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Frontiers of Biogeography

Title

Ecological climatology

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Journal

Frontiers of Biogeography, 8(4)

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Publication Date

2016

DOI

10.21425/F58433332

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Peer reviewed

Ecological Climatology: Concepts and applications

Gordon Bonan; 2016, Cambridge University Press, 691 pp., 3rd edition

£125 (Hardback) / £49.99 (Paperback); ISBN: 987-1-107-04377-0 / 987-1-107-61905-0

<http://www.cambridge.org>

Ecological Climatology is a very well-written and useful interdisciplinary text that explores the interrelationship between the abiotic environment and the living world, covering the many physical, chemical and geological processes that interact with the planet's diverse ecosystems. This third edition builds upon the last 2008 edition and seeks to reflect the expanded scientific literature that explores the many ways in which the living biosphere can influence the Earth's climate and *vice versa*.

The book is divided into six expansive sections. The first three explore the physical environment with overviews of the Earth System (i.e. the planet's components and global cycles), its physical climate (including climatic components, zones and climate change) and various physical processes (e.g. soil physics, water flows and energy fluxes). The next two sections are concerned with the biological environment and provide an overview of plant ecophysiology (such as photosynthesis and transpiration) and terrestrial plant ecology (including ecosystem biology and vegetation dynamics). The final section pulls these parts together with an overview of terrestrial forcings and feedbacks, taking in how ecosystems influence Earth System models, interactions between climate and vegetation dynamics, and anthropogenic influences on climate and ecosystems including land-use change, urban ecology and even geoengineering. The author has done an impressive job of covering a range of spatial and temporal scales from global biogeochemical cycles to cellular plant processes and from daily oscillations to historical and future climate trends.

Already it should be clear that this book has a very ambitious and broad scope and while some detail may be better covered in a more specialised plant ecophysiology or climate change textbook, for example, the author has done an exemplary job in covering the key areas. The text is written in

a clear style which makes deft use of well-studied examples to illustrate key points. This makes the work highly accessible to students and non-specialists. A minor criticism that I have is that many of the figures are in black and white, and although those that are difficult to interpret in greyscale are reproduced on colour plates, it is not always clear when this is the case. That said, most of the figures are clear and well-referenced in support of the text.

A key aspect of the Earth's climate is, of course, anthropogenic influence, particularly since the Industrial Revolution. A strength of this text is that while the author covers greenhouse gas emissions and predictions for future climate conditions, he also explores other aspects of man-made influences on the environment in new and expanded sections. This includes broad-scale issues such as alterations to nitrogen cycling and atmospheric aerosol content (primarily driven by anthropogenic sources) and how these will influence climate, as well as a number of chapters dedicated to somewhat more localised impacts such as increased urbanisation and land use change. It is this recognition of the interplay between the man-made and the natural environment and how this will influence the interactions between the biotic and abiotic environments that provides the reader with an important overview of the Earth's systems and our own profound impact upon it.

For example, the influence of land-use change is explored in a number of contexts. The impacts of deforestation are illustrated with reference to contrasting case studies such as tropical South America, dryland habitats in Australia and North Africa, and more temperate areas including Europe and North America, often resulting in decreased rainfall and increased temperatures as well as alterations to seasonal cycles. Similarly, urbanisation is explored in some depth with excellent and up-to-date discussions of the urban heat

island effect, heat fluxes and energy balance, together with a summary of the mitigating influences of urban greenspace and urban design and the importance of sustainable management.

These examples illustrate the interdisciplinary nature of this text and it is highly satisfying to see that the author has gone to great lengths to cover all aspects of the global environment and explore the different ways in which they can influence the climate in ways that range from changes to the vegetation, alterations to the energy budgets of a landscape, as well as changes in atmospheric gases (including greenhouse gases and aerosols).

Ecological Climatology is pitched at “advanced undergraduate and graduate students” but it must be said that such a broad work will interest both specialist and non-specialist alike. Gordan Bonan has done an excellent job of cover-

ing the key aspects of the interplay between climate and ecosystems, while also covering the natural and man-made world (including agricultural and urban systems). As such it provides a welcome resource for those interested in pursuing an interdisciplinary understanding of this planet as neither climate or ecology can be fully understood without reference to the other.

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Submitted: 15 December 2016

Accepted: 21 December 2016

Edited by Markus Eichhorn

Corrected version republished 20 January 2017