Risk assessment in conservation biology

M. A. Burgman, S. Ferson and H. R. Akçakaya, 1993. Chapman and Hall, London.
(Distributed in Australia and New Zealand by Thomas Nelson Australia.)
314 pp, 7 chapters + 4 appendices.
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POPULATION viability analysis (PVA) has become one of the standard tools of conservation biology. Unfortunately, few examples have entered the refereed literature. Most remain in the "grey" world of internal government reports, where the results of "what-if" scenarios become transformed into the firm basis for policy settings. The problem is that rough guesses of population parameters enter the black box of a modelling package, to emerge as attractive and apparently precise graphs of extinction probability as a function of population size. Somewhere in the process, it is often forgotten that the quantitative predictions cannot be better than the quality of the parameters which went into them.

Any attempt to demystify the process is therefore welcome and, overall, this book performs that task admirably. Its stated objectives are "to stimulate interest in conservation biology in general and risk assessment in particular" and to "continue to bridge the gap between modelling and biology". It meets the latter objective particularly well. Most treatments of stochastic modelling in ecology descend rapidly into a morass of algebra, before concluding that only the most trivial models can be handled analytically. This book is not algebra-free, but should be accessible to anyone who can follow the formulae in a basic statistics text. Most of the discussion is based on the results of repeated simulations, sidestepping the problem of analytic intractability.

In scope, the field covered is rather wider than the title suggests. This is a text on stochastic single species models, and it contains examples, models and applications on all aspects of ecology rather than just conservation biology. Whether this is considered an advantage or disadvantage will depend on the perspective of the reader, but the book is probably the most accessible treatment of stochastic models currently available. Initially, unstructured models are discussed, followed by age and stage structured models, metapopulation models and a brief discussion of conservation genetics.

In my opinion, the chapter on age and stage structured models is the most useful part of the book. Good descriptions of unstructured models, metapopulations and conservation genetics are available elsewhere (although not in a single book), but I know of no other treatment of structured models which would not intimidate the vast majority of practicing ecologists. Almost all conservation biology problems require models structured either by age or life-history stage. The descriptions here are wide ranging and accessible without being simplistic. While they would enable readers to write their own models, the most useful application is that they will enable non-expert readers to pick a suitable model, to understand what parameters should be fed into it and to understand the results generated by a packaged programme.

No text can entirely cover a field as large as conservation biology. The most obvious omission is any discussion of the modelling of interspecific interactions. Despite the recognition in the first chapter that extinctions are often a result of introduced predators, pathogens or competitors, these factors are not discussed further and do not appear in the index. In the words of Graeme Caughley (1994), this is thus a classic example of the dominant "small population paradigm" in conservation biology, seeking to understand threats to populations that exist because the population is small. The book has less to offer the "declining population paradigm", which seeks to understand why the population is decreasing.

A particularly attractive feature of the book is that new ideas are introduced through case studies. For example, birth and death models are introduced through white rhinos in Mozambique, density dependence and environmental stochasticity are introduced through Bayliss's (1989) study of magpie geese, and structured models are introduced via a model of loggerhead turtle dynamics. This approach not only keeps one's interest, but more importantly, enables one to evaluate how reasonable are the assumptions made and how useful are the insights gained.

Each model is presented as an algorithm: a series of simple numbered steps, explained in English and algebra rather than in a particular computer language. I find this much more satisfactory than the slabs of BASIC or FORTRAN that are sometimes included in texts, but the approach is not without its problems. For all but the most competent computer programmers, the tasks of writing appropriate input and output routines and of translating the algorithms into code will distract attention away from the process of modelling itself. A useful (though expensive) compromise is to purchase a risk analysis "add on" to a standard spreadsheet. The add on handles all the tedious jobs such as generating random numbers from a variety of distributions, iterating the model many times and producing summaries of the output. Attention can then be focused on the important part: the model itself. One suitable add on is @RISK (Palisade Corporation, 31 Decker Rd., Newfield, NY, USA 14867).

The authors state in the preface that "the most valuable aspect of building models is not the predictions they make, but the process of model building itself." Throughout, they support this argument by showing how progressive elaboration of models can lead to ecological understanding. This statement does not

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necessarily preclude the use of prepackaged models, but it does suggest that caution must be exercised. No particular package is strongly promoted, despite the authors' association with the RAMAS family of ecological models (Exeter Software, 100 North Country Rd, Setauket, NY, USA 11733). This book is in no sense a RAMAS manual.

Good as it is, the book is not without faults. Robert Lacy, who has been prominent in the development and application of PVA models, and has authored VORTEX (Lacy 1993), perhaps the most widely used PVA model, does not appear in the bibliography. To my taste, the book concentrates too much on the "how to" aspects of risk analysis to the detriment of "why". The authors clearly expect that once people know how the models work, they will discover how to use them appropriately. This is probably true to some extent, but I think it may be over-optimistic. Throughout the book, there are "boxes" briefly describing case studies. While these are certainly useful, most simply report findings and conclusions, rather than analysing them critically.

Perhaps the most crucial question in a review of a methodological book is how well it addresses the needs of its various reader constituencies. Professional modellers are a small market, but will find much of use to them here, particularly in the second half of the book. Postgraduate students exploring any form of single-species ecological modelling will find the book indispensable: I expect it will rarely be on the shelves of any academic library which buys it. It would prove an excellent text for a high level undergraduate or postgraduate course, but students would baulk at paying nearly Aus $120.

Wildlife managers who use PVA models need to read this book. Manuals to software packages cannot contain the detail necessary for models to be used properly. Few managers will want to write models from scratch, but a broad understanding of what the model is doing should help in appropriate selection of models, valid parameter inputs and critical interpretation of model results.

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Biological conservation, monitoring and assessment

Ian F. Spellerberg and Steven R. Hardes. 1992.
Biological Conservation.
Cambridge University Press, Cambridge, UK.
123 pp + vi, ISBN 0-521-39786-3.
RRP P/b £7.25 (US $15.95).

Ian F. Spellerberg. 1993 (1991).
Monitoring Ecological Change.
Cambridge University Press, Cambridge, UK.
334 pp + xvi.
H/b: ISBN 0-521-36662-3. RRP £50.00 (US $84.95);
P/b: ISBN 0-521-42407-0. RRP £16.95 (US $29.95).

Ian F. Spellerberg. 1992.
Evaluation and Assessment for Conservation.
Chapman & Hall, London, UK.
260 pp + vi, ISBN 0-412-44270-1.
RRP H/b £29.95.

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OF the three books Ian Spellerberg published from his broad experience in biological monitoring and conservation, *Biological Conservation*, co-authored by Steve Hardes, is the most elementary, dealing with practical conservation in concise form. It is published in the Biology in Focus series to supplement mainstream textbooks for senior biology students.

The aims of the book are "to give an insight into the importance of biological conservation, to describe why conservation is important, to give examples of conservation and, perhaps most importantly, to generate enthusiuasm, discussion and action." One-third of the book is allocated to ecological and international perspectives of biological conservation, highlighting significant environmental issues historically, and exploitation of biological diversity globally. The main part of the book offers examples of conservation in practice, ranging from ethnobotanical surveys to biological restoration in natural and human-induced ecosystems. Rehabilitation of degraded natural areas and maintenance of biodiversity for sustainable use of resources are preached as a means of stabilizing the supply assuming that the human population and its demand can be stabilized in future. An appendix provides exercises in practical management problems taken from terrestrial communities and landscape conservation. This small book gives an amazingly broad coverage without losing focus and serves as an excellent introduction to biological conservation.

The aim of *Monitoring Ecological Change* is to provide "a basis for practical applications of monitoring from the most basic to the more complex." As Dr Holdgate, Director-General of IUCN, points out in the Foreword, "living organisms integrate the impact of many variables" and "their biological efficiency, productivity or balance within the ecosystems they compose indicate the overall health of the system." This is the basis of biological monitoring, which Ian Spellerberg so adroitly applies to environmental quality, biodiversity and ecosystem processes.

The book is divided into three parts. In Part A the author introduces the science and art of monitoring using his own experiences of major environmental impacts in the Antarctic. Spellerberg stresses the need for long-term biological monitoring based on well worked variables and processes. This leads to a status

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