The State Of The Poles: Climate Lessons From The International Polar Year

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Book Reviews

THE STATE OF THE POLES: CLIMATE LESSONS FROM THE INTERNATIONAL POLAR YEAR. By Christian Bjørnœs and Pål Prestrud. Oslo, Norway: Unipub, 2012. 140 pp. $49.00 (softcover). ISBN 978-82-7477-491-9.

The latest International Polar Year (IPY) took place in 2007–2008. Scientists from more than 50 nations participated and results are now being published. However, the wide-ranging nature of the projects means that it can be difficult for the lay person to keep abreast of things. Thus, the appearance of a short monograph that summarizes some of the climate-related research is most welcome. The authors are two Norwegians: Christian Bjørnœs, Senior Information Advisor at the Centre for International Climate and Research, Oslo, has a background in journalism; and Pål Prestrud holds a PhD in biology from Oslo University and was Director of the Centre for International Climate and Environmental Research – Oslo from 2002 to 2012.

After a short introductory chapter, the book consists of eight chapters that focus upon different aspects of the polar environment. Each chapter starts with a summary of the problem followed by a discussion of relevant conclusions published in recent scientific papers. These are mostly from *Science, Nature, Nature Geoscience* and the various AGU journals, such as *Geophysical Research Letters* and *Journal of Geophysical Research*. Each chapter is intended to provide a climate 'lesson' as regards the polar regions and, more generally, to provide background to the current global warming debate.

Chapter two, *Melting Beauty*, deals with arctic sea-ice retreat. Clearly, this is the most obvious and dramatic effect of current global warming. For example, the most recent reports from the National Snow and Ice Data Center (NSIDC) (September 2012) indicate the lowest arctic summer sea-ice cover in a century (~3.4 million km^2). Therefore, this chapter is an important one. It starts by explaining what is meant by the terms ''arctic amplification'' and ''Arctic Oscillation'' and then goes on to explain why, in 2007, 40% more sea ice melted than usual. The chapter refers to 11 papers, many of a modeling nature, that conclude summer sea-ice cover will cease to exist somewhere between 2037 and 2065. Bjørnœs and Prestrud are cautious in drawing any climate lessons; they state that the main reasons why the arctic climate has continued to warm so rapidly since 2007 are a negative Arctic Oscillation, the influx of warmer ocean water, and the ice-albedo feedback mechanism. As regards sea-ice cover, they are uncertain about the relative importance of the mechanisms at play. The probable climate lesson is that our ability to predict the future fate of the arctic sea ice is uncertain. But maybe events are moving just too fast.....?

Chapter three, *Life on the Edge*, is concerned with ice-dependent ecosystems. Here, the authors state, '' Should the winter sea ice start to melt earlier in spring, and the summer sea ice disappear, not only the polar bear but the entire ice-dependent ecosystem which supports it, would be in trouble.'' The chapter begins by discussing the ''arctic bloom,'' or the sudden combination of nutrients and perpetual sunlight in spring as the ice cover disappears. Apparently, primary production in Antarctica is experiencing a temporal shift in space while the arctic bloom is experiencing a shift in timing. In some areas, ocean water is warming and fish from lower latitudes are migrating to higher latitudes. These changes are leading to dietary mismatches. The shrinking sea-ice cover is also critical to the ecology of seals, penguins, and bears; one study suggests that if greenhouse gas emissions continue at the present rate, polar bears in the Beaufort Sea will be in serious decline by 2055 and may completely disappear by 2100. Bjørnœs and Prestrud conclude this chapter by stating that the fate of the polar bear, the apex of the ice-dependent ecosystem, lies in our hands: if the polar bear does not survive, the arctic ecosystem will collapse. But is this a climate lesson or an ecology lesson?

Chapter four, *Corrosive Waters*, deals with ocean acidification. Several IPY-related studies indicate that ocean chemistry may be changing due to the absorption of anthropogenic carbon emissions that lead to a reduction in alkalinity. Nine papers are discussed but they are a mixed bag in terms of supporting the rationale for this chapter. For example, several studies rely upon relatively few samples collected at different places and at various times of the year; Bjørnœs and Prestrud state that ''... this introduces a lot of uncertainties.'' The rest of the chapter talks of buffering capacity and speculates about possible aragonite undersaturation of the Arctic Ocean and what effect acidification will have upon higher levels of polar and subpolar marine life. It also raises the specter that rising temperatures may limit certain species' ability to migrate to less acidic subpolar waters. I am unsure what the climate lesson is; to me, the chapter appears to be a 'straw man,' created by the authors to indulge their obvious marine and biological interests.

Chapter five, *Rising Oceans*, is concerned with the potential rise in sea level that might result from the melt of polar ice sheets and glaciers. According to Bjørnœs and Prestrud, the magnitude of future sea level rise was one of the most important questions addressed during the IPY 2007–2008. Sixteen papers are discussed that mostly document calving glaciers or relate, in general terms, to the possible melt of the Antarctic ice sheet. It appears the reason why ice shelves are breaking apart more frequently may be due to warmer ocean water. This conclusion has special relevance for the West Antarctica Ice Sheet because it is anchored by a marine-based ice shelf. Should this ice shelf melt it could lead to the complete collapse of the ice sheet. However, such collapse is speculation, and the time scale involved is unclear. Several studies estimate future sea level rise by comparing past temperature with past sea level. This approach suggests a rise of 3 °C in air temperature could lead to 90–160 cm of sea level rise by the end of the 21st century; Bjørnœs and Prestrud conclude that these data are ''guestimates.'' Again, the climate lesson is unclear. Perhaps sea level rise due to the melt of ice sheets and glaciers will be gradual and not catastrophic?

Chapter six, *Baked Alaska,* refers to the thawing of permafrost. Over the last 25 years the Circumpolar Active Layer Monitoring

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(CALM) network has collected data on long-term changes in active-layer thickness. Now, increasing attention is being given to the decay of organic matter held within the upper layers of permafrost and the associated release of carbon and methane. For example, the Northern Circumpolar Soil Carbon Database estimates that 1672 billion metric tons of carbon exists in the upper layers of permafrost. This could produce 6000 billion metric tons of CO_2, or twice the amount of CO_2 currently in the atmosphere. In northern Alaska, the expansion of thaw lakes between 1974 and 2000 increased methane emissions, an even more potent greenhouse gas, by 58%. The obvious lesson is that the thaw of near-surface permafrost will be an important accelerator of global warming in the high latitudes.

Chapter seven, *A Hazy Shade of Winter*, discusses the soot, transported into the Arctic, that results from fire in the boreal forests and from industrial pollution in northern Eurasia. Some argue that soot may be the next most important contributor to global warming after CO_2 because it darkens snow and enhances melt. Twelve papers are discussed by Bjørnœs and Prestrud but the results are inconclusive; it appears that arctic soot concentrations in the atmosphere and on the snow peaked in the 1960s. They conclude that the contribution of soot to arctic warming is limited. One wonders why this topic warranted a separate chapter.

The final two chapters are *For Better or for Worse* and *Southern Invasion*. They refer, respectively, to human life in the Arctic (chapter eight) and changes in terrestrial ecosystems (chapter nine). As such, climate lessons are not really applicable. The chapters discuss reindeer herding, fish stocks, transportation issues, the greening of the tundra as seen from space, the northward movement of the tree line, and the life cycles of lemmings and arctic fox.

The text is not without criticism. For example, the criteria for paper selection are unclear and the broader literature that gives appropriate background is sometimes lacking. Some chapters, such as those on sea ice and thawing permafrost, are far more important than others. Some chapters exaggerate the 'lessons' that can be learnt and are overly dramatic as regards possible impacts. The 'Nordic' component of the Arctic is overemphasized at the expense of the North American Arctic. Insufficient attention is paid to Antarctica as regards the global climate system.

Almost certainly, this monograph will have a short shelf life; this is because the text will be quickly overshadowed by newer research. Nevertheless, it throws light on some major climate-related concerns of high latitudes. Those interested in polar regions and global climate change will find this monograph an easy read that is well illustrated with simple and effective diagrams and photographs.

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CIRCUMPOLAR HEALTH ATLAS. By Senior Editor T. Kue Young and Associate Editors Rajiv Rawat, Winfried Dallmann, Susan Chatwood, and Peter Bjerregaard. Toronto, Buffalo, London: University of Toronto Press, 2012. vii, ix + 190 pp., maps, color and black-and-white illustrations, bibliography, credits. $75.00 (hardcover). ISBN 978-1-4426-4456-4.

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The *Circumpolar Health Atlas* is a highly accessible and attractive work. The size and design of the book adds to both its visual appeal and easy access of information. It is approximately 20 cm high by 25 cm wide and is thus easily handled. At only 190 pages, it is not heavy when it comes to weight, but in terms of information it is very solid. Upon opening it, one sees two pages at once, with a useful and eye-catching combination of illustrations and text. The editors claim to have tried to appeal particularly to the non-academic reader. By eliminating footnotes and avoiding jargon it will undoubtedly succeed in this. However, it still manages to be both scholarly and erudite. It is rare that a work can be of use to both the academic and general reader. An example of such a work, complementary to this one, is the ARCTIC HUMAN DEVELOPMENT REPORT (Einarsson et al., 2004), and the ATLAS also falls squarely into this category. In their preface, the editors note that working on the ATLAS has been a ''labour of love.'' This is undoubtedly the key to the fact that they have succeeded in producing a book that, in their words, is (they hope) ''not just a scientific book, but also a work of art!''

Although the book is called a ''Health Atlas,'' it is also a mine of general information concerning the arctic and polar regions. It is divided into five sections plus a useful bibliography and credits. The first section is entitled ''The Circumpolar World'' with four subsections: (1) Introduction; (2) Lands and Seas; (3) Changing Climate; and (4) Plants and Animals. This provides a general overview of the geography of the Arctic. The second section concerns ''Circumpolar Peoples'' with chapters on: (1) Cultures and Language; (2) Origins and Prehistory; (3) History and Politics; (4) Population and Settlements; and (5) Society and Economy. This focuses on the human dimension—the cultures and languages of the people who inhabit the circumpolar Arctic, as well as their social and economic conditions. The third through fifth sections address the main focus of the book. Section three is on ''Health Status'' and has chapters on specific diseases and their context. These are: (1) General Health; (2) Children and Youth; (3) Reproductive Health; (4) Infectious Diseases; (5) Cancer; (6) Cardiovascular Diseases; (7) Diabetes and Obesity; (8) Injuries and Violence; and (9) Mental Health and Suicide. Section four is on ''Health Determinants'' and considers: (1) General Susceptibility; (2) Cold and Dark; (3) Living Conditions; (4) Environmental Quality; (5) Nutrition and Physical Activity; and (6) Smoking, Alcohol, and Substance Use. The fifth and final section, ''Health Systems,'' considers: (1) Governance and Organization; (2) Financing and Expenditure; (3) Programs and Services; and (4) Education and Research.

The aim and focus of the book is stated clearly and concisely on the first page of the introduction: ''This is an atlas about the health of the diverse populations who inhabit the circumpolar regions in the northern hemisphere. As an atlas, it uses maps, charts, tables, and images to describe and explain visually the major health patterns and related issues'' (p. 2). On this page also, a number of