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Insects and Ecosystem Function

With 50 Figures and 12 Tables

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Preface

In the last decade there has been a dramatic increase in our understanding of the role of plant diversity and plant community composition in determining local ecosystem processes. In contrast, our understanding of the role of insects in ecosystem processes is relatively primitive. Because insects are a dominant component of biodiversity in terrestrial ecosystems, this state of knowledge is unsatisfactory. Insects perform a number of activities that influence ecosystem processes such as nutrient cycling, and insects are likely to play a key role in mediating the relationship between plants and ecosystem processes by influencing the physiology, population dynamics and competitive relationships of plants. For herbivorous insects, the scarcity of manipulative studies on the role of insects in ecosystem processes contrasts sharply with the existing knowledge of insect effects on individual plants and populations. A primary reason for the under-representation of insects in biodiversity-ecosystem function studies is the practical problems associated with controlled experiments. Insects do not lend themselves easily to diversity or composition manipulations. Because insects are small, mobile, and often capable of flight, maintaining a gradient of insect diversity is more difficult than maintaining a gradient in plant diversity. However, researchers in the field of insect herbivory have developed a number of methods to reduce, enhance or simulate insect herbivory that could be used to explore the relationship between ecosystem function and local insect diversity and composition. All of these methods have their advantages and disadvantages which have to be kept in mind when an experiment is designed. It is our firm belief that functional biodiversity research can benefit greatly, both conceptually and methodically, from the insights gained in the many years of research on insect—plant interactions.

The need for a such a synthetic vision of the future of research on the relationship between insect biodiversity and ecosystem function became clear in an ESF LINKECOL-funded workshop on “Manipulating insect herbivory in biodiversity-ecosystem function experiments” held in Jena, Germany, in September 2001. The purpose of the workshop was to highlight current research on insect herbivores in community and ecosystem ecology and to explore the

strengths and weaknesses of different methods of manipulating insect herbivory. The talks and interactions that took place at this workshop were the inspiration for this book. In particular, it became clear to us that there was a wealth of information that could be brought together to provide an overview of the current status of the field and help guide future research in this area. Thus, the aim of the book is to both review the known effects of insects on ecosystem functioning and to provide a detailed discussion of the strengths and weaknesses of various techniques of manipulating insect herbivory. We hope that this book is a useful tool for both students and researchers.

This volume is divided into five sections. The first section gives an introduction to the roles that insects play in ecosystem processes and discusses the progress that has been made to date in understanding the importance of insects in a variety ecosystem processes. The second section reviews some of the recent experimental work on the interactions between above-ground insect herbivory, the below-ground community and ecosystem processes. The third section provides a number of examples of the complex interactions between plants and insects that have both direct and indirect effects on ecosystem functioning. The fourth section reviews established and novel methods to manipulate the interactions between plants and insect herbivores. Particular emphasis is given to the advantages and disadvantages of the various methods to reduce, enhance or simulate the effects herbivory on plant communities. The fifth and final section is a synthesis of the other areas of the book and includes our thoughts on future directions of this area of research.

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June 2004
Jena, Germany
Houston, Texas, USA

Wolfgang Weisser
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