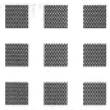

Preface

This book is based on selected papers covering the presentations at the 7th European Conference on Ecological Modelling, organized by ISEM and hosted by The Microsoft Research—University of Trento Center for Computational and Systems Biology from 30 May to 2 June, 2011 in Riva del Garda, Italy. The key theme of the conference was "models of all levels of the ecological hierarchy". The idea behind the conference was to demonstrate that we do have models of all the levels of the ecological hierarchy—from molecules, genes and cells to ecosystems, landscapes and the ecosphere. Yet, we do not have many models that include several levels and their interactions simultaneously, but it is expected that we will see more and more multilevel models in the future, which would be important progress in ecological modeling, because the ecological hierarchical levels are interacting and all levels in principle influence all the other levels. It implies that only a model that considers these interactions in more or less detail will be able to capture properly the ecological responses to, for instance, human impacts. We need, however, more experience in the development of models that include the interactions between hierarchical levels: this book gives some first prescriptions on how to integrate more hierarchical levels and their interactions in a model. This is discussed in the Introduction, in the last section (Models of Interactions between Hierarchical Levels and Hierarchy Theory) and in the last chapter (Conclusive Remarks About Hierarchy Theory and Multilevel Models).

The book has an Introduction and 32 chapters including the Conclusions, divided into nine sections, focusing on different levels of the ecological hierarchy. The first section is called "Models of the Infra-Individual Level". It has five chapters that cover quantum chemical modeling in the molecular ecology, evolution before life, gene flow modeling, cell population dynamics and molecular interaction networks. The second section has three population dynamic models, while the third section looks at the level of communities and has two chapters. The next level, ecosystems, probably the most widely modeled hierarchical level, has three sections. One section covers networks, food chains and food webs. It has four chapters. The next ecosystem section is entitled "Models of Elements Cycling in Ecosystems" and has three illustrative chapters and the last section about ecosystems is called "Models of Ecosystems" with three chapters. The section "Models of Landscapes" has five chapters. Generally, we have seen an increasing number of papers in the scientific literature about models of landscapes, because of the increased computer power today that allows us to model entire landscapes, consisting of several ecosystems. The last hierarchical level, the ecosphere, has three chapters encompassing the global carbon cycle, the impact on quality of life for biosphere dynamics and the global energy flow and its impacts on the ecological footprint. As already mentioned, we

need to develop models that are able to include the interactions between hierarchical levels, which is the focus of the last section together with hierarchy theory in general. Hierarchy theory is of course the prerequisite for a better model coverage of the interactions between hierarchical levels and to understand ecosystem reactions generally, because all the levels are significant for the ecosystem reactions. The last chapter attempts to summarize the conclusions that we can best draw from the 31 selected papers, and presents the state-of-the-art in hierarchy theory.

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