

# Preface

Ecology is sexy. Teaching ecology is therefore the art of presenting a fascinating topic to well-predisposed audiences. It is not easy: the complexities of modern ecological science go well beyond the introductory chapters taught in high schools or the marvellous movies about ecosystems presented on TV. But well-predisposed audiences are ready to make the effort. *Numerical* ecology is another story. For some unclear reasons, a majority of ecology-oriented people are strangely reluctant when it comes to quantifying nature and using mathematical tools to help understand it. As if nature was inherently non-mathematical, which it is certainly not: mathematics is the common language of all sciences. Teachers of biostatistics and numerical ecology thus have to overcome this reluctance: before even beginning to teach the subject itself, they must convince their audience of the interest and necessity of it.

During many decades, ecologists, be they students or researchers (in the academic, private or government spheres), used to plan their research and collect data with few, if any, statistical consideration, and then entrusted the “statistical” analyses of their results to a person hired especially for that purpose. That person may well have been a competent statistician, and indeed in many cases, the progressive integration of statistics into the whole process of ecological research was triggered by such people. In other cases, however, the end product was a large amount of data summarized using a handful of basic statistics and tests of significance that were far from revealing all the richness of the structures hidden in the data tables. The separation of the ecological and statistical worlds presented many problems. The most important were that the ecologists were unaware of the array of methods available at the time, and the statisticians were unaware of the ecological hypotheses to be tested and the specific requirements of ecological data (the double-zero problem is a good example). Apart from preventing the data to be exploited properly, this double unawareness prevented the development of methods specifically tailored to ecological problems.

The answer to this situation is to form mathematically inclined ecologists. Fortunately, more and more such people have appeared during the past four decades. The result of their work is a huge development of statistical ecology, the availability of several excellent textbooks and the increasing awareness of the

responsibility of ecologists with regard to the proper design and analysis of their research. This awareness makes the task easier for teachers as well.

Until relatively recently, however, a critical ingredient was still missing for the teaching to be efficient and for the practice of statistics to become generalized among ecologists: a set of standard packages available to everyone, everywhere. A biostatistics or numerical ecology course means nothing without practical exercises. A course linked to a commercial software is much better, but it is bound to restrict future applications if the researcher moves and loses access to the software that he or she knows. Furthermore, commercial packages are in most cases written for larger audiences than the community of ecologists and they may not include all the functions required for analysing ecological data. The **R** language resolved that issue, thanks to the dedication of the many researchers who created and freely contributed extensive, well-designed and well-documented packages. Now, the teacher no longer has to say: “this is the way PCA works... on paper”; she or he can say instead: “this is the way PCA works, now I show you on-screen how to run one, and in a few minutes you will be able to run your own, and do it anywhere in the world on your own data!”.

Another fundamental property of the **R** language is that it is meant as a self-learning environment. A book on **R** is therefore bound to follow that philosophy, and must provide the support necessary for anyone wishing to explore the subject by himself or herself. This book has been written to provide a bridge between the theory and practice of numerical ecology that anyone can cross. Our dearest hope is that it will make many happy teachers and happy ecologists.

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