Conservation Biology, with RAMAS EcoLab. (Review)_(book review)
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It is estimated that the earth is inhabited by 3 million to 100 million different species, of which approximately 1.5 million to 1.7 million have been systematically identified. Even though this gap of knowledge of the types, distribution, and survival probabilities of the planet's species exists, new discoveries and approaches add to the promise of expanding our knowledge base about the variety of existing life forms. Within the past few decades additional attention has been directed to the acquisition of new information on earth's biodiversity. As a consequence, new techniques, strategies, and models for understanding and managing programs for endangered and threatened species have been developed and implemented. This laboratory manual focuses on many of the promising approaches that can be used to explore a range of salient concepts and processes associated with conservation biology.

Designed for use with undergraduates or advanced high school students, this manual consists of a set of fourteen laboratory investigations that focus on authentic contemporary problems in ecology and conservation biology. Each of the fourteen labs consists of introductory comments on the targeted topic, specific background information, a set of exercises related to the topic, and a series of questions that could easily be used for discussion and for assessment purposes.

The first lab introduces students to the concept of biodiversity and engages them in representative sampling investigations. Successive labs provide opportunities to explore in depth core concepts and processes of conservation biology while utilizing specific species as case studies. For example, a lab on competition focuses on osprey, fish, and barnacles; stochasticity is explored with grizzly bear populations; sustainable levels of harvesting are illustrated in tuna exploration situations; and reintroduction of endangered species highlights information on ferrets and wild asses. The impact of human population growth is covered in a separate laboratory, as are island biogeography and reserve design.

In addition to the sets of well-developed and explained exercises, RAMAS EcoLab software accompanies the laboratories. A special section in the manual describes the functions of this type of technology and delineates clear step-by-step instructions on its use. By involving students in this technological option, the students utilize the same strategies that actual field researchers employ. To further assist teachers in integrating these lab investigations in their established curricular offerings, a matrix is provided that
identifies relevant chapters from major texts that correspond to the goals of the fourteen labs. The entire manual also could serve as the lab component of a conservation biology course or advanced placement environmental science course.

Throughout the manual, students are introduced to and involved in technical and procedural exercises so that they attain a fundamental understanding of conservation biology. The final laboratory challenges the students to synthesize and apply all the analytical techniques from the previous exercises and to become decision makers. The students are given a hypothetical case on protecting species and are asked to present recommendations for the resolution of the dilemma. This exercise reflects a real world situation as it exposes students to views of opposing interest groups, incomplete information, and varying values and belief systems. As exemplified in this culminating exercise, the labs provide the students with investigations that have the potential to add to their knowledge base of our planet's biodiversity as well as serving as a template and model for authentic explorations and data acquisition about the planet.

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**Named Works:** Conservation Biology, with RAMAS EcoLab (Book) - Reviews

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MAKING MODEL BUILDING ACCESSIBLE TO UNDERGRADUATES. (Review) (book review) DOUGLAS S. GREEN.


The titles of these two books suggest a tight focus on environmental and conservation issues, which are clearly vital topics, but peripheral, I thought, to the mainstream ecology taught at many undergraduate institutions. I quickly changed my mind. Both books do a good job of presenting fundamental concepts of conservation biology, the ways in which ecology applies to them, and more. The authors take as their central pedagogical premise the fact that quantitative analysis and model building are key components needed to understand ecological processes and make predictions about their future states. The authors also demonstrate that a clear explanation of the model building process, working in concert with well-designed software, can make model building accessible to students at a variety of levels. Although the authors have chosen conservation biology as the backdrop to their work, their books can also be a relevant part of courses in other areas that stress quantitative analysis, model building, and population interactions.

Applied Population Ecology is intended for upper-level undergraduates in biology, environmental science, or similar majors. The text covers several topics traditionally found in ecology texts: exponential growth, population regulation, age/stage structure, and spatial structure. It adds several topics drawn from conservation biology, including chapters on population viability and resource management and discussions of risk analysis and sensitivity analysis.

The approach the authors take is refreshingly nontraditional in two ways. First, the authors deal primarily with models based on discrete, rather than continuous, time. This approach allows their discussion of model building to focus on numbers of individuals born, dying, and migrating, rather than the more abstract concepts of rates. This focus in turn simplifies the initial discussion of model building and is more directly applicable to seasonal organisms.

Second, the authors rely on software simulations (using the RAMAS EcoLab package), rather than on analytical methods, to help students understand the properties of these models. This has several important consequences. It encourages students to work with
actual data, and a number of relevant examples are provided in the text. The simulation approach also permits the authors to address nondeterministic factors, uncertainty, and chaotic fluctuations. Students can run multiple simulations to discover not only the model's average behavior but also the range of behaviors it can display. This empirical approach does have its cost, however. To use it wisely, students need a good understanding not only of average parameter values but also how the values are likely to vary. With poor parameter selection it is possible for a student to get lost in a sea of unrelated (and unlikely) simulation results that do not illustrate the typical behavior of the underlying models. The discussion in the text and the software's context-sensitive help facilities minimize this danger.

Applied Population Ecology is a well-written and concise text. It can easily be covered in its entirety in a one-semester course devoted to this topic. It can also provide a good supplement to general ecology courses, or even an introductory applied mathematics course that has a particular emphasis on model building. For the most part, the authors have succeeded in their goal of making the development of quantitative, data-driven, predictive models accessible to reasonably well-prepared upper level undergraduates. Even so, students with little mathematical preparation will likely find the book difficult and see the software as a useful, if mysterious, "black box" existing mainly to help them find answers to problems assigned in a course. Instructors who plan to work with such students will find the text to be a good starting point, but they should be prepared to spend considerable time helping students with some of the mathematical concepts.

The second book, Conservation Biology, is a laboratory manual aimed at introductory to mid-level biology (or related) majors. Each of the 14 lab exercises addresses a particular conservation issue such as the plight of endangered species, levels of sustainable harvest, problems of overpopulation, and the relationship between park design and the preservation of biodiversity. These are topics that are likely to interest students, and the writing is sufficiently engaging to maintain their interest. Each lab begins with an introductory section that explains the issues that the lab addresses, followed by a variety of exercises. Some of these are paper-and-pencil exercises while others rely on the EcoLab software package, the same package used for the Applied Population Ecology text.

Although intended for students at a different level, Conservation Biology follows many of the same approaches used by the authors of Applied Population Biology. There is a strong emphasis on using real data to generate predictive models that illustrate what occurs in the populations over time. The models are mostly discrete in time and allow for the influence of nondeterministic features. Given that the same software package is used in both texts, these parallels are not surprising. The software does not drive either book, however. The model building approach is a sound one, and both books bring in the software in a way that supports and complements the discussion in the text.

The lab exercises in Conservation Biology are appropriate for several types of classes. They could provide an almost ready-made laboratory component for an introductory environmental science course or conservation biology course. Selected labs might be
relevant at several points in an introductory biology course. The possibility I find most intriguing is to use the exercises as the foundation for a nonmajors course in science. The exercises clearly point out the importance of, and the need for, quantitative models in science, and the intrinsic relevance and importance of conservation biology could provide students with enough motivation to master some of the mathematical concepts with which they might be unfamiliar.

I was impressed with the EcoLab (version 2.0) software. Although it is powerful, it runs on virtually any Pentium class PC. It installs easily and presents a consistent and intuitive interface that simplifies its use. The full version of EcoLab is supplied with each book. It contains three modules: models of single population growth, matrix models that incorporate age/stage structure, and models of multiple populations. EcoLab also includes a simple module that generates pairs of uniformly distributed random numbers useful for running simulations by hand. Students choose the appropriate module, enter parameters that define the population(s) they are working with, and run the simulation to compute the population size over the specified period of time. Students are able to view the simulation results in a variety of ways, as graphs and as tables of numbers, and they can print and save their work. Given the emphasis of the authors on discrete-time models, I was surprised that the population trajectories are drawn as if growth were continuous, but I suppose this makes the graphs a bit more readable. As mentioned above, selecting parameter values can be tricky but the software alerts you to invalid values and the online help facility does a good job of explaining the ranges of values that work.

I found that I did have to consult the text to fully understand how to set up and run a population model, but the short reference chapter on EcoLab included in each book is very helpful in this regard. The materials sent to me for review did not include the supplementary material, but both texts come with a standard instructor's manual, with answers to questions, transparency masters (Applied Population Ecology), and suggestions for teaching (Conservation Biology). One missing feature I'd strongly recommend is a student-oriented Web site. The EcoLab software draws heavily on developing models (actually parameter sets) that describe actual populations. The Web site could act as a repository of student models, promoting collaboration and peer review. As one example, students might study species that occupy a wide geographic range and compare models of population behavior that show firsthand the geographic variation between distant populations.

As researchers in the field know, biology, like other sciences, is a quantitative model-driven discipline. Unfortunately, biology curricula do not always adequately prepare students in this aspect of the field. Books such as these two help support efforts to bring standard techniques into the undergraduate classroom and lab. The authors have done a good job of advancing this important goal.

**Named Works:** Applied Population Biology: Principles and Computer Exercises Using RAMAS EcoLab (Book) - Reviews; Conservation Biology with RAMAS EcoLab (Book) - Reviews