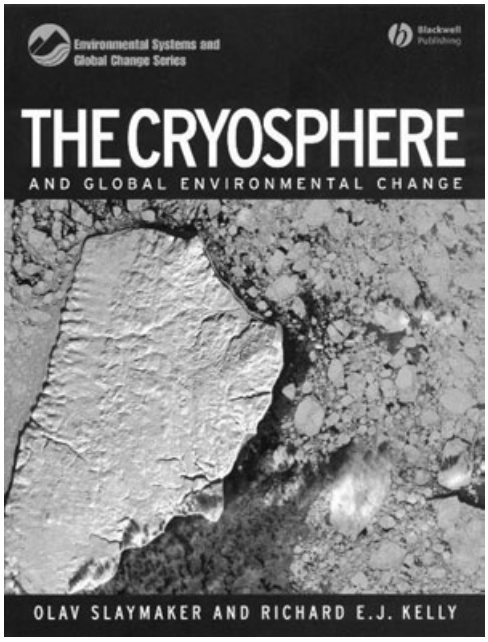
Review of *The cryosphere and global environmental change*, by Olav Slaymaker & Richard E.J. Kelly (2007). Malden, MA: Blackwell Publishing. 261 pp. ISBN 1-4051-2976-X.

There is no shortage of books on climate change. However, despite the work of the Intergovernmental Panel on Climate Change and the Arctic Climate Impact Assessment, we still know surprisingly little about the impact of global environmental change processes (not just climate change) on the broad range of biophysical and sociocultural systems that operate in the cryosphere. This lack of understanding prompts the authors to ask whether the global community cares about the future of the cryosphere, and the people who live within it. Justifying their work by pointing out the interconnectedness of the cryosphere with other components of the Earth, and discussing ongoing policy debates, geographers Olav Slaymaker and Richard Kelly aim to inform international debates on global change, in the broadest sense.

This is the first in a series of books on environmental systems and global change, edited by Professor Anthony Orme, and published by Blackwell. The series arises from the merger of Blackwell's "Environmental Systems" and Pearson's "Understanding Global Environmental Change" series. Intended to be multidisciplinary or interdisciplinary, and to show how environmental systems operate, interact and respond to change over different scales of time and space, the books are also intended to be relevant to international social and environmental challenges. The target audience is advanced undergraduates and graduate students from a wide range of disciplines, but especially physical geography, earth science and environmental science.

This series is timely, in my view. Scholars within the subdiscipline of physical geography have increasingly been expressing their frustration at their isolation from the mainstream of their discipline (e.g. Gregory 2001). Some key concerns have included the lack of theoretical frameworks and irrelevance to the human side of the discipline. However, these concerns certainly do not



apply to this book, which is not only a contribution to our understanding of environmental change in the cryosphere, but is also a step forward in the development and implementation of a much needed new paradigm for physical geography.

Olav Slaymaker, Professor of Geography at the University of British Columbia, made his reputation in mountain geomorphology and hydrology. However, he has also worked with distinction for many years on land use impacts, sustainable development and global environmental change in mountain environments. Co-author Richard Kelly, Associate Professor of Geography at the University of Waterloo in Ontario, is an expert in remote sensing of snow and ice. Together, their backgrounds provide the needed breadth of experience and expertise to write a book of this scope. Taking a comprehensive and integrated view of the cryosphere, Slaymaker and Kelly consider sedimentary, geomorphic and landscape systems of areas affected by ice sheets, sea ice, snow, river and lake ice, glaciers and permafrost. The authors marshal evidence of the processes, timing and causes of change, and invoke theories derived from geomorphology, ecology and social science to interpret those changes in terms

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of what the authors call "cryosphere transience and transitional landscapes". Drivers and resistance to change are examined in an attempt to account for transience of facies, landforms and landscapes.

The book signals a major advance in our thinking on environmental change in the cryosphere, by initiating discussion on theoretical approaches to cryosphere transience. Slaymaker & Kelly's main focus is on Buzz Holling's panarchy theory as a framework for understanding this change (Holling 2001). Originally developed to explain ecosystem response to disturbance, Holling's ideas are applied here in a broader system context. Although panarchy is a complex theory, the essence is that ecosystems go through a series of stages which Holling depicts as a loop. The initial steps in the process involve a dominant species accumulating biomass, capital and wealth. However, if conditions change then there is creative destruction and reorganization in the system backloop. The result is that biomass, capital and wealth is released to create irreversible and often unpredictable change to the system. Holling stresses that system interdependence means that changes in one system will also have implications for adjacent systems, including all biophysical, social and economic systems. Therefore, Slaymaker & Kelly also make connections to geomorphic theory (especially Brunsden 1990), and the work of Jared Diamond (2005).

The models are deployed in a broad conceptual manner. Together with data on Quaternary cryosphere change discussed earlier in the book, Slaymaker & Kelly use the models to suggest that punctuated change is the norm. The models link biological and physical factors with socioeconomic and cultural changes in such a way as to emphasize the two-way causality and interdependence of humankind with its environment. They also face squarely the historical and contemporary evidence that sociological systems collapse: some reorganize themselves creatively whereas others disappear.

If punctuated change is the norm, then the notion of sustainability as stability must be questioned:

> Is it even possible to reconcile the concept of global cryospheric change . . . with the idea of sustainability? The concept of sustainability seems to ignore the phenomena of transience, of transitional states, and the collapse of the cryosphere. (p. 202)

Slaymaker & Kelly conclude with some important questions. Expanding on their question about whether the global community cares about the cryosphere and the people who live within it, the authors ask in the book's conclusion, "how much 'collapse' can be absorbed and how much of the 'transience' can be accommodated to allow an orderly and ethical transition?" (p. 224). Hopefully, answers will be provided for such questions before they become irrelevant.

The book is for the most part well written. With first-rate illustrations and up-to-date references, the initial chapters provide an excellent synthesis of environmental change in the cryosphere. Although I would have liked to have seen a more thorough description and discussion of the theory in the final chapters, the book makes important contributions that deserve to be widely read and discussed.

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References

Brunsden D. 1990. Tablets of stone: toward the ten commandments of geomorphology. *Zeitschrift für Geomorphologie Supplementband 79*, 1–37.

Diamond J. 2005. *Collapse: how societies choose to fail or succeed*. London: Penguin Books.

Gregory K.J. 2001. Changing the nature of physical geography. *Fennia 179*, 9–19.

Holling C.S. 2001. Understanding the complexity of economic, ecological and social systems. *Ecosystems 4*, 390–405.