

Preface

Phosphorus (P) is an essential element for all living organisms. In terrestrial ecosystems, P is often the most limiting nutrient. Due to human alteration of the P cycle, pollution with excess P is prevalent in many aquatic ecosystems and can also affect biodiversity in terrestrial ecosystems. Because economically mineable P deposits are finite, a better management of the P cycle is mandatory. This requires a good understanding of the processes of soil P dynamics.

Soil P occurs in inorganic and organic forms. Forms of P in the mineral phase, the physicochemical processes of sorption and desorption, and their effects on P cycling and availability are well known and predictable. Organic P forms are less well characterized and the biological processes (e.g., mineralization and immobilization) affect P dynamics to varying and often unknown degrees. In addition, the interactions of P dynamics with carbon and nitrogen are not well understood.

The chemical characterization of organic P and its dynamics in terrestrial as well as aquatic environments have been reviewed in a book quite recently (Turner et al. 2005). One conclusion from this book was that information on the mechanisms and rates of organic P transformations is urgently needed in order to better manage soil organic P. Given the great amount of information included in this “Organic P Bible”, we hesitated when we were asked by the series editor Ajit Varma to publish a book on P in the Springer Series on Soil Biology. However, we realized that significant progress has been made in the last 5 years, and that it was indeed timely to collect the existing information on the biological processes in soil P cycling and present the state of the art. Measuring the rates of any reaction in soil is a step towards understanding the “action”, and therefore we decided that our book should focus on ‘phosphorus in action’.

We planned three sections: one on methods, one on processes, and one on ecosystems and management. We asked the authors to present case studies rather than a complete review of the topic, wherever appropriate. We also asked the authors to consider two aspects in particular: (1) that the role of biological processes in soil P cycling has to be examined against the availability of inorganic P resulting from physicochemical processes and (2) that interactions between carbon, nitrogen,

and P have to be examined to fully understand similarities and differences of P cycling to the cycling of the other elements. Lastly, authors were asked to point out gaps in methods and understanding.

We are extremely grateful to all authors for contributing such an impressive number of high quality chapters. Some chapters were written by scientists who have been working together before. In other chapters, authors published together for the first time and found the exchange of ideas during the preparation stimulating. Some chapters present the state-of-the-art of topics that have been reviewed previously. Other topics have never been summarized before and the authors thus compiled truly original chapters.

As a teaser for the book, we would like to point out some of its highlights (Table 1). To our minds, this table is an attempt to assess the progress that has been made in the field, but of course you will find much more in-depth and significant information within each chapter. At the end of the book, we have tried to draw some general conclusions and to summarize the main research needs.

Table 1 Editors' choice of highlights in each chapter

Chapter	Authors	Highlight
1	Doolette and Smernik	Useful summary of the relative merits of solution and solid state ^{31}P nuclear magnetic resonance (NMR), and X-ray absorption near edge structure (XANES) in terms of sample preparation, sensitivity, resolution and quantification
2	Bünemann et al.	Novel data on P forms in microbial cells extracted from soil, i.e. cells that grew in situ, including non-culturable soil microorganisms
3	Frossard et al.	First combined review of radioactive and stable isotopes in the study of P cycling, also summarizing recent progress in the measurement of gross and net organic P mineralization rates
4	Wasaki and Maruyama	Informative table listing the molecular tools to study soil P cycling and applications in the pioneering studies done in the past 10 years
5	Schnepf et al.	Three modeling case studies as excellent examples of how the most important processes of P cycling in soil-plant systems can be identified and quantified on different temporal and spatial scales
6	Jansa et al.	Stimulating information on the accessibility of different soil P forms by arbuscular mycorrhizal and ectomycorrhizal fungi
7	Jones and Oburger	Thorough summary of mechanisms of P solubilization by soil microorganisms
8	Chapuis-Lardy et al.	Interesting presentation of the role of earthworms' surface casts and termite mounds, respectively, in P transfer and erosion
9	Nannipieri et al.	Critical examination of the limitations of conventional enzyme assays
10	George et al.	Eye-opening section on the co-ordination of plant responses to variations in P supply
11	Jouany et al.	Noteworthy figure illustrating that a grassland sward is more efficient in converting nitrogen into biomass under non-limiting than under limiting P supply
12	Weintraub	Comprehensive section on P limitation in arctic and alpine soils, including results from fertilization studies

(continued)

Table 1 (continued)

Chapter	Authors	Highlight
13	Fox et al.	Concise summary of P cycling and management in temperate forest plantations
14	Reed et al.	Original section on the implications of P limitation on tropical forests under climate and land use change
15	Belnap	Novel case study on the interaction between exotic annual grasses and soil P availability that exemplifies effects of invasive plants on P availability
16	Dao and Schwartz	Detailed description of P transformations in semi-solid and liquid manures
17	Oberson et al.	Comprehensive table comparing the P status and various measurements of biological P cycling in a field experiment under organic or conventional management
18	Tiessen et al.	Eye-opening description of how global change affects P cycling and vice versa, which in essence is a plea for much more efficient P use everywhere in the world

Finally, we would like to acknowledge everyone who has contributed to this book. All 63 authors deserve a very warm thank you for their willingness to contribute, the many hours of work that went into each chapter, and for the excellent communication with us. We had been warned that we would have to write many reminders, but in fact it was a very positive experience for us to work with these 18 leading authors.

Each chapter was reviewed by one or two external reviewers. All of them readily accepted the task and their efforts helped to improve the quality of the book in a very significant way. Thus, we would like to thank all of them for their dedication:

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Lindau, Switzerland

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Astrid Oberson
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Reference

Turner BL, Frossard E, Baldwin DS (2005) Organic phosphorus in the environment. CABI, Wallingford

Phosphorus in Action

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