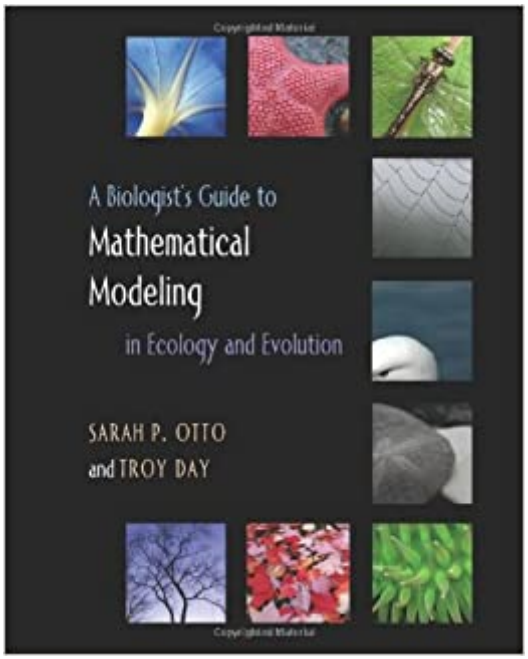
A Biologist's Guide To Mathematical Modeling In Ecology And Evolution



Synopsis

Thirty years ago, biologists could get by with a rudimentary grasp of mathematics and modeling. Not so today. In seeking to answer fundamental questions about how biological systems function and change over time, the modern biologist is as likely to rely on sophisticated mathematical and computer-based models as traditional fieldwork. In this book, Sarah Otto and Troy Day provide biology students with the tools necessary to both interpret models and to build their own. The book starts at an elementary level of mathematical modeling, assuming that the reader has had high school mathematics and first-year calculus. Otto and Day then gradually build in depth and complexity, from classic models in ecology and evolution to more intricate class-structured and probabilistic models. The authors provide primers with instructive exercises to introduce readers to the more advanced subjects of linear algebra and probability theory. Through examples, they describe how models have been used to understand such topics as the spread of HIV, chaos, the age structure of a country, speciation, and extinction. Ecologists and evolutionary biologists today need enough mathematical training to be able to assess the power and limits of biological models and to develop theories and models themselves. This innovative book will be an indispensable guide to the world of mathematical models for the next generation of biologists. A how-to guide for developing new mathematical models in biology Provides step-by-step recipes for constructing and analyzing models Interesting biological applications Explores classical models in ecology and evolution Questions at the end of every chapter Primers cover important mathematical topics Exercises with answers Appendixes summarize useful rules Labs and advanced material available

Book Information

Hardcover: 744 pages
Publisher: Princeton University Press (March 12, 2007)
Language: English
ISBN-10: 0691123446
ISBN-13: 978-0691123448
Product Dimensions: 8.4 x 1.8 x 10 inches
Shipping Weight: 4.2 pounds (View shipping rates and policies)
Average Customer Review: 4.8 out of 5 stars 10 customer reviews
Best Sellers Rank: #480,365 in Books (See Top 100 in Books) #19 inÂ Books > Science & Math > Mathematics > Applied > Biomathematics #400 inÂ Books > Textbooks > Science & Mathematics > Biology & Life Sciences > Ecology #1490 inÂ Books > Science & Math > Biological Sciences >

Ecology

Customer Reviews

Honorable Mention for the 2007 Best Professional/Scholarly Book in Biological Sciences, Association of American Publishers"A gentle but thorough introduction to the mathematical techniques employed in ecological and evolutionary theory. Readers who . . . finish this well-written book will be prepared to read and understand a sizeable fraction of the current literature."--Donald L. DeAngelis, Quarterly Review of Biology"At long last, Sally Otto and Troy Day have provided relief for biologists and epidemiologists in search of an easily read, practical, and thorough starting point from which to learn mathematical modeling. . . . We would recommend this book over shorter texts that are labeled as 'introductory'. . . . The depth and detail that Otto and Day have included in this text arc appealing rather than intimidating, and the structure of the text is empowering rather than didactic or formulaic."--Sanjay Basu and Alison P. Galvani, Siam Review"[T]he great value of the Otto/Day book is that it attempts pedagogical soundness, and so is useful for teaching. Besides being perfectly readable, it engages and impresses the reader quickly not only with the subject matter, but also with the quality of printing and layout which have to be seen to be believed. These praises may sound lavish by many a reader of these columns but first see the book or better still buy the volume and you will see our passion and rage for going all out in praise of this volume."--Current Engineering Practice"I highly recommend this book for every university biology department because it provides both a unique, and often uplifting, introduction and a comprehensive reference of techniques for building and analysing mathematical models."--Volker Grimm, Basic and Applied Ecology"I cannot help but think that future textbook authors will want to have Otto and Day front and center on the work desk, for this is a valuable source of material. . . . This book stands out, and its contribution is quite apparent. In sum, this book is a valuable contribution to the literature, and one to which I expect to refer regularly in connection with my teaching and writing duties."--Steven G. Krantz, UMAP Journal"[A] great textbook. . . . [M]asterful use of figures and illustrations and exercises . . . provide the reader with valuable practice in constructing models and implementing related mathematical techniques. I certainly recommend this text and can attest to its usefulness for budding researchers in the biological sciences."--Jason M. Graham, MAA Reviews

"A wonderfully pedagogical introduction to mathematical modeling in population biology: an ideal first course for biologists."--Simon A. Levin, Princeton University"This book is an amazing teaching resource for developing a comprehensive understanding of the methods and importance of

biological modeling. But more than that, this book should be read by every student of evolutionary biology and ecology so that they can come to a deeper appreciation of the fundamental ideas and models that underlie these fields."--Patrick C. Phillips, University of Oregon"There is an increasing use of mathematics throughout the biological sciences, yet the training of most biologists still woefully lacks crucial mathematical tools. Sally Otto and Troy Day are themselves two masters at the deft use of theoretical models to crystallize conceptual insights about ecological and evolutionary problems, and in this wonderful book they make accessible to a broad audience the essential mathematical tool kit biologists need, both to read the literature and to craft and analyze models themselves."--Robert D. Holt, University of Florida"I am often asked by biologists to recommend a book on mathematical modeling, but I must tell them that there is no single good book that will guide them through the difficult first stages of learning to make models. Otto and Day's book fills the gap. The quality is high throughout, the scholarship is sound, the book is comprehensive. The authors are both first-rate scientists. I think this will be a classic."--Steven A. Frank, author of Immunology and Evolution of Infectious Disease"This book provides a general introduction to mathematical modeling--in particular, to population modeling--in the biological sciences. This past year I taught a 400-level course in mathematical modeling of biological systems, and I had to do so without a textbook because no adequate text existed. Otto and Day's book would have met my needs beautifully. This book is an important addition to the field."--Carl Bergstrom, University of Washington"This book has the ambitious and worthy goal of teaching biologists enough about modeling and about mathematical methods to be both intelligent consumers of models and competent creators of their own models. Its concentration on the process of building rather than analyzing models is its strongest point."--Frederick R. Adler, author of Modeling the Dynamics of Life: Calculus and Probability for Life Scientists --This text refers to an out of print or unavailable edition of this title.

This book is a comprehensive tutorial on math modeling in biology, from the biology perspective it is not complete, given that there are a number of somewhat classic models that are not covered; however, from a modeling point of view it offers a general state of the art.The first chapters of this book are very gentle and easy to read. I found particularly useful the 2nd chapter, on How to Construct a Model, when writing my graduate research project on ecological modeling. I also thought the appendixes were very useful, because they make this book self contained. This makes it an advisable book for anyone starting in the modeling field and studying by himself. In the last chapters of the book, the authors address more advance models that are quite interesting but also

more complex. I found that this part is the hardest to follow, specially the two chapters dedicated to stochastic modeling, it feels like there is a missing appendix here. This couple of chapters should be compared to Marc Mangel's The Theoretical Biologist's Toolbox, who also offers a fine introduction into stochastic modeling.The biggest lack I found in this text is in the computational implementation of the analysis, the authors offer some supplementary material at their website and the scripts to generate the figures in Mathematica. Nevertheless, I found the scripts uneasy to follow and reproduce, not to mention that Mathematica is a expensive software.

This is a very clearly written, thorough, generally excellent guide. It was a great book in class, and I still use it as a reference regularly.(I even used it at work today!)The book explains everything very well, which I find rare for science textbooks. Its appendices are very helpful, and there are many examples. Well worth the investment!

A great way to learn about the topic. Useful for those with a math background and for bio-scientists who wish to learn relevant mathematics.

Good introductory book. Can be used as a textbook, or kept on the shelf for future reference. I bought second hand because this is not a collectible book nor something I will sell to someone else when I finish reading it. I see no point buying a new one.

This is a must-have reference book for any computational biologist. Even those who roughly work in the computational biology realm, need to master the skills introduced in this book to be effective at what they do. It's not overpriced, and it will reward you 10fold in the end.

This book introduces the mathematical models in use in various branches of biology and related fields. It is extremely well written and easy to follow. If you wish to own one book on this subject then this should be high on your list for consideration.

mathematical tools are a must for modern ecology and evolutionary research. This is a good book for students to understand how we can use mathematical models to understand ecological and evolutionary processes.

This gem of a book is terrific, not just for biologists but for anyone trying to get a handle on modeling

in ecology and evolution. I teach an evolutionary game theory class to a law school class (yes, that's right, law school), and couldn't find a good textbook that would teach students with a basic math proficiency what they needed to know about stability, probability theory, etc. to be able to model some of the more interesting EGT methods. This book fit the bill. My notes all come straight from here, even when we are using other textbook problem sets. Highly recommend.

A Biologist's Guide to Mathematical Modeling in Ecology and Evolution Evolution and Christian Faith: Reflections of an Evolutionary Biologist Deliver Us From Evolution?: A Christian Biologist's In-Depth Look at the Evidence Reveals a Surprising Harmony Between Science and God Maximum Entropy and Ecology: A Theory of Abundance, Distribution, and Energetics (Oxford Series in Ecology and Evolution) Ecology: Global Insights and Investigations (Botany, Zoology, Ecology and Evolution) Ecology: Global Insights & Investigations (Botany, Zoology, Ecology and Evolution) A Course in Mathematical Modeling (Mathematical Association of America Textbooks) Peril in the Ponds: Deformed Frogs, Politics, and a Biologist's Quest Animals Matter: A Biologist Explains Why We Should Treat Animals with Compassion and Respect Under the Ice: A Marine Biologist at Work Visualizing the Invisible: Imaging Techniques for the Structural Biologist Gorilla Mountain: The Story of Wildlife Biologist Amy Vedder (Women's Adventures in Science (Children's Press)) Louis Pasteur: Groundbreaking Chemist & Biologist (Essential Lives) 3ds Max Modeling for Games: Insider's Guide to Game Character, Vehicle, and Environment Modeling: Volume I 3ds Max Modeling for Games: Insider's Guide to Game Character, Vehicle, and Environment Modeling: 1 Atmospheric and Space Flight Dynamics: Modeling and Simulation with MATLABÂ® and SimulinkÂ® (Modeling and Simulation in Science, Engineering and Technology) The Model's Bible & Global Modeling Agency Contact List - An Insider's Guide on How to Break into the Fashion Modeling Industry Buddhism and Ecology: The Interconnection of Dharma and Deeds (Religions of the World and Ecology) The World of Wolves: New Perspectives on Ecology, Behaviour, and Management (Energy, Ecology and Environment) Introduction to the Numerical Modeling of Groundwater and Geothermal Systems: Fundamentals of Mass, Energy and Solute Transport in Poroelastic Rocks (Multiphysics Modeling)