Particularly fascinating is the discussion of Martian climate change. Climate change biologists rarely think that their field extends to Mars, but the polar-like features found on that planet provide compelling evidence that just such changes have occurred in the distant and even recent history of that planet.

The third chapter peers in more detail at the soils of Antarctica and explores the role of ancient and receding water bodies on their biogeochemistry. The chapter underlines the more general fact that the history of water is essentially the core of this field. By understanding the changes in both the quantity and chemical characteristics of water in Antarctica, particularly the Dry Valleys, we have a key to understand the past conditions for water, and life, on Mars.

All of this work becomes of real interest when we start to fit life into the geological and chemical framework. The well-known 'cryptoendoliths' of Antarctica (organisms that live within the interstices of rocks) are explored in the chapter that follows. These organisms are not endemic to Antarctica, but are found worldwide. However, the unique set of extremes to which they are exposed provides important boundary conditions to our understanding of life in extremes and the potential habitability of extraterrestrial environments.

The three chapters that follow return again to the central theme of water and explore the nature of streams, lakes, ponds and glaciers in the Dry Valleys and Antarctica in general. All three of these chapters intermingle a discussion on the physical and chemical characteristics of these water bodies with an examination of their biota and implications for the possibilities of life elsewhere. The microbiology of Blood Falls, an iron-rich outflow from ancient marine water, is described: a place in which chemolithotrophs (organisms which use inorganic electron donors for growth) thrive. Such occurrences show how even apparently mundane glaciers can harbour remarkable environments for life within or under them.

At this point in the production we are treated to a deeper discussion of what exactly controls microbial diversity in the Dry Valleys of Antarctica. Investigations of spatial and temporal heterogeneities in diversity, and attempts to use both culture and culture-independent methods to characterise the phylogeny and functional capabilities of organisms in Antarctica have provided better insights into how microbial diversity in these extreme cold environments is constrained.

The final chapter explores other environments on the Earth and what they might tell us about Mars. Locations include Arctic environments, the Rio Tinto system in Spain and high altitude lakes in Chile. It is an important chapter since it shows how the lessons, experience and knowledge gained in Antarctica can be applied to many other settings from which common data and even large differences in physical, chemical and biological conditions can be better understood and investigated.

The book is a remarkable accomplishment. My only criticism is that it would have been interesting to know a little more about how human exploration has impacted these environments and what that might tell us about planetary protection and the impact of scientific investigations on other worlds, particularly Mars. It would seem to me that polar biologists have much to tell us about whether we should be concerned. Having said that, this would be an applied chapter, and what we are offered in this book is an excellent set of scientific chapters, which anyone with an interest in extreme environments, astrobiology, polar science and even robotics, should read.

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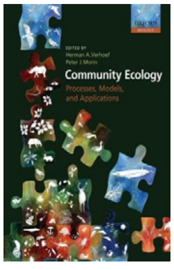
Book Review

Community ecology: stasis, evolution or revolution?

Community Ecology, Processes, Models and Applications edited by Herman A. Verhoef and Peter J. Morin. Oxford University Press, 2009. US$136.50 hbk/US$68.50 pbk (288 pages) ISBN 978 0 19 922897 3/978 0 19 922898 0

Carlos J. Melian

Center for Ecology, Evolution and Biogeochemistry, Swiss Federal Institute of Aquatic Science and Technology, Kastanienbaum, Switzerland



A major goal in community ecology is to explain patterns of diversity using a minimum number of parameters. This requires that observations, experiments and models are able to capture how ecological communities work. To achieve this goal we must face the well known complexity versus simplicity question [1]: Which kind of simplifications should we use and which should we avoid? This dilemma is currently hotly debated in community ecology [2]. Simplifications and assumptions are linked, but in most cases we do not know how. Which assumptions are more reasonable given the observed patterns? This question came to mind while reading the first chapter of this book and remained present throughout.

Owen Petchey, Peter Morin and Han Olff (Chapter 1) discuss mechanisms driving the patterns observed in ecological networks. They feel mechanisms such as those in which a species adapted to the left-tail of some underlying niche axis outcompetes a species from the right-tail or vice versa, will be seen to dominate the observed patterns. They leave the door open for future tests: for example, which degree of niche specialization among individuals do we need to explain patterns of diversity in ecological networks? Owen Petchey, Peter Morin and Han Olff's chapter

Corresponding author: Melian, C.J. (carlos.melian@eawag.ch).

illuminates mechanisms that can be tested in the context of new theories [3].

The second chapter, by Herman Verhoef and Han Olff, clarifies the assumptions underlying long-term species coexistence. They discuss simple food webs involving antagonistic and competitive interactions. They report problems in addressing coexistence when using data from organisms with life spans that are long compared with the duration of the study. Even if some recently collected data deal with this problem, the authors identify a further lack of studies addressing how simple food webs are organized into complex interaction webs, and how the interplay between these modules changes their dynamics when compared to their behavior when isolated. However, there are recent studies addressing such problems, at least partially [4].

Ulrich Brose and Jennifer Dunne (Chapter 3) discuss one of the most successful approaches to studying food webs in recent years: the addition of allometric bioenergetic dynamics to understand species coexistence in large food webs. They discuss several improvements that can be made, such as the addition of individual body mass instead of species means, but the progress made by linking bioenergetics, species-level food web dynamics and species diversity has been huge.

Up to this point, the book focuses on potential mechanisms, but subsequent chapters discuss how these ideas can be tested through experimental studies. In Chapter 4, Tadashi Fukami focuses on the experimental challenges to studying community assembly in space and explores the mechanisms underlying species coexistence. He discusses situations in which different patches diverge to contain different sets of species if immigration history differs between them, even if the communities initially share the same environmental conditions. Here, I feel we need tests of the mechanisms explaining this pattern. Are those mechanisms just driven by neutral processes and environmental stochasticity? Similar questions were recently discussed by Graham Bell and he proposes a model of evolution in multi-scale fluctuating environments [5].

Jonathan Chase and Janne Bengtsson (Chapter 5) and Matty Berg (Chapter 6) then scale up from a single community to a set of interconnected communities. Chase and Bengtsson focus on diversity at different scales, the interaction between stochastic and deterministic factors, species interactions and cross-ecosystem boundaries. They conclude that evolutionary factors can play a significant role in structuring metacommunities. Matty Berg focuses on soil communities and spatio-temporal variability and suggests that better understanding of changes in community composition requires a more spatio-temporal approach. The conclusions of these two chapters suggest that ecological fluctuations and evolutionary processes should be considered together. Mark Vellend's recent review of community dynamics [6] helps to summarize this stage of the book: ". at the most general level, patterns in the composition and diversity of species are influenced by only four classes of process: selection, drift, speciation, and dispersal. Selection represents deterministic fitness differences among species, drift represents stochastic changes in species abundance, speciation creates new species, and dispersal is the movement of organisms across space."

The synthesis of Chapters 5 and 6 links directly to Chapter 11 where Jacinta Ellers does a great job in introducing the gap between evolutionary biology and community ecology. She argues that "considering variation in individuals and species together is going to be essential to understand and predict community functioning and composition, and, viceversa, that community composition is a key component of the selective forces determining genetic and phenotypic variation at the individual level." New models, tests and higher resolution data suggest such a merging process is now happening [7,8].

In summary, despite this being the era of massive, high-resolution data based on individual-level sampling and satellite images, the main focus of the book "Community ecology, processes, models and applications" is the species level and deterministic modeling. Should we add to community ecology the view that results from the mass of data collected at the individual level and satellite images? What role is there for stochastic dynamics? The 'Applications' and 'Future direction' chapters provided by Wim van der Putten, Emmett Duffy, Janne Bengtsson, Jan Bakker *et al*., Jacintha Ellers, Nicolas Loeuille and Michel Loreau, David Kothamasi *et al.*, and Peter Morin identify some big gaps in the methods used in both applied and theoretical community ecology and offer new ways to link theory with applications. Some of these new suggestions include merging high resolution data such as that for individual size-dependent interactions, with ecological and evolutionary perspectives. Overall this book contributes to a better understanding of the mechanisms shaping ecological communities. It also helps modelers to think about the mechanisms to test with the current explosion of high resolution data and models.

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