Dispersal Ecology

Symposia of The British Ecological Society

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History of the British Ecological Society

The British Ecological Society is a learned society, a registered charity and a company limited by guarantee. Established in 1913 by academics to promote and foster the study of ecology in its widest sense, the Society currently has around 5000 members spread around the world. Members include research scientists, environmental consultants, teachers, local authority ecologists, conservationists and many others with an active interest in natural history and the environment. The core activities are the publication of the results of research in ecology, the development of scientific meetings and the promotion of ecological awareness through education. The Society's mission is:

To advance and support the science of ecology and publicize the outcome of research, in order to advance knowledge, education and its application.

The Society publishes four internationally renowned journals and organizes at least two major conferences each year plus a large number of smaller meetings. It also initiates a diverse range of activities to promote awareness of ecology at the public and policy maker level in addition to developing ecology in the education system, and it provides financial support for approved ecological projects. The Society is an independent organization that receives little outside funding.

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Preface

Dispersal has been recognized as an important subject throughout the relatively short history of ecology as a science. However, development of refined techniques for measuring dispersal, extension of ecological theory and attempts to solve current applied problems have all led to dispersal assuming a central role in modern ecology.

Population ecologists have long been able to obtain accurate measurements of survival and fecundity in plant and animal populations, and there is a good understanding of these processes even in microbial population. However, dispersal, the remaining element of many life cycles, has traditionally been measured only rarely. Theoretical advances in several areas of ecology have highlighted this omission, and have created a need for empirical analyses of dispersal. Dynamics of metapopulations centre on dispersal between habitat patches. Invasion ecology, island biogeography and colonization studies require data on how individuals reach virgin communities. Landscape ecology needs to incorporate dispersal to understand the effect of landscape change. The spatial modelling of metapopulations, invasions and even the persistence of individual populations requires a representation of the amount and form of dispersal between patches. Dispersal underpins ecological genetics, and is vital for understanding gene flow between populations and species. Life-history evolution and theories of the development of life-history strategies need to take more account of dispersal abilities and the costs and benefits of particular dispersal strategies. Biogeographical interest in the limits of species distributions and the formation of regional biota also needs information on dispersal. Studies of dispersal are fundamental to many problems in applied ecology: the spread of alien species, responses to habitat loss and fragmentation, re-establishment in species recovery programmes, the spread of diseases, species' ability to track climate change, and the escape of genetically modified organisms.

These considerations have caused an upsurge in interest in the study of dispersal, especially over the last 2–3 years. The 2001 Ecological Society of America meeting in Madison, Wisconsin had a special symposium on 'Long distance dispersal' (to be published in *Ecology*), and there have been two recent symposia with associated

books on particular aspects of dispersal; the genetics and evolution of dispersal, especially in animals (Clobert *et al.* 2001) and dispersal in insects (Woiwod *et al.* 2001). What is missing, however, is a broad overview of dispersal in terms of its role in all areas of ecology and covering the range of taxa from microbes to vertebrates. This book aims to achieve this and is based on the BES Symposium on Dispersal which took place in April 2001 at Reading University, UK. As well as a review of the status of knowledge about dispersal, it provides suggestions as to where dispersal research is going and what gaps in knowledge need to be plugged.

To achieve this we commissioned 21 chapters by international experts in particular fields. Within the size constraints of this book, these represent as wide-ranging an overview of dispersal as is available. The chapters cover most taxa—baculoviruses, bacteria, fungi, plants, invertebrates and vertebrates—in order to consider similarities and differences in the problems and questions being tackled in traditionally separate disciplines. Despite the great differences in approach, the outcome is an emergence of many basic similarities (see Nathan 2001 for an insightful review of this symposium). These include the fundamental importance of dispersal for all taxa, the role of dispersal in linking ecological processes across different scales, the problems of accurately quantifying dispersal, and the importance yet difficulty in measuring rare long-distance dispersal events.

Many debates in ecology arise through semantic differences. To achieve clarity, we therefore asked authors to use a common definition of dispersal, as 'intergenerational movement'. So, for example, we exclude so-called 'dispersal in time' (e.g. seed banks) and foraging movement of animals. The authors have mostly kept to this definition, and any deviations are explained. Another term used often is 'migration'. The *Oxford English Dictionary* defines this both as 'The action . . . of moving from one place to the other' and as 'Change in . . . the distribution of a [species]'. We have not imposed a definition, so where 'migration' is used in passing, the context must be considered. However, where authors have used this word extensively they have provided a definition. The periodic migrations by many birds and other animals, e.g. from summer to winter grounds, are termed 'annual migrations' in this book.

The structure of the book is to consider the four fundamental questions in dispersal research: (i) *what techniques are available to measure dispersal*; (ii) *what is the evolutionary and behavioural basis of dispersal*; (iii) *what is the role of dispersal in spatial processes at all scales*; and (iv) *what do we need to know about dispersal to solve applied ecological problems*? Because of the biological differences among different taxa, the chapters on techniques are classified taxonomically, although molecular methods merit a separate overarching chapter. Otherwise, the chapters are designed to cover a full range of issues within each question, either using a specific taxon or a range of taxa to illustrate each issue. Generality is achieved by a consideration of links among chapters, but also by the literature reviews presented in each chapter and the modelling approaches which are at the core of many. Thus the second question is addressed by considering dispersal cues, dispersal behaviour, genetic structure at different scales, evolutionary trade-offs, and the effects of dispersal trait changes on fitness, in a range of taxa that includes baculoviruses, birds, plants, bryozonans and insects.

The scales of spatial processes considered in different chapters are within populations, metapopulations, landscapes and biogeographical regions. The explicit consideration of dispersal in each chapter means that none stick to one particular (anthropomorphically defined) scale, but rather the role of dispersal by individual bacteria, plants, insects or vertebrates in linking scales is a common theme. Applied problems are many, and the chapters in the fourth section show how dispersal is at the core of approaches to solving these. Thus, the chapters consider: the spread of non-native organisms, of pests and diseases and invasions in general; conservation re-introductions and responses to habitat fragmentation; and whether species will be able to track climate change. It is indicative of the increasing involvement of ecologists in environmental concerns that many of the other chapters in this book also consider applied questions. Finally, Mark Williamson provides a personal overview of the book in terms of the objectives we set ourselves.

We would like to thank the BES for funding both the symposium and the production of this book, particularly Hazel Norman whose organizational skills made the symposium such a success. Ian Keary and Paul Hatcher also helped enormously with the running of the symposium. The authors all worked very hard to produce the top-quality reviews for which they were asked, and we are grateful to the many ecologists who helped enhance the quality by critically reviewing the chapters.

It has been extremely exciting to be involved in production of a book in such a fast-developing and important field. This book describes the state of the art. It will be very interesting to come back in 10 years' time to review the leaps and bounds forward this subject will have taken—partly, we hope, as a result of this book.

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