Soil Ecology in Northern Forests

A Belowground View of a Changing World

Forest soils form the foundation that underpins the existence of all forests. This book encapsulates soil ecology and functioning in northern forests, focusing on the effects of human activity and climate change.

The authors introduce the fundamental principles necessary for studying forest soils, and explain the functioning and mutual influence of all parts of a forest soil ecosystem. A chapter is dedicated to each of soil acidity and heavy metal pollution, elevated carbon dioxide, nitrogen deposition and climate change, highlighting the most important anthropogenic factors influencing forest soil functioning, and how these soils are likely to respond to environmental change.

With its unique view of the functioning of the soils found under temperate and boreal forests in today's rapidly changing world, this book is of interest to anyone studying forestry and forest ecology in European, North American and North Asian contexts.

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To Emilia and Barbara (ML)

To Oda, Jasmin and Colin.

With thanks to the people who gave me my chance in science and influenced my thinking: Horst Marschner, Aloys Hüttermann and Fakhri Bazzaz (DLG)

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Preface

Why forest soils? What makes forest soils unique and worthy of study in separation from other types of soil? There is probably a myriad of reasons, as every forester or forest soil scientist would attest, but the most compelling motives surely must be their extent, their close links with the forests under which they develop and their role in the global biogeochemical cycles. We study the structure and functioning of forest soils in order to understand the relationship between the soil and the forest. The ultimate goal is then to utilise such knowledge in forest management and conservation. To further the argument in favour of studying forest soils, one can draw a very clear distinction between agricultural and silvicultural use. Although one could argue that both agriculture and silviculture treat the soil as a resource to be used when growing the desired crop, there is an important difference between the two land use types. Soil as a resource influences the quantity and the quality of the crop and, to some extent, the crop management techniques; however, it is only in a forest where the soil develops together with the crop. This is because of the length of the forest life cycle: a particular tree species or mixture has sufficient time to affect the microclimate and the site conditions, to alter the character and the functioning of the soil.

The main motivation for writing this book has been the provision of a single volume concentrating on forest soil development and functioning in temperate and boreal forests. The book describes fundamental soil characteristics and their use and shows the link between the forest and soil development. It introduces the principles of soil ecology in terms of material and energy flows and in terms of the roles and functions of all types of soil biota. To illustrate some of the present-day issues, the book sets forest soil ecology against the background of anthropogenic pressure and climate change. This is, undoubtedly, the greatest environmental factor shaping the near future of forests and forest soil. The latter part of the volume introduces the environmental functions of forest soils and discusses the management challenges that have to be met to ensure sustainability of forest soils in the future.