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Review: Holistic Population Analysis

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pecially in the manakin and bird-of-paradise chapters. One of the few disappointments in the descriptive chapters is the lack of comparisons in evolutionary trends among groups, a topic that would have been appropriate for a summary chapter. Finally, although the author is careful to give information about male mating behaviors and size and color dimorphisms between the sexes, little attention is given to female mating behaviors.

Overall, this book will make a welcome addition to an ornithologist's and/or evolutionary biologist's reference li-

brary. The book is not meant for use as a primary text in the classroom; however, its background information and illustrated examples are highly useful for discussions of avian mating behavior at any class level.

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HOLISTIC POPULATION ANALYSIS

Maurer, Brian A. 1994. **Geographical population analysis: tools for the analysis of biodiversity.** *Methods in Ecology.* Blackwell Scientific Publications, Cambridge, Massachusetts. x + 130 p. \$32.95 ISBN: 0-632-03741-5.

Biodiversity is a "hot" topic that has recently spawned much interest in the popular and scientific press and in Washington. Part of the reason for this interest has been the fear among scientists and laypersons that we are going to be confronted with a mass extinction event driven by human encroachment on the biosphere. The magnitude of the problem, however, is very difficult to assess as it is difficult to determine when and if a particular species, or group of species, is going to go extinct. These considerations provide the backdrop and motivation for Brian Maurer's book *Geographical population analysis*, which is one of a series of books edited by John Lawton and Gene Likens for Blackwell Scientific Publications entitled *Methods in Ecology*. The books in this series are intended to provide an overview of new and emerging techniques that can be applied to ecological problems. In the case of *Geographical population analysis*, this entails analytical techniques for assessing the status of a species by analyzing patterns of distribution and abundance over its entire geographic range.

The book is divided into six chapters. The first chapter introduces the concept of the geographical population as a hierarchical collection of populations representing the distribution of a species at the continental scale. It then goes on to present a brief overview of the topic of biological diversity and to argue that a broader spatial perspective, such as a consideration of geographical populations, must be adopted in dealing with this issue. The second chapter presents a brief introduction to geostatistical techniques, primarily variogram analysis, as a general framework for characterizing the distribution of geographical populations. The next three chapters represent the heart of the book, and present techniques for analyzing the shape, size, and orientation of the geographic ranges of species (Chapter 3); for analyzing spatial patterns of variation in the abundance of geographical populations (Chapter 4); and for analyzing temporal patterns of variation (Chapter 5). The last chapter (Chapter 6) goes on to reiterate that species must be analyzed at the scale of the geographical population if we are to determine which species are going to

be most sensitive to global environmental change. The last chapter also points out some of the potential benefits, as well as some of the problems, in carrying out this type of analysis for a wide range of species.

In essence, what this book presents is an overview of a grab bag of analytical techniques that have been working their way into the ecological literature over the last decade or so; and, in particular, the book presents them as they might be applied to a study of the geographical distribution of species. The techniques presented include, among others, variogram analysis, interpolation through kriging, fractal analysis, dynamical systems theory, and information theory as applied to time series. Each of these techniques is quite complex as a topic alone and obviously can only be dealt with superficially in a book of 130 pages. This is perhaps a weakness of the book that may restrict its utility to an audience of readers that has some prior experience with these techniques. This weakness is exacerbated in a few places through editorial errors and insufficient information. For example, the formula presented for the semivariance function (Equation 2.2) is missing a term that could lead to a complete misinterpretation of how semivariance analysis responds to a process containing no spatial trend. In another example, all of the variograms presented in the example analyses fail to indicate the actual measurement scale along the x-axis, limiting the reader's ability to interpret the results in a meaningful way.

What I found of particular interest in the book, and an aspect that may allow it to reach a broader audience, was the application of the analytical techniques to data obtained from the Breeding Bird Survey (BBS). The BBS is arguably the best data set available for characterizing the distribution and abundance of a group of species throughout their geographical range. The examples were quite interesting and helped illustrate the utility of the analytical techniques being presented. However, this also brings up the question of how easy it is going to be to take the ideas presented in this book and apply them to taxa other than birds. There are few data sets that have the scope and completeness of the BBS, and little hope that more of equal quality will become available without a massive effort of time and money. In the last chapter Maurer does address this problem and suggests that remote sensing technology may eventually provide a means for obtaining the type of data needed.

I think that, on the whole, the approach taken in this book is quite interesting and has many valuable insights to offer, but I would caution potential readers that, unless they already have some experience with the techniques presented, they may find the going a bit rough.

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ECOLOGY AND NATURAL HISTORY OF A NEOTROPICAL RAIN FOREST

McDade, Lucinda A., Kamaljit S. Bawa, Henry A. Hespenheide, and Gary S. Hartshorn (eds.). 1994. **La Selva: ecology and natural history of a neotropical rain forest**. University of Chicago Press, Chicago, Illinois. x + 486 p. \$90.00, £71.95 (cloth), ISBN: 0-226-03950-1; \$28.95, £23.25 (paper), ISBN: 0-226-03952-8.

The Organization for Tropical Studies' La Selva biological station in Costa Rica is one of the most intensively used sites for research on tropical biology in the world. In the brief span of its existence as a research station (since 1968), over 1000 articles on many aspects of tropical biology have been published on studies conducted primarily on La Selva property. Many of our current ideas about forest dynamics, tropical diversity, and plant-animal interactions have been formulated and/or tested at La Selva. This long-awaited volume will bring readers up to date on the current state of research at La Selva, and provides a comparative overview of what we know from other tropical sites as well.

The book is divided into five sections plus eight appendices. The introduction and the appendices describe the station, its environs, governance and philosophy, and patterns of research use over the years. Part I treats the abiotic environment, with chapters on climate, geomorphology and aquatic systems, soils, and nutrient cycling. Part II introduces the plant community. The seven chapters in this section cover basic vegetation, demography, forest dynamics (especially the importance of treefall gaps), physiological ecology, patterns of flowering phenology, and reproductive systems in plants. Part III covers the animal community, from butterflies (the only invertebrates discussed), through all of the vertebrate classes, and ends with a summary chapter on animal population biology. Part IV includes two chapters on plant-animal interactions: herbivory and frugivory. Finally, Part V focusses on a relatively new area of research at La Selva, i.e., the human environment and applied ecology, with chapters on regional land use patterns, agricultural systems, and forestry. The last chapter is an overview of the current state of knowledge in tropical biology and discusses the role tropical field stations such as La Selva will play in the future. Finally, six more appendices provide species lists of the vascular plants, fish, amphibians, reptiles, birds, and mammals of La Selva. A bibliography, compiled from all 26 chapters, concludes the text.

Almost all of the 41 contributors have worked as long-term researchers at La Selva, and their chapters provide a useful review of the current state of knowledge in their particular field. Most chapters are organized similarly. After setting the stage, authors describe what is known to date about their

subject at La Selva, often comparing or supplementing that knowledge with information from other tropical sites, and end with notes on major gaps in current knowledge and suggestions for future research. The same theme resounds throughout the book: we have just scratched the surface of tropical diversity, and there is a crying need for many more studies ranging from basic natural history, to experimental demonstrations of mechanisms and processes, to long term studies and parallel studies among different sites. Almost every author concludes that more questions have been raised than answered by the work done to date in his or her particular area at La Selva, as well as elsewhere in the tropics.

Most chapters were excellent—both interesting and informative. I found the chapter on soils particularly illuminating. Few other field stations, particularly in the tropics, have data on soil composition, yet soils are important determinants of vegetation and thus of animal distribution and abundance. Sollins et al. provide a workable alternative to the simplistic division of La Selva soils into nutrient poor residual and nutrient rich alluvial categories. Despite the terminology unfamiliar to most non-soil scientists, the chapter is readable and well-explained. I also enjoyed D. A. Clark's chapter on plant demography, as well as the more interdisciplinary chapters on herbivory and frugivory. Of the faunal studies, I found Donnelly's coverage of amphibian natural history, and Levey and Stiles' review of bird ecology and behavior, especially complete. Butterfield's and Montagnini's chapters on land use, agriculture, and conservation are particularly relevant as La Selva and most other tropical field stations become islands in a sea of human economic and social concerns. A few chapters try to cover too much ground (such as Braker and Greene's review of population biology, which attempts to cover life histories, abundances, demography, and predator-prey interactions of every major animal group at La Selva), and become confusing and unfocused. The inclusion of a section on vertebrate herbivores, about which almost nothing is known at La Selva, seemed gratuitous in Marquis and Braker's otherwise excellent and comprehensive chapter on herbivory. Conversely, Bussing's chapter on fish is disappointingly brief and superficial, but this may reflect the paucity of studies done on these animals at La Selva. Conspicuous in its absence from the appendices is a checklist on any group of insects—the real movers and shakers in a tropical rainforest. However, the current project on La Selva arthropods (ALAS) should help to fill that gap.

In scope and style the La Selva book is reminiscent of the 1982 volume on the Smithsonian Institution's Barro Colorado Island research station in Panama, *The ecology of a tropical forest: seasonal rhythms and long term changes* (Leigh, E. G. Jr., A. S. Rand, and D. M. Windsor. [eds.]. 1982. Smith-