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Book Reviews

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Life at the limits - organisms in extreme environments

by *David A. Wharton*
Cambridge University Press, Cambridge. (2002)
ISBN 0 521 782120. 307 pages. £18.95/ US$25

"We are fascinated by the seemingly impossible places in which organisms can live." So starts the introductory text of the flysheet of this wide-ranging book. But just how much do we know about where these places are, what conditions are faced by the organisms living in them, and how they do it? – these are questions that can be fairly asked not only by the "educated amateur" natural historian or the developing student, but also the disciplinary specialist. Herein lies both the strength and the potential vulnerability of this book. David Wharton has set out with the ambitious and important aim of bringing what might be thought of as a series of specialist fields – the biology found under a surprisingly wide range of different extreme conditions – to a wider readership, while including sufficient attention to detail to satisfy the "expert".

The book is divided into eight chapters, all deliberately written in an easily accessible style. This avoids the danger of the volume being seen as a daunting or dry textbook, and also manages to avoid the risk of "dumbing down" by the inclusion of a useful glossary and an up to date (to 2000) chapter by chapter bibliography, which is sufficiently wide ranging to direct the interested reader to a range of key scientific references. One slight niggle for me is that the chapter titles, in trying to be catchy, do not all give a clear idea of content.

Even the question of "what is extreme?" is not as simple as it seems. Chapter 1 gives a very useful overview of how to look at extremes in the context of biology, and introduces the reader to the range of extremes that biota may face, as well covering some necessary physical and biological groundwork. This is followed in Chapter 2 with a whistle-stop tour of the range of extreme environments found on this planet. The next four chapters cover how organisms cope with the main physical stresses that they face. Desiccation, heat and cold get a chapter each and are covered comprehensively. In part, these chapters cover taxa and subjects close to Wharton's own expertise in the physiology of cold and desiccation tolerance in nematodes and arthropods, but they succeed in their aim of giving a more general treatment, with pertinent examples explored from microbes to plants and vertebrates. These chapters alone could provide the key basis for much undergraduate teaching of stress ecophysiology.

The fourth "stress" chapter (Chapter 6) is rather less successful. On the plus side it includes material on subjects as wide ranging as pressure, radiation and toxins while, on the minus side, covering each in a rather brief and superficial manner. Chapter 7 moves into more speculative realms, starting with a consideration of the nature and evolution of life, before moving on to discuss the subject of extraterrestrial life. While clearly relevant to the subject of extreme biology, this discussion is, inevitably, largely speculative and lacks the rigour of earlier chapters. Nevertheless, it will interest the wider reader. The final chapter returns to firmer ground, synthesising information given in the earlier chapters to create a coherent "extreme biology", encompassing environments, organisms, physiology, ecology and evolution. In many cases, this synthesis emphasises the common features shared in the biological responses to a range of stresses. The discussion also returns to the basic problem of defining what is extreme, highlighting the potential for circularity in many such definitions.

Overall, this book is an interesting and entertaining read. The emphasis on bringing together information across a wide range of environmental stresses and taxonomic groups gives a welcome addition to the literature available to students of extreme biology.

PETER CONVEY

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Geoecology of Antarctic ice-free coastal landscapes

Edited by L. Beyer & M. Bölter
Ecological Studies 154, Springer, Berlin (2002)
ISBN 3 540 42268 4. 427 pages. £76.50/ US$129.

As used in the title, "geoecology" indicates a primary focus on soils and soil-forming processes. Scales of interest are broad, ranging from microbes within soils to vegetation on the soil surface and influences of the surrounding environment on soil formation. Although aspects of human impact are covered this is not a major part of the book.

A primary theme is comparison between coastal locations in maritime and continental Antarctica. The former is exemplified by Admiralty Bay region of King George Island (KGI) and the latter by ice-free areas in the vicinity of Ongul Islands, Dronning Maude Land (OI) and Windmill Islands, Wilkes Land (WI). However, there is relatively slight discussion of OI and emphasis is on KGI.

Part I provides five introductory chapters which place these locations in context and describe the environment at each. Part II, entitled "Soils, soil development and soil properties", starts with an overview of recent glacial retreat

in Admiralty Bay. This is followed by three chapters which provide detailed data comparing soils of KGI and WI. Physico-chemical properties, soil classification, weathering processes and features of refractory organic matter are all covered. Sparser data on soils of OI are provided in an earlier introductory chapter. The section closes with discussion of ornithogenic soils on KGI.

Part III, "Soil microbes, plants and soil fauna", presents a somewhat eclectic collection of chapters. A comparison of heterotrophic microbial biomass and activity in soils of KGI and WI is followed by three chapters which describe plant communities at all three ice-free areas. The description of vegetation at KGI provides details of species composition of communities. A more general review of WI vegetation includes aspects of ecophysiology and human impact. The chapter on Dronning Maud Land partly strays away from the coast and into inland mountain ranges. It is the only one to give more than passing mention to microalgae. The section finishes with a general review of soil fauna which chooses mites and collembola as its focus.

The final section, Part IV, "Integrating aspects for soil ecology in Antarctic coastal landscapes" is similarly diverse in content. Two chapters relate edaphic factors to heterotrophic microbial activity and vegetation occurrence at KGI and WI. Much broader is the discussion of a classification of terrestrial algal communities which extends from dry desert environments to temporary water bodies. The book's longest chapter is a stimulating discussion of Antarctic vascular plants, bryophytes and lichens. Distribution, dispersal and physiology are themes, together with an emphasis on contributions these organisms make to soil processes. This section finishes with a brief account of human influences on coastal regions.

Some chapters note gaps in knowledge and suggest further research. However, these points can be difficult to find and it would have been good to have seen them brought together in the concluding chapter.

Most chapters end with extensive bibliographies in which the large majority of references span the period 1990-2001. Thorough subject, taxonomic and geographical indexes aid the search for specific information.

In some places I found the language rather difficult. There is some repetition, for instance in several descriptions of the distribution pattern of vascular plants. Typographical errors are few, but my favourite is reference to "inhibited (sic) nests of penguins".

Overall this is a valiant effort in comparing three regions not covered in earlier books. Production of a coherent account from contributions of 25 authors must have been difficult. As the editors state, the task of comparison has been hampered by a lack of similarity in research interests and methods. However, the advantage of application of standard methodology is exemplified by the detailed comparison of the composition and ecology of soils of KGI and WI. May be future research under the umbrellas of the Regional Sensitivity to Climate Change in Antarctic Terrestrial Ecosystems (RiSCC) programme and the Latitudinal Gradient Programme (LGP) will achieve a greater level of valuable standardisation whilst also allowing free rein to individual creativity.

This volume should be an essential addition to any Antarctic science library. Certain chapters would be of great interest to specialists whilst, for an excellent overview, I would point post-graduate students to the integrating review chapter on plants. The book is a step along the way towards a thorough comparison of soil processes and terrestrial biota in contrasting regions. At a time of potentially large environmental change the need for us to continue to improve our knowledge in this regard has never been greater.

PAUL BROADY

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Science into policy: global lessons from Antarctica

by *P.A.Berkman*
Academic Press, New York & London (2002)
ISBN 0 12 091560 X 252 pages + CD-ROM. US$59.95.

This is a singular book in several ways. Firstly, it is the first undergraduate textbook that is focussed solely on the Antarctic. Secondly, it is the first time I have seen such extensive inter-weaving of science and policy in any Antarctic volume. Thirdly, it contains a CD-ROM with all the Treaty documents from 1959–99, something that has been needed for years. And fourthly, it is suffused throughout with the author's own philosophical approach to science, which encompasses the beauty of the polar world, the need for its rational use and conservation and the way that the Antarctic experience can offer an exemplar for the future.

The author has had considerable first hand experience of Antarctic field work and has been teaching a course on Antarctic Marine Ecology and Policy since 1982. The book, an outcome of the development of the course and his increasing interest in the interaction between science and the Antarctic Treaty System, is divided into five parts comprising 12 chapters. The title of each part conveys immediately the unusual flavour of the approach - Earth System Science: Sense of Wonder, Progress of All Mankind: International Policy, Our Dynamic Planet: Interdisciplinary Science, Sustainable Resource Use: Resource Economics, and Our Global Commons: Precedent for Humanity. There is a Foreword by Robert Rutford and a Preface by the author which attempts to explain the reason for the structure of the book and provides guidance on how to use the enclosed CD-ROM which contains the Antarctic Treaty searchable database which he developed.

Each part has an introductory few pages explaining the general theme and each chapter has a chapeau of a pertinent piece of poetry or prose - from Goethe to Star Trek! I liked this feature, too rarely seen in science books. In each chapter he identifies what he calls "thought questions" for the reader or student to use as a basis for discussion or further enquiry.

In a book as detailed and wide ranging as this attempts to be it would be amazing if a reviewer could not find things to comment on. I found quite a few, some of which could have been caught by more careful checking of sources or copy editing. Some examples: Fig.3.4 has South Georgia Island marked; why are the US sealers not specifically mentioned for their role on p.43; on p.46 the Falklands war had nothing to do with the Antarctic claim by Argentina which is based on a different premise; on p.48 how could Wilkes have realised that krill was the principal food for penguins and seals without sampling the stomachs of all the species; it seems strange on p.55 to completely ignore the scientific achievements of the Trans-Antarctic Expedition; on p.56 the origin of SCAR is not quite correct as it was established by ICSU as the Special Committee on Antarctic Research in September 1957; the description of the origins of CCAS and CCAMLR on p.70 is less than illuminating; why is there no mention of the IPCC interest in the stability of the West Antarctic Ice Sheet on p.101 and what about the controversy over "sudden threshold changes"; I would disagree on p.153 that the *Bahia Paraiso* oil spill caused the Treaty Parties to abandon CRAMRA; sealing on South Georgia did not collapse in 1964 (p.159) it simply ceased as it was not profitable except as an adjunct to whaling; an omission on p.166 is any mention of the successful measures introduced by CCAMLR to reduce longline mortality of birds; the change in lake nutrients attributed to fur seals on p.171 should refer to Signy Island not South Georgia as should the damage to moss banks; on p.175 the Seals Convention (CCAS) was developed by the Parties as a pre-emptive response to what was believed to be the likelihood of commercial sealing beginning in the Antarctic and was not directly related to the national seal management practised on South Georgia.

From a list such as this it sounds as though the book is terrible, but that is far from the truth. The author has gone to great lengths to make the text accessible to students and provides, in many of his tables and figures, unusual compilations or syntheses; for example Table 12.1 listing international ecosystem and environmental treaties and conventions. And many of his key questions, for example "How do we balance economic, governmental and scientific perspectives in managing resources for the common good?", are global in their focus and of continuing importance.

Paul Berkman has provided a fascinating blend of science, philosophy and law in this unusual volume. It has the potential to provide a wide range of students with some exciting material, and hopefully to help motivate some young people into taking up the challenge of Antarctic research. If you teach Antarctic science this book will be very helpful!

D.W.H.WALTON

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Protecting the Polar Marine Environment - Law and Policy for Pollution Prevention,

Davor Vidas (ed.)
Cambridge University Press, Cambridge (2000).
ISBN 0 521 66311 3. 275 pages. £45/ US$69.95.

This book is the outcome of a research project carried out by a group of distinguished scholars of international law and politics with particular expertise in Arctic and Antarctic issues. Although the contributors are mainly lawyers and political scientists, and the content of the book largely concerns the legal instruments dealing with the protection of the Arctic and Antarctic environment, this book also deserves the attention of researchers that work in other scientific fields. In fact, the analysis of law and, especially, of international law appears to be only a means to reach the objective of the identification of the best instrument to preserve the environment within ice-covered areas. In order to identify such instrument, lawyers need to follow the suggestions of scientists with regard to the peculiar characteristics of the polar regions, the most frequent risks of damage that can affect such regions, and the most effective manner to prevent or repair such damage. Without this information no legal instrument, no matter if international or domestic, can provide an effective protection to the polar environment.

The three main issues in this book are the polar regions, the marine environment and the existing legal regimes dealing with the protection of such environment.

The book is divided in two parts. The first part considers the level of regulation for the protection of the polar environment. The second part provides some examples of legal regimes aimed at fighting specific sources of polar pollution. The linkage between the two parts of the book appears sometimes tenuous. The examples provided by the second part do not completely take into account the theoretical legal problems raised in the first part. This is certainly due to the scarce national and international practice in this field.

The main aim of the first part of the book is to ascertain the applicability of international and domestic norms to the Arctic and the Antarctic and their effectiveness. This part is, therefore, particularly interesting for lawyers who are engaged in the study of the effectiveness of treaty regimes both within the international and national legal orders. The seven chapters analyse all the three above mentioned issues

(the poles, the sea, and their regulation), focussing on the different levels of regulation of the protection of the marine environment within the two polar areas. Particular importance is given to the comparison between instruments of global and regional character by highlighting mutual interferences and overlaps.

A description of the concept of the polar regions is provided by Boyle in Chapter 1. His conclusion is that the delimitation of a region is mainly political rather than on geographic grounds. Although the identification of a geographic area must exist in order to give rise to cooperation between the States interested in such area, the extent of cooperation (that is the number of States involved) and, thus, the extent of the area to which a regime is applicable depends on the political will of individual governments. Such conclusion is indisputable. Moreover, the importance of political choices for the management of the polar regions is also shown by the fact that international norms of global nature (that, in principle, should be applicable in any area of our planet) sometimes cannot be applied to a region due to its peculiar political status. In Chapter 2 Vukas indicates that only the general principles included in the UN Convention on the Law of the Sea can be applied to Antarctica. In fact, the lack of recognised sovereign rights of Claimant States over Antarctic territories prevents the application of the majority of the provisions of the UN Convention, which are based on the criterion of State sovereignty. In the same way, notwithstanding the similarities between the Arctic and the Antarctic that are highlighted by Vidas in the introductory chapter of this book, the possibility of unifying the regulation of the protection of the marine environment within the two polar areas is made difficult by the contrary views of States concerned. For example, States party to the Antarctic Treaty have refused to establish a single Polar Code regulating the navigation in the two polar seas, (see Brigham Chapter 11).

The prevalence of the political will of national governments makes the role of scientists very important in the improvement of the protection of the polar regions. Only scientists, who carry out their research without regard to national flags and borders, can compel governments to make decisions aimed at achieving the conservation of the environment for the benefit of the international community rather than the selfish State advantage.

Chapters 3, 4, and 5 of the first part of the book analyse some specific international instruments dealing with the protection of the marine environment at the global and regional level. However, the peculiarities of the polar areas prevents the direct applicability of such instruments to these areas. The protection of the polar marine environment requires specific information about the causes and the consequences of the damage to such environment that only scientists can provide. For instance, it is necessary to know the current status of the polar environment (See Vidas Chapter 4) and what response to emergencies is required in order to prepare the appropriate contingency plans which are required by some international treaties such as, for instance, the 1990 Oil Pollution Preparedness, Response and Cooperation Convention (For this view, see Rothwell at Chapter 3).

Therefore, international cooperation, not only between governmental authorities, but also between scientists, seems to be the best means to achieve a satisfactory level of protection of both the Arctic and Antarctic environment, a conclusion also reached by Joyner, Chapter 5.

Cooperation seems to be especially important when one takes into account sub-regional and domestic legislation. Chapters 6 and 7, by Stokke and Rothwell-Joyner, respectively, deal with the issues of the protection of the environment within the Barents Sea and of the Australian, Canadian, and US legislation on polar matters.

The second part of this book analyses some important sources of pollution for the Arctic environment such as land-based sources, radioactive waste, and navigation.

Chapter 8 (by VanderZwaag), on the prevention of pollution from land-based sources, highlights three main problems affecting the protection of the Arctic environment. First, international conventions of global nature, which can be applied to prevent this type of pollution, have too general provisions. Thus, they cannot be effective in resolving this problem unless their content is specified by legal interpretation and scientific information. In particular, the author analyses the "precautionary principle" the content of which is still unclear. Under Principle 15 of the Rio Declaration on Environment and Development (which describes the precautionary principle) States cannot justify their omission in the adoption of cost-effective measures aimed at preventing environmental damage by reason of the lack of scientific certainty. It appears clear that only scientific expertise can clarify when scientific certainty exists and what measures are cost-effective for the prevention of environmental damage. The second difficulty on land-based pollution is the fact that, although political cooperation is very active at the regional level, it has not yet led to the creation of a international regime for the Arctic comparable to the Antarctic Treaty system. Thus, strictly speaking, Arctic States are not bound by any common regional rule regarding the prevention of land-based pollution. Finally, the too general content of global international provisions and the lack of regional norms raise a further impediment to the effective protection of the Arctic environment because States are free to decide whether and to what extent to ensure environmental protection. This is another case where political choices can prevail over the safeguard of fundamental interests such as the protection of the environment. It appears clear that only the pressure of scientists over their national governments can attract the attention of Arctic States on the prevention of land-based pollution.

Chapter 9 (by Stokke) examines the issue of radioactive

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waste management in order to ascertain how effectively States apply international norms. This chapter shows the difficulty of implementing international norms (in this case the London Dumping Convention) when State internal political authorities (i.e. Russian Ministries) do not find it convenient to comply with international standards. This chapter points out that international instruments can still provide an input in order to make national legislation most responsive to the safeguard of common interests such as the protection of the environment. When there is internal political disagreement, national legislation can be improved through a step-by-step process rather than by the immediate implementation of all international obligations. In fact, the unavoidable need to comply with some treaty obligations, such as that imposing the creation of national organs of control, can compel States to conciliate the opposite views of the newly created organs, which are environmentally concerned, with the attitude of the pre-existing national authorities that have little interest in environmental protection.

Chapter 10 (by Brubaker) concerning the prevention of pollution from navigation through the Northern Sea Route provides some examples of national legislation from Canada, Russia and USA that are more stringent than international norms. Although State legislative acts, which limit the freedoms established by international law, should be considered contrary to it, the acquiescence of third States to these national acts make the author think that new customary law arose within this Arctic area, and this differs both from the provisions of the UN Law of the Sea Convention and international customary law of a global nature.

These three chapters show the lack of uniformity of national and international regulation in the Arctic. This problem should be resolved, to some extent, by the Polar Code that the IMO is preparing. The draft Code is examined by Brigham in Chapter 11. However, this instrument has not yet been approved by the States concerned, some Antarctic Treaty States have refused to extend it to the Treaty area.

In sum, all the chapters of this book highlight the importance of cooperation between States in order to allow the best protection of the polar marine environment at the international (global and regional) and national levels.

The book shows that States have chosen different ways to achieve such cooperation in the Arctic and in the Antarctic. The protection of the Arctic environment is regulated by international non-binding instruments which call for the coordination of States' legislation. Conversely, States party to the Antarctic Treaty have established a proper international regime where State cooperation and the adoption of international legislation are the distinguishing features.

The differences between the Arctic and the Antarctic do not only concern the binding or non-binding character of the relevant norms. The differences are also the result of a political choice of the States involved. The refusal by the Antarctic Treaty Consultative Parties to apply the Polar Code to Antarctica is proof of such choice. However, if the similarities of the two polar areas are not taken into account at the political level, they can still be highlighted by the advice of scientists to their national governments in order to achieve the best protection of iboth polar areas. In the same way, the advice of scientists can help harmonise international, regional, and national legislation dealing with the protection of the Arctic and Antarctic environment making such legislative acts more environmentally concerned.

One of the tasks of scientists is to make people aware of the importance of the protection of the environment and conscious of the existing risks that can affect it. As this book demonstrates, the existence of such awareness plays a role in the recognition of the effectiveness of a legal regime. Effectiveness, in fact, cannot be ascertained only on legal bases, such as the extent of application of a regime. For example, global instruments concerning the protection of marine environment have a wide range of application, but seem inadequate in dealing with the peculiar problems of the polar regions. Conversely, the specific content of the norms of regional acts and national legislation regulating the management of the polar areas does not make such norms completely effective due to the difficulty of applying them to third States. Thus, the effectiveness of a legal regime, no matter if international or national, concerning the protection of the polar marine environment, must be evaluated in light of its concrete operation, considering the capacity of such regime of protecting the interests to which scientists have drawn the attention of the international community.

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