Insect Species Conservation

Insects are the most diverse and abundant animals that share our world, and conservation initiatives are increasingly needed and being implemented globally, to safeguard the wealth of individual species. This book provides sufficient background information, illustrated by examples from many parts of the world, to enable more confident and efficient progress towards the conservation of these ecologically indispensable animals. Writing for graduate students, academic researchers and professionals, Tim New describes the major ingredients of insect species management and conservation, and how these may be integrated into effective practical management and recovery plans.

TIM NEW is Professor of Zoology at La Trobe University, Australia. He has broad interests in insect ecology, conservation and systematics, and has published extensively in these fields. He is recognised as one of the leading advocates for insect conservation. He is currently editor-in-chief of the *Journal of Insect Conservation*.

ECOLOGY, BIODIVERSITY AND CONSERVATION

The world's biological diversity faces unprecedented threats. The urgent challenge facing the concerned biologist is to understand ecological processes well enough to maintain their functioning in the face of the pressures resulting from human population growth. Those concerned with the conservation of biodiversity and with restoration also need to be acquainted with the political, social, historical, economic and legal frameworks within which ecological and conservation practice must be developed. The new Ecology, Biodiversity, and Conservation series will present balanced, comprehensive, up-to-date, and critical reviews of selected topics within the sciences of ecology and conservation biology, both botanical and zoological, and both 'pure' and 'applied'. It is aimed at advanced final-year undergraduates, graduate students, researchers, and university teachers, as well as ecologists and conservationists in industry, government and the voluntary sectors. The series encompasses a wide range of approaches and scales (spatial, temporal, and taxonomic), including quantitative, theoretical, population, community, ecosystem, landscape, historical, experimental, behavioural and evolutionary studies. The emphasis is on science related to the real world of plants and animals rather than on purely theoretical abstractions and mathematical models. Books in this series will, wherever possible, consider issues from a broad perspective. Some books will challenge existing paradigms and present new ecological concepts, empirical or theoretical models, and testable hypotheses. Other books will explore new approaches and present syntheses on topics of ecological importance.

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Preface

This short book is about conserving insects, the most diverse and abundant animals that share our world. In particular, it is about the common focus of conserving individual species of insects. This so-called 'fine filter' (or 'fine grain') level of conservation parallels much conservation effort for better-understood groups of animals such as mammals and birds, for which species-focused conservation exercises are commonplace. The need for insect conservation can appear puzzling, and how to undertake it can seem daunting to the many conservation practitioners unfamiliar with insects but to whom vertebrates or vascular plants are familiar – and, thus, that they can treat with greater confidence because of being within their range of practical expertise. We are thus dealing with insects as specific targets or individual foci for conservation. My main aim is to provide sufficient background information, illustrated by examples of insect species needs and conservation programmes from many parts of the world, to enable more confident and efficient progress for conservation of these ecologically indispensable animals. I hope to demonstrate and clarify to potential managers what the major ingredients of insect species management for conservation may be, and how those needs and ingredients may be integrated into effective and practical management or recovery plans.

The examples demonstrate the great variety of needs of ecologically specialised insects, the small scales over which they may operate, and how both assessment of conservation status and design of species conservation necessarily differs from that for many of the more popular and more widely understood organisms.

The need for such an appraisal has been stimulated largely by my experiences in Australia, where most people involved 'officially' in managing insects for conservation, such as by belonging to State or Territory conservation or related agencies, are (in common with many people in similar positions elsewhere in the world) not primarily entomologists, but versed in the management or ecology of vertebrates or other organisms.

They commonly fail to appreciate the idiosyncrasies and importance of the threatened insect species with which they are obliged to deal. Similar perspectives are also common elsewhere, but this book is also an opportunity to present some Australian cases to a wider readership and to integrate them with better-known examples from elsewhere to provide a wide geographical picture of progress in insect species conservation. Much of the relevance of Australian cases in this perspective reflects the relatively recent rise of insect conservation interest in the country, in contrast to its much longer recognition in much of the northern hemisphere, and that it has thus been able to draw on the much more substantial framework of insect conservation practice established elsewhere. I emphasise that these cases are not presented as examples of 'best practice', but simply as ones with which I am most familiar, and that are sufficiently varied to demonstrate successes and failures of various components of insect species management.

The book deals primarily with insect ecology and its central role in understanding and formulating practical conservation measures, and also with the legislative and regulatory environment relevant to insect conservation at this level. It is not a compendium of sampling theory and methods. Those are available elsewhere (see, for example, the books by Southwood & Henderson 2000; New 1998; Samways *et al.* 2009), but references to various methods used for sampling and monitoring are inevitable and the above texts may be consulted for further details of these. Much of the best insect conservation practice hangs on the approaches and field methods employed. Many individual species studies contain original, often innovative, modifications of standard methods tailored to the biology of the focal species, and the 'methods' section of published papers and reports usually bears close scrutiny. Likewise, many of the broader aspects of insect conservation biology are included in the volume arising from a recent Royal Entomological Society symposium on this topic (Stewart *et al.* 2007). Rather than revisit all those themes, I discuss insect biology as the scientific background to insect species conservation, the scope and extent of species conservation, and how the requisite management may be undertaken effectively through realistic planning and regulation justified by biological understanding. My main emphasis is on the design and implementation of effective insect species management plans.

'Species level conservation' is the means through which many people have been introduced to insect conservation and to the often intricate conservation needs of specialised insect species, with the important

lesson that every insect species differs in subtle ways from every other, and that it is often unwise to extrapolate uncritically ecological details from one species even to its closest relatives. Nevertheless, each of the many individual species management plans which have beeen published demonstrates principles, ideas and – sometimes – detail that can help refine plans for other species.

I do not deal in this book with the 'coarse filter' levels of insect conservation, namely insect assemblages and communities, despite the increasing needs for these, and the accelerating realisation that they may be the only practical way for insect conservation to proceed effectively in many parts of the world. This wider need occurs simply because the vast number of individual needy species is overwhelming. They cannot all be given individual attention, and some form of allocating priority or triage between deserving species is inevitable, with the consequence that many needy species will be neglected. Those wider levels of focus, emphasising the conservation of insect diversity, are summarised admirably by Samways (2005). Nevertheless, understanding the ecological peculiarities and details of individual insect species' conservation needs will continue to emphasise their importance as flagships for the less-heralded components of the world's biodiversity, and to enhance understanding of the natural world. The lessons learned from insect species conservation programmes over the past half century, in particular, provide important leads toward promoting more efficient and more effective programmes for the future. Accelerating that aim is a main driver of this book.

In many parts of the world, resources available for insect species conservation are in very short supply, and their allocation for best effect difficult to arrange or, even, to suggest. Resident concerned entomologists or conservation biologists are few over much of the tropics, for example. The wellbeing of individual butterflies, dragonflies or beetles (or, even less so, of barklice or flies) is understandably accorded very low priority in relation to pressing requirements of human welfare and in places where land use for food production for people is a primary need. Much of this book is based on examples from countries where this is not the case, and where such aspects of conservation (some of them based on many decades of experience and very detailed planning, and well-resourced interest and management) are accepted easily as part of a 'national psyche'. In particular, I draw on selected examples from Europe (in particular the United Kingdom), North America, Australia, New Zealand, Japan and South Africa to discuss the development of insect species conservation practice and theory. Essentially,

these are predominantly from the temperate regions of the world, and equivalent species conservation programmes in much of the tropics simply do not exist, other than by rare chance. In all these named regions, individual species cases have been central to development and promotion of insect conservation interests. Many of them are based on 'charismatic' insects, particularly butterflies, dragonflies and some larger beetles, that have captured public interest in various ways, and some of which have become significant local flagships for wider conservation efforts. A broad spectrum of priorities and tactics for conservation collectively contribute to a synthesis, which may lead toward more effective protocols for wider adoption. At the least, wider awareness of the varied approaches, activities and possibilities, many of them intermeshing excellent science with protective regulation or legislation, should enable managers to aid the future of many insect species through improving practical conservation, and also to assess how insect species conservation programmes may participate in assuring wider benefits and be pursued with greater confidence.

Some cases are discussed in greater detail, and a selection are presented in Boxes in the text, to illustrate particular management points or approaches to study or assessment. Collectively these provide examples of recovery measures that have worked, or have been unsuccessful, and indicate the kinds of information and practice that may contribute to the eventual outcome. Some will be well known to entomologists as 'classics' of insect conservation but, equally, they will commonly be less familiar to other people – except, perhaps, through casual acquaintance. They provide the foundation both for wider understanding and the lessons learned so far in a rapidly evolving science, and also for energetic debate about optimal ways to proceed and develop what we understand at present to ensure a more secure future for insects in the increasingly unnatural world.

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