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C. Wirth, G. Gleixner, and M. Heimann (Eds.)

Christian Wirth • Gerd Gleixner • Martin Heimann
Editors

Old-Growth Forests

Function, Fate and Value

Springer

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Cover illustration: This book explores how ecosystem functions change with progressive forest development from young over mature to old-growth forests. The photographs by Thomas Stephan illustrate the change in canopy structure with stand age in a mixed beech forest in the Hainich National Park, Thuringia, Germany.

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This book is dedicated to Ernst-Detlef Schulze

Homage to Ernst-Detlef Schulze

During the course of a very long career I have met legions of scientists but none comparable to Ernst-Detlef Schulze. I have had the pleasure of knowing him since the beginning of his extraordinary career and he is certainly one of the most distinctive and unforgettable scientists that I have encountered. I first met him when he came to the University of California at Los Angeles for a master's degree after studying forestry in Göttingen, Germany. Unfortunately, he set a very bad example for me as to what I should expect from master's students for the rest of my academic career, which was just starting. In less than a year while he was at UCLA, he completed a successful thesis performed at 3,000 m elevation, during the wintertime, on the gas exchange of needles of bristlecone pine – the oldest-known living tree – foreshadowing his lifelong interest in old forests and long-lived trees.

But that arduous thesis was only a part of his accomplishments during that brief period. He also participated in a tropical program in Costa Rica, where he completed a publishable study on soil respiration. Then, to cap off his stay at UCLA he traveled by vehicle to the Arctic on his way home. I am sure I am forgetting many other things he did in his spare time during his short stay with us. As far I can see he has never slacked off the torrid pace to this day since that awesome start. He went on to study for his PhD with the pioneering and leading plant physiological ecologist Otto Lange at the University of Würzburg. He subsequently went on to establish a vigorous plant ecology program at the University of Bayreuth. He then became a founding director of the Max Planck Institute for Biogeochemistry in Jena, Germany.

Since those early days, I have had the privilege of working with Detlef in many parts of the world – the redwoods of California, the tropical dry forests of Mexico, the temperate forests of Argentina, and the sand dunes of the Kalahari. In all of these studies he used his unique approach to science. He dives into the system with ferocious intensity, learning about the system as he goes by probing until he finds the critical measurements needed to test his hypotheses. His desire to learn, first-hand, about the functioning of the diversity of ecosystems of the world can be appreciated by those who visit his institute, where there are displays of wonderful pictures of all of the ecosystems where he has worked. Clearly he has been inspired, as have all ecologists, by the pioneering studies of Alexander von Humboldt seeing, doing and learning.

His deep knowledge about science and science history is phenomenal. A field trip with him is incredibly interesting since he can tell you everything about an area that you would want to know: its history, the geomorphology, and its natural history. If he is driving during his exposition, the trip can be very exciting and certainly death defying.

Detlef has published extensively. It is lucky that electronic PDF files have been developed this past two decades since without them I would have run out of file cabinet space for his prodigious contributions. He has led the way in melding process level physiological ecology with ecosystem and landscape functioning. His strong contributions and interests in the carbon cycle in recent years are reflected in the final chapters of his monumental Plant Ecology textbook at one level and, at another, his work with the IPCC and the Framework Convention on Climate Change.

For a long time, Detlef has been interested in bringing attention to the old-growth forests of the world and the important role they play in so many environmental and social dimensions but in particular in carbon storage. This book is a fitting tribute to Detlef's deep interest in this topic as well as to his enormous accomplishments. He should be very gratified to see all of the new and exciting insights that have been brought together in this volume. Hopefully it will provide a stimulus for greater protection of those remaining islands of a once vast sea of old-growth forests with their extraordinary storehouses, of not only carbon, but also biotic diversity.

Harold A. Mooney
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Preface

How do old-growth forests function in comparison to younger and managed stands? There exists a whole suite of negative attributes that are commonly used to characterise the old-growth stage (e.g. 'senescent', 'over-mature', 'break-up', 'decay') implying that these forests are less vigorous, less productive and less stable than earlier stages of forest development. Another line of thinking that goes back to Clement's climax concept [Clements FE (1936) Nature and structure of the climax. J Ecol 24:252–84] and Odum's ecosystem theory [Odum EP (1969) Strategy of ecosystem development. Science 164:262–270] emphasises the notion of a compositional and biogeochemical equilibrium: The same set of species replaces itself via gap-phase regeneration, and input of carbon and nutrients equals the output. It is the latter perception, which suggests the inability of old-growth forests to sequester carbon, that led to the exclusion of non-managed old-growth forests from the carbon accounting schemes of the Kyoto-Protocol of the United Nations Framework Convention on Climate Change (UNFCCC). In the last two decades, an increasing number of ecological studies employing novel methods, improved sampling designs, and large datasets have yielded results that challenge these views of decline or neutrality.

Synthesising the new findings and integrating them into a more comprehensive picture of old-growth forest functioning was the goal of a symposium entitled "Old-growth forest: function and value of a vanishing ecosystem", which was held at the Max-Planck-Institute for Biogeochemistry in Jena, Germany, on 12–13 September 2006. A second, equally important purpose of this symposium was to celebrate the 65th birthday of Ernst-Detlef Schulze – one of the founding directors of our institute – to whom this book is dedicated. His endless scientific curiosity in general and his long-standing fascination with old-growth forests in particular inspired a large portion of the research documented in this book.

During the production of this book it turned out that many authors were willing to go far beyond a mere review of existing studies. A large number of chapters in this book present new original data and comprehensive meta-analyses based on large datasets that have so far not been evaluated in the context of old-growth forest research. Many people have contributed to this book. In particular, we would like to

thank the main authors of this book, who have all contributed to the overall effort by providing constructively critical reviews of one or several chapters. Among them, we are specifically indebted to Jeremy Lichstein, who carried the extra load of reviewing the introduction and synthesis chapters. In addition, we would like to thank the following external reviewers: Richard Birdsey, Ivan Jansen, Jill Johnstone, Till Pistorius, and Thomas Wutzler. Two other 'external' reviewers, Göran Ågren and Sebastién Fontaine, got so deeply involved in the book project that they eventually became co-authors. Martina Mund, Marion Schrumpf, Anja Fankhänel, and Natalia Ungelenk provided critical comments and helped with the acquisition of literature. Annett Börner provided superb software support and Dirk Sawade took on the great task to improve and harmonize the figures and graphics presented in this volume.

Without the help of Dorothea Frank and Angela Nüske from the Organismic Biogeochemistry Group of our institute, this book would probably not exist. They helped with just about everything, from erasing typos, pre-formatting figures, critically reviewing the chapter contents, adding mark-ups for the subject indices and the glossary, to chasing up manuscripts, reviews and revisions from over-committed scientists.

Finally, we would like thank our families for their patience in enduring our absent-mindedness during the writing of this book.

Jena, February 2009

Christian Wirth
Gerd Gleixner
Martin Heimann

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