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A second look at fynbos biodiversity

Fynbos: Ecology, Evolution and Conservation of a Megadiverse Region. Nicky Allsopp, Jonathan F. Colville & G. Anthony Verboom (Editors), 2014, Oxford University Press. 395 pp. £65.00 (hardback) ISBN 978-0-19-967958-4; <http://global.oup.com/>

The exceptional levels of plant diversity and endemism of the Cape Floristic Region (CFR) in the southwestern corner of Africa continue to captivate scientists and naturalists from all over the world. Fynbos is the dominant vegetation type of the CFR—or the second-dominant if the CFR and the adjacent succulent karoo region are considered together under the Greater Cape Floristic Region (GCFR). Either way, fynbos is renowned as the epitome of plant biodiversity in this region. This by itself explains the title of this book, as the editors point out in their preface, and although the book deals with five major vegetation types within the GCFR, fynbos receives the main focus throughout.

The title also highlights the connection of this volume to Cowling's (1992) influential book *The Ecology of Fynbos: Nutrients, Fire and Diversity*, published more than 20 years ago and focused on ecological, evolutionary and biodiversity patterns of the CFR. The present book not only synthesises the knowledge gained on the topic since then, but it puts more emphasis on processes than on patterns. By taking advantage of the rapid advances in DNA sequencing and molecular phylogenetic analyses in the last two decades, it aims at understanding how ecological and evolutionary processes affect the outstanding biodiversity of the CFR (or the GCFR) and how this can be preserved. It would be difficult, however, and probably unwise, to ignore the earlier book (Cowling 1992) in the review of this new volume.

The new book describes the five major vegetation types of the GCFR (fynbos, renosterveld, succulent karoo, thicket and forest) and the main environmental factors that determine their geographical distribution: soils, topography, climate and fire. Although it is a very detailed description, complemented with a multivariate analysis to explore floristic similarities between vegetation types, little is added to what was already known

from the first book. However, thanks to more recent phylogenetic studies, the more recent book provides compelling new insights into the evolutionary history of the GCFR flora and vegetation. For instance, long-distance dispersal rather than vicariance can now explain the Australasian connections of the fynbos flora. Also, unlike the ancient thicket and forest floras, a significant phylogenetic clustering has been detected in fynbos, renosterveld and succulent karoo floras, suggesting either a recent origin or greater isolation through their evolutionary histories. While recent, rapid speciation seems to account for the high species richness of succulent karoo and renosterveld vegetation, fynbos biodiversity is explained by less rapid speciation coupled with low extinction due to long-term climatic and topographic stability. The extremely high species diversity of these vegetation types, particularly fynbos and succulent karoo, contrasts with their low levels of functional and structural diversity.

Unquestionably the main novelty of this book, compared to the first fynbos book, is the incorporation of a rich body of knowledge on the evolutionary processes underlying the high biodiversity of the GCFR flora through both phylogenetic and population-level approaches. Several causes of plant speciation have been suggested, from topographic and edaphic (micro)habitat specialisation to pollinator-driven diversification. Add to this the key role of fire in boosting plant diversification in fynbos, which surprisingly was hardly mentioned in Cowling's (1992) book. Fire in that book was only used to explain the transition from fynbos to forest or thicket in fire refugia, to account for key reproductive traits in fynbos plants and, at the end of the book, in a chapter on CFR ecosystem management.

Another new aspect of this new book, although less resolved, is the incorporation of faunal data to explore consistencies of both flora and

fauna in biogeographical patterns. It is concluded that phylogeographic patterns in the GCFR are not consistent across plant and animal taxa. Cowling's (1992) book included a short, narrative chapter on human settlement, from the Pleistocene to the more recent colonial settlement. The new book goes substantially beyond such a setting with a very detailed description of human occupation of the GCFR through the Pleistocene and Holocene. It focuses on the role of the Palaeo-Agulhas Plain, a wide continental shelf off the south coast (from Cape Agulhas to Port Elizabeth) exposed by sea level drops in Pleistocene glacial maxima, as a temporary dispersal route for large mammals, limestone fynbos and humans.

Like Cowling's book, the new fynbos book includes a comprehensive review of the research on biotic interactions, although putting an accent on their role in plant diversification and conservation in the GCFR. The book also includes an updated synthesis on plant ecophysiological diversity, covering interesting aspects not mentioned in Cowling's book, such as root specialisations for nutrient acquisition. Unlike Cowling's, the new book includes a synthesis of community ecology and species assembly rules in the GCFR. The overall low levels of functional and structural diversity of fynbos and succulent karoo species challenge our understanding of how they assemble in species-rich plant communities. Changes in fire patterns, loss of biotic interactions, climate change and alien invasion may alter assembly rules and threaten these highly diverse communities. Regarding invasive alien plants and animals, particularly their ecological consequences and management in the CFR, a lot has been achieved since 1992, and this is nicely reflected in the new book. It also includes a review and evaluation of conservation management policies in the CFR and

a comprehensive report on people, ecosystem services and sustainability. Finally, whereas Cowling's book concluded with a Californian's perspective of fynbos, here the geology, climate and fire history of the GCFR are set in the context of the rest of the world's Mediterranean-type regions.

This new fynbos book not only documents advances in the knowledge of patterns and driving forces of biodiversity in the CFR (or GCFR) since the last major synthesis over 20 years ago, as the editors clearly state in their preface, but also illustrates the increasing interest of biological researchers in this topic. While Cowling's book contained 15 chapters by 22 contributors, this book contains 16 chapters by 70 contributors. Nevertheless, there is a nice parallel between the two books: many of the contributors are young, prolific researchers in early to middle stages of their careers. Overall, this new volume is an excellent reference for scientists and practitioners interested in the ecology, evolution and management of the biodiversity of fynbos and other biomes in the GCFR, or elsewhere.

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Reference

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