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Patterns in Nature. The Analysis of Species Co-occurrences, James G. Sanderson and Stuart L. Pimm. The University of Chicago Press (2015). 205 pp. \$45.00, ISBN: 978-0-226-29272-4 (hardcover)

In the 1970s, Jared Diamond and Edward F. Connor / Daniel Simberloff were protagonists in a dispute about species co-occurrence patterns on islands. An analysis of the distribution patterns of bird species on Pacific islands led Diamond (1975, in Cody and Diamond, eds, *Ecology and evolution of communities*, Belknap) to conclude that the combinations of species to be found on the different islands were not random, but followed some “assembly rules”, with certain pairs of species being never found together. A few years later, Connor and Simberloff (1979, *Ecology*, 60: 1132-1140), to test if the observed co-occurrence patterns of species on islands significantly deviated from what could be expected by chance alone, compared observed incidence matrices (species presence/absence on islands) with randomly generated matrices (null models). Using data from islands different from those considered by Diamond (since Diamond's primary data were published only later), they concluded that species co-occurrence patterns do not follow assembly rules, but are random. Over the last 35 years, these contrasting views have stimulated a wide range of studies on co-occurrence and nestedness patterns, and prompted the use of null-models in a variety of other ecological fields.

In this small and provocative book, Sanderson and Pimm offer an historical reconstruction of the debate between Diamond and Connor/Simberloff, re-analyse their data with the aid of modern statistical tools and present a critique about the current (sometimes blind) use of null models. Moving from a re-analysis of the various issues involved in the Diamond vs. Connor / Simberloff debate, the book is also a detailed technical review of the co-occurrence indices used to quantify deviations from null expectations and the algorithms used to generate null-matrices. Dealing with such a fast moving research field, this review is timely, but, at the same time, destined to an accelerated ageing. This is clearly demonstrated by the recent proposal of a new randomization

algorithm by Strona et al. (*Nature Communications*, 5: 4114), which is not covered, probably because it appeared while the book was already in press. However, technical aspects are not the focus of this book, which is much more conceptual. The main message of the book is about the need for biologists to make use of statistics and the power of computers to analyze large amounts of data. But as the authors say in their concluding sentence “A computer can tell us which species pairs are most unusual; it remains for us to go forth and explain why”.

This call for a more ecologically based approach to the analysis of species co-occurrence is made particularly clear by authors' claim of not focusing on ensemble metrics, but examining single-pairs metrics. This may sound like an appeal to move away from overly general and simplistic “nomothetic” approaches (which seek to establish general laws) in favour of more “idiographic” analyses (which aim to understand the unique and non-recurrent).

I think that in an era in which ecologists have access to fast and user-friendly software, people may be tempted to accept the simplest “overall” description of species distribution patterns, without trying to explain the details of variations. But in the details is potentially much useful knowledge. The idea of finding a general pattern is always exciting, but when incidence matrices are analysed, there is a strong risk of accepting false conclusions because idiosyncratic patterns are ignored. Finding general patterns may cause us to miss more detailed relationships, which may be essential to understand species ecology. This risk is particularly serious when co-occurrence analyses are used to draw conclusions that may have conservation implications, because we are not interested in conserving abstract overall patterns (if any), but concrete species. For this reason if no other, this book which appears theoretically focused, has many practical lessons and should be not ignored by conservationists.

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