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**Ecosystem Organization
of a Complex Landscape:
Long-Term Research**

**in the Bornhöved
Lake District, Germany** (2008)

O. Fränzle, L. Kappen, H.-P. Blume,
and K. Dierssen (Eds.)

Otto Fränzle • Ludger Kappen
Hans-Peter Blume • Klaus Dierssen
Editors

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Long-Term Research in the Bornhöved
Lake District, Germany

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Cover illustration: Land/lake ecotones of Lake Belau with reed belt and adjacent alder carr in the fore- and middle ground discussed in Chapters 3, 4, 5, 8, 9 and 10

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Preface

This book presents the major findings of a 12-year ecological study of the Bornhöved Lake District, situated some 30 km south of Kiel. Historically speaking, the present research scheme, like comparable long-term ecosystem studies at Göttingen, Bayreuth, München, and Berchtesgaden, has been conceived as the core of a comprehensive ecological surveillance system for Germany (Ellenberg et al. 1978). Comprising three interrelated components, namely an ecological monitoring network, comparative ecosystem research, and an environmental specimen bank, this system is intended to promote both ecological science and planning and policy. In this connection the geo- and bioscientifically based ecosystem research aims at understanding the structure and functions of systems, the natural equilibrium and stress tolerance of singular components and the entire system against changes and disturbances from within and from outside, and the relationships between diversity, productivity, and stability. Thus, ecosystem research forms the indispensable basis for the rational analysis of the comprehensive data sets made available by ecological monitoring networks and for the adequate selection of plant, animal, and soil specimens for environmental specimen banking purposes.

The concept of such an ecological surveillance system reflects the basic ideas of UNESCO's Man and the Biosphere Programme as a follow-up action of the International Biological Programme. As an international pilot project of the United Nations Educational, Scientific and Cultural Organization the inter- and transdisciplinary research scheme implemented in the Bornhöved area has made major contributions to the following of the 14 MAB project areas: (3) impact of human activities and land use practices on grazing lands, (5) ecological effects of human activities on the value and resources of lakes, rivers ... and coastal zones, (9) ecological assessment of pest management and fertilizer use on terrestrial and aquatic ecosystems, (13) perception of environmental quality, and (14) research on environmental pollution and its effect on the biosphere.

In accordance with the above MAB core areas of research and in realization of the focal IBP Programme proposition to study landscapes as ecosystems, which had remained unfulfilled at that time, the general aim of the Bornhöved Project has been to study ecosystem organization in a structurally highly diversified landscape which is representative of the whole set of ecotope complexes along the margins of the Weichselian Glaciation. The emphasis was on production and trophic structure,

energy flow pathways, biogeochemical cycling, limiting factors, and species diversity. If each of the topics analysed by about 40 working groups, including those of the University of Hamburg, the Max-Planck Society, Fraunhofer Society, the German Meteorological Service, and the Schleswig–Holstein Industrial Inspection Board, was to be justly treated, this book would be too extensive. Therefore, our main purpose was to draw together the findings of the different sub-projects into an integrated view of the structure and function of the particular ecosystems of the Bornhöved Lake District which have been liable to exponentially growing human impact since early Neolithic times.

Thus, the book aims to be a synthesis of research rather than a summary, which means that most of the studies undertaken in the area, and in particular those in and around Lake Belau, get at least a mention. Accordingly, the book is divided into four major sections. In the sense of an introductory methodological reflection, Part I defines the research programme and presents the study area in terms of ecological setting. Part II addresses in nine chapters the structure and function of the different ecosystems at various scales and their interactions. In a transdisciplinary manner Part III finally relates the results of fundamental research to application, emphasizing the practical importance of comparative ecosystem analyses for landscape planning, sustainable land use and rural conservation.

The findings reported in this book result from the work of a great many people, including scientists, administrators, students, and technical staff. As far as possible the discussion is based on published data, and citation is the main form of acknowledgement of the data source. In all cases without such explicit reference the comprehensive relational data bank of the project was directly drawn upon by the authors of the individual chapters. Here the reader may also find additional information on selected topics at <http://www.ecology.uni-kiel.de/bornhoeved-report>.

Research funding for a project of such an order of magnitude is derived from both the Federal Republic of Germany through the Bundesministerium für Forschung und Technologie (now Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie) and the State Government of Schleswig–Holstein. Extensive preparatory investigations covering the whole of Germany with an end to reproducibly defining a set of representative ecotope complexes for comparative ecosystem research purposes were financed by the Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. The editors and all the participants in the research scheme are deeply indebted to the responsible representatives of the ministries mentioned, who exhibited an outstanding amount of interest and commitment, in particular the MinR Dr. Krause and Dr. Schulz as representatives of the Bundesministerium für Forschung und Technologie, and MinR W. Goerke in his double function as a representative of the Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit on the one hand and Chairman of the German National Committee of the UNESCO MAB Programme on the other.

Sincere thanks are expressed to the Scientific Advisory Board of the Project for its meticulous, very intensive and constructive help and criticism, to the Schleswig-Holstein electric power supply company Schleswag for providing energy to the different sites, and to the burgomasters, farmers, and fishermen of the study area, who

so readily and with great personal interest supported the enquiries. We gratefully acknowledge in particular the close and trustful co-operation with the farmers and foresters of the core area around Lake Belau, among whom the late Mr. Banck won special merit by his incessant care for our expensive installations in the field. We are much obliged to the editors of the Ecological Studies Series and to Springer-Verlag for giving us the possibility to publish this book and for their friendly co-operation on a number of details, and we are no less grateful to Dr. Breuer, Ecology Centre of the Kiel University, who provided invaluable services in his capacity as a technical editor.

May this book further the awareness that the ecosystem concept remains the best way of understanding the complex interrelationships and functions of the biosphere. It provides a most valuable structure for the comprehensive analysis of organism–environment interactions and change in order to achieve a science-based compromise between economic needs related to humans' use of the land and an ecology-based care and treatment of landscapes. By developing methods over the long term for managing resources so that all of humankind's needs are provided in a socially acceptable and balanced fashion, ecosystem research also provides a structure whereby complex ideas can be communicated to policy makers and administrators for better stewardship. For both of these reasons, the ecosystem concept, and its application to ecological and environmental problems, has a continuing importance for science and a broad spectrum of society alike.

November 2007

O. Fränze, L. Kappen, H. -P. Blume, and K. Dierssen

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