

Forest Dynamics, Growth and Yield

From Measurement to Model

Bearbeitet von
Hans Pretzsch

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Preface

How do tree crowns, trees or entire forest stands respond to thinning in the long term? What effect do tree species mixture and multi-layering have on the productivity and stability of trees, stands or forest enterprises? How do tree and stand growth respond to stress due to climate change or air pollution? Furthermore, in the event that one has acquired knowledge about the effects of thinning, mixture and stress, how can one make this knowledge applicable to decision making in forestry practice? The experimental designs, analytical methods, general relationships and models for answering questions of this kind are the focal point of this book.

Forest ecosystems can be analysed at very different spatial and temporal levels. This book focuses on a very specific range in scale within which to analyse forest ecosystems, which extends spatially from the plant organ level through to the stand level, and temporally from days or months to the life-time of a forest stand, spanning decades or possibly even centuries. It is this range in scale addressed in the book that gives it its special profile. General rules, relationships and models of tree, and stand growth are introduced at these levels. Whereas plant biology and ecophysiology operate at a higher resolution, forest management and landscape ecology operate at a broader spatial-temporal resolution. The approach to forest dynamics, growth and yield adopted in this book lies in between; it integrates knowledge from these disciplines and, therefore, can contribute to a cross-scale, holistic systems understanding.

The scales selected have practical relevance, as they are identical to those of biological observation and the environment in which people live. As interesting as fragmented details at small temporal or spatial scales obtained through reductionist approaches might be, system management requires rather an integrated, holistic view of the system in question. In this book I outline some ways to draw information of practical relevance from the scientific knowledge acquired.

Why a new book about structural dynamics, growth and yield in central European forests, why this effort when, in any event, very little is read today? The well-known works from Assmann (1970), Kramer (1988) and Mitscherlich (1970) focus on even-aged pure stands, classic silvicultural thinning methods and wood yield at the stand level. However, over time, the structure, dynamics and tending regimes in, and demands on, the forest in central Europe have changed immensely as evident in the

transition from largely evenaged pure stands to structurally diverse mixed stands, from homogenizing thinning regimes to the targeted promotion of individual trees or groups of trees in the stand, from wood production forestry to multipurpose forestry, which is concerned with a broad range of ecological, economic and social functions and services of forest. In short, the forest structure, management activities, and the anticipated effects on the forest in general and forest production in particular have become more complex in the sense that, in a forest ecosystem today, essentially more elements need to be investigated, more relationships among these elements understood, and these need to be taken into account in forest management. In response to this tendency towards increasing complexity, new investigation concepts, analytical methods and model approaches have been developed over the years. They complete the transition from stand-oriented approaches to individual tree approaches, from position independent to functional-structural concepts, from descriptive approaches focussed mainly on the volume growth and yield to interdisciplinary model-oriented ones. As yet these approaches have not been summarised in a textbook.

Given the structures dealt with, which range from plant organs through to the tree, stand and enterprise level, and the processes analysed in a time frame of days or months through to decades or even centuries, this book is directed at all readers interested in trees, forest stands and forest ecosystems. This book has been written especially for readers who are seeking in depth information about individual-based functional-structural approaches for recording, analysing and modelling forest systems. It integrates and imparts essential forest system knowledge to all green-minded natural scientists. The work is compiled for students, scientists, lecturers, forest planners, forest managers, forest experts and consultants.

The book summarises the author's lectures and scientific work between 1994 and 2008 while at the Ludwig Maximilian University, Munich, the Technische Universität München, and at Universities in the Czech Republic, Canada and South Africa. The contents represent the lecture material, the scientific approach and a compilation of the current methods used at the Chair for Forest Growth Science at the Technische Universität München, Germany. This book is dedicated to all students, researchers and colleagues at my Chair who have contributed to the realisation of this book.

For their support in editing specific subject areas, I would like to thank my colleagues Peter Biber (Chap. 8), Rüdiger Grote (Chap. 11), Thomas Rötzer (Chap. 2) and Stefan Seifert (Chap. 11). I also thank Gerhard Schütze and Martin Nickel for their unerring support of the research analysis, Marga Schmid for editing the bibliographical references and Ulrich Kern and Leonhard Steinacker for the cover design. Helen Desmond and Tobias Mette accomplished the overwhelming task of translating and editing the text, Charlotte Pretzsch the compilation of the index, and Ulrich Kern the equally extensive task of preparing the graphic illustrations. I thank you all for the affable and effective collaboration. The willingness to take on the considerable additional workload was founded on the common commitment to all things pertaining to the forest, and it is for all things pertaining to the forest, that is for a better understanding of, and a higher regard for the forest, that this book aims to make a contribution.

Finally, I also extend my thanks to the editors at Springer Publishing, Ursula Gramm and Christine Eckey, for their constructive contribution, and reliable and congenial assistance.

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Hans Pretzsch