

# Editorial

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This Special Issue of *New Phytologist* contains the latest information and new ideas about how root dynamics might alter in the face of a globally changing environment. The importance of this topic is clear: changes in the production and turnover of roots in forests and grasslands in response to rising atmospheric CO<sub>2</sub> concentrations, elevated temperatures, altered precipitation, or nitrogen deposition could be a key link between plant responses and longer-term changes in soil organic matter and ecosystem carbon balance.

The introductory review (Norby & Jackson, 2000), which draws together the different contributions to the volume, asks three central questions:

- Do elevated atmospheric CO<sub>2</sub>, nitrogen deposition, and climatic change alter the dynamics of root production and mortality?
- How do physiological responses of roots to global change factors impact whole-plant and ecosystem metabolism?
- What are the implications of root dynamics for soil microbial communities and the fate of carbon in soil?

Ecosystem-level observations of root production and mortality in response to global change factors are just starting to emerge. The challenge to root biologists is to overcome the profound methodological and analytical problems and assemble a more comprehensive data set from which ecosystem responses can be explained. The commissioned reviews and research papers in this volume attempt to meet that challenge. Following the introductory review, three papers provide a framework for subsequent analyses by presenting a global perspective on root turnover, a review of morphological and physiological attributes of roots, and a discussion of concepts of carbon allocation in plants. This is followed by a series of papers describing experimental studies on the effects of elevated CO<sub>2</sub> and climatic change in various ecosystems. Three papers consider the physiological responses of roots to global change factors, followed by three papers reviewing mycorrhizal interactions and soil biology, and the implications for carbon sequestration in soil. The final paper returns to a global perspective with an analysis of how roots are handled in models of global change. Throughout these articles there is information on topics such as methodology for studying root dynamics, the major gaps in our knowledge, and the idea that leaves are a good analogy for roots.

## ACKNOWLEDGEMENTS

The articles in this volume developed from the 5th *New Phytologist* Symposium held in Townsend, Tennessee, USA in October 1999. Participants met to discuss the latest information and new ideas about how root dynamics might change in the face of a globally changing environment. In addition to the invited presentations, many participants presented some of the latest research in posters, one of which has been developed to form a contribution to this volume, and others we hope to see published here in the future. There were lively discussions throughout, and Martyn Caldwell captured much of this and the spirit of the symposium in a perceptive report in the January 2000 *Bulletin of the Ecological Society of America* (Caldwell, 2000; also see <http://gcte.org/rootrep.htm>). The participants left Townsend with a deeper understanding of the issues and opportunities for exploring root dynamics and global change and the challenges for interpreting responses with an ecosystem perspective.

The idea for this symposium developed from discussions within Focus 1 of the Global Change and Terrestrial Ecosystems (GCTE) core project of the International Geosphere–Biosphere Programme (see <http://www.gcte-focus1.org/>). The response of fine roots to elevated atmospheric CO<sub>2</sub> was identified as a key research area that needed to be encouraged in order to advance our understanding of ecosystem physiology, and was therefore listed as a topic for a future GCTE workshop. GCTE workshops have been a successful vehicle for identifying important, emerging research areas and fostering their development. We thank Pep Canadell for encouraging this symposium and the GCTE Focus 1 Office for helping to publicize it and disseminate the results.

We thank the Trustees of *New Phytologist* for the financial support for this symposium and for the foresight to invest in the continuing advancement of plant biology. This was the first *New Phytologist* symposium to be convened in North America, and it coincided with the inauguration of the journal's USA Office in Oak Ridge, Tennessee. The commitment of the Trustees to serve the plant biology community internationally is evidenced as well by the joining of interests with GCTE.

We also thank the authors and reviewers of the papers in this volume, and gratefully acknowledge the heroic efforts of the *New Phytologist* Central Office staff for making rapid publication possible.

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