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Biological diversity and function in soils. By Richard D. Bardgett, Michael B. Usher and David W. Hopkins

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► **To cite this version:**

Jean François Ponge. Biological diversity and function in soils. By Richard D. Bardgett, Michael B. Usher and David W. Hopkins. *European Journal of Soil Science*, 2006, 57 (6), pp.924-925. <10.1111/j.1365-2389.2006.00860_3.x>. <hal-01083695>

HAL Id: hal-01083695

<https://hal.science/hal-01083695v1>

Submitted on 17 Nov 2014

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Book review

Bardgett, R.D., Usher, M.B. & Hopkins, D.W. (eds) *Biological Diversity and Function in Soils*. Cambridge University Press, Cambridge, 2005. xiv þ 411 pp. £38 (US\$65), paperback. ISBN 0-521-60987-9. £75 (US\$130), hardback. ISBN 0-521- 84709-5.

This book, based on a symposium held in 2003 at Lancaster University, under the auspices of the British Ecological Society, provokes questions. Why are there so many species living in the soil? Which important functions of the soil could be expected to be lost or gained from a decrease or increase in biodiversity? Are there functional links between below-ground activity and biodiversity in the soil? Is part or whole soil biodiversity important for the maintenance of terrestrial ecosystems? What impact on soil biodiversity could result from changing land use, pollution or a warming of the climate? These questions are still unsolved in the main or answers remain controversial. The purpose of the book, comprising 20 chapters from 65 contributors, is to throw new light on the present debate about soil biodiversity. As stated by the editors in the preface, ‘it is now time to open the “black box” and to start to understand how it works’.

The book is divided into six parts. In the seminal Introduction, the historical development of soil ecology is described and challenges for future research are highlighted, within the framework of ecosystem science and sustainable management. Ten tenets of soil ecology are discussed, and point to singularities of soil communities.

The second part of the book (three chapters) is devoted to the soil environment. Although limited in its scope, because other books deal more extensively with the soil environment, it embraces important aspects of soil structure and communities: the pore space of the soil is tortuous, perhaps fractal, and organisms cannot move and disperse freely and in straight lines through the

soil in the same way as they can in air and water.

The third part (five chapters) concerns patterns and drivers of soil biodiversity. Answers to the 'enigma of soil diversity', posed by J.M. Anderson as early as 1975, are attempted in the light of most recent experience in soil microbiology and animal ecology. An interesting paper by D. Wardle on the impact of plant communities (and processes that affect them, such as herbivory) on soil trophic networks should attract our attention in view of the threats of global warming.

The fourth part (six chapters) deals with consequences of soil biodiversity at the ecosystem level. The importance of feedback processes in place of strict causality, for the understanding of the relations between plants and soil, is stressed time and again. This is highly relevant. The problem of functional redundancy (many species apparently share the same function: are they all necessary?) is examined in the light of most recent theoretical developments in our understanding of the ecology of ecosystems and communities.

The fifth part deals with the applications of soil biodiversity in the context of nature conservation and ecosystem restoration. Through increased knowledge of soil foodwebs, we ought now be able to manage below-ground biodiversity and exploit it for restoring damaged ecosystems after destruction by war, deforestation or pollution. Here, the concept of ecosystem engineers (including earthworms and termites among many others) is of paramount importance. As this has been brilliantly demonstrated by P. Grime in vegetation ecology, the knowledge of dominant and subordinate species is crucial for protecting and restoring the ecosystem.

Origins and consequences of below-ground biodiversity are listed in an 'overview' concluding chapter. Mostly based on examples taken from microbial ecology, it shows how, beyond biomasses and species numbers (the subject of most investigations till now), and despite its (apparent) complexity and unpredictability, soil biodiversity matters for the future of mankind.

Most contributions to this book are of a high quality. All important aspects of modern soil

ecology are embraced, ranging from the molecular to the ecosystem level, from microbes to invertebrates and to plants. It offers a clear, often brilliant demonstration that the knowledge of soil biodiversity is the key for the sustainable management of terrestrial ecosystems.

J.-F. PONGE