considered under impacts-driven research, and can include livelihood enhancement, poverty alleviation, education, improved institutional arrangements, strengthening food security. These activities fall under the general rubric of sustainable development and are issues often of major concern to vulnerable populations.<sup>42-43</sup> Moreover, integrating the management of climate change risks into broader sustainable development goals (known as mainstreaming) can lead to ‘no-regrets’ adaptation, where policy reduces vulnerability to climatic risks while addressing other priorities.

## 5. VULNERABILITY-BASED ADAPTATION POLICY AND RESEARCH: AN ARCTIC CASE STUDY

The above section argues that vulnerability-based adaptation policy development is more likely to meet the needs of the vulnerable and be more effective in addressing climate change risks. This section draws upon an example from the author's own work in Arctic Canada to highlight how adaptation planning *can* be integrated into broader sustainable development goals at a regional and national level.

### 5.1 Climate Change in the Arctic

The Inuit of Canada's Arctic are at the forefront of climate change, which is posing significant risks and hazards to communities.<sup>44-45</sup> Many of the risks are associated with traditional har-

---

<sup>36</sup> B. Lim, E. Spanger-Siegfried, I. Burton, E.L. Malone, and S. Huq, *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures* (New York: United Nations Development Programme, 2005).

<sup>37</sup> Burton et al.

<sup>38</sup> Fussel and Klein.

<sup>39</sup> R. W. Kates, C. Hohenemser, and J.E.X. Kaspersen, *Perilous Progress: Managing the Hazards of Technology* (Colorado, 1985).

<sup>40</sup> J. Ford, J. MacDonald, B. Smit, and J. Wandel, “Vulnerability to climate change in Igloolik, Nunavut: What we can learn from the past and present,” *Polar Record* vol. 42 (2006): pp. 1-12.

<sup>41</sup> Smit and Wandel.

<sup>42</sup> F.S.I. Chapin, “Building resilience and adaptation to manage arctic change,” *Ambio* vol. 35 (2006): pp. 198-202.

<sup>43</sup> Fussel and Klein.

<sup>44</sup> S. Nickels, C. Furgal, M. Buell, and H. Moquin, *Unikkaaqatigiit – Putting the Human Face on Climate Change: Perspectives from Inuit in Canada* (Ottawa, 2006).

vesting activities, which have great social, cultural, and economic importance to Inuit. Increased prevalence of hunting accidents due to changing conditions have been noted and many Inuit have complained that changes in the sea ice and weather patterns have reduced hunting success. Given community dependence on the physical environment, future climate change is expected to challenge the sustainability of existing ways of life.<sup>46-47</sup>

## 5.2 Adaptation planning and research

In light of the impact of current changes and predictions of future vulnerability, policy makers are seeking to identify means of promoting adaptation. The Territory of Nunavut, for example, began developing a climate change adaptation plan in late 2006. To identify opportunities for adaptation planning to reduce vulnerability to climate change, Ford et al. conducted vulnerability-based studies with Inuit communities in Nunavut between 2003 and 2007.<sup>48-49</sup> This work was largely undertaken in collaboration with the communities of Arctic Bay (population: 700) and Igloolik (population: 1,500). Both are small Inuit communities, have mixed economies composed of waged-employment and subsistence hunting, and can be considered representative of Nunavut's 26 mostly small communities. During four years of fieldwork, 112 in-depth semi-structured interviews were conducted with local residents and were complimented with focus group discussion sessions and interviews with local and territorial decision makers. Based on this work, four main areas for adaptation policy at a federal and territorial level are suggested and are summarised here (see Ford et al. for detailed recommendations<sup>48</sup>). It is noteworthy that these recommendations address key determinants of climate change vulnerability, but more importantly they simultaneously address broader community concerns in areas of economic, social, and cultural development, and strengthen resilience to everyday climatic risks.

### *Traditional knowledge enhancement and cultural preservation*

The erosion of traditional knowledge and land-based skills over the last few decades, a consequence of changing social norms and Western educational requirements, has created climate vulnerabilities among Inuit youth across Arctic Canada.<sup>50-51</sup> Recent climate change has compounded the erosion of traditional knowledge, increasing the dangers of an insufficient understanding of Arctic survival skills. Strengthening land-based skills and traditional knowledge through the development and promotion of hunting camps and land skills courses have the potential to increase safe hunting practices among vulnerable groups, thereby reducing sensitivity and increasing adaptive capacity to current and future climatic risks. Programs of this nature have value well beyond reducing climate vulnerability and preparing for climate change: traditional knowledge forms the basis of Inuit cultural identity, spirituality, and values, the preservation and promotion of which has importance for community well-being.

---

<sup>45</sup> ACIA.

<sup>46</sup> Ibid.

<sup>47</sup> AHDR, *Arctic Human Development Report* (Akureyri, Iceland: Stefansson Arctic Institute, 2004).

<sup>48</sup> Ford et al. (2007).

<sup>49</sup> J. Ford, B. Smit, J. Wandel, H. Ittusarjuat, and K. Qrunnut, "Climate change in the Arctic: Current and future vulnerability in two Inuit communities in Canada," *The Geographical Journal* (in press).

<sup>50</sup> S. Gearhead, W. Matumeak, I. Angutikjuaq, J.A. Maslanik, H.J.L. Huntington, D.G.T. Matumeak, and R.G. Barry, "It's not that simple: Comparison of sea ice environments, observed changes, and adaptations in Barrow Alaska, USA, and Clyde River, Nunavut, Canada," *Ambio* vol. 35 (2006): pp. 203-211.

<sup>51</sup> T. Pearce, B. Smit, F. Duerden, F. Katayoak, R. Inuktalik, A. Goose, J. Ford, and J. Wandel, "Travel Routes, Harvesting and Climate Change in Ulukhaktok, Canada," Northern Research Forum Open Meeting – The Borderless North, Oulu, Finland and Lulea, Sweden.

### *Targeted financial support*

The ability to cope with climatic stresses, including climate change, is influenced by access to financial resources. Replacing equipment damaged or lost in climate-related hunting accidents imposes a significant financial burden on community members, especially those with limited access to money. In these circumstances, accidents can result in loss of livelihood and with climate change accidents are increasingly common. Programmes are currently offered by the territorial government to provide financial support for the replacement of lost or damaged equipment, and these programs are increasingly being used to finance climate change adaptations. These new demands, however, in combination with rising equipment and fuel costs, are exacerbating shortcomings in funding allocation, which is widely considered to be insufficient in many communities. Subsidised insurance schemes for hunters and targeted harvester support funds have the potential to increase livelihood security, particularly in the context of a changing climate, and will help Inuit (especially youth) balance traditional activities with economic demands of the twenty-first century.

### *Resource co-management*

The opportunistic nature of resource use among Inuit is widely recognised to facilitate adaptability to environmental stress. The imposition of quota systems by the federal government in the 1980s, which limit the number of animals that can be caught in a given year and, in some instances, the times at which they can be caught, has reduced the flexibility with which hunters can respond to environmental stress. Climate change is increasing pressure on existing quota systems and increasing demand for quotas to be developed for currently unregulated species. In this context it is important that communities, scientists, and wildlife managers are collectively involved in the co-management of wildlife harvesting. The development and alteration of quotas in response to climate change or other pressures that do not take into account local hunting needs, the ecology of harvesting, or community concerns will almost certainly increase community vulnerability to climate change and other stresses, limiting the flexibility characteristic of hunting that has traditionally facilitated adaptive capacity.

### *Emergency support*

During times of climate stress when access to traditional food resources is constrained, those people who rely on traditional foods have difficulty offsetting reduced traditional food consumption with store-bought food due to the high cost of food in the North and low household income. This can create episodes of acute food insecurity. Emergency intervention to subsidise store-food prices for high risk groups, or ensure food access via food banks during periods of climate induced stress, would increase adaptability to climatic events which are predicted to become more prevalent with climate change. Emergency intervention to support fuel prices during times of climate stress would also be important. Many adaptive mechanisms involve travelling further to avoid dangerous areas on the ice or to find animals. Subsidised gasoline prices during times of stress would moderate the burden of having to travel further to obtain traditional foods, particularly for vulnerable low income hunters.

## **6. CONCLUSION**

Adaptation has increasingly figured on the international and national climate change agenda since the 2001 Marrakech Accords to the Kyoto Protocol, when several new programs to support adaptation research and policy development were established. Research that seeks to identify what adaptation policies are required to moderate or reduce the negative effects of climate change and how they can be best developed, applied, and funded, is increasingly using vulnerability-based ap-

proaches. Vulnerability approaches broaden the scope of adaptation policy to consider measures to increase adaptive capacity and reduce climate sensitivity, alongside measures to reduce climate change exposure while emphasising the importance of social, cultural, and economic factors in determining the potential effects of climate change. In Nunavut, for example, where climate change is already having considerable effects, policies that seek to preserve and promote traditional knowledge and land skills, improve access to financial resources, develop co-management of wildlife resources, and provide emergency support during times of climate stress, are likely to be effective in reducing climate vulnerability. These policies fall under the general rubric of sustainable development.

Reframing adaptation as part of sustainable development can help ‘put the vulnerable first,’ and is increasingly being advocated by NGOs, researchers, and regional policy makers.<sup>52</sup> Indeed, in Arctic Canada many community members have expressed concern at how the climate change issue at the national and international level is eclipsing what they see as more important concerns facing their livelihoods, including suicide, lack of jobs, erosion of traditional knowledge and culture, and the expense of undertaking traditional activities including hunting. Mainstreaming adaptation can help address these social-economic issues, reduce vulnerability to everyday climatic risks, and reduce vulnerability to climate change. A broader treatment of adaptation by the Framework Convention and national governments is required if the needs of the vulnerable are to be addressed in a changing climate.

## REFERENCES

- ACIA. *Arctic Climate Impacts Assessment*. Cambridge: Cambridge University Press, 2005.
- Adger, W.N. and K. Vincent. “Uncertainty in adaptive capacity.” *Competus Rendus Geoscience* vol. 337 (2005): pp. 339-410.
- AHDR. *Arctic Human Development Report*. Akureyri, Iceland: Stefansson Arctic Institute, 2004.
- Burton, I., S. Huq, B. Lim, O. Pilifosova, and E.L. Schipper. “From impacts assessment to adaptation priorities: The shaping of adaptation policy.” *Climate Policy* vol. 2 (2002): pp. 145-159.
- Chapin, F.S.I. “Building resilience and adaptation to manage arctic change.” *Ambio* vol. 35 (2006): pp. 198-202.
- Chapman, W. and J. Walsh. “Simulations of Arctic Temperature and Pressure by Global Coupled Models.” *Journal of Climate* vol. 20, no.4 (2007): pp. 609-632.
- Crenson, M. “Scientific debate on the wane, fight brews over how to address climate change.” *International Herald Tribune*. Available online: <http://www.iht.com/articles/ap/2007/02/23/america/NA-FEA-GEN-Climate-Change-An-Update.php>
- Ford, J., J. MacDonald, B. Smit, and J. Wandel. “Vulnerability to climate change in Igloolik, Nunavut: What we can learn from the past and present.” *Polar Record* vol. 42 (2006): pp. 1-12.
- Ford, J., T. Pearce, B. Smit, J. Wandel, M. Allurut, K. Shappa, H. Ittusujurat, and K. Qrunnut. “Reducing vulnerability to climate change in the Arctic: the case of Nunavut, Canada.” *Arctic* vol. 60 (2007): pp. 150-166.

---

<sup>52</sup> E. Wall and B. Smit, “Climate Change Adaptation in Light of Sustainable Agriculture,” *Journal of Sustainable Agriculture* vol. 27 (2005): pp. 113-123.

- Ford, J., B. Smit, and J. Wandel. "Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada." *Global Environmental Change* vol. 16 (2006): pp. 145-160.
- Ford, J., B. Smit, J. Wandel, H. Ittusarjuat, and K. Qrunnut. "Climate change in the Arctic: Current and future vulnerability in two Inuit communities in Canada." *The Geographical Journal* (in press).
- Fussel, H.M., and R.T.J. Klein. "Climate change vulnerability assessments: An evolution of conceptual thinking." *Climatic Change* vol. 75, no.3 (2006): pp. 301-329.
- Gearhead, S., W. Matumeak, I. Angutikjuaq, J.A. Maslanik, H.J.L. Huntington, D.G.T. Matumeak, and R.G. Barry. "It's not that simple: Comparison of sea ice environments, observed changes, and adaptations in Barrow Alaska, USA, and Clyde River, Nunavut, Canada." *Ambio* vol. 35 (2006): pp. 203-211.
- Hare, W.L. and M. Meinshausen. "How much warming are we committed to and how much can be avoided?" *Climatic Change* vol. 75, no.1-2 (2006): pp. 111-149.
- Huq, S., F. Yamin, A. Rahman, A. Chatterjee, X. Yang, S. Wade, V. Orindi, and J. Chigwada. "Linking climate adaptation and development: A synthesis of six case studies from Asia and Africa." *IDS Bulletin* vol. 36 (2005): pp. 117-122.
- IPCC. *Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, 1995.
- . *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Second Assessment of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, 2001.
- . *Climate Change 2007: The Physical Science Basis. Summary for Policy Makers*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, 2007.
- Kates, R.W., C. Hohenemser, and J.E.X. Kasperson. *Perilous Progress: Managing the Hazards of Technology*. Colorado, 1985.
- Kelly, P.M. and W.N. Adger. "Theory and practice in assessing vulnerability to climate change and facilitating adaptation." *Climate Change* vol. 47 (2000): pp. 325-352.
- Lim, B., E. Spanger-Siegfried, I. Burton, E.L. Malone, and S. Huq. *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies and Measures*. New York: United Nations Development Programme, 2005.
- Lynch, A.H. and Brunner, R.D. "The importance of context in climate change impacts assessment: Lessons from Barrow, Alaska." *Climatic Change* (in press).
- McCarthy, J. and Martello, M.L. "Climate change in the context of multiple stressors and resilience." In *Arctic Climate Impact Assessment*, pp. 880-892. Cambridge: Cambridge University Press, 2005.
- Monbiot, G. *Heat: How to Stop the Planet Burning*. Toronto: Penguin Books, 2006.
- Nicholls, R.J. and R.S.J. Tol. "Impacts and responses to sea-level rise: A global analysis of the SRES scenarios over the 21st Century." *Philosophical Transaction of the Royal Society A – Mathematical, Physical and Engineering Sciences* vol. 361 (2005): pp. 1073-1095.
- Nickels, S., C. Furgal, M. Buell, and H. Moquin. *Unikkaaqatigiit – Putting the Human Face on Climate Change: Perspectives from Inuit in Canada*. Ottawa, 2006.
- Pearce, T., B. Smit, F. Duerden, F. Katayoak, R. Inuktalik, A. Goose, J. Ford, and J. Wandel. "Travel Routes, Harvesting and Climate Change in Ulukhaktok, Canada." Northern Research Forum Open Meeting – The Borderless North, Oulu, Finland and Lulea, Sweden.
- Pielke, R., G. Prins, S. Raynor, and D. Sarewitz. "Climate change 2007: Lifting the taboo on adaptation." *Nature* vol. 445 (2007): pp. 597-598.

- Schipper, E.L. and M. Pelling. "Disaster risk, climate change and international development: scope for, and challenge to, integration." *Disasters* vol. 30 (2006): pp. 19-38.
- Smit, B. and J. Wandel. "Adaptation, adaptive capacity, and vulnerability." *Global Environmental Change* vol. 16 (2006): pp. 282-292.
- Stern, N. *The economics of climate change: The Stern Review*. Cambridge: Cambridge University Press, 2006.
- Tschakert, P. "Views from the vulnerable: Understanding climatic and other stressors in the Sahel." *Global Environmental Change* (in press).
- Turner, B., R.E. Kasperson, P.A. Matson, J. McCarthy, R. Corell, L. Christensen, N. Eckley, J.X. Kasperson, A. Luers, M.L. Martello, C. Polsky, A. Pulsipher, and A. Schiller. "A framework for vulnerability analysis in sustainability science." *Proceedings of the National Academy of Sciences* vol. 100 (2003): pp. 8074-8079.
- UNFCCC. *United Nations Framework Convention on Climate Change - Convention Text*. IUCC: Geneva, 1992.
- . *The Delhi Declaration on Climate Change and Sustainable Development*. IUCC: Geneva, 2002.
- Wall, E. and B. Smit. "Climate Change Adaptation in Light of Sustainable Agriculture." *Journal of Sustainable Agriculture* vol. 27 (2005): pp. 113-123.
- Wigley, T.M.L. "The climate change commitment." *Science* vol. 307 (2005): pp. 1766-1769.