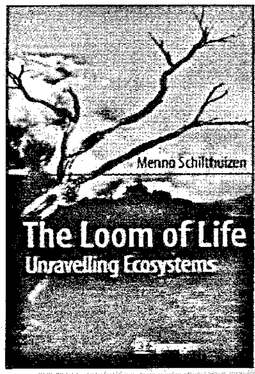


The Loom of Life – Unravelling Ecosystems

Menno Schilthuizen (2008), Springer, Berlin.
£39.99 (hbk)

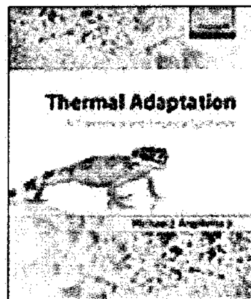
ISBN 978-3-540-68058

There is no shortage of books popularizing all manner of scientific topics, except perhaps one: theoretical ecology. How do you explain to that ubiquitous intelligent layman the difference between log-normal species abundance distribution and a zero-sum multinomial model, or why weak interactions can be decisive in the structure and stability of food webs, or what a species/area curve is and why it matters? Or where can you turn for an equation-free tutorial when you have to lecture a little way off your own speciality, and halfway through that discourse on island biogeography or top-down regulation suddenly realise you don't understand it?

The author of this charming and readable odyssey through the history of ecological ideas has the answers. He skilfully charts the progress of our understanding of biological diversity and species interactions from the mid 19th century to the latest effusions on community stability and extinction rates in Science and Nature. Dr Schilthuizen neatly sweetens the pill by first giving us little cameos of the great names: where they came from, why they became ecologists, what excited them, their setbacks and even what they died of, before effortlessly slipping in the mathematics in an imaginative English which only the Dutch can manage nowadays, with their mastery of what used to be our British language. Connell, Diamond, Elton, Fisher, Hubbell, Hutchinson, Kitching, Lindeman, Lovejoy, MacArthur, May, Mayr, Polis, Shannon, Simberloff, Slobodkin, Tansley, Volterra, Wilson and even Alfred Wallace get their mention, and many more. Knowing the context of their work makes the understanding of it so much easier. The story of Raymond Lindeman is especially touching.

As expected from a tropical snail biologist, the colonisation of islands features prominently in this ecology of ecologists, with Wilson and MacArthur's work documented in some detail. Proclivities for birds and ants are also evident in many of the examples. Little sketches by the author enliven the text and his account of our natural environment begins with an engaging but thoughtful account of his domestic garden ecosystem in tropical Sabah as seen from an easy chair, with cold beer in hand.

David Bignell



Thermal Adaptation: a Theoretical and Empirical Synthesis

Michael J. Angilletta Jr. (2009) Oxford University Press, New York.
£65.00 (hbk)

ISBN 978-0-19-857087-5

£34.95 (pbk)

ISBN 978-0-19-857088-2

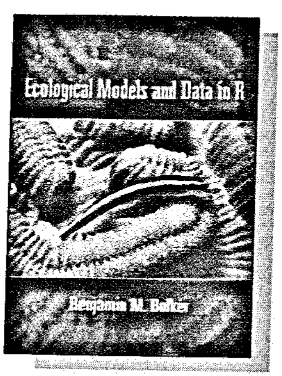
In the face of rapid, anthropogenic climate change, most populations must adapt or face extinction. Adaptation can encompass changes such as behavioural alteration, rapid microevolution, shifts in phenology or geographic range, or any combination of these. However, with different populations reacting in different ways and at different rates, fundamental ecological interactions are already being disrupted. A sixth mass extinction is an ever more plausible outcome. It is against this backdrop of intensifying interest in the way that organisms adapt to climate, that Michael Angilletta has produced his timely book.

Motivated by the sense that thermal biology has lagged behind some other subdisciplines in its readiness to embrace theory, Angilletta's book is intended to synthesise theory and empiricism; in so doing, the author hopes to drive forward the science of thermal biology, rooting it more firmly within the powerful predictive framework of natural selection. Angilletta also recognises the potential to provide a more mechanistic foundation for current attempts to predict population responses to climate change.

The book progresses rapidly through the empirical underpinnings of fundamental concepts, such as thermal heterogeneity and sensitivity, before turning to the issue of how theoretical models can advance our understanding of the forces underlying observed variation. Optimality models, quantitative genetic models and allelic models are all assessed with respect to empirical data to determine the insights that they can offer. Throughout, the author tackles issues at a range of scales, from the sub-cellular to the population and from phenotypic plasticity to long term evolution. The book concludes with a rapid summary of the challenges for ecologists and thermal biologists that arise from climate change, leaving the reader in no doubt about the seriousness of this discipline.

The author yearns for the dissolution of the boundaries between theoretical and empirical biology, and the emergent suggestion appears to be that thermal biologists are to blame for the lack of theoretical rigour within their discipline. By contrast, I was struck by the fact that more general theoreticians have missed a trick by failing to embrace the challenges of thermal biology as rapidly as those of many other disciplines. This book should serve as a clarion call for theoreticians to remedy that relative neglect. Importantly Angilletta notes that, unlike many areas of biology, empirical data on thermal biology has actually outstripped theory. The unusual potential of this situation will be immediately obvious to most theoreticians. Though not for the faint-hearted (Angilletta covers complex material at an occasionally fearsome pace), this book is broad in its scope and far-reaching in its implications; every forward-thinking ecologist with some theoretical aptitude should consider what it offers.

Phil Stephens



Ecological Models and Data in R

Benjamin M. Bolker (2008) Princeton University Press, New Jersey.

£32.95 (hbk)

ISBN 978-0-691-12522-0

Over the last few decades we have seen an exponential increase in computing power. What used to pass for a super-computer in the 1960's now sits inside our washing machine determining the spin cycle for our woollies. The upshot for ecology is that (1) there has been an explosion of theory, most of which remain untested (or sometimes untestable); and (2) a rapid development of sophisticated statistical techniques that can be used to analyse data. Arguably combining the models and the data is where ecology is going to make the make the most progress, and this is exactly the interface at which this book is aimed. Ben is a popular theoretical ecologist in the US and his writing style is generally very laid back, filled with humour, and despite being precise, he never forgets that his target audience are ecologists and NOT other statisticians/mathematicians/theoreticians.

For many people tackling this book I would recommend going straight to the appendix, because here he sets out the basic mathematics required in order to make sense of the book (roughly equivalent to parts covered in A-level mathematics in the UK). If the well thought out but brief definitions of logarithms, differential calculus, and probability make no sense then a primer in these areas is required before the main text is approached. In addition, and as pointed out in the introduction, the reader should already have a reasonable to good understanding of classical statistics and experimental design. From this background the book goes on to describe why sophisticated statistical tools such as maximum likelihood methods are more powerful than traditional methods such as correlation and regression (briefly, the former is flexible and the researcher defines the assumptions about the data by defining the underlying model, whereas the latter is inflexible and makes many assumptions about the data). If nothing else the early chapters serve as a great way for understanding why we all need to make the effort to learn the new breed of statistical methods that are starting to dominate the top ecological journals.

All of the methods introduced require computational effort at some point, and the tool upon which this book is principally based is the freeware statistical package R. For anyone not familiar with this package, then Chapter 2, on exploratory analysis of data is an ideal way of getting into this flexible piece of software. The meat of the book deals with maximum likelihood: what are the parameters for a given model that make the data most likely to happen, and early chapters on probability distributions, deterministic functions, and optimisation all build up to this point in a logical manner. It is at this point however, that the going gets harder. Ben generally does a good job of presenting it to non-statisticians, although I suspect that some readers will require a damp towel to the back of the neck for the early, more