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not imply that the injustice situation does not exist or is unimportant.

Guariguata *et al.* [1] do not see the associated costs to NoNES derived from linguistic injustice as a big problem nor do they believe that they can result in any important bias in the research output of scientists (although, surprisingly, they do propose solutions to overcome it). However, the available evidence highlights the role of linguistic difficulties of NoNES as a source of publication bias. Primack *et al.* [3] analyzed the results of the review process for manuscripts submitted to *Biological Conservation* and found that "there is substantial disadvantage of not having English as a first language; this disadvantage could result in a decrease of around 30% in the chance of acceptance". Vasconcelos *et al.* [4] showed that the research output of Brazilian scientists was tightly related to their English-language skills and Man *et al.* [5] found that English proficiency was a good predictor of national research production, even better than the investment of each country in science. I found that the proportion of papers published exclusively by NoNES in ecological journals was negatively related to the journals' prestige while, for any given Impact Factor, this proportion was clearly larger in journals published in non-Anglophone countries [6]. Thus, the beliefs of Guariguata *et al.* [1] do not seem to be supported by available evidence, and there is a notable disadvantage of NoNES when going through peer review processes [7]. Of course, having good English skills is not the only factor determining the quality and quantity of scientific production; this is so obvious that it does not deserve further discussion.

Guariguata *et al.* [1] suggest that NoNES scientist should: (i) train harder on their English scientific writing; (ii) become editors of scientific journals; and (iii) not get angry when receiving a send-to-a-NES paper revision. However, I think that the fair scenario needed to reduce linguistic inequalities among researchers would necessarily imply actions from NES scientists, the part of the scientific community for which English was a gift.

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Book Review

Social networking in the world of ants

Ant Encounters: Interaction Networks and Colony Behavior by Deborah M. Gordon. Princeton University Press, 2010. £13.95/US$19.95, pbk (184 pages) ISBN 9780691138794

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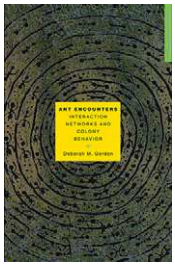

Ants are a highly successful group, found in almost every terrestrial environment and frequently ecologically dominant. They are diverse, with over 11 000 species known and at least as many still to be described. Ants are never solitary, but instead live in colonies comprising up to several million individuals. The combination of these large societies with such wide-ranging success immediately raises the question posed by author Deborah Gordon on the first page of this book: 'How can ants get anything done, when no-one is in charge?' Despite the use of the term 'queen' for a reproductive female ant, this is no hierarchical monarchy, neither are there foremen (or forewomen) to direct other workers. Nevertheless, ant colonies effectively allocate workers to different tasks, respond to changes in the environment, and perform complex collective feats, such as excavation, construction and cooperative foraging. One cannot find the explanation for these impressive achievements by studying individual ants in isolation, no matter how thoroughly, because the interactions between the individuals have a crucial role. Through processes involving positive feedback, inhibition and redundancy, these patterns of interactions make the whole vastly greater than the simple sum of its parts, in a manner comparable to other complex biological systems, such as the developing embryo and the brain.

Ant Encounters forms part of the *Primers in Complex Systems* series from the Santa Fe Institute, and is clear in its aim to present a single idea: 'the behaviour of ant colonies arises from dynamical networks of interaction'. The book covers how this idea sits in the context of earlier work on social insects, the evidence that contributed to the development of the idea of interaction-based organisation, and its implications for ant ecology. Gordon also describes

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her personal journey to her current understanding of ant organisation. This book does not position itself as a review of a solved problem: Gordon is open about how much there is still to learn. The book covers not only what is known, but also what is not, and how one might attain that knowledge in the future.

Ant Encounters provides the reader with a thorough introduction to the idea of an ant colony as a complex biological system. Gordon admits to a preference for her own study species, the harvester ant *Pogonomyrmex barbatus,* and she illustrates many of her points with her observations of, and experiments on, that species, studies that were instrumental in developing her ideas. However, this does not make the book narrow in scope: numerous examples from other species are drawn on to illustrate the range of challenges faced by ant colonies and the novel solutions that they unearth. Those whose appetites for general ant behaviour are whetted by these tasters can find more on the diverse activities of ants in Laurent Keller and Elisabeth Gordon's *The Lives of Ants* [1] or Bert Hölldobler and Edward O. Wilson's tour de force *The Ants* [2].

Gordon makes it clear that the principles she describes, of self-organised complexity emerging from simple interactions, are widespread among biological systems, drawing parallels with processes occurring within the brain and during cellular differentiation. Similar processes also operate in many engineered systems, but Gordon is careful to point out the limitations of such parallels. The chapter on evolution of colony organisation is the most speculative, naturally, given the paucity of behavioural information in the fossil record. The discussion of Hamilton's rule (that altruism can evolve when the reproductive benefits to the recipient, weighted by its relatedness to the donor, outweigh the costs in lost offspring to the donor) is rather overfocussed on the haplodiploid genetic system of the ants. However, Gordon's dedication to her subject is evident throughout, in her enthusiastic creativity (e.g. using a soccer ball covered with a stocking and suspended from a wire to create an arena without edges for investigation of the effects of ant density) and in her determination to address outstanding problems, such as the heritability of colony-level behavioural characteristics.

This concise, well-written book will be of interest to biologists and complexity scientists, but is written to also be accessible to non-scientists. Various key models of ant behaviour are introduced so gently that a non-mathematical and model-wary person could read it and, without realising, take in the concepts of the model. *Ant Encounters* is an enjoyable read, full of neat experiments and lively anecdotes illustrating the scientific points.

References

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Book Review

Aboveground–belowground interactions: the way forward

Aboveground–Belowground Linkages: Biotic Interactions, Ecosystem Processes, and Global Change by Richard D. Bardgett and David A. Wardle. Oxford University Press, 2010. £60.00, hbk (301 pages) ISBN 978-0-19-954687-9

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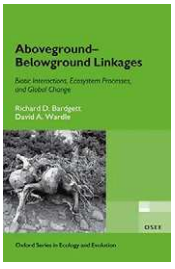

Not so long ago, studies that considered both aboveground and belowground linkages between plants and other organisms were rather exceptional. However, the scene has now changed entirely, and incorporating aboveground–belowground interactions into ecological studies has become very trendy. The number of empirical studies has risen rapidly, but so has the number of syntheses, opinions and reviews on this topic. Is *Aboveground–Belowground Linkages* just another synthesis? Certainly not. In this book, Bardgett and Wardle address a topic that has not received much attention in aboveground–belowground research: the role that aboveground and belowground interactions have in influencing community dynamics and ecosystem functioning. One of the key messages of the book is that aboveground and belowground interactions are essential for an improved understanding of how terrestrial ecosystems function. Central throughout the book is the question of how human-induced global changes impact aboveground and belowground biota and their subsequent influence on ecosystem functions. Many of these effects are indirect and, therefore, a thorough understanding of the aboveground and belowground interactions that occur within terrestrial ecosystems is essential to understand the impacts of these global changes.

The book consists of six chapters and starts with a brief historical perspective on how terrestrial ecosystem processes have been studied traditionally, and how aboveground–belowground interactions have been considered so far as drivers of ecosystem processes. The second chapter

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