

Book Reviews

Hawai'i as an Ecosystem Model

Vitousek, P.M. 2004. *Nutrient cycling and limitation. Hawai'i as a model system*. Princeton University Press, Princeton, N.J., U.S.A. xx + 223 pp. Cloth, ISBN: 0-691-11579-6, \$79.50 (USD); paper, ISBN: 0-691-11850-X, \$35.00 (USD).

Over the past two decades, ecologists have become increasingly interested in understanding the key drivers of ecosystem properties and processes. One approach which has considerable potential for studying this, but which has been used by relatively few ecologists is the use of model systems, which by their nature allow insights into the 'big pictures' of ecology. Peter Vitousek's book makes the case for the use of Hawaiian island chain as a model for better understanding the basic principles of nutrient cycling and limitation in terrestrial ecosystems. The system works well as a model, because it is biologically relatively simple, contains impressive gradients of rainfall, temperature and substrate age, and because a single plant species (*Metrosideros polymorpha*) dominates across each of these gradients.

The book provides an overview of the research programme that Vitousek has led over the past 20 years on these islands to better understand ecosystem biogeochemistry, and which is widely regarded as amongst the most important recent research performed on this topic. Specifically, it synthesises the previous outputs of this work, scattered throughout dozens of journal articles, into a single easy to read volume. The early chapters provide a justification for Hawai'i as a model system, a brief description of the natural history and geology of the region, and a discussion of the key gradients in the system. Most of the remainder of the book provides a detailed description of the work of Vitousek and colleagues on a chronosequence created by volcanism across the island chain and which spans 4.1 million years, specifically in relation to inputs and outputs of nutrients, key ecosystem processes, and the nature of nutrient limitation across the chronosequence.

Vitousek does an effective job in linking the findings from his research programme to the broader concepts of ecosystem ecology. Unlike many U.S. authors who all but ignore non-U.S. literature, Vitousek usually recognises the contribution of relevant non-American literature (although there are still a few instances in which he cites only US literature to

support points of a global nature). Further, to Vitousek's credit, he does a good job of recognising prior contributions of others whose ideas he develops. It is pleasing, for example, to see earlier New Zealand work, specifically the pioneering studies of Walker and Syers on phosphorous dynamics along the Franz Josef chronosequence, profiled as a significant building block for Vitousek's own work on phosphorous limitation.

I believe that this book is definitely relevant to a New Zealand audience. New Zealand has many parallels with montane Hawaii, for example in terms of biological components, remarkable gradients, and recent nature of human occupation and introductions of alien organisms. Any New Zealand ecologist reading this book could reasonably conclude that New Zealand has just as much potential as Hawaii to serve as a model system for asking the 'big' ecological questions; I personally believe that New Zealand ecologists need to be more proactive in recognising this. In a broader sense, this book serves as a valuable synthesis of what is amongst the most important programmes of ecosystem-level research conducted over the past 20 years, and is a must-read case study for any ecologist interested in the functioning of terrestrial ecosystems.

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Planes, trains, and automobiles: Introduction pathways of nonindigenous species

Ruiz, G.M. and Carlton, J.T. (Editors) 2003. *Invasive Species: Vectors and management strategies*. Island Press, Washington D.C., USA. xiii + 518pp. Hardback ISBN: 1-55963-903-2, \$75.00 (USD); Paperback, ISBN: 1-55963-903-2, \$40.00 (USD).

Biological invasions have had noticeable economic, ecological and human health effects worldwide, and New Zealand has not been an exception. The study of biological invasions, and in particular the ability to predict and thus prevent potential invaders, has traditionally been hampered by viewing them as simple one-step processes. A relatively recent shift to examine invasions as a sequence of events (e.g., entrainment,

transport, introduction, establishment and spread) has greatly improved our understanding. This book unashamedly examines the earlier phases of the invasion process: the vectors (i.e., conveyances: e.g., ships, planes) and pathways (i.e., purposes: e.g., aquarium trade, horticulture) for introduction into new areas. Such an approach provides the best method to manage invasions by providing options for prevention, in preference to expensive control or the practically impossible task of eradication. Examination of these earlier stages has been all too rare, and for their efforts in dealing with this topic, the editors of this book should be commended. In many respects such an approach is already acutely familiar in New Zealand, most noticeably at airport border control to reduce the threat from potential agricultural pests, or from the occasional news reports of species interceptions associated with shipping containers.

The book is divided into two major sections. The first, "Invasion causes, routes, and vectors", is its more scientific side. It contains reviews and original analyses concerning spatial and temporal trends in invasion pathways focussing on 1) different taxonomic groups (e.g., snails and slugs (Cowie & Robinson), terrestrial (Kraus) and aquatic vertebrates (Fuller)), or 2) vectors and pathways irrespective of taxonomic group (species movement by transoceanic ships; Fofonoff et al.; Colautti et al.). The book starts on a high note, featuring a review by Richard Mack on global plant dispersal. Although plants are not my area of taxonomic expertise, this chapter is highly entertaining in its writing style and examples used. It not only discusses the dominant pathway for this taxonomic group, deliberate introductions, but also features more interesting examples, including invasions of weeds associated with the movement of straw and hay, and their spread with troop movements through various wars. Overall, most of the chapters in this section provide an appreciation of the increasing rate and spatial scale of invasions, and of the changing nature of invasion pathways. As a case in point, the first chapter uses the example of the slow natural dispersal by plants from Australia to New Zealand; starkly contrasting to this is movement through human intervention, with species now having the potential to arrive from almost any point on the globe and at much greater rates due to the progressively escalating development of transportation systems (e.g., shipping and air travel).

The second section of the book covers "Invasion policy and management", and may thus be of less direct interest to most biologists. The initial chapters relate to legislation for reducing introductions of species in various regions (e.g., Australia, USA). The contribution by Hayden & Whyte (Chapter 11; Invasive species management in New Zealand) provides good coverage of vector management for species entering

New Zealand (e.g., border control, import health standards). It also gets into areas of invasion management not relating to vectors or pathways *per se* (e.g., pest and disease management strategy), but in doing so it provides a more holistic review of New Zealand's biosecurity processes. Perhaps missing in this chapter, however, is a focussed discussion of vector management for species dispersal within New Zealand, including the roles of, for example, the Conservation Act 1987, Biosecurity Act 1993 and Freshwater Fisheries Regulations 1983 to prevent translocations of biota within the country. However, this is a minor problem overall. Later chapters in this section cover risk assessment methods.

Overall the book is well edited. A slightly frustrating aspect is that the terminology is not used consistently throughout; a problem not restricted to this publication but common in the invasion biology literature. The editors pre-empt this criticism in the preface by stating that to alleviate the problem terms are defined within each chapter, although I found this was not always the case. This is particularly true for the plants, where many terms have been devised that are perhaps well understood by plant biologists, but are not in common usage for invasion biologists outside of this taxon (e.g., "adventives" and "naturalizations" being distinguished from "invasions", without explanation). However, on the whole the book is of higher quality and has greater depth than previous books with similar aims. The book is the result of a conference, "Pathways of nonindigenous species", held in late 1999 at the Smithsonian Environmental Research Center, Edgewater, Maryland, USA. As such it is multi-authored, and perhaps not surprisingly the quality is variable among chapters and sections both in the readability and in the level of focus (i.e., geographical region, depth). Much of the book has a global focus, while some chapters are narrower examining specific geographic areas and as such lose their generality. Collectively, the chapters do not provide a comprehensive review, although they serve their purpose and the concluding chapter goes some way to tie things together. Those points aside, individual chapters provide many useful references, and will be "citable" for some time to come. At the very least, many chapters are full of useful ideas and examples for research of similar ilk, and some provide fascinating reading. Overall, I believe readers interested in aquatic habitats and the role of shipping may be more pleased with the contributions provided than those dealing with terrestrial habitats, perhaps reflecting the interests and biases of the books editors. This book is of relevance and interest to New Zealand ecologists, not just for Hayden & Whyte's contribution, but because most chapters in the first section include New Zealand examples. More importantly, however, most of the

invasion vectors or pathways and taxa discussed are also applicable to New Zealand.

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Ecological genetics

Lowe, A., Harris, S. and Ashton, P. 2004. *Ecological Genetics: Design, Analysis, and Application*. Blackwell Science, Oxford, U.K. 320 p.p. pbk. ISBN: 1-4051-0033-8, £29.99.

The use of molecular markers has revolutionized ecological genetics in the last 20 years, with increased application of genetics in solving a range of biological problems. The fundamental problem that faces new researchers is which of the many markers should be used to address a particular problem, and how the resulting data should be analysed. This handbook of ecological genetics provides useful guidelines to those working in the field and highlights some pitfalls to be avoided. For those new to this area, chapter one starts off very briefly with a history of the topic, the way it has developed and why the study of ecological genetics is important. Chapter two investigates ways in which information can be gathered. Sampling is crucial and here we are given an overview of sampling principles both in theory and in practise. Also within this chapter, there is a section on genetic markers and the characteristics of markers derived from different genomes and regions within genomes. Chapter three looks at the factors affecting the diversity, differentiation and distance (range of variation) of a species. It also describes some of the common tests that can be used and highlights their strengths and weaknesses with case studies. Chapter four examines the ideas of dispersal and subsequent establishment of a species and the range of gene flow tests that can be applied. Phylogeography is the geographical study of lineages and the subject of Chapter five. A range of methods is described along with case studies showing how they work. In a slight change of course, chapter six look at the theory and nature of speciation and the use of cladistics. The last chapter looks at a range of case studies that integrate aspects of ecological genetics, from butterflies and ragworts to brown bears and oak trees.

There is much to like in this text. Each chapter is very well illustrated in black and white with graphs, diagrams, line drawings and tables. In addition there

are the usual summaries, boxes and references (very full lists for each chapter). Some chapters have detailed accounts of methodologies in addition to other textual material. In addition, there are two appendices, one providing a comprehensive list of available data analysis software along with their features and URLs, the other outlining which distance algorithm should be used and when for a particular dataset.

The book will be of interest to final-year undergraduate students, postgraduates and researchers. Although molecular methodology and available genetic markers have changed significantly in the last 20 years, the main focus of this text is based on fundamental genetic principles and applications to ecological research. As such, this book will not be outdated quickly in comparison to other more method-focussed texts. It is a welcome addition to my bookshelf.

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