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## Ecological Studies

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R.K. Wieder D.H. Vitt (Eds.)

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# Boreal Peatland Ecosystems

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With 73 Figures, 6 in Color, and 22 Tables

 Springer

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*Cover illustration:* Boreal peatlands at Thickwood Hills, northeastern Alberta, Canada. Large wooded bog island with open internal lawns caused by localized permafrost melt. Paludified upland island (foreground left) surrounded by patterned rich fen (left and background) and bordered by aspen-dominated upland ridges (sand dunes) in center background. Photo taken May 23, 1982 by Dale H. Vitt. Insets: (top left to bottom right) Weather station in continental bog (Canada) [photo taken by Kimberli Scott; *Rubus chamaemorus* (Canada) [photo taken by Bin Xu]; *Sphagnum riparium* (Canada) [photo taken by Dale Vitt]; peat core with Macaulay corer (Canada) [photo taken by Rose Boise].

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# Preface

Boreal peatland ecosystems – bogs and fens – cover only about 3% of the earth's land surface, but their overall ecological and societal importance is proportionately much greater than their area might suggest. Most of these ecosystems are located in the northern hemisphere in areas that were completely covered with ice 10,000–25,000 years ago. In the relatively short period of time since deglaciation, peatlands have become widely established in northern boreal regions. Peatlands are characterized, of course, by accumulations of incompletely decomposed organic matter, or peat, that is often deep. Globally, peatlands contain about 30% of the world's terrestrial soil carbon, such that their carbon storage is much greater than their land surface area would suggest. The fate of this carbon, and indeed of boreal peatland ecosystems, in the face of ongoing climate change remains uncertain.

Peatlands also are the basis for a variety of human activities, including harvest for the horticultural industry, harvest for fuel, and forestry, the last especially in Scandinavian countries. Peatlands provide habitat for a unique suite of animal species. Several peatland plant species produce fruits that are consumed, directly or indirectly by humans (cranberries and cloudberry being prime examples). Many of the world's peatlands receive atmospherically deposited pollutants, including nitrogen, sulfur, and heavy metals, whose local and regional deposition patterns have changed in the past and will continue to change in the coming decades. With organic soils that are aerobic near the surface, and anaerobic below the water table, the behavior of these anthropogenically deposited materials differs considerably from the behavior in other terrestrial ecosystems.

Especially over the past 2 decades, boreal peatlands have received considerable attention from researchers in various parts of the world. In preparing this volume of *Ecological Studies*, our goal was to produce a current synthesis of the considerable research on boreal peatland ecosystems in which an *ecosystem perspective* is maintained throughout. At the heart of ecosystem science are the fundamental processes of nutrient cycling

and energy flow. To understand these fundamental processes for a particular ecosystem, it is necessary to quantify nutrient pools and fluxes, as well as the biotic and abiotic controls on fluxes. Key processes include net primary production, decomposition, and secondary production through fauna, with important controls that include climate and hydrology, along with their anthropogenic influences. In putting together the new volume, we have asked chapter authors to do their best at synthesizing available information from peatlands around the world. We also have encouraged chapter authors to keep an ecosystem perspective in mind in preparing their chapters. Our overall goal was to produce the first truly ecosystem-oriented peatland volume, with global, rather than local or regional, relevance.

Villanova, PA, March 2006

*R. Kelman Wieder and Dale H. Vitt*

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