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Book Reviews

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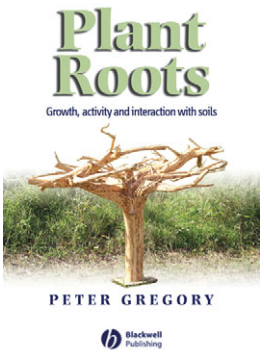

Plant roots. Growth, activity and interaction with soils
Gregory P. J. 2006. Oxford: Blackwell Publishing. £99·50 (hardback). 318 pp.

It is (or should be) self-evident that life on Earth depends mainly on life in earth, and in this respect soil–plant interactions are of key importance. This book brings together areas that are still often compartmented into fields such as chemical and physical aspects of soil science (where plants are still sometimes regarded as a 'black box' of uncertain relevance), plant physiology (now sometimes re-badged as plant functional biology), and soil microbial ecology. Agricultural scientists have, of course, rarely been guilty of ignoring soil factors in relation to plant growth and productivity. Plant ecologists sometimes have, and to some of them it's the soil that is the 'black box' when it comes to understanding plant population and community ecology. Models of the impacts of global climate change are increasingly including soil-based factors, for example carbon sequestration below-ground, and there is increasing awareness that as world climates change nutrient availability is likely to influence changes in plant populations and communities: plants don't just rely on water, light and CO_2. This all makes Peter Gregory's book very useful at the present time.

In his short Preface, Gregory relates how the book came about. Influences included a 'career change' in Australia, and there is certainly a strong Australian flavour in the research that is cited. He gives very sensible caveats. Thus, it is very true that roots of few plant species (mostly cereals and legumes) have been studied in detail and that many studies in the literature have been done with young plants grown in solution or non-soil media. The roots are often considered unrealistically as uniform absorbing surfaces, and bacterial and fungal associations found under field conditions–whether in agro/forest or natural plant ecosystems–are still often ignored in laboratory-based work. However, as Gregory says, this situation is changing. Diversity below-ground in terms of root structure and function, and interactions with bacterial and fungal populations at the soil–plant interface are now receiving increasing attention, with increasing contributions from study of molecular biology, both of plants and microbes.

The brief introductory chapter touches on evolution of roots and sets the scene for the substantive chapters that follow. Types of roots, their structure and the architecture of root systems are dealt with first, followed by a chapter on development, growth and turnover that has a good section on methods for measuring root systems. Attention is next turned to root functions, with sections on anchorage (and anchorage failure), followed by material dear to the hearts of plant physiologists, namely uptake of water and nutrients. The chapter on the physicochemical environment is wide-ranging, focusing on temperature, gravity and other tropic responses, aeration and water, and nutrients and nutrient-related stresses; it ends on the highly topical subject of atmospheric CO_2 concentrations. There is next a very thorough chapter on the biological environment in which roots grow, and which they can influence. It covers general interactions with bacteria, fungi, protozoa, nematodes and mesofauna, before turning to the major symbiotic associations with N_2-fixing rhizobia and mycorrhizal fungi. Root parasites and pathogens have a separate section, as do the parasitic weeds *Orobanche* and *Striga*, and root herbivory.

Although the rhizosphere is mentioned throughout, it receives a chapter to itself. This focuses mainly on chemistry–some, of course influenced by the plant (e.g. pH and release of organic acids and other root material). Given the preceding chapter on soil biology, it would have been worth making the point that for the large majority of land plants (and excluding notably the Brassicaceae and Chenopodiaceae) the natural rhizosphere is actually a much more extensive mycorrhizosphere. Therefore many experimental studies with artificial growth media may have very limited relevance to the real world of soil. When Sally Smith made this provocative comment at the international conference 'Rhizosphere 2004' held in Munich it did not go down well with some in the audience. Nevertheless it is true irrespective of whether or not the plant itself shows identifiable benefits directly from the symbiosis.

Finally, there are two quite short chapters, one on genetic control of root system properties–an area receiving increasing attention in agricultural science–and one on 'root systems as management tools'. This rather clever title encompasses a range of topics, including optimal root systems for nutrient acquisition and competition for resources, as in intercropping and agroforestry (and hence relevant to natural plant ecosystems), biological drilling, allelopathy, biofumigation and phytoremediation.

It serves a good purpose in extending and integrating the topics covered earlier but it is rather an abrupt way to end the book. I would have liked to see a 'Conclusions' chapter with suggestions about possible future advances and even encouragement to those whose sights are set mainly above-ground to help open up the 'black box' of soil.

The book is commendably free of typographical mistakes – given the nature of root anatomy I quite liked the use of 'stellar' for 'stelar' (tissue) on page 118. On the whole the illustrations are well selected and there is a selection of colour plates grouped together in the middle of the book. I am not convinced that a whole page (Fig. 6·10) had to be devoted to a quite complex data set to reinforce the point made in the text that there is no simple relationship between the extent of arbuscular mycorrhizal fungal in soil and host-plant responses. I also some had concerns about Fig. 8·5, which showed 'yield advantage of wheat lines selected for narrow xylem vessels', using results not published when the book was written. This had seven points from separate field experiments, averaged over two genetic backgrounds, and would have been strengthened by indication of variance about means to suggest which of the points actually gave a significant positive percentage yield advantage (mean values ranged from −1 % to 8 %). The text (p. 262) says the project (by R.A. Richards and J.B. Passioura) ended because one of the varieties had disease problems and other traits were perceived as more important to yield improvement. This sadly goes to show that no matter how good the 'science', improving plant productivity is never easy.

I would have preferred references to be grouped together at the end of the book, rather than at the ends of individual chapters. However, this is another minor quibble. Unfortunately, the index is poor. First, whoever did it obviously had problems in deciding whether or not include plant names. Thus, lucerne is included but not lupin, though this plant is mentioned repeatedly. Rice is there but not wheat. As another example, many references to mycorrhizas are not in the index–giving a false impression that this topic is mainly compartmented in Chapter 6, although this is not the case. This poor indexing may mean that those who first turn to the index for information about some topics will miss it–unless they decide to read the whole book.

These points aside, this book is very well designed for its target readership in advanced university or college courses that cover (or should cover) soil–plant relationships, as well as soil, plant, agricultural and environmental scientists who are seeking to widen their knowledge of root growth and functions. Like this reviewer, they will find many useful references for further reading. Last, and by no means least, the very clear style of writing means that the book should be attractive to readers whose native language is not English.

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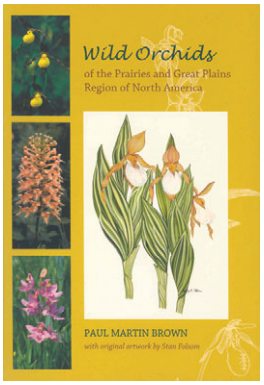

Wild Orchids of the Prairies and Great Plains Region of North America
Brown P. M. 2006.
Gainesville, FL:
University Press of Florida.
$29·95 (softback). 342 pp.

With *Wild Orchids of the Prairies and Great Plains Region of North America*, published by University Press of Florida, Paul Martin Brown offers the sixth in his series of regional orchid books. The others are: *Wild Orchids of the Northeastern United States*; *Wild Orchids of Florida*; *Wild Orchids of Southeastern United States North of Peninsular Florida*; *Wild Orchids of the Pacific Northwest and Canadian Rockies*; and *Wild Orchids of the Canadian Maritimes and Northern Great Lakes Region*. All but the first were published by the University Press of Florida. It is straightforward to deduce that Brown eventually intends to produce regional orchid floras covering the United States and Canada. If so, a significant increase in quality is mandated. In the preface Brown says 'By combining the resources of keys, descriptions, photographs, and line drawings the user should be able, with relative simplicity, to identify all the orchids within the range of this book'. Sadly, that goal is not achieved due to errors, incomplete data, incorrect keys and blurred or indistinct photographs and drawings.

A key word in the title defines the scope of this book: region. This is not a book about the orchids of prairies and the Great Plains. Rather this is a book about native orchids occurring in a region that encompasses North American prairies and the Great Plains. Brown tells us on page 5 that only a dozen or so of the 64 covered species grow in prairie and plains habitats. He does not tell us until page 241 that those species are *Calopogon oklahomensis, C. tuberosus, Cypripedium candidum, Platanthera lacera, P. leucophaea, P. praeclara, Pogonia ophioglossoides, Spiranthes magnicamporum* and *S. tuberosa*. The other species treated in the book grow in different habitats in mountains, forests and river valleys within the region. This region contains the entire states of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Missouri and Arkansas. Also covered are parts of nine neighbouring states, and southern portions of the Canadian Provinces of Saskatchewan and Manitoba.

Wild Orchids of the Prairies and Great Plains Region of North America follows the four-part pattern established in Brown's earlier books. Part 1 has a brief description of the prairie and plains region, an introduction to orchids and a key to the genera. Part 2 has descriptions of covered species, each with corresponding range map, drawing and multiple photos, including photographs of recognized varieties and forms. If, as speculated, Brown intends to cover the United States and Canada with regional orchid books, this