PREFACE

This second edition provides an updated and expanded synthesis of feedbacks and interactions between insects and their environment. A number of recent studies have advanced understanding of feedbacks or provided useful examples of principles. Molecular methods have provided new tools for addressing dispersal and interactions among organisms and have clarified mechanisms of feedback between insect effects on, and responses to, environmental changes. Recent studies of factors controlling energy and nutrient fluxes have advanced understanding and prediction of interactions among organisms and abiotic nutrient pools.

The traditional focus of insect ecology has provided valuable examples of adaptation to environmental conditions and evolution of interactions with other organisms. By contrast, research at the ecosystem level in the last 3 decades has addressed the integral role of herbivores and detritivores in shaping ecosystem conditions and contributing to energy and matter fluxes that influence global processes. This text is intended to provide a modern perspective of insect ecology that integrates these two traditions to approach the study of insect adaptations from an ecosystem context. This integration substantially broadens the scope of insect ecology and contributes to prediction and resolution of the effects of current environmental changes as these affect and are affected by insects.

This text demonstrates how evolutionary and ecosystem approaches complement each other, and is intended to stimulate further integration of these approaches in experiments that address insect roles in ecosystems. Both approaches are necessary to understand and predict the consequences of environmental changes, including anthropogenic changes, for insects and their contributions to ecosystem structure and processes (such as primary productivity, biogeochemical cycling, carbon flux, and community dynamics). Effective management of ecosystem resources depends on evaluation of the complex, often complementary, effects of insects on ecosystem conditions as well as insect responses to changing conditions.

Two emerging needs require the integration of traditional and emerging perspectives of insect roles in ecosystems. First, we are becoming increasingly aware that global environ-

mental changes must be addressed from a global (rather than local) perspective, with emphasis on integrating ecological processes at various levels of resolution and across regional landscapes. Insect population structure, interactions with other species, and effects on ecosystem processes are integral to explaining and mitigating global changes. Second, the changing goals of natural resource management require a shift in emphasis from the traditional focus on insect–plant interactions and crop "protection" to an integration of ecosystem components and processes that affect sustainability of ecosystem conditions and products. Integrated pest management (IPM) is founded on such ecological principles.

The hierarchical model, familiar to ecosystem ecologists and used in this text, focuses on linkages and feedbacks among individual, population, community, and ecosystem properties. This model contributes to integration of evolutionary and ecosystem approaches by illustrating how properties at higher levels of resolution (e.g., the community or ecosystem) contribute to the environment perceived at lower levels (e.g., populations and individuals) and how responses at lower levels contribute to properties at higher levels of this hierarchy. Some overlap among sections and chapters is necessary to emphasize linkages among levels. Where possible, overlap is minimized through cross-referencing.

A number of colleagues have contributed enormously to my perspectives on insect and ecosystem ecology. I am especially grateful to J. T. Callahan, J.-T. Chao, S. L. Collins, R. N. Coulson, D. A. Crossley, Jr., R. Dame, D. A. Distler, L. R. Fox, J. F. Franklin, F. B. Golley, J. R. Gosz, M. D. Hunter, F. Kozár, M. D. Lowman, G. L. Lovett, H.-K. Luh, J. C. Moore, E. P. Odum, H. T. Odum, D. W. Roubik, T. R. Seastedt, D. J. Shure, P. Turchin, R. B. Waide, W. G. Whitford, R. G. Wiegert, M. R. Willig, and W.-J. Wu for sharing ideas, data, and encouragement. I also have benefited from collaboration with colleagues at Louisiana State University and Oregon State University and associated with U.S. Long Term Ecological Research (LTER) sites, International LTER projects in Hungary and Taiwan, the Smithsonian Tropical Research Institute, Wind River Canopy Crane Research Facility, Teakettle Experimental Forest, USDA Forest Service Demonstration of Ecosystem Management Options (DEMO) Project, USDA Western Regional Project on Bark Beetle-Pathogen Interactions, and the National Science Foundation. L. R. Fox, T. R. Seastedt, and M. R. Willig reviewed drafts of the previous edition. Several anonymous reviewers provided useful comments addressed in this edition. I also am indebted to C. Schowalter for encouragement and feedback. K. Sonnack, B. Siebert and H. Furrow at Elsevier provided valuable editorial assistance. I am, of course, solely responsible for the selection and organization of material in this book.