

## BOOK REVIEWS

**From Populations to Ecosystems: Theoretical Foundations for a New Ecological Synthesis, Monographs in Population Biology, Vol. 46, M. Loreau. Princeton University Press, Princeton (2010). 328 pp., £30.95 (paper), £69.95 (cloth), ISBN: 978-0-691-12270-0 (paper), 978-0-691-12269-4 (cloth)**

Book titles in the “Monographs in Population Biology” series tend to be somewhat grandiose, and this book is no exception. The quest to provide a theoretical foundation for ecology is certainly ambitious for any single ecologist. But who should be better placed than Michel Loreau to attempt such a “new ecological synthesis” based on ecological theory? Loreau’s impact on the theoretical developments in the field of biodiversity research can hardly be overstated. This book puts many of his studies, and those of others, into a structured framework.

The book is organised into eight chapters and a “postface” and they follow a hierarchy from populations to ecosystem. The first chapter links together classical population models with mass-balance models. This is a central theme and aim of Loreau, and he convincingly argues that mass-balance and energy constraints allow us to turn the machinery of theoretical ecology into ecosystem theory. The second chapter reviews a lot of work on coexistence with the added mass-balance constraint. As a by-product, the classical Lotka–Volterra predator–prey model is rejuvenated with an energetic interpretation of its coefficients. The next chapter is the first to introduce Loreau’s own work and ideas. He describes how his models allow us to explore and differentiate between sampling and complementarity effects and how it helps to reconcile Grime’s large-scale diversity–productivity relationship with the small-scale, experiment-based biodiversity–ecosystem functioning paradigm.

In Chapter 4 Loreau adds additional trophic layers onto what was so far a plant-only model. Here the book, as well as the current state of research, becomes more disintegrated. Adding food webs and interaction webs (here defined as additionally comprising interactions that modify other interactions) opens the room for a much larger number of diversity–ecosystem functioning patterns. Espe-

cially the step towards allowing “interaction modifications” can change model outcome substantially and is, as Loreau points out, not yet explored in sufficient detail to allow for generalisations. Chapter 5 aims at reconciling stability and complexity of ecosystems by shifting the perspective from population-stability to ecosystem-state stability. The crucial process for the latter is de-synchronisation of population dynamics in order to achieve a portfolio effect. In Chapter 6, Loreau moves away from a population-centred view to a nutrient-flow ecosystem model. Diversity and species are fine-tuning conversion rates through competition, but the mass-balance and energy constraints on the ecosystem as a whole also severely constrain the set of possible ecosystem configurations.

Chapter 7 sketches a spatial extension of the work discussed so far. By explicitly considering exchange of species and mass within meta-communities and meta-ecosystems, Loreau scales the local ecosystem models up to an integrated, large-scale, multi-system approach. The functions he uses are by now familiar to the reader (differential equations coupled in space, rather than through trophic interactions) and are explored less comprehensively as in the previous chapters. The final chapter is conceptually cutting edge, too. Loreau aims to derive a formal description of how evolution at the level of individuals affect interactions, and thereby ecosystem functions and ecosystem properties. Only some of his own work is presented in this context, indicating that cross-fertilisation from complex system dynamics has yet to take place.

Loreau closes with an outlook on which steps are still missing in the work presented in the book (and thus in ecological theory in general): ecophysiological representation of species and physico-chemical representation of their environment; the link from genes through traits to ecosystem functioning; and integration of ecology and economy. This postface also illustrates the huge challenge ahead, as Loreau does not once mention ecophysiology-based modelling approaches of terrestrial or marine systems. His perspective is clearly from a population level up, rather than from an ecosystem state down, as many ecosystem models are. This starting point makes the book far more accessible to readers trained in classical theoretical ecology than to physics-oriented process modellers. Another shortcoming, acknowledged by Loreau

right on the first pages, is its focus on terrestrial systems, particularly terrestrial grassland systems. While the ideas and fundament developed can possibly applied, say, to forests, their extension to marine and limnic systems may not be as straightforward.

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**Vegetation Mitteleuropas mit den Alpen, H. Ellenberg, C. Leuschner., 6th ed., Eugen Ulmer, Stuttgart (2010). 1334 pp., 716 figures and 203 tables, €99.00, ISBN:978-3-8252r-r8104-5**

The arrival of this book makes a special moment for the vegetation scientist. Had not the 5th edition, completed just one year before Heinz Ellenberg's death in 1997, loomed large like a legacy that would be impossible to live up to in terms of style, depth and interdisciplinarity? I have met few colleagues that had not admired its convincing balance between review, synthesis and vivid description. Thus, critical reading of the new edition is preceded by great respect for the second author, Christoph Leuschner, who steps into those huge footsteps and sums up contemporary vegetation science in what is probably the best studied region of the world.

The design of the book remains largely unchanged. Journal-like typesetting in two columns with graphs and tables on almost every double page achieves a good compromise between compactness and legibility. With the exception of one printed sheet containing coloured overview maps of natural vegetation, climate, soil and geology (the latter two coarsely rasterised), photographs are black and white, but usually of brilliant quality and very well chosen to show typical aspects of vegetation types. Most diagrams are highly illustrative, real life examples adopted from original research, fully justifying the detailed captions. Vegetation tables present exemplary classifications from certain regions.

The qualitative description of plant cover relies on the taxonomy and nomenclature of species and vegetation types, which is daunting in well-studied, but intricately subdivided Central Europe. The good intention to relate to the German standard lists by Wisskirchen & Haeupler and Rennwald, as expressed in the introduction, was only partially met by referencing valid names in the subject register. When it comes to details, the reader has to be prepared for checking names and concepts.

Following a concise introduction to Central Europe as a natural, historical and cultural region, major sections are devoted to forests, to natural non-forest vegetation and to anthropogenic vegetation. The scope of these topics is intim-

idating to the reviewer, who can only judge a fraction of the field properly.

The 6th edition as a whole having grown by one fifth, it is interesting to identify the focal points of growth. Thus, the chapters on anthropogenic vegetation have doubled in size, which is largely due to extensive sections on the biogeochemistry, population biology and dynamics of grasslands and heathlands, reflecting the heyday of quantitative and often experimental research on these ecosystems.

Beyond working in a host of new references, Leuschner has thoroughly re-structured individual chapters. Where the old edition was arranged by vegetation types, subchapters now form a stringent, recurring sequence on flora, history, site ecology, classification, ecophysiology, traits, dynamics and human impact. This clarity minimises redundancy and facilitates selective reading. A tangible downweighting of phytosociology at the expense of structure and function is particularly inevitable for intensive grasslands, where only a small fraction of extant vegetation conforms to the classical types.

With a plus of a little less than one-third compared to the 5th edition, forests are the runners-up. Leuschner has re-organised the chapters by drawing physiological and biogeochemical aspects of upland forests into one extended opening section. Site ecology, tree physiology, the biology of ground plants and biogeochemical cycling receive roughly equal shares of attention. It is consistent, that stand dynamics of beech and coniferous forests are treated in separate sections further on. The concluding section on human influences concentrates on pollution, which has already been treated in the general opening, with a focus on forest decline. Where in 1996 Ellenberg's sober position on the topic had still been in danger of being misunderstood as downplaying environmental problems, Leuschner has the advantage of weighing arguments without ideology. While scientific attention has shifted from acidification and decline to eutrophication and biodiversity, forest ecology has not grown at the same pace as grassland studies, probably because experiments in forests are much more difficult to carry out. True to his focus on empirical facts rather than scenarios and models, Leuschner does not lend too much space to climate change.

In contrast to grasslands, recent vegetation changes due to forest management are not treated comprehensively. Thus, the restoration of mixed deciduous forests does not figure in the register, nor are the consequences of mechanisation with its dense mesh of extraction lines mentioned. These antagonistic trends in naturalness of contemporary forests would have been important updates to the chapter on plantations, which has been slightly shortened by moving fertilisation to the forest chapter.

In a natural forest land like Central Europe some redundancy between general introduction and forest chapter is inevitable. The gradual growth of the work and the reliance on published schemes and figures entails the risk of conflicting information. Thus, the altitudinal belts of the Alps are presented in no less than five, not fully compatible figures.