Book Reviews

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Analysis of Capture–Recapture Data

Amstrup, Steven C., Trent L. McDonald, and Bryan F. J. Manly, editors. 2005. **Handbook of capture–recapture analysis**. Princeton University Press, Princeton, New Jersey. xviii + 313 p. $99.50 (cloth), ISBN: 0-691-08967-1 (alk. paper); $49.50 (paper), ISBN: 0-691-08968-X (alk. paper).

Key words: capture–recapture; population size; recruitment rate; statistical models; survival rate.

The aim of this book is to "guide biologists toward a greater appreciation of capture–recapture methods in theory and practice." The editors rightly felt there was a need to bridge the gap between statistician and biologist in the understanding of modern methods of capture–recapture analysis. As the book is primarily aimed at biologists, the editors have kept the mathematical detail to a minimum, whilst also ensuring that the interested reader is able to follow up on the derivations of the methods from the extensive number of key references given in each chapter. This means that the book will also appeal to statisticians working in this area. The book contains the following 10 chapters, with authors shown in parentheses:

1. Introduction (Manly, McDonald, and Amstrup)
2. Classical closed-population models (Chao and Huggins)
3. Classical open-population models (Pollock and Alpizar-Jara)
4. Modern closed-population models (Chao and Huggins)
5. Modern open-population models (Nichols)
6. Tag-recovery models (Hoenig, Pollock, and Hearn)
7. Joint modelling of tag-recovery and live-resighting data (Barker)
8. Multistate models (Schwarz)
9. Examples (McDonald, Amstrup, Regehr, and Manly)
10. Capture–recapture methods in practice (Manly, Amstrup, and McDonald).

There is also an Appendix that provides a summary of the capabilities of the following packages: Mark, Popan-5, Surph 2.1, Care-2, Surge 4.2, Jolly/Jollyage, Release, Mult, Capture/2 Capture, Estimate, and Noremark.

Chapter 1 provides a brief overview of each of the topics covered and includes a flowchart to help the reader decide which chapters are most relevant to them. It also contains a nice introduction to the ideas underlying model selection and maximum likelihood estimation, and a useful summary of the notation used throughout the book.

Chapters 2 and 3 provide fairly gentle introductions to closed-and open-population models, guiding the reader through the classical developments from the pre-computer age. They provide a useful foundation for the more modern methods described in Chapters 4 and 5.

I found Chapter 5 to be particularly useful. Jim Nichols provides a highly readable and lucid account of the methods available for open-population models, showing how modern methods of analysis can greatly improve our understanding of population dynamics. This is in contrast to Chapter 4, on modern methods for closed models: whilst it provides a useful review of available methods, one is left with the impression that the main aim is to provide interesting problems for statisticians to work on. As the editors state in Chapter 10, "... the very large number of analytical choices presented [in Chapters 2 and 4] may be intimidating and confusing for someone needing to analyze closed-population capture–recapture data for the first time." The editors recommend general use of Huggins' method, and give a clear outline of the reasons for their recommendation. This kind of guidance occurs throughout Chapter 10, which proves to be a very useful complement to the rest of the book.

Chapters 6 and 7 consider tag-recovery data, either alone or together with live-resighting data. Richard Barker provides a particularly readable and thorough review of the ideas underlying joint analysis of the two types of data. In Chapter 8, Carl Schwarz provides an excellent summary of multistate models, which are proving to be useful in a wide range of problems. He also highlights the need for extra care in fitting these models, as there can be problems in obtaining reliable estimates for all but the simplest types of models, unless the data contain a lot of information about transitions between states.

Chapter 9 provides an interesting set of example-analyses, designed to illustrate some of the methods discussed earlier in the book. Much of the chapter involves guiding the reader through these analyses using program MARK. Whilst undoubtedly beneficial to the newcomer, there is obviously the danger that this kind of material quickly becomes dated, due to the ever-changing nature of software. The kind of reader who would benefit from this guidance can also refer to the excellent user guide and discussion forum for MARK ⟨www.phidot.org⟩. Having said that, there is some interesting discussion of the disadvantages of the "design matrix" approach in MARK. The authors prefer an alternative "general regression approach," which they have implemented in a library of S-plus or R routines. I expect that some of the current users of MARK may share their concerns about the non-intuitive nature of the design matrix approach, but will put up with it for the sake of being able to use a single program to carry out many types of capture–recapture analysis. I found Chapter 10 to be very useful, in that it provides a critical summary of the topics covered in the book, and aims to help the biologist put Chapters 2–8 in perspective.

There are some notable (possibly deliberate) omissions in terms of the topics covered. There is little or no mention of Bayesian methods, which are having a major impact in terms of the types of models that can be fitted. They also greatly facilitate the joint modeling of different types of data, such as census and capture–recapture data. There is also nothing on the important concept of "random effects" models, nor on the benefits of using profile likelihood confidence intervals. I also found the order of the references at the end of the book a little hard to follow for those authors with more than one paper listed.

Despite these criticisms, I thoroughly recommend this book to anyone working in the area of capture–recapture. It is highly readable and contains contributions from some of the leading experts in the field. The layout and presentation of the material is excellent, with only a few minor typographical errors. Although the editors have primarily aimed the book at biologists, I think that statisticians will find it equally useful as a compact, readable overview of recent developments in this area.

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OPENING THE BLACK BOX: BIOLOGICAL DIVERSITY AND FUNCTION IN SOILS

Bardgett, Richard D., Michael B. Usher, and David W. Hopkins, editors. 2005. **Biological diversity and function in soils.** Ecological Reviews. Cambridge University Press, New York. xiv + 411 p. $130.00 (cloth), ISBN: 0-521-84709-5; $65.00 (paper), ISBN: 0-521-60987-9.

Key words: biodiversity; ecosystem function; microbial ecology; plant ecology; soil ecology.

This edited book has its origin from the 2003 British Ecological Society symposium of the same title. The symposium was then hailed as a successful meeting that tried to synthesize what was known about soil biodiversity and its role in the soil ecosystem. This book presents a series of 20 reviews on various aspects of soil ecology. Most of the first authors are senior authorities that have influenced soil ecology with their ideas over the years. The bar is set quite high in terms of thoroughness of the reviews and thoughtful analysis. In the preface, the editors note that above-ground ecology is rich in ecological theory, but the conceptual (and food web) linkages with below-ground ecology have not been sufficiently addressed because of methodological difficulties. They set one task of this book as opening the soil ecology black-box so that we can begin to understand feedbacks between the above-ground and below-ground communities. Overall, the book accomplishes this aim and it should be on the bookshelves of most terrestrial ecologists.

The writing style throughout is comfortably readable and should be accessible to most ecologists and graduate students. The chapters remain focused on topic and they are concise and up-to-date, with literature referenced up to 2002–2004. The index reflects an effort that was well worth the time. I tried searching words that may have been omitted in a more superficial index but found them indexed. The editors are to be commended on their effort.

The focus of each review chapter is generally from a community ecology perspective. Some chapters are focused on methodology, some on concepts, others on evidence for certain ideas. The reviews are grouped into four sections, with the intention of structuring the book. The content of the chapters do not always match closely the section topics, and the structure seems rather forced. The book would have been fine without these sections, or chapters could have been ordered into more naturally related clusters.

The various chapters review the soil as a habitat; the organic matter as a source of nutrients; bacteria diversity and function; fungal diversity and function; trophic structure of the micro-invertebrate consumers; plant effects on the soil community, and the soil community's effect on the plant assemblage; as well as restoration and conservation issues. Overall, the book integrates decomposition with the primary production sub-system and places soil ecology within a conceptual framework, to the extent of what is known. There are two recurring themes addressed in several chapters from different perspectives, with diverging opinions. One theme is the issue of species richness, species or functional niche redundancy, tied to ecosystem function, productivity, and resilience. The other theme is to question the limitations of ecological theory, derived mostly from plant and animal communities. Do soil communities behave differently from above-ground communities? Both of these themes reflect where soil ecology is today.

It was disappointing that a number of topics were not addressed by a chapter. For example, several chapters refer to climate change and its impact on ecosystems. Most chapters address the role of decomposition in recycling dissolved nutrients to plant roots and carbon dioxide for photosynthesis. Yet, an ecosystem scale and global scale analysis of the biogeochemistry, and expected impact of climate change on decomposition, is missing. One chapter could have been dedicated to stepping back from the community perspective, and discussing the Free Air CO_2 Enrichment (FACE) experiments and other climate change related experiments. This topic is important to how we view the future of forest management and agro-ecosystems.

The other hole in the book is the omission of protists and viruses. Protists are the main bacterivores of the soil microbial loop, but do not have a chapter and are barely referred to in chapters. There is only one index entry for protozoa. To place it in perspective, an equivalent text on aquatic systems that avoided protist grazers would be unthinkable, if not ridiculous. Similarly, viruses are known to be abundant in the soil, and their role in nutrient recycling in aquatic food webs has clearly established they cannot be ignored from models. Even though some chapters acknowledged the protists, the viruses are glaringly absent from the text and the models.

Another interesting point that emerges is the lack of consensus among the authors on what the functional groups or guilds are. Some diagrams even treat broad taxonomic groups as a guild and many omit cytotrophy on protists. The term microbe is also used variably to mean bacteria (or prokaryotes), bacteria and fungi (primary saprotrophs), or all microbes (bacteria, protists, and fungi). This is one fundamental area that will require further consideration in a modern context. Clearly the gross generalizations into categories such as Gram-negative bacteria based on lipid assays, and protozoa or microarthropods will be too crude for future studies. Most chapters make it clear that future work will need to focus on genera, species, and more realistic functional diversity.

It would be difficult, if not unfair, to highlight some chapters instead of others in a book that is evenly strong. Despite the omissions, the book provides solid reviews of the literature that are discussed in light of ecological theory developed largely from above-ground ecology. The introductory chapter is a well-thought-out and insightful commentary on modern soil ecology. Indeed, this chapter is also a commanding commentary on ecology and the challenges that lie ahead. It raises the excitement and that is maintained throughout the book.

The editors remind us in the preface that in 2003 Donald Kennedy (*Science*. 302:2040) identified soil biodiversity and ecosystem function as one area to watch in 2004. Much of the credit for this accomplishment goes to a generation of soil ecologists, many of who have contributed to this book, who provided this exciting body of work as a foundation for the new generation.

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Real Solutions for False Absences

MacKenzie, Darryl I., James D. Nichols, J. Andrew Royle, Kenneth H. Pollock, Larissa L. Bailey, and James E. Hines. 2006. **Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence.** Elsevier, Burlington, Massachusetts. xviii + 324 p. $64.95, ISBN: 0-12-088766-5 (alk. paper).

Key words: Bayesian; detection probability; monitoring; population dynamics, presence; sampling; statistics; study design.

Ecologists don't like to be told that their data are inadequate. Especially when they have subjected themselves to miserable weather, rapacious insects, and stale beer in the process of collecting those allegedly inadequate data. It may be mollifying that a considerable proportion of one's peers are in no better position. The recent ascendance of robust methods for modeling occupancy has emphasized that although most ecologists can be fairly confident about what they have observed (ivory-billed woodpecker debates notwithstanding), there is good reason to be far more circumspect about what has not been observed. *Occupancy estimation and modeling* synthesizes the conceptual basis for calculation of detection probability, current statistical approaches, and how such knowledge can be applied to improve the design and interpretation of ecological research.

Seminal papers on site occupancy and detection probability by the authors and by other researchers have been reviewed and published in peer-reviewed journals; this is not a review of that body of work. Instead, I aimed to evaluate how well the book presents a readable, cogent argument for consideration and quantification of detection probability in various contexts. In general, it succeeds. MacKenzie et al. write clearly and make sensible points that are illustrated with excellent case studies and figures. The authors plainly have an agenda, but their style is temperate and, as a result, convincing.

The book is intended to reach not only ecological modelers but practitioners who may not have strong quantitative skills. The authors claim to have "taken great pains to use as little statistical jargon as possible," although they allow "in places some readers may struggle to understand the techniques exactly." Where extensive sections either minimize statistical terminology or explore mathematical issues in some detail, the text flows well. The two are not always well integrated, however, and transitions can be abrupt. This is not a fatal flaw, assuming that readers who are more comfortable with words than equations will turn the page rather than setting aside the book.

Occupancy estimation and modeling opens with a straightforward introduction to ecological modeling, monitoring, and inference. In Chapter 1, MacKenzie et al. outline the principal reasons why there seems to exist so much data yet so little knowledge of system dynamics. Observations like "monitoring of animal populations and communities is not a stand-alone activity of great inherent utility" are not new, but abundant evidence suggests that they bear repeating. By focusing on application of occupancy modeling to monitoring, rather than attempting to present a primer for monitoring in general, the authors demonstrate specific ways in which monitoring can be directed toward an effective process of research and management. In the process, they provide a gentle introduction to statistical notation that will be used throughout the book.

Chapter 2 is a concise overview of the role of occupancy in population ecology throughout the past century. Attention to and respect for historical work throughout this book, in fact, is one of its notable strengths, as is the geographic and taxonomic breadth of citations. The authors highlight relationships among concepts and methods such as resource selection functions, metapopulation dynamics, and community-level or assemblage-level metrics, emphasizing that reliable occupancy data can enhance diverse approaches to ecological investigation.

In Chapter 3, the authors review statistical concepts germane to their subsequent discussion of occupancy modeling. Although most work by MacKenzie and colleagues has used frequentist statistics, they recognize here the potential and growing acceptance of Bayesian methods of estimation and inference, with several pages dedicated to basic theory and comparison with maximum likelihood estimation. The level of detail seems appropriate for readers with a basic grasp of statistical topics and terms, and I suspect that few individuals without that background will dedicate much time to the book. But if the authors honestly do intend to engage practitioners, they may be assuming slightly too high a level of fundamental statistical literacy.

Estimation and modeling of occupancy patterns of a single species in a single period of population closure ("season") are addressed in detail in the next two chapters. It is easy to become impatient if one's own data are not amenable to treatment with these relatively simple occupancy models, but the material is worth reading because it builds a strong foundation for models that incorporate data for multiple seasons or multiple species. Several sections in particular should be useful to most ecologists. In Chapter 4, these include a frank discussion of critical assumptions of the single-species, single-season model and consequences of violating those assumptions and a section on assessment of model fit. I also appreciated a section on Bayesian formulations of the model using WinBUGS. This material may appeal to only a small proportion of the current audience, but it may prove to be a valuable reference as Bayesian methods become more prevalent and user-friendly. Accessibility to non-statistical readers suffers a bit in Chapter 5, which covers situations in which detection probability is unequal among sites. With an eye toward application of occupancy models to management, treatment of covariate effects in particular might have benefited from a more extensive verbal explanation.

Chapter 6, which concentrates on the design of occupancy studies, is outstanding and demonstrates that the authors have a firm grasp of the realities and constraints of field research. For example, MacKenzie et al. offer guidance on how to balance number of sites against number of visits per site. They also demonstrate how cost functions can be used to optimize allocation of effort given concrete financial limitations. Other pragmatic methods are covered in this chapter, such as removal designs in which a site is not visited following initial detection of the focal species.

The authors believe that their chapter on single-species, multiple-season occupancy models "may be the most important in the book" because these models have great potential to provide meaningful inferences about occupancy dynamics and underlying mechanisms. In that light, I wondered why the chapter, which includes both discussion of models and related discussion of spatial and temporal aspects of study design, was not emphasized in the introductory material. Alternatively, sections on study design could have been melded with the material in Chapter 6.

Two chapters address how imperfect detection of single species may be conflated in studies of multiple species or assemblages. As MacKenzie et al. acknowledge, software and illustrative examples are not yet available for the full suite of concepts raised in these sections—a constraint that I believe needs to be recognized by ecologists who may be tempted to discount community-level analyses that do not explicitly calculate detection probability. In a final chapter, "Future directions," the authors explore a range of topics for which satisfactory models are still under development, such as multiple occupancy states, shifting distribution of habitat, and relationships between occupancy and abundance. In so doing, they effectively draw the audience into their thought processes and encourage complementary research.

In the introduction, the authors distinguish among conceptual, verbal, and mathematical models. When a robust quantitative model exists, it can be tempting to focus on parameterization to the exclusion of ideas or hypotheses that motivated development of the mathematics. But if we are to improve the scientific basis for land-use and conservation planning, especially in an era of diminishing human and financial resources for ecological research, we cannot forget that careful thought should precede action. In other words, if the ecological community aims to improve feedbacks between sampling, monitoring, and management practice, there may be a lag between awareness of detection probability, efforts to improve sampling methods in the field, and widespread implementation of modeling procedures. Ongoing work that formed the basis for *Occupancy estimation and modeling* should help ensure that necessary tools increasingly will be available as people reach out for them.

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TAKING THE LONG VIEW IN SETTING CONSERVATION PRIORITIES

Purvis, Andy, John L. Gittleman, and Thomas Brooks, editors. 2005. **Phylogeny and conservation**. Conservation Biology. Number 8. Cambridge University Press, New York. xiii + 431 p. $120.00 (cloth), ISBN: 0-521-82502-4; $60.00 (paper), ISBN: 0-521-53200-0.

Key words: conservation; evolutionary history; extinction; phylogeny; speciation; species concepts

To many, success in conservation is still a matter of counting the number of species which can be preserved, but the simplest thought experiment shows that species are not equal in the minds of conservationists and the general public. If forced to make a choice, would you rather preserve the Giant Panda, or a species of mouse? If you chose the Giant Panda, you are clearly not alone. But how can we move beyond anthropocentric appeal to more rationally defensible criteria? Gathering pace over the decades (with a particular upsurge in the early 1990s) has been the idea of preserving, in Bob May's term, evolutionary history, and using phylogenies to make this assessment. This book is the result of a conference in 2003 and more than a progress report it shows how the idea of evolutionary history ramifies throughout conservation biology. Chapters include ones on how to use phylogenies in conservation assessment, studies of evolutionary process, to visionary predictions of biodiversity in a world without even semblances of wilderness. A chapter on how to make a molecular phylogeny (Sinclair, Pérez-Losada, and Crandall) is not specifically conservational but valuable for anyone seeking an in-depth review by one of the leading teams in phylogenetics.

An early chapter (Agapow) meets the question of species head-on. At first glance it is a straight-forward method, but using the number of species as a metric for biodiversity is seriously bedevilled by differences between species definitions, especially between the biological species concept (BSC) and the phylogenetic species concept (PSC). One could say that the BSC relies on distinctness and PSC on difference. The number of species recognized using the PSC is typically larger than under the BSC, but this is not invariable. Clearly, if data are gathered from different systematists applying different species concepts, then the comparison of regions, or even different groups from the same region, could be hopelessly compromised. Worse, when PSC and BSC classifications of the same fauna are available, which set of regions gives the highest species number can differ between concepts. To a considerable extent, using not the number of species but their phylogeny gets around these taxonomic problems.

The various chapters reflect a division in conservation genetics, of which the phylogenetic approach can be considered a subset (because of growing importance of molecular phylogenies). One approach attempts to maximise the evolutionary history preserved across all species, the other to maximise the genetic diversity maintained within a single species or a few close relatives. The first approach has to be the long-term goal, but the second arises naturally from a tradition of managing highly endangered and charismatic species. Avise's chapter falls into the second tradition, following easily from his highly influential concept of phylogeography. In fact, Avise argues that the phylogenetic approach will be most useful at the inter-population level, although I'd say that the rest of the chapters lead to a different view.

Conservationists interested in phylogenetic approaches usually qualify their findings with remarks that other factors than evolutionary history will also mediate which species or regions are preserved. A major consideration is cost, as discussed by Martin Weitzman (1993. What to preserve? An application of diversity theory to crane conservation. *Quarterly Journal of Economics* 108:157–183), who brought out the paradox that resources should often be assigned to less- rather than more-endangered species to give the best preservation of evolutionary history in the long term. Avise makes a valuable attempt at a complete scoring system for assigning preservation priorities to single species, with phylogeny being only one of five attributes used, the others including "ecology" and "charisma." An example of where phylogeny might be overwhelmed by other criteria is the polar bear, nested within brown bear populations but high on such things as charisma. Avise gives equal weighting to his five criteria, but it might be politically sounder to have scientists provide scores for criteria whose weights are set by others (Helene Marsh, *personal communicaton*).

Scaling up to meet the goal of preserving biodiversity overall, as opposed to preserving a few favored species, faces problems, such as the lack of comprehensive phylogenies outside a few "model" groups such as primates. Lacking such large phylogenies, Rodrigues, Brooks, and Gaston argue that species richness does provide a reasonable surrogate for evolutionary history after all, although understandably their simulation study doesn't address the serious problem of species concepts. Certainly the goal of preservation of the tree of life may not absolutely demand that every priority-setting exercise be a phylogenetic one. Another surrogate is to use systematic nomenclature to infer phylogeny, an approach that appears promising as an interim measure. Beyond that is the "phylogenies for all" approach of DNA barcoding, which naturally presents itself for use in phylogenetic setting of priorities. However, using the barcodes must involve approaches such as the Bayesian methods covered by Sinclair, Pérez-Losada, and Crandall to yield the statistical sufficiency without which conservation recommendations must lack plausibility. DNA barcodes can be produced at a prodigious rate, so that provided they are combined with statistical approaches, they have the potential to include more and more of the great bulk of biodiversity in the evolutionary history approach. Nee points out that the bulk of evolutionary history is in protists and bacteria, which many will likely find an uncomfortable insight.

Moritz, Hoskin, Graham, Hugall, and Moussalli provide a particular detailed chapter on using phylogenies to infer past processes. Moritz et al. show how concurrent phylogenetic patterns enable recognition of the processes yielding current distributions in Australia's Wet Tropics, using numerous herpetofaunal phylogenies. Other chapters cover other continents, using approaches varying from explicit phylogenies to species numbers counts.

Elucidating the processes which gave rise to today's biodiversity is important not only for our general understanding of evolution at large scales, but also for managing it in the future. But it is very naive to think that such management can consist of simply trying to preserve processes which have operated until now. There are two overwhelming phenomena which interfere with the preservation of past processes: climate change and the increasingly large fraction of the planet being directly devoted to human use. Taking the optimistic view that climate change is to a large extent anthropogenic, it can in principle be stabilized or reversed; if not, many species will become extinct through either complete loss of suitable habitat or failure to follow moving climatic zones. The other phenomenon is at least as important—the "gardenification" of the earth, in which increasingly no species can survive without our concurrence. In the final chapter, Barraclough and Davies extrapolate present trends and conclude that increasingly species will be selected for their ability to flourish and speciate in human-use habitats, but that speciation in these circumstances would yield a low-diversity world. Their conclusion that much effort should go into managing habitat outside the human-use areas to preserve high biodiversity faunas is not that surprising, but certainly understandable.

This book should be examined by all concerned with conserving biodiversity. If you are already convinced of the importance of preserving evolutionary history you'll find a broad review of the area. If you're still leaning toward simple species number counts, this book may convince you to recognize the importance of phylogeny.

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Food for Thought on Plant–Carnivore Interactions

Wäckers, Felix L., Paul C. J. van Rijn, and Jan Bruin, editors. 2005. **Plant-provided food for carnivorous insects: a protective mutualism and its applications**. Cambridge University Press, New York. xii + 356 p. $130.00, ISBN: 0-521-81941-5.

Key words: biological control; food-web; mutualism; omnivory; tritrophic.

The study of tritrophic interactions has long been a core area of research in ecology. Work on plant–arthropod interactions has played a particularly important role in building our current understanding of the ecology and evolution of complex food webs. Although studies of plant–carnivore interactions have typically focused on their indirect interactions, as mediated by herbivores, direct interactions between plants and carnivores are common. *Plant-provided food for carnivorous insects* starts by pointing out that most carnivores are in fact omnivores (i.e., they feed on both plant and animal tissue) and the multiple chapters consider in detail the ecology and evolution of direct plant–carnivore interactions and mutualisms.

This edited book is the most comprehensive treatment to date on the ecology of plant–carnivore mutualisms. The first chapter gives a detailed and deep historical background on the topic, outlines the different omnivorous life-history strategies employed by arthropods, and puts the subsequent chapters into the context of the book's theme. The chapters that follow are divided into three parts. Part one (Chapters 2–4) considers the different types of plant-provided foods, their hypothesized function, and the benefits and costs that plants incur by attracting predators and parasitoids as an indirect defense against herbivores. Part two (Chapters 5–7) focuses on the importance of plant feeding for carnivorous insects and how plant-provided food affects suppression of herbivores by carnivores. One chapter in this section (Chapter 7, by Romeis, Städler, and Wäckers) reviews the effects of pollen and nectar feeding on herbivorous arthropods, and the rationale for its deviation from the book's theme is not adequately explained. The final part of the book (Chapters 8–11), considers how plant–carnivore mutualisms can be applied to biological control, particularly in agricultural settings.

Plant-provided food for carnivorous insects will serve as an important resource for ecologists interested in mutualisms and tritrophic interactions. In particular, researchers who study omnivory, the ecology of plant–carnivore mutualisms, as well as the biological control of pest insects, will find certain chapters well worth reading. The editors (Wäckers, van Rijn, and Bruin) have brought together an impressive group of scientists who have each contributed substantially to our knowledge of plant–carnivore biology. The book as a whole presents a thorough review on the ecology of plant–carnivore interactions, with a bias towards the arthropod side of the equation. Biologists looking for insight into the evolution of plant–carnivore mutualisms will likely be disappointed (but see Chapter 4). The chapters are generally well written and referenced, although recent references (post 2002) are few.

Several chapters give a cogent synthesis of the literature, and important conclusions arise from these reviews. For example, Chapter 4 (Sabelis, van Rijn, and Janssen) looks at selection on plants for food provision to carnivores. They illustrate gaps in the literature, suggest avenues for future research, and derive testable predictions based on theory and empirical data. Eubanks and Styrsky (Chapter 6) also present a clear and novel review. They compile the available empirical data to address the question: does plant feeding affect the performance of carnivores and their ability to suppress prey populations? Their results are interesting using statistics and often striking, but the lack of formal hypothesis testing makes the strength of some of their conclusions difficult to assess. Possibly the best chapter in the book (Chapter 8, van Rijn and Sabelis) examines how apparent competition theory can be used to predict when plant-provided food will reduce herbivore populations in agricultural settings. The chapter builds on previous theoretical and empirical work by this group, and many of their results are novel and should be of general interest to biologists interested in both basic and applied problems relating to tritrophic interactions and mutualisms.

Although the book as a whole is fairly thorough, several chapters fall short of a clear and concise review from which the reader can identify general patterns. As one example, Chapter 2 (Wäckers) provides an extensive review of the nutritional value and suitability of several types of plant-provided foods (e.g., floral nectar, extrafloral nectar, pollen). Despite the superb organization of the review, the 58 pages of text were overwhelming. Tables and figures would have helped to summarize the existing data and to illustrate patterns relating to how nutritional quality varies among the plant foods that carnivores consume. Most authors do, however, make a point of identifying the unanswered problems remaining in the field, with suggestions for future research.

The final chapters of the book (Chapters 10 and 11) consider the practical aspects of using carnivores as biological control agents and in this way they offer important food for thought to applied ecologists and those working in agriculture or forestry. Wilkinson and Landis (Chapter 10) consider how the effectiveness of carnivores to suppress pest herbivores is influenced by crop diversity (e.g., polycultures), the diversity and scale of the surrounding habitats, and landscape spatial complexity and history. These topics will be familiar to most ecologists, so this chapter will be of most value to the newcomer looking for a general overview. The final chapter by Gurr et al. (Chapter 11) contrasts simple and complex approaches used in biological control, and effectively illustrates how to implement the science behind Chapters 2–10; it is an excellent review.

On the whole, *Plant-provided food for carnivorous insects* will help bring attention to the study of plant–carnivore mutualisms and the use of arthropods as biological control agents. Its strength rests with its extensive review of the ecological and applied aspects of how carnivores use plant-provided foods. As a non-specialist in applied ecology, the book convinced me that there is promise for the increased use of arthropods in programs of integrated pest management. It is clear, however, that we still have a long way to go before we understand the ecology and evolution of plant–carnivore interactions in natural systems. In particular, we know very little about the relative costs and benefits of direct versus indirect plant defense strategies, and how commonly plants have evolved to employ arthropods as indirect defenses in nature. *Plant-provided food for carnivorous insects* will be an important resource for biologists hoping to contribute to this field.

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Spotlight

RECENT PUBLICATIONS OF PARTICULAR INTEREST

Beidleman, Richard G. 2006. **California's frontier naturalists.** University of California Press, Berkeley, California. xv + 484 p. $39.95, ISBN: 0-520-23010–8 (alk. paper). This book tells the tale of naturalists who explored California from 1786 to 1891. It is divided into eight sections, generally organized by time period and highlights both specific exploratory expeditions and individual naturalists.

Trask, Crissy. 2006. **It's easy being green: a handbook for earth-friendly living.** Gibbs Smith, Salt Lake City, Utah. 168 p. $12.95, ISBN: 1-58685-772-X. This is a small, inexpensive book that could supplement environmental courses. The chapter titles reflect the topical diversity of the book: "Green living myths," "Making a difference," "Eco-tips for living greener," "Buying green," "Green shopping online," "Getting involved," and "Resources to help the earth."

BOOKS AND MONOGRAPHS RECEIVED THROUGH MARCH 2006

Abbadie, Luc, Jacques Gignoux, Xavier Le Roux, and Michel Lepage, editors. 2006. **Lamto: structure, functioning, and dynamics of a savanna ecosystem.** Ecological Studies. Volume 179. Springer, New York. xix + 415 p. $129.00, ISBN: 0-387-94844-9 (acid-free paper).

Adams, Clark E., Kieran J. Lindsey, and Sara J. Ash. 2006. **Urban wildlife management.** CRC Press, Boca Raton, Florida. 311 p. $79.95, ISBN: 0-8493-9645-X.

Alexander, R. McNeill. 2003. **Principles of animal locomotion.** Princeton University Press, Princeton, New Jersey. viii + 371 p. $39.50, ISBN: 0-691-08678-8 (alk. paper).

Barsanti, Laura, and Paolo Gualtieri. 2006. **Algae: anatomy, biochemistry, and biotechnology.** CRC Press, Boca Raton, Florida. 301 p. $119.95, ISBN: 0-8493-1467-4 (alk. paper).

Beidleman, Richard G. 2006. **California's frontier naturalists.** University of California Press, Berkeley, California. xv + 484 p. $39.95, ISBN: 0-520-23010-8 (alk. paper).

Braun, Clait E., editor. 2005. **Techniques for wildlife investigations and management.** Sixth edition. The Wildlife Society, Bethesda, Maryland. xiv + 974 p. $75.00, ISBN: 0-933564-15-5.

Channing, Alan, and Kim M. Howell. 2006. **Amphibians of East Africa.** Cornell University Press, Ithaca, New York. xi + 418 p. $45.00, ISBN: 0-8014-4374-1 (alk. paper).

Drosopoulos, Sakis, and Michael F. Claridge, editors. 2006. **Insect sounds and communication: physiology, behaviour, ecology and evolution.** Contemporary Topics in Entomology. CRC Press, Boca Raton, Florida. xvii + 532 p. + CD-ROM. $139.95, ISBN: 0-8493-2060-7 (alk. paper).

Herrel, Anthony, Thomas Speck, and Nicholas P. Rowe, editors. 2006. **Ecology and biomechanics: a mechanical approach to the ecology of animals and plants.** CRC Press, Boca Raton, Florida. 334 p. $139.95, ISBN: 0-8493-3209-5 (alk. paper).