

## **Darkening Peaks: Glacier Retreat, Science and Society**

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## **Darkening Peaks: Glacier Retreat, Science and Society**

Edited by Ben Orlove, Ellen Weigandt, and Brian Luckman. Berkeley, CA: University of California Press, 2008. viii + 282 pp. US\$ 26.95. ISBN 978-0-520-25305-6.

Glaciated mountains have evoked many responses in the hearts and minds of their human observers. Fear and religious reverence remain today for many, and have been augmented, rather than supplanted by, modern scientific analysis. This book seeks to provide a synthesis of impacts caused by the oft-repeated assertion that glacier retreat is the clearest sign of ongoing global warming, with severe consequences for humans. This is, to my knowledge, the first book with these ambitions, although it does not discuss the large ice sheets with their potentially catastrophic impact on sea levels. Instead, the focus is entirely on the human relationship with glaciated mountains, and the book tackles this very well indeed.

The volume originates in a workshop held in Switzerland in 2004. It is therefore not surprising that Alpine methods and subjects represent about one-third of the chapters. While each and every chapter held new insights for me, I found many of the other subject regions, such as the Andes, to be more interesting, because the cultural and economic relationships between local peoples and glaciated mountains are so diverse there, and more intense than in the developed economies of Europe. However, the European setting is where much of the science of glaciology developed, and that is excellently presented in the book. Despite rather wide geographical coverage, there is a lack of information from the Himalayas or Asia, with only 1 chapter on Nepal and nothing at all from China or Russia, despite the fact that these are countries and regions

in rapid transformation, with glaciers of tremendous local and global significance and where glaciology is an active field of research.

The introductory chapter will be required reading for all of my students, from PhD-level modelers to interdisciplinary Arts majors. It represents a rare example of synthesis between physical science and its cultural impact. The prose here, and in much of the rest of the book, is of considerably higher quality than in many edited volumes of science. I only noticed 1 typographical error in the book (Cotacachi is 4939, not 4039, m high). In their introduction, the editors of the volume illustrate how glaciers form a cultural and literal backdrop, in tourist brochures as well as in the soaring of the human spirit associated with their beauty. And of course they bring forth the corollary, that the disappearance of glaciers—the literal darkening of the peaks—effects a diminution of the human spirit as it recognizes that the (eternally) faded glory will be invisible to future generations. The authors strikingly draw a parallel between glacier retreat and the destruction of the Twin Towers, which caused distress not only because of the loss of life that occurred, but also because of the Twin Towers' prominence in the global perceptions of man's built environment. The authors suggest that the high peaks with their glittering glaciers play a similar role in the natural environment, and that glacier disappearance exerts a similar emotional impact. In fact, I would go further. As shown in the chapter by Rhoades et al on the recent deglaciation of Cotacachi, Ecuador, local people are in denial: they continue to depict the mountain with a snow and glacier mantle, even though they see that it has gone. They perhaps realize that that to remove the shining white covering represents a deep offense against Nature. This manifests itself in the globally widespread disbelief that humans could possibly cause such unprecedented change in the

natural order of things, and a primeval fear that there will surely be a reckoning to come.

The book is divided into 5 sections. Part 1 discusses societal perceptions of glaciers, with chapters on the European Alps, and Switzerland in particular, to the fore. This section reflects historical documented evidence of the impact of glaciers on, and their importance to, the local inhabitants. Haeberli points to the vast evidence now clearly showing that many of the Alpine glaciers are in rapid and, quite likely, terminal decline. Instead of romantic vistas of forested mountain slopes and fertile fields, we will be faced with geomorphologically unstable slopes, as seen after the extreme summer of 2003. Other authors discuss legal and business frameworks for water rights, forestry, spring water, tourism, and risk assessment, with case studies from the USA (Mount Shasta), Mexico, Peru, and North Ossetia.

Scientific observations are treated in Part 2, with the first 3 chapters providing overviews of mass balance measurements based on photographic records and field measurements, and reflecting the curiosity inherent in the development of glaciology from a series of tourist photographs through to the modern science. Corripio et al write about the dry Andes, where more than a million people depend on glacier melt waters for irrigation. The role of penitentes in glacier mass balance regimes, and how they change under climate shifts, is intriguing. Their unusual geometry, resembling tall narrow spires, creates a slow ablation surface; in a warming climate they will migrate upslope, temporarily enhancing summer water supply while being transformed into a simple snow melt surface—until the glacier reserves become exhausted.

Part 3 discusses trends in landscapes, which seems here to mean long-term change in glacier response to climate, illustrated for the Alps, the American Rockies and, most strikingly, Kilimanjaro. This work by

Mölg et al fully encapsulates the spirit of the book's intentions in a single chapter which discusses field campaigns, atmospheric models, and societal impacts. Kilimanjaro is an icon for disappearing mountain glaciers: only 2.6 km<sup>2</sup> remain of the 20 km<sup>2</sup> that existed in 1880. However, it is the moisture fluctuations due to varying El Niño Southern Oscillation or Indian Ocean-atmosphere dynamics, rather than direct warming, that have caused the decline. Glaciers will likely disappear between 2020 and 2050, but seasonal snow will still occur in the wet season. In addition to large-scale circulation patterns, local deforestation is reducing the trapping of fog moisture, thereby reducing runoff for human use as well as starving the glaciers.

Part 4 deals with impacts on human landscapes. Changes in mass tourism in New Zealand—along with

greater hydro-power and reduced electricity consumption in warmer winters—are positive outcomes expected from change. On the negative side, exploitation of mineral wealth from beneath glaciers, or involving their destruction, is typified by plans to move parts of glaciers in Peru to “geomorphologically similar” locations. That this was not done was due not to legislation, but to a dip in gold prices after 2001. However, mobilization of interested groups around the globe seems to have forced change to the idea, which was not re-approved in 2004.

Part 5, entitled “Responses,” deals with the political factors that govern exploitation of glaciers: hydropower in Nepal, international relations in the former Soviet republics in Central Asia, and attempts at social reorganization as a response to glacier flood disasters in Peru provide a

neat illustration of the broad factors spanned by the book.

Glaciers have taught society 2 important lessons: that the Earth is dynamic and ancient; and that the Earth is sensitive and affected by humans. I found a new lesson in this book: the global response to ice-sheet deglaciation and sea-level rise threat mirrors the response of local peoples everywhere when glaciers threaten their livelihoods—response that is both rational and irrational, both farsighted and blinkered.

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