

Book Reviews

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Aboveground–belowground interactions in a changing world

Bardgett, Richard D., and David A. Wardle. 2010. **Aboveground–belowground linkages: biotic interactions, ecosystem processes, and global change.** Oxford Series in Ecology and Evolution. Oxford University Press, New York. x + 301 p. \$108.50 (cloth), ISBN: 978-0-19-954687-9 (acid-free paper); \$52.95 (paper), ISBN: 978-0-19-954688-6 (acid-free paper).

Key words: ecosystem dynamics; global change; plant–soil feedbacks.

This book, *Aboveground–belowground linkages: biotic interactions, ecosystem processes, and global change*, surprised me. I was expecting another text that expounds upon how complicated and contextual the links between aboveground and belowground systems are, but instead I found a well-organized, up-to-date, and insightful text that synthesized what we know (and just as importantly, don't know) about aboveground–belowground linkages. The aim of this book, to synthesize the ever-increasing number of studies on linkages between aboveground and belowground interactions and connect these findings to global change, is clearly laid out in the Introduction and I think the authors accomplish this feat. The book is organized into six chapters, some of which are more interesting and better organized than others.

The first chapter is the introduction and sets up the book and its aims well. The second chapter, on biotic interactions as ecosystem drivers, was by far my favorite chapter in the book. The science presented is new and the authors discuss many current issues in soil biology, e.g., trophic interactions in soil, bacterial- and fungal-based energy channels, and the temperature sensitivity of soil organic carbon. Chapter two is also well organized, points to where to find other, related information in the rest of the book, and does a nice job of connecting concepts. I would buy this book for this exciting chapter alone.

Chapter three, on plant influences and plant–soil feedbacks, wasn't as well organized or interesting as chapter two. This could be because this area of research is more developed and thus there have been a number of recent review papers on the topic. Organizationally, I wish the authors had continued with the review of each section as a starter to the section because this format worked well connecting topics in chapter two. In spite of this, the sections on spatial and temporal variability and contrasting plant species and trait axes were highlights and the discussion of ecosystem retrogression is interesting and missing from other ecosystem leaning texts.

Chapter four, significance of aboveground consumers, is another topic that has been reviewed previously; however, the authors do a nice job of integrating recent advances in this area. For example, sections on how herbivore population dynamics and life histories alter nutrient cycling at different spatial scales, the role of plant traits in regulating herbivore impacts, links between aboveground and belowground herbivore communities, and transfers between aquatic and terrestrial ecosystems clearly present the advances in the field over the last five years. While the authors do a nice job integrating current studies, there seems to be a bias toward boreal and arctic ecosystem examples. Changes in precipitation and warming will clearly

alter ecosystems, but we have less of an understanding on how biotic factors such as herbivory will modify those response. Chapter four ends by nicely highlighting this challenge, but I wish there had been a little more discussion on how using models coupled with experiments might help point the way forward in this exciting, and important, research area.

Chapter five, “Consequences of species losses and gains,” argues that more work on species loss at the aboveground–belowground interface needs to occur under realistic field conditions and goes on to discuss how invasive plants, herbivores, and predators may shape aboveground and belowground interactions. I found their discussion of the consequences of range-expanding species for soil communities and ecosystem processes particularly interesting and new. The authors end this chapter by arguing for more experiments that manipulate non-random species loss in native ecosystems. Such experiments are rare, but critically important to understand the consequences of species loss.

Chapter six, “Underlying themes and ways forward,” tackles how the topics of each chapter operate at different spatial and temporal scales and does a nice job of integrating the themes of the book. The discussion on soil microbial community analysis and interpretation using emerging genetic techniques (e.g., 454 sequencing) is a bit disappointing, but given the infancy of the field, not all that surprising and perhaps a bit beyond the scope of this book. A discussion of plant trait influences on ecosystems, a theme in this book, is summarized nicely and points to areas of work that are needed (e.g., understanding how fungal and bacterial energy channels may be influenced by plant traits). The last section of the chapter, “Global change phenomena,” does a nice job exploring the need to (and the challenges of how to) better understand how interactions and feedbacks between above- and belowground systems will shape our understanding of future ecosystem functions.

One of the strengths of this book is that it provides enough background for those who have limited knowledge of the topic to follow, but also provides enough synthesis of new topics to engage researchers in the field. For this reason, I think it will appeal to a broad range of scientists, including invasion biologists, microbial ecologists, plant and soil biologists, researchers who focus on plant–herbivore interactions and, of course, ecosystem ecologists. The sections in each chapter end with suggestions of what work is needed to move that area of research forward, and I think this characteristic of the book will particularly appeal to beginning graduate students.

For the most part, this book is clearly organized which makes it a pleasure to read. Each chapter is nicely introduced and there is discussion about how it fits with the rest of the book. Both of the authors have successfully used conceptual diagrams to illustrate their work in their numerous empirical and review papers, and this book is no exception. The figures, pictures, and schematics complement the text and are well used to illustrate points. In fact, I really like the photographs used in the text and think they will make a great teaching tool (especially if they were available online in color). These organizational characteristics make *Aboveground–belowground linkages: biotic interactions, ecosystem processes, and global change* an excellent teaching text for an upper-level undergraduate class or a graduate-level seminar.

In the last three weeks of my upper-division (3rd and 4th year students) ecosystem ecology class this fall I used two sections of this book as background reading—the section on bacterial based and fungal-based energy channels and the section on contributions of soil biotic interactions to climate change via carbon-cycle feedbacks. While challenging, the students found these sections to be clearly presented and understandable. They especially found the schematics and diagrams in these sections helpful in shaping our classroom discussions. I have been looking for a text to use in my upper-division terrestrial ecosystem ecology course that integrates soil ecology with ecosystem ecology and I think I have finally found it. This text contains numerous current topics that I often discuss in class, but are not addressed in the standard ecosystem ecology texts, e.g., bacterial and fungal pathways, plant-soil feedbacks, and the influence of the belowground community on

ecosystem dynamics. While using this book would require some supplemental readings from the primary literature to explore topics such as soil development and nutrient cycling in more depth, the topics in this short and affordable book are well integrated and up to date. Given that the authors are pioneering leaders in this field and have had a long and productive collaboration, it is no surprise that their new book is excellent.

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A long, productive, and inspiring career

Langenheim, Jean H. 2010. **The odyssey of a woman field scientist: a story of passion, persistence, and patience.** Xlibris, Bloomington, Indiana. 539 p. \$ 34.99 (cloth), ISBN: 978-1-4415-7442-8; \$ 23.99 (paper), ISBN: 978-1-4415-7441-1.

Key words: autobiography; careers in science; chemical ecology; plant ecology; women in science.

Jean Langenheim has written an important historical work, not only the autobiographical portrait of her career, but of science and societal changes over her lifetime. The book is highly detailed, as if transcribed or guided by a meticulously kept diary. In its pages we meet many people, learn a great deal about academia and the field of ecology, and see the world through the eyes of an intelligent, talented, and compassionate woman scientist. It is very interesting, and engaging on many levels, but hardly “light reading,” for it is basically a first-hand account of the evolution of the field of ecology during the 20th century, as well as the story of the shifting roles of highly educated women in academia over the same period of time. As a graduate student researcher, and later, teacher, she considered the divergent views of the Clementsian view of the community as a superorganism, vs. the individualist concept of plant distributions, along with the evolutionary influences of biosystematics. Later she helped develop the field of evolutionary ecology with her interests in chemical ecology, at the time that ecosystems ecology claimed to be the more scientific and legitimate approach.

Before reading this book, I was familiar with Langenheim’s neotropical work on the origins of amber, fossil resin from leguminous trees, especially in the genera *Hymenaea* and *Copaifera*. I learned here of her broader experience and expertise in plant ecology, beginning with vegetation studies done in mountains of the western U.S. (some of the places she worked later became national parks), and her pioneering fieldwork at the Rocky Mountain Biological Laboratory (RMBL). Her original partner in the field was her husband, but her later ventures included many other colleagues, and she was frequently the sole woman in all-male teams, often working in the field where no women were normally permitted. Being

married to another scientist meant that her own career path was greatly constrained by the anti-nepotism laws prevailing in the early 1950s, and so she moved to UC–Berkeley and the University of Illinois, fitting her research in as opportunities presented themselves. She was involved in a multitude of projects over her lifetime, first in collaboration or highly influenced by other scientist collaborators and field partners, but eventually quite independent and leading her own teams of graduate students and postdocs. She credits the Radcliffe Institute for Advanced Study and the American Association of University Women for logistic and financial support to make her transition into an independent scientist, studying the origins of amber throughout the world’s collections of this highly prized, fossilized resin, prior to becoming a faculty member.

Jean Langenheim was invited to join the faculty of the University of California Santa Cruz (UCSC) faculty to develop a new type of undergraduate education, beginning her professorial career at an institution she helped to grow, and where she stayed connected until long after her retirement as an emerita professor. As one of the founding professors at UCSC, she lived and worked with students in a residential college, and served on many varied committees, becoming eventually the head of the Graduate Council. Over her career she had increasing responsibilities on university and other committees, where she was often the only woman. When commended on her promotion to full professor, the same year her first two Ph.D. students graduated, she was asked by the Chancellor what would help advance her career the most. She replied “a wife,” an answer often voiced by other women academics who have observed how a dedicated spouse can help a person’s career.

Over her research career, Professor Langenheim made an impressive global coverage of field sites. I was previously familiar only with her work in the neotropics on tropical tree resins, but her earlier and later career took her to the Rocky Mountains, Alaska, Mexico, Europe (including Soviet block nations during the Cold War era), Africa (including South Africa during apartheid), Brazil and many other South American countries, and later trips to Asia. Her travels also gave many insights into the social changes over the decades of her life as a pioneering woman in science, as well as a scientific ambassador. She graciously weathered culture clashes: a rare giant Amazonian turtle was beheaded and cooked in her honor;

a giant *Hymenaea* tree was felled for her to obtain specimens; as an honored guest she was served fish heads for the succulent fish cheeks, the best part! And her account of a flight in an overcrowded small plane in Costa Rica, leaving no one behind, but her own behind protruding from a partially open door was very evocative of the North American caution being cast to the wind by Latin American necessity. The detailed nature of the book presents us with a cavalcade of famous scientists (mentors, colleagues, friends, students—too many to mention here), as well as cultural icons. At one time, Jean Langenheim was next-door neighbor to Julia Child, the renowned television chef. Ansel Adams was invited to be a guest lecturer in one of her early courses; his interest in talking to students led to a long-term involvement with UCSC. In Brazil, she visited the studio of Genaro de Carvalho and received a gift of a painting for the UCSC students.

Jean Langenheim was (and is) a fellow of the California Academy of Sciences, an academic achievement, but was also elected a member of the Society of Women Geographers, a society formed by “traveled women,” many of whom had been excluded from the academic mainstream in California. She had important roles in many scientific societies, the EPA, NAS, various editorial boards, OTS, and the Brazilian Research Council, as well as frequently being invited to be chair or dean at other universities. Being a successful woman meant that she was a prime candidate for institutions wanting to increase their representation of women and minorities. This honed her ability to be able to say no, for self-preservation—she agreed to involvements that also benefited her research and graduate teaching, a valuable lesson for any academic person. The pinnacle of her academic service achievements was to serve as president of OTS, then (simultaneously) ISCE and ESA, and later, SEB. She has given generously to support graduate

studies and a professorship in Plant Ecology at UCSC, giving back while she is still around to see the benefits of her legacy. Clearly, she is someone who has really enjoyed her life and her work.

The book is well illustrated, with photos of many of the places and people. Included also are maps, with arrows depicting routes of her journeys on different continents, accompanying the very detailed accounts of activities in research and teaching. There are many names and lots of anecdotes, but many of the scientists were familiar names to me and so it was illuminating to learn more about their lives and careers as they intersected with those of Jean Langenheim. Most endearing were her continuing encounters, everywhere she went, with cats and other animals—being hugged by a three-toed sloth, cuddling and carrying a wombat (the cutest photo in the book).

Overall, the book is very engrossing reading, but the details may be overwhelming at times. And there are some minor errors and oversights—the chemical ecologist Dave Seigler may be disappointed to see himself called D. Zigler! But maybe this book will only be read by women? I hope not, for ecologists of all ages and genders may find much of interest in this book, as it offers a first-hand look at the challenges, excitement, and accomplishments of a highly regarded woman ecologist of the turn of the 21st century.

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