Invertebrate Conservation and Agricultural Ecosystems

Invertebrate Conservation and Agricultural Ecosystems is both an introduction to invertebrate conservation biology for agriculturists and an introduction to crop protection for conservation biologists, demonstrating how these two disparate fields may draw on each other for greater collective benefit. It makes use of recent literature to show how invertebrate conservation in highly altered landscapes may be promoted and enhanced.

The book deals with problems of, and approaches to, invertebrate conservation in highly managed agricultural ecosystems, and examines how biodiversity may be promoted without compromising agricultural production. It draws attention to the importance of invertebrates in agricultural systems and their role in ecosystem functions.

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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. This 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.

Ecology and Control of Introduced Plants
Judith H. Myers and Dawn R. Bazely

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Preface

Increasing commitment of land to agriculture and the intensification of agricultural practices in many parts of the world have been associated with widespread and substantial loss of biodiversity, much of it undocumented and unheralded. As the most diverse larger components of that biodiversity, insects and other invertebrate animals play major roles in ecosystem function and sustainability in both natural and modified ecosystems, including agricultural ecosystems. However, agriculturists and conservationists have a long history of differing attitudes towards these animals. The former are concerned with crop and other commodity protection, in which depredations by invertebrate pests cause major economic losses, and suppression of their effects (commonly by killing them) is a major management necessity. The latter are concerned over the replacement of complex natural habitats with relatively simple 'agroecosystems', which reputedly support only very limited numbers of species, and with the wider environmental ramifications of crop-protection measures, such as use of pesticides and exotic species on non-target areas and species.

This book is both an introduction to the principles of agricultural pest management for invertebrate conservation biologists and an introduction to invertebrate importance and conservation for applied entomologists and pest managers. My major aim is for each party to appreciate more fully the perspectives of the other and to realise the amount of common ground that their viewpoints may encompass. This appreciation is vital in order to promote more holistic management for the benefits of invertebrates and other organisms, and for wider ecological sustainability in the mosaic of modified and more natural areas that comprise modern landscapes. Whereas the principles are of much wider relevance than to invertebrates alone, the relatively fine ecological scales on which many invertebrates operate provide wide lessons for increased understanding of their responses to environmental changes and of the ways in which their wider wellbeing can be promoted. Agroecosystems are a critical focus in any such endeavour.

Many of the topics discussed here have been treated extensively in a series of papers, symposia and books in the past decade or so, and part of the aim of this book is to provide a balanced synthesis of these diverse and scattered publications. The major focus is reducing damage to environments and enhancing conservation prospects through refining agricultural practices and harmonising these with wider conservation needs, and demonstrating the sincere and substantial progress that has been made in this endeavour. Many of these recent publications are cited in the text, and the great variety of scientific journals that encompass relevant issues are evident from the references provided; some, indeed, cover little but these topics. And, as with much other scientific advance, the amount of pertinent material on the World Wide Web is both daunting and of very mixed relevance and accuracy.

The first chapter introduces the changes to natural ecosystems wrought by agricultural development, the characteristics of agroecosystems, and the importance of incorporating these modified ecosystems into a wider conservation perspective to complement the conventional 'conservation estate' founded on protected areas. The broader ecological importance and diversity of invertebrates in agroecosystems, together with background on the main groups involved, are introduced in Chapter 2, and this is followed by a broad appraisal of the threats they face and their values in wider assessments of environmental change and quality (Chapter 3). A practical agricultural perspective of invertebrates as pests is given in Chapter 4, together with a summary of the development of the science of integrated pest management. The consequences and concerns of one of the three main early strands of crop protection, application of pesticides, are also discussed. The wider concerns of other aspects of pest management on crops are discussed in the next two chapters, which deal respectively with biological and cultural control measures. Expansion to the wider environment and considerations of landscape ecology to harmonise pest management and conservation ideals comprise Chapters 7 and 8, with the latter emphasising the consequences of habitat fragmentation and the need to promote wider connectivity in landscapes. Conservation concerns in pasture management are treated briefly in Chapter 9. Finally, Chapter 10 evaluates and discusses ways in which agroecosystem management and more conventional conservation management may both benefit from lessons from terrestrial invertebrate ecology, and how these may be integrated to promote more holistic conservation for invertebrates without unduly compromising the needs for agricultural commodity protection and assured economic sustainability.

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