Intro to Book on Dispersal Ecology

Seeking the secrets of dispersal

Dispersal Ecology edited by James M. Bullock, Robert E. Kenward and Rosie S. Hails. Blackwell Publishing, 2002. £29.95 hbk (458 pages) ISBN 0-632-05877-3

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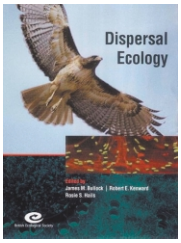

Dispersal, the journey of an organism from its place of birth to another site, often has profound effects on the fate of individuals, and the dynamics of populations, communities and ecosystems. This makes understanding dispersal crucially important for answering questions associated, for example, with the effects of climate changes, habitat fragmentation, invasive species and diseases.

The study of dispersal has recently seen an incredible increase in both the quantity (Fig. 1) and quality of research, providing better means to quantify dispersal patterns over a broader array of species, habitats and geographical regions, and to understand dispersal processes, their underlying mechanisms, causes and consequences. *Dispersal Ecology* provides an excellent point of entry into the burgeoning literature on dispersal and its many implications.

The book covers a diversity of topics and an unusually broad array of taxonomic groups, from viruses through butterflies to marine mammals. It is a collective volume arranged in four main sections, followed by an overview. Each section includes five chapters, and each chapter provides excellent updated review of the current state of knowledge in its field. Although the authors are said to be 'international experts', 73% are from UK, thus they do not really form a balanced international team.

The first section of the book focuses on the tools, old and new, employed in studying dispersal. The different chapters emphasize technical features that are, to a large extent, specific to different taxonomic groups. Collectively, these chapters suggest that many 'traditional' tools can provide valuable data about dispersal at local scales, yet their application to large-scale aspects of dispersal is limited. One of the most exciting messages is that dispersal researchers are currently pursuing better ways to address those challenges, and ingenious creative solutions are being developed.

The second section explores the evolutionary and behavioural basis for dispersal. Steve Compton, for example, argues that the challenge of long-distance dispersal (LDD) is especially great for small insects searching for a specific host plant far away. Aphids and fig wasps differ in many important attributes, but they achieve LDD in a similar way: they sail with the wind over long distances, terminate this passive flight (presumably) intentionally in a suitable patch, and use short-distance active flight to reach specific host plants. This system has all the required ingredients to provide the basis for an exemplary spatially explicit mechanistic model of dispersal, such as those applied for vertebrates by Andy South *et al.* Their chapter provides an excellent example of how to consider a broad set of factors whilst incorporating dispersal into spatial population models, and how to evaluate such models. Even for land vertebrates, there are still big gaps in our understanding of dispersal processes and how they are affected by environmental heterogeneity and other processes, such as competition. South *et al.* discuss the consequences of such uncertainties for the predictions of models of different approaches, and how to match the best modeling approach to a particular case in question.

The third section is devoted to the role of dispersal, mostly in population dynamics, at multiple spatial scales. With the use of the well studied experimental system of root voles at Evenstad, Norway, Harry Andreassen *et al.* integrate insights from behavioural and population studies of vertebrate dispersal into a spatiotemporal population model that implies that dispersal is less important than local reproductive rate in determining vole population size. The opposite conclusion, based on a coupled dispersal–demographic model, is described by

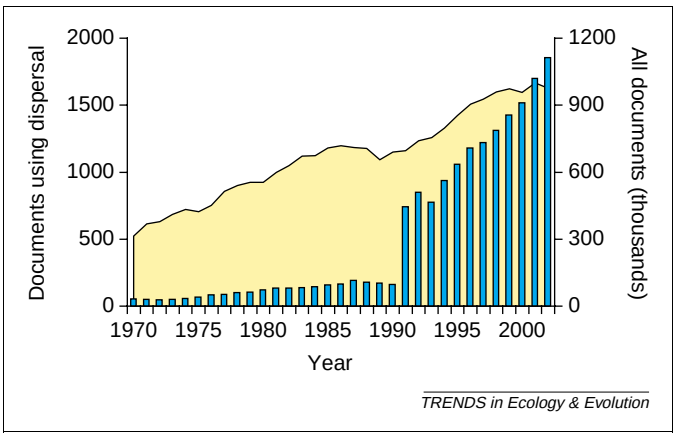

Fig. 1. A remarkable increase (by a factor of 37) in the relative frequency of publications using the word 'dispersal' (blue) in their title, keywords, or abstract, compared to a much lower increase (by a factor of 3) in the total number of publications (yellow) included in Science Citation Index (ISI Web of Science), over the years 1970-2002. A random check of 100 selected articles from each of the years 1990, 1995 and 2000 showed that the majority (roughly 90%) of those papers use dispersal in the ecological sense, with no indication of any significant change in the (low) frequency of other meanings over the years.

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James Bullock *et al.* who argue that dispersal is often of overriding importance for both local and regional plant population dynamics.

The fourth section focuses on applied dispersal-related questions, including human-mediated species invasions (Andy Cohen), plant pathogen spread (James Brown *et al.*) and climate change (Andrew Watkinson and Jenny Gill). It also includes a useful review by Nanaka Shigesada and Kohkichi Kawasaki of various mathematical models of spatial spread, emphasizing the role of LDD. Their final paragraph mentions attempts to extend dispersal models by incorporating demographic processes that follow dispersal, a key point emphasized throughout the book. The remarkable progress in dispersal research, as reflected in this collective volume, could soon lead to advances not only in developing of such inclusive models, but also in rigorously testing their performance against field data.

In final chapter, Mark Williamson provides an interesting and somewhat provocative overview, emphasizing LDD and landscape structure in particular. These are by all means two of the most crucial topics in dispersal research, and he provides some integration of material about them from other chapters and several recent publications. At a level of the entire book, the editors emphasize that integration is achieved by links among chapters. Yet, my one big disappointment is a lack of integration. The book's most notable strength comes from its broad taxonomic coverage, yet we are left with no critical distillation of the key similarities and dissimilarities among different taxonomic groups in dispersal, its causes and consequences. Such integration could have provided a basis for discussing important questions and future directions for dispersal research. Admittedly, it is hard to achieve integration in an edited volume. An additional (22nd) concluding chapter, titled, say, 'Integration and Future Directions' and perhaps written by the editors, could have helped. Commentaries for each of the four main sections (e.g. [1]) could have also helped. More specific lines of possible integration have been suggested in a review of the book's symposium [2].

Among several other new books on dispersal, a comparison with *Dispersal* [3] seems inevitable. I see the two books as complementary rather than competing alternatives. This is in part reflected by the very low degree of overlap: they share only two out of a total of 107 authors. *Dispersal* focuses on theoretical aspects of genetics and evolution of dispersal, mostly of animals, whereas *Dispersal Ecology* focuses on various ecological aspects of dispersal, over a broader array of organisms. Both books offer excellent summaries of key topics.

In summary, the editors of *Dispersal Ecology* have largely accomplished their goal of describing the state of the art in ecological studies of dispersal across a broad range of taxa. As such, the book provides an excellent background for future dispersal research, hence constitutes an important contribution to the toolbox of dispersal researchers, highly recommended to both beginners and professionals. Things move fast in dispersal nowadays, and its secrets are repeatedly being exposed. High priority should now be given for integrating the insights gained from studying different systems into a coherent research discipline. This book constitutes an important contribution towards this goal.

References

1 Real, L.A. and Brown, J.H. (1995) *Foundations of Ecology: Classic Papers with Commentaries*, The University of Chicago Press
2 Nathan, R. (2001) The challenges of studying dispersal. *Trends Ecol. Evol.* 16, 481–483
3 Clobert, J. *et al.* (2001) *Dispersal*, Oxford University Press

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