

Book Reviews

Introduced Mammals of the World: Their History, Distribution and Influence

J. L. Long. CSIRO Publishing, Collingwood, 2003, 585 + xxi pages. Price AUD\$135.00. ISBN 0 64306714 0.

For most Antipodeans, unless you have been living under a very large rock for a very long time, the problem of introduced mammals will be all too familiar; rabbits, house mice, foxes and cats have caused immeasurable damage to native flora and fauna, farming and industry in Australia, while New Zealand's native bird populations have been decimated by introduced predators such as weasels, stoats and rats. Unfortunately, introduced mammals are not limited to Australasia and in *Introduced Mammals of the World: Their History, Distribution and Influence*, John L. Long has produced a remarkable work which documents the introduction, re-introduction and translocation of 337 species of mammal around the globe. The book is extraordinary both in the number of species it covers and the breadth in which those species, and the history of their introductions, are described.

The general introduction begins by covering the 'why' factor. Over the years, the reasons for introducing species out of their native range appear to have been many and varied, but unfortunately seldom thought through or researched. Initially, the majority of mammalian introductions appear to have been in order to establish food sources for early human settlers. Later introductions for sport hunting are less common, but the effects no less devastating – the red fox and rabbit were introduced to Australia largely for hunting purposes. Commercial enterprises such as fur farming have also resulted in a number of unintentional introductions due to escapees. Deliberate releases, both by disgruntled fur farmers and also by well-meaning, but ill-informed, animal rights activists have also resulted in colonization by exotic species such as American mink and coypu. However, some of the most damaging introductions have been those that were targeted at controlling pests, such as the introduction of weasels and stoats to New Zealand, with government support, to control introduced rabbits.

The introduction goes on to discuss the 'where' aspect of mammal introductions. This section contains an informative table that details the number of mammal species known to have been introduced to countries globally. It will come as no surprise to most that Australia and New Zealand, along with the US, hold the dubious honour of being up in the top three,

totaling 79 and 45 introduced mammal species, respectively. Following this is a section detailing the threats of introduced exotic mammals, including competition and hybridization with native species, the potential for introduced disease and parasites and agricultural damage. To the credit of the book, the potential benefits of introduced species are also discussed here. However, the potential benefits rarely seem to outweigh the costs, except for the examples given of re-introductions and translocations of threatened species. The final section of the introduction considers the future, including risk assessment, political will – emphasizing the need for better communication between scholars and politicians – and also the need for a consistent global approach to the management and eradication of introduced mammals.

Following the relatively short, but informative, introduction the book goes on to the species descriptions, which are organized systematically beginning with the Order Monotremata. The natural history descriptions are necessarily and purposely short, but do include brief details on morphology, distribution, habits and behaviour. Following this is a history of introductions for the species, notes on current status within the introduced range and a section on damage and problems caused. Many, but not all of the species descriptions also include a map, detailing native, former and expanded ranges, with arrows pointing to offshore introductions. For the better known and more problematic species, such as the domestic cat, there are tables detailing place of introduction, date, number of individuals introduced and notes on whether the introduction was successful or unsuccessful. As mentioned previously, the book also includes re-introductions and translocations of species back into their native or former ranges. Some of the more well-known of these include the black-footed ferret and Arabian oryx, both of which have been re-introduced to their former ranges, across the US and Middle East, respectively, via captive breeding programs.

Introduced Mammals of the World is an outstanding book, and a credit to its author, who sadly never got to see his life's work in print. Any criticisms are minor and are mostly unavoidable, for example some of the details are already outdated – the recent introduction of the red fox to Tasmania is not included. Rather than merely recommending this book, I would consider it an essential reference for anyone involved in managing or researching the impact and control of introduced mammals, including academics, wildlife managers and policy makers. Furthermore, the information on attempts at re-introducing threatened and endangered

mammals makes this book indispensable for those involved in captive breeding and re-introduction programs – one can only hope these will be the only type of mammal introductions we see in the future.

JOANNE L. ISAAC
School of Zoology and Tropical Ecology
James Cook University
Townsville Queensland, Australia
Email: Joanne.Isaac@jcu.edu.au

The Kruger Experience. Ecology and Management of Savanna Heterogeneity

Johan T. du Toit, Kevin H. Rogers and Harry C. Beggs (eds). Island Press, Washington DC, 2003, XV + 519 pages. Price US\$75. ISBN 1 55963 981 4 (cloth), US\$40. ISBN 1 55963 982 2 (paper).

Kruger National Park in South Africa is one of the largest and most important protected areas in the world, with a long and changing history of management and intensive scientific research. *The Kruger Experience* documents this history and changing management philosophy as well as drawing together much of the biological, geological and hydrological knowledge about the park. About 50 authors have contributed to this book, and give a fascinating account of the interplay between science and park management, and the growing appreciation that conservation areas do not exist in isolation but are strongly influenced by surrounding lands and the people living there.

The Sabi Game Reserve (now part of Kruger) was created in 1902 after over-hunting and the rinderpest epizootic had caused alarming declines in the numbers of many game animals. Over the next 70 years 'fences were constructed, migrations stopped, the seasonal flux of surface water ameliorated with boreholes and dams, seasonal grass fires tamed and managed, and populations of animals manipulated to match predetermined levels' in the aptly named 'command and control era'. However, lessons have been learned from many of these inadvertent experiments, and park managers and scientists now understand that spatial patchiness at different scales enables the system to absorb sudden disturbances. Variability in time and space leads to both high biodiversity and greater resilience of the system.

Kruger has a long history of research, and close contact between researchers and park managers. Now, however, with around 300 research projects active in the park at any one time, ensuring that research results are used effectively in park management is no trivial matter. Staff at Kruger have pioneered a strategic adaptive management system, built on recent develop-

ments in ecology and business management, which has a strong goal-setting component and specified thresholds of potential concern. Once these thresholds are approached or exceeded, a prescribed sequence of actions is triggered. Some well-chosen examples bring this approach to life.

The book's theme of heterogeneity works well for most subjects, but is a bit forced for subjects (e.g. insects) for which such knowledge is limited. Part I highlights the irony that early attempts by European colonists in Africa (and elsewhere) to tame the land and reduce temporal fluctuations in water availability actually increased the susceptibility of animals to drought by eliminating areas of reserve forage. Decreased spatial heterogeneity can thus increase temporal heterogeneity, with unfortunate consequences.

Spatial and temporal variability in climate, geology, geochemistry, surface water availability and river flow, and the way they influence the park's biota, are covered in Part II. There is also an excellent chapter on fire as a driver of ecosystem variability; this condenses results of decades of research in Kruger and elsewhere into 19 very readable and informative pages.

Research at Kruger has made an enormous contribution to our understanding of savanna ecology and plant/animal interactions. Researchers have been drawn to the park because of the very high species richness of plants, birds, reptiles, fish, amphibians and insects and, of course, mammals. Kruger contains 30 species of large herbivore, and questions about why there are so many, and how they coexist, have been the focus of much research. Interactions between biotic components, including vegetation dynamics, insects, birds, large herbivores, carnivores and wildlife disease, are covered in Part III. Chapter 16 deals with the dilemma a large elephant population poses to park managers. These charismatic animals have the capacity to kill large numbers of trees, which reduces habitat heterogeneity and thus diversity of other species. On the other hand, they have been driven to extinction across much of their former range and their culling provokes much controversy. The park's latest policy, 'likely to appease everyone . . . and please no one', creates six regions, two of which will be high-impact zones, two will be low-impact zones in which populations will be systematically reduced, and two will serve as botanical reserves. The high and low impact zones may be reversed in future to increase park-wide heterogeneity. This solution typifies the new approach at Kruger – it is openly experimental, with thresholds of potential concern set according to best available knowledge, and careful quantitative monitoring.

The final section of the book deals with the impact of humans on the savannas in and surrounding Kruger. Communal land with high densities of poor people dependant on agriculture surrounds much of

Kruger. To many of these people, who suffered greatly under apartheid, Kruger still symbolizes white dominance and privilege. Their attitudes will change only if they derive some benefits from the park.

This book is ultimately a celebration of Kruger's heterogeneity. The large cast of authors gives the book authority in its diversity, and it is generally extremely well-written and well-edited, with a comprehensive index, and very reasonably priced. I recommend *The Kruger Experience* to everyone interested in researching or managing natural resources; for those working in savannas, it should be compulsory reading.

LYNDA PRIOR

Key Centre for Tropical Wildlife Management
Charles Darwin University
Darwin, Northern Territory, Australia
Email: Lynda.prior@cdu.edu.au

Predators with Pouches: the Biology of Carnivorous Marsupials

M. Jones, C. Dickman and M. Archer (eds). CSIRO Publishing, Collingwood, 2003, 504 pp. Price AUD\$185. ISBN 0643066349.

Carnivorous marsupials are conspicuous not only in their morphology, but also in their astonishing taxonomic and ecological diversity. Intuitively, therefore, we might expect that such a taxon-rich group would attract a corresponding level of research interest. Regrettably, this is not the case – we have only scant information existing for many species. This paucity of information should be of concern to all, given the current suite of threats affecting mammals globally. Without appropriate knowledge, we risk potentially driving species towards extinction through inappropriate management. In order to avoid tragic scenarios such as the loss of the thylacine, we require research to be directed towards those areas in which we are most lacking information. With this in mind, the release of *Predators with Pouches: the Biology of Carnivorous Marsupials* could not be more timely.

Predators with Pouches is largely the result of a symposium on carnivorous marsupials which was held in 1999, supported by the Australian Mammal Society. The text comprises five parts: Evolution and systematics; Reproduction and development; Physiology; Evolutionary ecology and behaviour; and Conservation. Each section contains a series of short papers and, at a total of 504 pages, this text represents a highly significant contribution towards our understanding of carnivorous marsupials and mammals in a broader context.

There are a number of particularly exciting aspects of this book. Foremost is the inclusion of a number of papers focused on South American carnivorous marsupials. I have little doubt that some readers will be surprised by the richness and diversity of these species outside of Australia! These papers assist in providing the reader with a broad perspective on taxonomic and ecological relationships within and between families of marsupial carnivores. In addition, this text is a fine exhibition of the varying and novel approaches researchers are using to investigate challenging questions. An excellent example is the use of BIOCLIM modelling to look at the distributional ecology of dasyurids in Australia (Dickman, Chapter 21). This approach, coupled with detailed field information, uncovered the complexities that drive the structure of dasyurid assemblages at varying scales. Another highlight is the chapter on marsupial moles, surely a prime candidate for the award for most challenging study species! Despite this inherent challenge, the authors provide a good overview of marsupial mole biology and conservation, highlighting interesting research questions (e.g. 'how boy meets girl in the subterranean world of the marsupial mole'). I was most pleased that this paper drew attention to the benefit of drawing on indigenous knowledge, a collaboration that is sadly missing from the majority of studies. Lastly, it is a welcome relief to read of successful recovery programmes, such as that of the numbat, given that many mammal species appear to be on rapid trajectories towards extinction.

To its credit, *Predators with Pouches* is far more than just a volume of the most recent research into marsupial carnivores. It delivers a number of important messages that may not appear new, but are unquestionably in need of more consideration. First, this text promotes the macroecological approach of looking at both species- and community-level interactions with the environment. This is particularly important when we consider the landscape-scale changes that will occur as a result of climate change. Second, our need for long-term studies is clear. Many carnivorous marsupials are known for their rapid life histories (e.g. *Antechinus*), however, this does not mean the habitats in which they live should be studied on similar time scales. Lastly, the book draws attention to the bountiful research opportunities that exist within such groups as the dasyurids.

I have only two criticisms, testament to the clarity of presentation and the depth of information that is covered in this text. First, the lack of an index is a major oversight, making it very difficult for readers to access information quickly. The addition of an index would serve to make the text more accessible to a broader audience. The second issue is perhaps more a comment on current research attitudes rather than a direct criticism of this text. The lack of information

presented from the viewpoint of indigenous people is conspicuous. This is disappointing considering the wealth of indigenous knowledge about many species for which contemporary ecology has little, if any, data. As highlighted by Benshemesh and Johnson (Chapter 32) this information has a finite life, and urgency is required before it is lost forever. I can only hope this will be remedied in similar texts in the future, where ethical considerations permit.

I am sure a major aim of *Predators with Pouches* is to inspire a surge of dedicated research effort on carnivorous marsupials, particularly from early career scientists. If this was indeed the aim, I have little doubt it will be achieved and hence its authors should be commended.

EUAN G. RITCHIE
Mammal Ecology Laboratory
School of Tropical Biology
James Cook University
Townsville, Queensland, Australia
Email: euan.ritchie@jcu.edu.au

Spatial Data Analysis: Theory and Practice

R. Haining. Cambridge University Press, Cambridge, 2003, xx + 432 pp. Price AUD\$99. ISBN 0521 77437 3.

The techniques of spatial data analysis have been developed in a diverse range of disciplines that include plant and animal ecology, geostatistics, landscape ecology, geography and applied statistics. *Spatial Data Analysis: Theory and Practice* covers a number of methods that can be used to analyse quantitative spatial data, i.e. data that have location information.

This book contains 11 chapters that are divided into five parts. Essentially this break up can be summarized as: Part A – what is spatial data and how is spatial analysis used as a tool in science and for policy development?; Part B – where does one obtain spatial data and then assess its suitability and quality for the problem being examined?; Part C – what are the methods that can be used to summarize spatial data?; Part D – how to handle spatial autocorrelation; and Part E – statistical analysis of spatial data using descriptive and explanatory models.

Part A consists of two chapters that provide novices with an overview of spatial data and spatial data analysis (SDA) by introducing them to the various terms used in spatial science. Chapter 1 provides an overview of the book's layout and defines some of the concepts used throughout the rest of the book. The author also introduces some issues that anyone considering SDA must be aware of. They include the

different role SDA plays as a tool for science and for policy decision. For someone with knowledge of SDA this part will help to refresh the memory. This chapter also highlights what types of problems or data types are not appropriate for the methods described later on. Chapter 2 deals with the representation of geographical space, data classification, sampling and data quality. Points, lines, areas and surfaces are used to represent geographical space, the choice of which is influenced by the type of application as well as the spatial scale. The chapter concludes with a detailed discussion on data quality issues that must be considered before analysis; spatial resolution and aggregation, data accuracy, resolution, consistency and completeness.

Part B consists of two chapters. Chapter 3 looks at the sources of spatial data. It deals mainly with primary spatial data: data that are collected in the field by the researcher for a specific problem through a range of spatial sampling methods. Secondary spatial data from remote sensing, paper maps, vegetation maps are available but can be of varying quality. The author also covers the generation of maps through simulation based on a process of data input into a model, followed by model validation and an output map of predicted values. Chapter 4 then discusses how gross errors in data values and spatial location and their propagation through arithmetic operations can impact SDA.

Part C contains three chapters that deal with exploratory spatial data analysis (ESDA). Chapter 5 introduces some conceptual models of spatial variation that provide the background for the next two chapters. Chapter 6 covers data visualization in general and the additional tools required for exploring spatial patterns. A number of selected methods for visualizing univariate, bivariate and multivariate spatial data are covered. Chapter 7 continues with ESDA using numerical methods. These include smoothing methods that reveal spatial patterns in the data, tests for the detection of global clustering and tests for localized clustering. Many of these techniques can be applied to area and point spatial data.

Part D is a single chapter that deals with issues of spatial dependence. Often spatial data do not satisfy the conventional assumption of independence and spatial autocorrelation needs to be considered during hypothesis testing. Two aspects are examined: first, spatial autocorrelation and the mean of a spatial data set and second, adjusting standard correlation and chi-squared statistics for spatially autocorrelated bivariate data.

Part E is made up of three chapters that examine the type of models available for statistical analysis of spatial data. Chapter 9 characterizes two models: statistical models used to describe the spatial variation in a single variable and making population inferences and explanatory models for continuous valued response

variables. Chapters 10 and 11 then expand on various techniques of descriptive and explanatory modelling using epidemiological and crime data sets.

In summary Haining provides a detailed description of the techniques of SDA and their strengths and weaknesses. Some readers may find the numerous equations used throughout the text a little taxing to wade through. While most of the examples used to illustrate the methods come from epidemiology, crime and social research, the methods are equally applicable to any number of areas of ecological research. Ecologists should note that Haining does not deal specifically with point pattern data and the analysis of spatial point distributions. Techniques that look at global and local clustering of area data such as Ripley's K, global G-statistic and local Getis-Ord statistics, can also be

used for point data. For those interested specifically in the spatial analysis of point patterns, Diggle (2003) would be more appropriate.

KRIS SIDEROV

*CRC for Australian Weed Management
School of Mathematical and Geospatial Sciences
RMIT University
Melbourne, Victoria, Australia
Email: kris.siderov@rmit.edu.au*

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