
BOOK REVIEWS

New Books Received

Biogeochemistry: An Analysis of Global Change—*W.H. Schlesinger*. Academic Press, San Diego, CA. 1997. \$49.95. ISBN 0-12625-155-X.

Bioremediation: Principles and Applications—*Edited by R.L. Crawford and D.L. Crawford*. Cambridge Univ. Press, New York. 1996. \$100.00. ISBN 0-52147-041-2.

Biotechnology: Building on Farmers' Knowledge—*Edited by J. Bunders, B. Haverkort, and W. Hiemstra*. MacMillan Education Ltd, London. 1996. ISBN 0-33367-082-5.

Environmental Statutes, 1997 Edition—Government Institutes, Rockville, MD. 1997. ISBN 0-86587-562-6.

Experiments in Ecology: Their Logical Design and Interpretation Using Analysis of Variance—*A.J. Underwood*. Cambridge Univ. Press, New York. 1997. \$34.95. ISBN 0-52155-696-1.

Foodplain Management: Ecologic and Economic Perspectives—*N.S. Philippi*. Academic Press, San Diego, CA. 1996. \$69.95. ISBN 0-12554-010-8.

Geochemical Processes, Weathering and Groundwater Recharge in Catchments—*Edited by O.M. Saether and P. deCaritat*. A.A. Balkema Publishers, Brookfield, VT. 1997. \$75.00. ISBN 9-05410-641.

Glossary of Soil Science Terms, Revised Edition—Soil Science Society of America, Madison, WI. 1997. \$5.00. ISBN 0-89118-827-4.

Green Backlash: The History and Politics of Environmental Opposition in the U.S.—*J.V. Switzer*. Lynn Rienner Publ., Boulder, CO. 1997. \$21.00. ISBN 1-55587-635-8.

Inorganic Chemistry: An Industrial and Environmental Perspective—*T.W. Swaddle*. Academic Press, San Diego, CA. 1997. \$65.00. ISBN 0-12678-550-3.

National Parks: The American Experience, Third Edition—*A. Runte*. Univ. of Nebraska Press, Lincoln, NE. 1997. \$16.00. ISBN 0-80328-963-4.

Technological Trajectories and the Human Environment—*Edited by J.H. Ausubel and H.D. Langford*. National Academy Press, Washington, DC. 1997. \$42.95. ISBN 0-30905-133-9.

Vertisols and Technologies for Their Management—*Edited by N. Ahmad and A. Mermut*. Elsevier Science, Amsterdam, the Netherlands. 1996. \$495.00. ISBN 0-44488-789-X.

Biospheric Feedbacks in the Global Climate System

Edited by G.M. Woodwell and F.T. Mackenzie, Oxford University Press, 200 Madison Avenue, New York, NY 10016. 1995. 416 p.

“The balance of evidence suggests a discernible human influence on global climate.” This is a quote from the recently published *Second Assessment Report of the Intergovernmental Panel of Climate Change (IPCC)*, which even made it into the headlines. The IPCC report is currently the most comprehensive and up-to-date assessment available of climate change and its consequences, and the sheer mass of its three volumes with 572, 878, and 448 pages, respectively, is a bit overwhelming. Thus, what is the role of yet another book on the topic of climatic change?

Biospheric Feedbacks in the Global Climate System goes back to a workshop attended by invited experts from many disciplines, held in October 1992 in Woodshole. It was endorsed by IPCC, but received no formal IPCC approval. Apart from some commonality in topic, that's about the only tie or similarity the workshop's outcome has with the IPCC report. The book has been carefully edited by George Woodwell and Fred Mackenzie over the course of several years. It attempts to bring together outspoken voices from leading individual scientists—not the conservatively balanced synopsis IPCC has to struggle for and does indeed offer. Since the book covers in comparison a relatively narrow topic, it can thus give individual scientists a forum to express their own, personal views. This may take place regardless of contrasts or inconsistencies in-between single contributions. The visibly elaborate editing

also sets this book considerably above any ordinary proceedings I have seen so far.

The topic of biospheric feedbacks to the global climate system is a well picked one, since it is particularly important and deserves attention for many reasons. For one, it encompasses an intensely disputed issue: What is the net effect of the CO₂-fertilization on a global scale? For another, it is at the heart of some of the most crucial challenges currently facing the science of climate change, since it hampers critically our ability to project consequences of climate change on an adequate time-scale. General Circulation Models (GCMs) are considered to be an indispensable tool to probe the future of the globe's atmosphere (e.g., Houghton et al., 1996). But their capabilities to reach far enough into the future, I mean beyond a 2 × CO₂ world, are not only limited because of their intrinsic, physical difficulties or limited computer sources alone, but also because biospheric components threaten to blur the view too soon. And given the big likelihood that the middle of next century will actually experience a 2 × CO₂ atmosphere, the future beyond may be much more at stake than the United Nations Climate Convention would want it to be true (see also Kauppi, 1995). The challenge is to integrate scientific efforts from the physical as well as the life sciences, a task yet to be accomplished, and, I believe, IGBP has at best just started to really embark on it.

With a few notable exceptions, the book contains mostly review articles. Each addresses a particular topic and gives a state-of-the-art summary of the most important findings from the point-of-view of the authors. The articles have been grouped by the editors into four book parts: The first, "Global Warming: Perspectives from Land and Sea," gives a partly colorful introductory, overall picture of the main issues. The second, "Biotic Processes and Potential Feedbacks," has three subsections focusing on "Plants and Plant Communities," "Soils," and "Oceans and Estuaries." The third concentrates on "Global Carbon Budgets, Models, and Geophysical Constraints." The fourth, "Biotic Feedbacks in the Global Climatic System," is an attempt to sum up and assess net results from all what has been said before. The editors introduce each subsection with comments.

In the first and biggest part of the book, the first subsection "Plants and Plant Communities," gives voice to plant ecophysiologicals, reviewing experimental evidence from CO₂-enrichment studies, intriguing mathematical approaches to assess the maximum potential of a CO₂-fertilization effect (sticking out of the crowd because not just an ordinary review article), the missing evidence from tree-rings, the role of disturbances and lessons from a past Eurasia, the last interglacial 125 000 years B.P. (≈+2°C above current mean temperatures) and the Holocene optimum 5500 years B.P. (≈+1°C) used as analogues for future climatic changes and interestingly held up against the patterns of GCM based scenarios. The second subsection on "Soils" gives adequate space to this often neglected aspect. It discusses the capacity of soils to hold on their vast amounts of carbon currently stored in them, at least about twice as much as the atmosphere presently contains. It inspects what a warmer and wetter world might imply for soil respiration, not only from the perspective, that soils currently store a lot of carbon, but also from that of time scales, soils operating on a particularly delayed one. Evidence for the potential role of peatlands with their deep layers of organic material and methane trapped in soils and as gas hydrates in sedimentary rocks are reviewed and assessments, with somewhat big surprises potentially lurking, made as well. Finally, the close ties between N and C are reviewed, important since N depositions affect now many ecosystems significantly and increasingly via emissions from heavily industrialized areas. The third subsec-

tion on "oceans and estuaries" gives this small, thus often overlooked, but highly productive area a platform.

The second part of the book is subdivided into two subsections: "Terrestrial and Oceanic Interactions" and "Modeling the Carbon Sink." The first subsection features somewhat widely differing approaches, like using forest models or a phytogeographic model to assess C exchange between atmosphere and terrestrial biosphere and C pools in vegetation. This somewhat contrasts with attempts to detect CO₂-climate feedbacks via global C cycle models and atmospheric measurements. In this subsection the link to terrestrial and oceanic interactions are not always that obvious. The fact that about 20% of the carbon additionally injected every year by human activities into the air disappears from the atmosphere into an unknown sink, has been nicknamed the *missing sink*. This problem has plagued scientists for the last two decades, without evidence convincingly balancing the atmosphere's C budget. Only quite recently some scientists put forward full arguments, where the carbon goes, i.e., to the northern latitudes, and by what mechanism it is sucked up (here opinions sharply deviate, nevertheless, in this book claims are made to be able to explain it all). Effects of land use change, of flux budgets on storage and the role of perturbations are explained in a detailed manner, using mostly models and comparing measurements with in-depth model results analysis.

The third part offers attempts to integrate interactions between atmosphere and the terrestrial biosphere in models. The first subsection attempts to address terrestrial and oceanic interactions, but falls short to really integrate these issues, albeit the individual articles are mostly excellent. The second subsection offers most interesting efforts to quantify and model the missing sink.

The last part finally puts forward some research recommendations and makes an attempt to conclude whether the net effects of biospheric feedbacks will exacerbate global warming or slow it down. It is worth noting that the majority of the articles are kept refreshingly short and concise.

As you can see, somewhat arbitrarily selections had to be and have been made. But they were done in a considerate, careful way, demonstrating a genuine concern for preserving a balanced palette. Reasons and justifications for the particular choices made form part of the editorial comments heading subsections. Albeit, having personally suffered the exorbitant (sometimes exhaustive), presifting effect of IPCC's review processes in a first-hand experience, I'm certain, these choices wouldn't have survived that selection process. Fortunately so, because the result is a book, which contains a colorful, inspiring variety fully preserving contrasts among experts. Perhaps most importantly, the book manages to bring forward the arguments, why many scientists so dearly hold on to their conclusions. Despite all possible arguments which may be put forward against the choices made, what certainly can't be held against the editors, is their obvious and sincere concern for the globe's future, which appears to be behind some of the not always completely impartial selections.

Throughout the book errors have survived into print. For instance, many figures are of a rather poor quality and their caption texts are sometimes hard to decipher. To give an example: The caption of Fig. 5.1 mentions temperature records, but they can't be identified, since the legend fails to explain what the curves stand for; they could as well be the missing temperature record or a moving average of tree ring indices. Neither is explained what unit indices are given in, which might be obvious for the tree ring experts, but not for the general reader this book has been written for. This is also true for several table captions, like Table 4.3, where bad typesetting got footnote marks merged into formulas, making

the symbols even harder to read than they already are throughout the entire article. Similarly, some equations are simply wrong, e.g., 4.3, fortunately without affecting content, since errors are later corrected. Other examples are wrong figures, like an outrageously big, annual carbon accumulation rate of 0.04×10^{15} Pg/year (p. 160) or a wrong chemical formula for acrylic acid (p. 253). Of course, it is noticeable, that the editors were focusing their attention on content, not form, but readers would appreciate easier reading and a final technical editing round would have helped a great deal to digest the important contents better. I think the topic would have deserved it.

All in all the book is neither lopsided nor hype. I can warmly recommend it to any reader interested in the topic. Some texts are even entertainingly funny; for instance when in one sweeping statement mooses are mentioned together with hippopotamuses having an effect on the global carbon balance because of being attracted by aquatic plants (p. 199). Does the book answer the question is raises, "Will the warming feed the warming?" I don't think so. I hear the argument, but believing is an all different matter. But I wouldn't have expected it anyway; there is still too much research to be done before this question can be adequately answered. The big merit of this book is the forum it gives the controversially disputed topic of biospheric feedbacks. It is a good way to learn from many involved experts, what the scientific debate is all about. If you wish to learn about the origins and the diversity of the arguments in this controversy, read this book. If you wish to learn how to balance these views and what an overall assessment might look like, read the IPCC report. It's your choice; fortunately, we have it now.—ANDREAS FISCHLIN, *Institute of Terrestrial Ecology, Terrestrial Systems Ecology, Grabenstrasse 3, CH-8952 Schlieren, Switzerland (fischlin@ito.umnw.ethz.ch)*.

References

- Houghton, J.T., L.G. Meira Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (ed.). 1996. Climate change 1995—the science of climate change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel of Climate Change. Cambridge Univ. Press, Cambridge, UK.
- Kauppi, P.E. 1995. The United Nations Climate Convention: unattainable or irrelevant. *Science* (Washington, DC) 270:1454.

Environmental Modeling: Fate and Transport of Pollutants in Water, Air, and Soil

Jerald L. Schnoor, John Wiley & Sons, 605 Third Avenue, New York, NY 10158. 1996. 682 p. \$69.96. ISBN 0-47112-436-2.

Environmental modeling, according to the author, "is designed to be an introductory textbook for senior undergraduate students in environmental sciences and engineering." The book truly evolved from earlier manuscripts that were used over the years by Schnoor and others at several U.S. universities. The book is a *reader-friendly* description on the fate and transport (not effects) of chemicals in the environment written by an experienced researcher and teacher.

Chapters 1 and 2 provide introductory material, particularly on mass balances and transport phenomena. The descriptions of dispersion, turbulent and molecular diffusion, advection, and sediment transport are particularly well presented for these weighty subjects in Chapter 2. Chapters 3 and 4 cover chemical equilibria, rate constants, reaction order, Michaelis-Menten kinetics, Freundlich adsorption, redox, and several other topics. Only a small section (3 pages), though, covers

parallel reactions, cycles, and food webs, the essence of ecological models. Chapters 5 through 9 apply the basics of the first four chapters to lakes and eutrophication, DO/BOD models, toxic organic models, trace metal models, and groundwater hydrology and chemistry models. Chapters 10 and 11 deal with regional/global issues of acid deposition models and global climate-change models. In essence, Chapters 5 through 11 trace the history of much of the use of environmental modeling for fate and transport as funding, interest, and needs changed from the 1920s (Streeter-Phelps) to the present (global environmental models).

The comprehensiveness of this book is impressive on subjects related to physical and chemical processes. The material, while rigorous in its mathematical treatment, is presented clearly with the reader/student in mind. Example problems and problems for homework assignments also strengthen the book as a textbook. With 659 pages of text, the book would be a lot of material to cover in depth in one semester.

The book is of less use to ecological modelers who emphasize biological processes as well as physical and chemical ones. It is curious that the journal *Ecological Modelling* was hardly cited here. As a stylistic comment, references should have been compiled by author in the back of the book rather than at the end of each chapter, and titles of journal articles in those citations would have been useful.

But I quibble. For its intended purpose and audience, Schnoor has put together a very nice compilation of environmental modeling in a readable yet comprehensive text that will teach the next generation of environmental engineers. Schnoor's book will and should be a part of every environmental engineer's library. It is also a good reference text for ecological modelers, aquatic chemists, environmental scientists, and several other professions.—WILLIAM J. MITSCH, *School of Natural Resources, The Ohio State University, Columbus, OH 43210*.

Environmental Management Tools on the Internet: Accessing the World of Environmental Information

Michael Katz and Dorothy Thornton, St. Lucie Press, 100E Linton Blvd., Suite 403B, Delray Beach, FL 33483. 1997. 170 p. \$59.95. ISBN 1-57444-059-4.

This book is a guide to the internet, written for both the newbie (inexperienced internet user) and for the experienced user who needs some tips on sources of environmental information. My first thought on picking this up was, How could one write a guide to something that changes as fast as the internet? In the Preface, the authors declare that they cannot tell you everything about the internet, nor can they show you all the best places to look. Very sensible. They acknowledge that the manual was out of date the minute they wrote it, because the internet is changing so fast. Nonetheless, the authors have done a good job to keep this book current: there are notes indicating specific items were accurate as late as July 1996. I also found that it has basic internet information that likely will be useful for years to come, and the information about specific internet sites and sources of information will probably have an accuracy *half-life* of several years. Most importantly, the authors have prepared the readers for change, not only by warning them of the dynamics of the internet, but also by providing suggestions on how to find things that seem to be missing.

The first chapter, about 6 pages, describes the hardware and software you need and the internet service providers that are available. The advantages and disadvantages of alterna-