engaging agenda for conservation action: the overarching problems we face, the challenges of meeting conservation goals, and the roles available to current and future conservation biologists (students reading this text, one hopes).

Essentials concludes with a useful appendix of selected environmental organizations. I rely on this appendix early in the semester in my teaching of conservation biology because it is important for students to be able to see who the players are and to connect what is being done with who is doing it. It is also important for today's students to be able to picture themselves in any of a wide variety of governmental or nongovernmental organizations because the landscape for employment in the field of conservation biology has changed dramatically in the recent past.

Although I am generally satisfied with *Essentials,* I have found the need to compensate for some topics that are weakly presented or that somehow get lost in the shuffle as a result of Primack's organization. For example, it is important to distinguish clearly between sustainable use and sustainable development, but these topics are treated separately and not contrasted. Issues surrounding sustainable use are collapsed into a narrow discussion of maximum sustainable yield (in chapter 10, on overexploitation). Primack states that there is an extensive body of literature on the scientific harvest of species, but the heuristic background for sustainable-yield calculations is not presented (one equation for MSY is thrown in, but not properly placed into context). Thus, students do not get a sense of the difference between optimum and maximum sustained yields or the nuances of varying levels of optimum sustained yields and the conditions under which they apply or should be engaged. In fact, the concept of optimum sustained yield is not introduced at all. Sustainable development is presented in chapter 20, but here Primack fails to capitalize on the opportunity to clarify the role of the sustainable use of natural resources in development programs.

Some topics are weak because they are not presented with sufficient rigor. Because most of the (sometimes acrimonious) debates at the Conference of the Parties to the Convention on International Trade in Endangered Species center around the placement into or movement of species between convention appendices, students would better understand these proceedings if given more complete definitions of Appendix I and II species (chapter 21). Considerable space is given to the process of red listing—determination of the global status of species using the categories and quantitative criteria of the World Conservation Union (IUCN). Unfortunately, the material is outdated; although revised IUCN categories and criteria were introduced in February 2000, Primack uses the initial 1994 version of these quantitative criteria. The discussion emphasizes the need for quantitative criteria (pre-1994 listing processes), yet it falsely presents the 1994 categories as those that "have proved problematic." More important, it is impossible to understand the actual process of evaluating a species with the IUCN criteria from the disordered treatment given in *Essentials*.

I approach the teaching of geographical and spatial issues with the metaphor of peeling an onion in mind, treating spatial scales as layers to be understood and then broken down into finer levels of resolution. My use of this approach means that my syllabus does not follow the topics sequentially as they are presented in *Essentials*. Island biogeography is treated in chapter 7 (and again in chapter 16), whereas metapopulation analysis appears in chapter 12. I also believe that an understanding of the spatial structure of populations is necessary before introducing the concepts of minimal viable population (MVP) and population viability analysis (PVA) because both factor heavily into how MVP and PVA must be interpreted. In *Essentials*, however, both these concepts appear before the discussion of metapopulations.

The clear strengths of *Essentials* are its breadth of coverage and its accessibility to students beginning their exploration of conservation biology. Therefore, both Primack and Sinauer Associates must be commended for their vision and outreach in ensuring an active translation program for various editions of *Essentials*. Earlier editions have appeared in German, Chinese, Hungarian, and Spanish, and at the time this edition was published French, Greek, Arabic, Italian, Thai, Russian, Romanian, and Mongolian editions were in the works, as were volumes to service India, Africa, and Madagascar. Conservation biology is a global discipline, and Primack's *Essentials* is a major contributor to its future.

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Conservation Biology for Biologists

Conservation Biology. Pullin, A. S. 2002. Cambridge University Press, New York. 345 pp. $120.00 (hardcover). ISBN 0-521-64284-1. $45.00 (paperback). ISBN 0-521-64482-8.

Since its birth, the field of conservation biology has faced an inherent tension in how to take an interdisciplinary approach to the current extinction crisis. This tension is due partly to the reticence of biologists to extend their teaching and research outside the comfort zone of biology. In his new text book, *Conservation Biology,* Pullin explicitly addresses this issue by purposely sticking to the science of conservation biology. Pullin argues that topics such as politics, economics, and social sciences have not been covered adequately in other books and thus he decides a priori to avoid these topics

The argument that conservation biology texts have not adequately discussed human dimensions has merit. Recently, Niesenbaum and Lewis (2003) reported that social issues were not well integrated throughout most textbooks. They also reported, however, that more recent editions of some texts had "improved" by integrating these topics more thoroughly. I agree with Niesenbaum and Lewis (2003) that conservation biology should strive toward more effective integration of human dimensions. As a professor, however, I appreciate Pullin's argument. It certainly has been uncomfortable at times to lecture on topics out of my area of expertise, but one could easily apply the same logic to subdisiplines within conservation science. For instance, it may be uncomfortable for conservation geneticists to lecture on topics such as landscape ecology. However, conservation biology ultimately requires students, professors, and practitioners to work outside their comfort zone. The question is how far should one venture?

Pullin provides a suitable text for instructors that prefer to concentrate on the science of conservation biology. Each chapter is well organized and the book is exceptionally easy to read. Side boxes are used effectively to provide details on specific concepts. Likewise, Pullin successfully uses vivid examples for most major concepts. Whereas most texts are dominated by case studies from North America, Pullin purposely refers to European case studies, with a particular emphasis on examples from the United Kingdom. Indeed, it was refreshing to see case studies not reported in other texts.

This book introduces students to the complexity of conservation science. Arguments for and against various hypotheses are presented throughout the book. This illustrates how uncertainty is a central theme in the field of conservation biology. Each chapter concludes with a list of excellent discussion topics, but additional reading or lecture may be necessary to adequately cover certain discussion points. The final chapter includes a problem-based assignment that requires students to apply their newly gained knowledge to writing a management plan for a reserve in the United Kingdom. Individual instructors may easily modify this exercise for a reserve in their own geographic region.

Pullin organizes his book into three sections. The first section (chapters 1–2) provides an overview of the major ecosystems and an introduction to the concept of biodiversity. I would have liked additional ecological concepts to be presented, especially in the field of community ecology. However, the first section provides adequate background information for students with a minimal background in ecology.

Section two (chapters 3–6) focuses on the human activities that threaten biodiversity, and it begins with a short history of human impacts (chapter 3). Chapters 4, 5, and 6 are dedicated to three of the major threats to biodiversity: habitat destruction, habitat disturbance, and overexploitation. Oddly, exotic species are considered within the chapter on habitat disturbance. Although this is a reasonable context, it does injustice to the importance of exotic species as a major threat to biodiversity. Despite this minor criticism, section two provides a fine overview of the major threats to biodiversity.

The real meat of the book is in the third section (chapters 7–15), which considers the *science* of conservation biology. Topics covered range from the conservation of rare species to the field of restoration ecology. Chapter 8 considers the various criteria used for reserve selection, such as biodiversity, endemism, and taxonomic distinctiveness. Practical approaches such as gap analysis also are covered. Principles of reserve design (size and shape) and the need for active reserve management are considered in chapter 9. Pullin points out that reserve management often is experience-based, and he advocates a more rigorous approach to evaluating different management strategies.

Chapters 10 and 11 focus on the conservation and management of individual species. Chapter 10 considers the application of genetic and demographic analyses to the conservation of targeted species. The advantages and disadvantages of ex situ conservation are covered in excellent detail in chapter 11.

Although conservation biology has strong roots in species-specific conservation, the discipline is moving toward a landscape perspective. Nevertheless, these two approaches are not mutually exclusive. In chapter 12, Pullin explicitly considers population biology in a landscape context. This chapter also addresses urban ecology and introduces the concept of ecosystem management.

It was refreshing to see an entire chapter dedicated to the conservation of evolutionary process. Chapter 13 discusses the application of genetic tools to evaluating evolutionary patterns at the landscape level. This chapter illustrates how phylogeography is applied to identifying evolutionary management zones. Other evolutionary concepts, such as the evolutionarily significant unit, are also discussed in nice detail.

Chapter 14 is dedicated to the important field of restoration ecology. This chapter is particularly useful because many conservation biologists will conduct work with restored habitats. Pullin provides a brief but important synopsis of the major costs and benefits associated with restoration management.

In the final chapter, Pullin calls for scientists and practitioners to work more closely to better incorporate science directly into conservation plans. For students, this advice cannot be stated too strongly, and I was glad to see an entire chapter addressing this topic.

After reading Pullin's new text, I found myself conflicted yet again by the inherent challenges of teaching conservation biology. I am still convinced that conservation biologists

must be willing to stray from their area of expertise, but I confess that Pullin has made a nice case for sticking to the science

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Bio[statistics]philia

Experimental Design and Data Analysis for Biologists. Quinn, G. P., and M J Keough 2002 Cambridge University Press, Cambridge, United Kingdom. 537 pp £75 00 (hardcover) ISBN 0–521–81128–7 £29.95 (paperback). ISBN 0–521–00976–6.

Most conservation biologists must draw on experimental design and data analysis in their roles as teachers, empiricists, authors, and reviewers, but few have an extensive background or aptitude in biometry. As a result, we typically experience mild discomfort when confronted with issues of statistical rigor and validity. Depending on the situation, our needs run the gamut from a refresher course in basic hypothesis testing to an overview of new methods that may be unfamiliar but are robust and innovative. In response, Gerry Quinn and Michael Keough have supplied us with a book that is exhaustive without being exhausting Like the hip-pocket trail guides prized by backpackers, *Experimental Design and Data Analysis for Biologists* helps navigate the statistical path without making us feel foolish or clumsy. Ecologists themselves, Quinn and Keough frame their material using language and contextual examples that resonate with their audience They frequently remind us that "for biologists, *statistics is a tool* that we use to illuminate and clarify biological problems" (p. xvi; emphasis theirs). Statisticians who evaluate this reference might find something to quibble about, but the overall assessment of most biologists likely will be quite positive

Several features of the book render it especially friendly to biologists. First, the authors recognize that readers are likely to use statistical software to conduct most of the tests described, but they do not advocate or emphasize any particular package. Instead, they point out common quirks of statistical software that affect how tests are implemented. For example, they caution that there are two types of coding for turning categorical predictor variables into continuous dummy variables for ordinary least-squares regression and that interpretation of coefficients and odds ratios depends on which method is used. Second, descriptions of statistical techniques are accompanied by diverse examples from recent ecological publications. These examples illustrate real-world applications of various analyses and suggest that the authors keep abreast of current literature. To assist readers in understanding both statistical models and statistical software, the authors provide raw data files for examples included in the book on a public-access Web site. Third, most chapters conclude with "General Issues and Hints for Analysis," which serves as both a summary of key points and a cheat sheet for data manipulation. The book is well-written and designed, and it maintains an accessible, conversational tone

Chapter 1 presents a broad introduction to the scientific method, with several elements that are well-suited to applied ecology For example, the chapter explains the differences between empirical and theoretical models and between research and statistical hypotheses. It also examines alternatives to Popperian falsification that derive from Kuhn (1970), Lakatos (1978), and other theorists Quinn and Keough believe that manipulative experiments are ideal, but they recognize the challenges of drawing inferences from small-scale manipulative experiments to large scales of space and time They emphasize that although observational data cannot demonstrate causality, well-designed sampling can be used effectively to refute a null hypothesis

Chapter 2, "Estimation," reviews common parameters and statistics and standard errors It also explains two popular resampling methods, the bootstrap and the jacknife. Given the increasing emphasis on resampling in the ecological literature, I appreciated that these topics were introduced early in the book as opposed to being relegated to a back chapter. Chapter 3 covers a wide range of issues related to hypothesis testing, including Type I and Type II errors, parametric and nonparametric tests, and meta-analysis An outline of statistical tests of hypotheses that explains some of the historical and philosophical underpinnings of those tests is followed by a critique of statistical hypothesis tests in general and significance tests in particular. The authors state their own opinion clearly, but by no means do they imply that readers who come to a different informed conclusion are misguided. Although they comment that "misuse of statistical testing does not mean that the process is flawed . . . it can provide a sensible and intelligent means of evaluating biological hypotheses" (p. 54), they also point out that "only by planning studies and experiments so they have a reasonable power to detect an effect of biological importance can we relate statistical and biological significance" (p. 54)

Sections in the first three chapters provide a lucid synopsis of Bayesian approaches, or "degrees of belief" (p. 8), compared with frequency interpretations of probability. The authors favor frequentist methods, but