Introduction: Rapid Landscape Change and Human Response in the Arctic and Subarctic

Antony R. Berger and David G. Liverman

Human development has taken place against a variable climatic and geological backdrop, especially over the last 10,000 years (the Holocene). Dramatic shifts in climate and extreme biophysical events have, throughout time, ensured that nature is in flux, not static balance. These can happen not only over the long term, but also on time scales of concern to individuals within their own lifespan, say over a period of 100 years or less. Such "rapid" environmental disturbances to ecosystems and communities include both instantaneous catastrophes (e.g., volcanic eruptions, earthquakes, and floods) and slower-onset, more pervasive changes to the environment, such as climate change.

Sudden, sweeping change may be beneficial to life, with many environments requiring regular disturbance by hurricanes, wildfires, or floods to maintain their ecological biodiversity. There are, of course, also many ways that the natural environment can inflict long-lasting harm on people and ecosystems. Some natural disturbances affect too large an area, act with too excessive an intensity, or simply occur too fast or too frequently to pave the way for environmental opportunism. A continuum of natural disturbance exists and communities and ecosystems cope with this change through migration, mitigation, or adaptation.

Contemporary climatic and environmental change is clearly seen in the far North. Arctic and Subarctic peoples are closely tied to the land, and are now seeing a range of effects on landscapes, ecosystems, and on their traditional way of life. The region may, thus, yield important insights into basic human responses to rapid change, whether climate-induced or not. How did past human communities adapt to an ever-moving natural background and recover from abrupt changes? Are there lessons from the past to aid future adaptation to rapid change? How can we disentangle the

environmental and cultural consequences of natural change from the results of human actions?

These questions were at the core of a two-year international project funded by the International Council of Scientific Unions entitled "Dark Nature - Rapid Natural Change and Human Responses," which held six interdisciplinary meetings in 2004 and 2005. The project helped to refine the record of rapid environmental changes affecting physical environments and ecosystems during the Holocene, and examined how past societies and communities reacted in the face of harmful change. The meetings were held in areas where major natural changes have had profound effects on people and ecosystems in Africa, Asia, Europe, and North and South America.

The fifth Dark Nature conference was held at Yukon College in Whitehorse, Yukon Territory on June 15–17, 2005, under the title "Rapid landscape change and human response in the Arctic and Subarctic." The meeting reviewed research on the effects of Holocene climate and landscape change in the North, and research on the chronology and nature of past environmental events. Participants sought insights from past landscape changes and the ways in which ancient peoples responded that might be useful for today's changing environments. Research presentations contributed to a reconstruction of the history of environmental and cultural transitions and to unravelling the cultural history of major environmental downturns. Of special interest were the contributions by and about Yukon First Nations and other northern Aboriginal peoples, for there is still a need to integrate scientific research with their concerns.

The articles in this issue of the *Northern Review* give but a small sampling of the many topics discussed at the conference. They do, however, illustrate well the inter- and multidisciplinary nature of the meeting and the kinds of disciplines involved in tackling such a complex issue as environmental change and its effects on human history. Abstracts and short summaries of the other papers and posters presented can be found on the conference website (www.taiga.net/rapidchange). A brief summary of these follows.

David Liverman (Geological Survey of Newfoundland & Labrador) reviewed ways to track rapid geological changes in northern landscapes, and Suzanne Leroy (Brunel University, UK, and leader of the Dark Nature project) gave a keynote address on patterns of environmental change and collapse of civilizations. Marianne Douglas (University of Toronto) described rapid warming in the high Arctic over the last 150 years as shown by research on lake sediments. Lesleigh Anderson (University of Massachusetts) outlined a study of high-resolution records of climate variability as shown by lake sediments in the southwest Yukon, and David Fisher (Geological Survey

of Canada) interpreted the results of Mount Logan ice core studies. Chris Burn (University of Ottawa) provided an excellent example of community involvement in research with his project on permafrost changes that is assisted by volunteer monitors in Mayo, Yukon. Two Russian scientists—Marina Liebman and Alexander Kizyakov (Earth Cryosphere Institute, Moscow)—described the relationship between permafrost, landslides, and climate change in the Russian Arctic.

Oleg Raspopov (St. Petersburg) discussed cyclical climate variation on the Eurasian Arctic coast as delineated by 500-year tree ring records. Brian Luckman (University of Western Ontario) reviewed a variety of tree ring studies in the Yukon, demonstrating chronological control and providing insight on rapid landscape changes in the Kluane area. Ryan Danby (University of Alberta) showed clear evidence of recent changes at treeline in Kluane, and Dan Youngblut (Carleton University) examined fire records in the Yukon using tree ring evidence. Suzanne Carrière (Wildlife and Fisheries, Northwest Territories) gave an interesting presentation linking fire history, snowshoe hare populations, and rapid development of defences in birch in Arctic Canada; and Scott Green (University of Northern British Columbia) looked at detailed forest ecology across treelines.

Julie Brigham-Grette (University of Massachusetts) provided a long-term view of climate, sea level changes, and vegetation changes in Beringia, and related this to the history of human occupation in the area. Kevin Edwards (Aberdeen University) examined the Norse settlements in the Faroe Islands, Iceland, and Greenland, applying paleoecological information to give insight into the historical record. Luis Borrero (CONICET, Buenos Aires) talked about paleoecological studies from Patagonia, and suggested that the archaeological record showed a population that was resilient and flexible, surviving climatic shifts with little problem. Greg Hare (Yukon Heritage) described some results from ice-patch work in the Yukon, where careful examination of perennial but now melting ice patches, used by caribou to escape summer heat, revealed a collection of superbly preserved artifacts. He demonstrated a clear cultural change, with the adoption of bow and arrow hunting methods coincident with the fall of the White River ash. This points to a major disruption of society perhaps caused by the effects of volcanic eruption.

Nick Brooks (University of East Anglia) outlined the relationship between risk, hazard, and vulnerability, and commented on the balance between adaptation and mitigation in response to change. Using examples from northern Africa, he demonstrated different means by which past civilizations adapted, as well as the costs associated with adaptation. Wayne

Howell (Glacier Bay National Park) showed how oral history of the Huna Tlingit related to glacier expansion in Glacier Bay, Alaska. Karl Gad and Frank Duerden (Ryerson University) illustrated how newspaper reports could be used to portray a history of hazards, using the Yukon as an example.

The meeting ended with a lively discussion of how to improve communication between scientists, communities, and the media, and how to ensure greater involvement of northern peoples in Arctic research. These and other key points were summarized in a conference statement on rapid landscape change (reproduced below). This was sent to various news media and circulated through the Internet to remind readers of the importance of integrating scientific research with social concerns as climate change becomes ever more evident.

The Whitehorse conference was hosted by the Northern Climate ExChange, which was created in 2000 as an independent source of information and action in response to the awareness that climate change impacts were being felt first and foremost in the North. The conference also received assistance from many local organizations, including the Canadian Climate Impacts and Adaptation Research Network, Yukon College, Yukon Geological Survey, and the Yukon Department of Tourism and Culture. Support for young researchers and foreign participants was provided by the International Council for Science, the International Union of Geological Sciences and the International Union for Quaternary Research, the Canadian International Development Agency, the Association of Universities and Colleges of Canada, and the Canadian Quaternary Association. About one hundred people took part, representing First Nations, Arctic organizations, governments, and universities, and including geographers, earth scientists, ecologists, archaeologists, anthropologists, and environmental philosophers.

The Conference Statement

Rapid Landscape Change and Human Response in the Arctic & Subarctic: A Message from Whitehorse, June 17, 2005

The Arctic and Subarctic are now undergoing disturbing changes to land and sea, ecosystems and people. Coastal erosion, increases in landslides, melting of permafrost and glaciers, changes in sea ice distribution and timing, influx of new species and decrease in others (e.g., caribou, polar bears, seals, birds), and many changes to boreal and tundra flora are commonly reported. Potential damage to towns, roads, and other built structures is now a major concern. Because the Arctic and Subarctic are integral parts of the global earth system, changes in the North are both driven by and have consequences for other regions.

In addition to climatic variations, there are also rapid disturbances associated with forest fires, earthquakes, volcanic eruptions, and other non-climatic "drivers" of environmental change. Sudden and surprising changes will continue to be common. However, in many places, social, economic, and political pressures interact tightly and intricately with natural climatic and non-climatic earth processes, so that they are very difficult to separate. Despite potential benefits, rapid changes on land and sea are typically disruptive and challenge efforts to maintain stability and to achieve a more lasting and equitable society.

Extensive paleoenvironmental and archaeological research shows that there were earlier periods of abrupt climatic and landscape change, which affected trees and plants, animals, and aquatic life, as well as the people who depended upon them for sustenance. Though the current warming is clearly linked to human activity, such as greenhouse gas emissions, this is unlikely to have been so in the case of changes that took place more than 500–1,000 years ago. Many past changes took place on a millennial time scale, but others appear to have been much more rapid, even taking place over a few years: these would certainly have been obvious to local people.

Their own stories and culture indicate that as conditions on land and sea changed, the early peoples of the North adapted their migration and living patterns. Changes in average temperature of a few degrees Celsius or less can be linked to major shifts in hunting modes and to occupation-abandonment cycles. However, northern peoples have maintained cultural continuity and creativity in the face of marked environmental and social change. Indeed, the history of Arctic exploration by Europeans is replete with disasters and tragedies that might have been avoided had local environmental knowledge been taken into account.

While there are obvious difficulties in reading the lessons of the distant past, and in understanding the way early people reacted to environmental stress, we affirm that their story, when better understood, can add insight to the contemporary situation, as climatic and environmental crises loom ahead. How, for example, was cultural and ecological diversity maintained? Traditional ecological knowledge is a different way of knowing, which can contain insights of value for environmental management.

Belief systems and actions, and the way people think about nature are likely to be strongly influenced by their experience with rapid change. There are, for example, northern traditions in which glaciers are held to be living entities and require certain behaviours towards them.

Their contemporary dependence on built structures may have increased the vulnerability of northern peoples to climate change. Elsewhere, huge

cities and fixed international borders may leave modern societies less resilient than ancient ones when faced with certain environmental hazards and risks. Many people persist in living where earthquake, volcano, or flood risks are high; others return to tsunami-ravaged areas rather than seeking safer ground. Developing a capacity to adapt to change is a complex matter, and carries its own risks.

We call upon governments and environmental authorities to ensure that:

- Efforts to monitor and track environmental change, both current and past, are expanded and maintained into the future: sound planning requires accurate and current data from field, laboratory, and modelling studies;
- Those responsible for planning responses to future climate change take into account the effects of past rapid changes on people, settlements, and ecosystems;
- Because Indigenous people maintain close cultural and spiritual ties to the land and depend on it for food and medicine, a better understanding is developed of how northern ecosystems respond to climate and other environmental changes; and
- Decisions and policies recognize that rapid environmental change is part of the natural background—we emphasize that this does not lessen the urgency of dealing with human drivers of harmful change.

We call upon researchers working on environmental issues, past and present, to ensure that:

- A more complete understanding is developed of the ways in which peoples' beliefs and values reflect their experience with landscape and climate change;
- Concepts of uncertainty, vulnerability, risk, and resiliency are discussed more widely in preparing for future changes;
- Ways are found to acknowledge in environmental policies the reality of the "perpetual" disappearance of life, as well as its continual renewal;
- A better understanding is developed about the mechanisms by which a society learns from its experience with past environmental changes and catastrophes;
- Efforts to learn from the lessons of Indigenous Knowledge are strengthened;

- The search is enhanced for the kind of learning needed to adapt and cope with change;
- Efforts are intensified to distinguish the consequences of non-human environmental changes from those resulting from social, economic, and political pressures; and
- Research results are communicated much more effectively to the public and to decision-makers.

We call upon university and research funding agencies to ensure that:

- In coming to terms with rapid landscape changes, interdisciplinary research is strengthened;
- Funding agencies and the academic enterprise increase their support for efforts to link different disciplines, existing knowledge and especially Traditional Knowledge;
- More credit is given to young researchers who work with interdisciplinary teams and publish their work on the Internet and in non-specialist journals and books;
- Efforts are made to strengthen links between researchers and the media; and
- Research which takes place in the North is always carried out with the participation of northerners, with the results communicated fully to them.

Authors

Antony R. Berger is an adjunct professor at the Institute for Environment and Development at the National University of Malaysia, and at Sir Wilfred Grenfell College, Memorial University of Newfoundland and Labrador.

David G. Liverman is Director of the Newfoundland and Labrador Geological Survey, and an adjunct professor in the Department of Geography, Memorial University of Newfoundland.

Notes

1. Two issues of the journal *Quaternary International* published in 2006 (volumes 150 and 151) were devoted to this project.
2. Based on the conference report by D. Liverman and P. Lipovsky published in *Episodes*, December 2005, pp 288–89.