

Eric Renshaw

Cambridge University Press

Modelling Biological Populations in Space and Time



Modelling Biological Populations In Space And Time

**Olin E. Rhodes, Ronald K.
Chesser, Michael H. Smith**



Modelling Biological Populations In Space And Time:

Modelling Biological Populations in Space and Time Eric Renshaw, 1993-08-26 This volume develops a unifying approach to population studies emphasising the interplay between modelling and experimentation Throughout mathematicians and biologists are provided with a framework within which population dynamics can be fully explored and understood Aspects of population dynamics covered include birth death and logistic processes competition and predator prey relationships chaos reaction time delays fluctuating environments spatial systems velocities of spread epidemics and spatial branching structures Both deterministic and stochastic models are considered Whilst the more theoretically orientated sections will appeal to mathematical biologists the material is presented so that readers with little mathematical expertise can bypass these without losing the main flow of the text

Modelling Biological Populations in Space and Time Eric Renshaw, 1993 Population Dynamics in Ecological Space and Time Olin E. Rhodes, Ronald K. Chesser, Michael H. Smith, 1996-08 As profound threats to ecosystems increase worldwide ecologists must move beyond studying single communities at a single point in time All of the dynamic interconnected spatial and temporal processes that determine the distribution and abundance of species must be understood in order to develop new conservation and management strategies This volume is the first to integrate mathematical and biological approaches to these crucial topics The editors include not only a wide variety of theoretical approaches but also a broad range of experimental and field studies with chapters written by renowned experts in community ecology ecological modeling population genetics and conservation biology In addition to providing new insights into well known topics such as migration the authors also introduce some less familiar subjects including bacterial population genetics and ecotoxicology For anyone interested in the study management and conservation of populations this book will prove to be a valuable resource

Stability in Model Populations Laurence D. Mueller, Amitabh Joshi, 2020-03-31 Throughout the twentieth century biologists investigated the mechanisms that stabilize biological populations populations which if unchecked by such agencies as competition and predation should grow geometrically How is order in nature maintained in the face of the seemingly disorderly struggle for existence In this book Laurence Mueller and Amitabh Joshi examine current theories of population stability and show how recent laboratory research on model populations particularly blowflies *Tribolium* and *Drosophila* contributes to our understanding of population dynamics and the evolution of stability The authors review the general theory of population stability and critically analyze techniques for inferring whether a given population is in balance or not They then show how rigorous empirical research can reveal both the proximal causes of stability how populations are regulated and maintained at an equilibrium including the relative roles of biotic and abiotic factors and its ultimate mostly evolutionary causes In the process they describe experimental studies on model systems that address the effects of age structure inbreeding resource levels and population structure on the stability and persistence of populations The discussion incorporates the authors own findings on the evolution of population stability

in *Drosophila*. They go on to relate laboratory work to studies of animals in the wild and to develop a general framework for relating the life history and ecology of a species to its population dynamics. This accessible, finely written illustration of how carefully designed experiments can improve theory will have tremendous value for all ecologists and evolutionary biologists.

Spatiotemporal Models of Population and Community Dynamics T. Czaran, 1998. This book presents a comprehensive typology and a comprehensible description of spatiotemporal models used in population dynamics. The main types included are reaction-diffusion systems, patch models, metapopulation approaches, host-parasitoid models, cellular automata, interacting particle systems, tessellations, and distance models. The models are introduced through examples and with informative verbal explanations to help understanding. Some of the cellular automation examples are models not yet published elsewhere. Possible extensions of certain model types are suggested.

MATHEMATICAL MODELS - Volume III Jerzy A. Filar, Jacek B. Krawczyk, 2009-09-19. Mathematical Models is a component of Encyclopedia of Mathematical Sciences in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty-one Encyclopedias. The Theme on Mathematical Models discusses matters of great relevance to our world, such as Basic Principles of Mathematical Modeling, Mathematical Models in Water Sciences, Mathematical Models in Energy Sciences, Mathematical Models of Climate and Global Change, Infiltration and Ponding, Mathematical Models of Biology, Mathematical Models in Medicine and Public Health, Mathematical Models of Society and Development. These three volumes are aimed at the following five major target audiences: University and College students, Educators, Professional practitioners, Research personnel, and Policy analysts, managers, and decision makers, and NGOs.

Encyclopedia of Ecology Brian D. Fath, 2018-08-23. Encyclopedia of Ecology, Second Edition, Four Volume Set, continues the acclaimed work of the previous edition published in 2008. It covers all scales of biological organization, from organisms to populations to communities and ecosystems. Laboratory, field, simulation, modelling, and theoretical approaches are presented to show how living systems sustain structure and function in space and time. New areas of focus include micro and macro scales, molecular and genetic ecology, and global ecology, e.g., climate change, earth transformations, ecosystem services, and the food-water-energy nexus are included. In addition, new international experts in ecology contribute on a variety of topics. Offers the most broad-ranging and comprehensive resource available in the field of ecology. Provides foundational content and suggests further reading. Incorporates the expertise of over 500 outstanding investigators in the field of ecology, including top young scientists with both research and teaching experience. Includes multimedia resources such as an Interactive Map Viewer and links to a CSDMS Community Surface Dynamics Modeling System, an open-source platform for modelers to share and link models dealing with earth system processes.

Population and Community Ecology for Insect Management and Conservation Johann Baumgartner, Pietro Brandmayr, Bryan F.J. Manly, 2020-03-09. One of the themes of the 20th International Congress of Entomology held in Florence in August 1996 was Ecology and Population Dynamics, with papers presented on single species

dynamics population interactions and community ecology This book contains a selection of the papers that were presented and gives a late 1990s picture of the latest research in this fast developing area *Stochastic Population Processes* Eric Renshaw,2015-03-19 The vast majority of random processes in the real world have no memory the next step in their development depends purely on their current state Stochastic realizations are therefore defined purely in terms of successive event time pairs and such systems are easy to simulate irrespective of their degree of complexity However whilst the associated probability equations are straightforward to write down their solution usually requires the use of approximation and perturbation **Ecology - Volume II** Antonio Bodini ,Stefan Klotz,2009-10-20 Ecology is a component of Encyclopedia of Environmental and Ecological Sciences Engineering and Technology Resources in the global Encyclopedia of Life Support Systems EOLSS which is an integrated compendium of twenty one Encyclopedias Ecology is the study of the interrelationships between living organisms and their environment The term ecology was introduced by Ernst Haeckel at the end of the nineteenth century Since that time spectacular advances have been made Much has been learned about the relationship between organisms and environmental factors and about the processes that regulate the abundance and distribution of species The Theme on Ecology with contributions from distinguished experts in the field discusses the Science of Ecology for a Sustainable World The two volumes are aimed at the following five major target audiences University and College students Educators Professional practitioners Research personnel and Policy analysts managers and decision makers and NGOs **Population Ecology in Practice** Dennis L. Murray,Brett K. Sandercock,2020-02-10 A synthesis of contemporary analytical and modeling approaches in population ecology The book provides an overview of the key analytical approaches that are currently used in demographic genetic and spatial analyses in population ecology The chapters present current problems introduce advances in analytical methods and models and demonstrate the applications of quantitative methods to ecological data The book covers new tools for designing robust field studies estimation of abundance and demographic rates matrix population models and analyses of population dynamics and current approaches for genetic and spatial analysis Each chapter is illustrated by empirical examples based on real datasets with a companion website that offers online exercises and examples of computer code in the R statistical software platform Fills a niche for a book that emphasizes applied aspects of population analysis Covers many of the current methods being used to analyse population dynamics and structure Illustrates the application of specific analytical methods through worked examples based on real datasets Offers readers the opportunity to work through examples or adapt the routines to their own datasets using computer code in the R statistical platform Population Ecology in Practice is an excellent book for upper level undergraduate and graduate students taking courses in population ecology or ecological statistics as well as established researchers needing a desktop reference for contemporary methods used to develop robust population assessments **Progress in Botany** Karl Esser,2001-11 With one volume each year this series keeps scientists and advanced students informed of the latest developments and results in

all areas of the plant sciences The present volume includes reviews on genetics cell biology physiology comparative morphology ecology and vegetation science

Contemporary Approaches and Methods in Fundamental Mathematics and Mechanics Victor A. Sadovnichiy, Michael Z. Zgurovsky, 2020-11-24 This book focuses on the latest approaches and methods in fundamental mathematics and mechanics and discusses the practical application of abstract mathematical approaches such as differential geometry and differential and difference equations in solid mechanics hydrodynamics aerodynamics optimization decision making theory and control theory Featuring selected contributions to the open seminar series of Lomonosov Moscow State University and Igor Sikorsky Kyiv Polytechnic Institute by mathematicians from China Germany France Italy Spain Russia Ukraine and the USA the book will appeal to mathematicians and engineers working at the interface of these fields

Extinction and Quasi-Stationarity in the Stochastic Logistic SIS Model Ingemar Nåsell, 2011-07-06 This volume presents explicit approximations of the quasi stationary distribution and of the expected time to extinction from the state one and from quasi stationarity for the stochastic logistic SIS model The approximations are derived separately in three different parameter regions and then combined into a uniform approximation across all three regions Subsequently the results are used to derive thresholds as functions of the population size N

A Practical Guide to Ecological Modelling Karline Soetaert, Peter M. J. Herman, 2008-10-14 Mathematical modelling is an essential tool in present day ecological research Yet for many ecologists it is still problematic to apply modelling in their research In our experience the major problem is at the conceptual level proper understanding of what a model is how ecological relations can be translated consistently into mathematical equations how models are solved steady states calculated and interpreted Many textbooks jump over these conceptual hurdles to dive into detailed formulations or the mathematics of solution This book attempts to fill that gap It introduces essential concepts for mathematical modelling explains the mathematics behind the methods and helps readers to implement models and obtain hands on experience Throughout the book emphasis is laid on how to translate ecological questions into interpretable models in a practical way The book aims to be an introductory textbook at the undergraduate graduate level but will also be useful to seduce experienced ecologists into the world of modelling The range of ecological models treated is wide from Lotka Volterra type of principle seeking models to environmental or ecosystem models and including matrix models lattice models and sequential decision models All chapters contain a concise introduction into the theory worked out examples and exercises All examples are implemented in the open source package R thus taking away problems of software availability for use of the book All code used in the book is available on a dedicated website

Ecological Models Jay Odenbaugh, 2019-10-10 In this book we consider three questions What are ecological models How are they tested How do ecological models inform environmental policy and politics Through several case studies we see how these representations which idealize and abstract can be used to explain and predict complicated ecological systems Additionally we see how they bear on environmental policy and politics

Sustainability in

Environmental Engineering and Science Sunil Kumar,Ajay Kalamdhad,Makarand M. Ghangrekar,2020-09-01 This book consists of select peer reviewed papers from the International Conference on Sustainable Environmental Engineering and Science SEES 2019 The main focus of the book is to propose sustainable technologies to address the growing environmental challenges The contents cover several topics of relevance such as air pollution solid waste management wastewater treatment industrial pollution and suggests eco friendly and cost effective techniques to tackle them Given the range of topics covered the book will be useful to researchers and professionals working in the multidisciplinary area of sustainability

Food Process Modelling L M M Tijskens,M L A T M Hertog,B M Nicolai,2001-06-14 Food process modelling provides an authoritative review of one of the most exciting and influential developments in the food industry The modelling of food processes allows analysts not only to understand such processes more clearly but also to control them more closely and make predictions about them Modelling thus aids the search for greater and more consistent food quality Written by a distinguished international team of experts Food process modelling covers both the range of modelling techniques and their practical applications across the food chain

Redesigning Animal Agriculture David Lloyd Swain,2007 At a time of increased concern over animal welfare and environmental degradation the global demand for animal based protein is necessitating the development and use of emerging agricultural technology Focusing on livestock production systems this comprehensive text addresses how the growing diversity of global food demands will be met in the future providing insights into new and emerging scientific areas and the implications for addressing global drivers for change Contributions from a wealth of international experts cover ethical philosophical and systemic considerations the impact of genomics on livestock production the holistic systems perspective the complex systems approach using stochastic modelling methods and how all these factors can be linked to achieve sustainable outcomes

Individual-based Modeling and Ecology Volker Grimm,Steven F. Railsback,2013-11-28 Individual based models are an exciting and widely used new tool for ecology These computational models allow scientists to explore the mechanisms through which population and ecosystem ecology arises from how individuals interact with each other and their environment This book provides the first in depth treatment of individual based modeling and its use to develop theoretical understanding of how ecological systems work an approach the authors call individual based ecology Grimm and Railsback start with a general primer on modeling how to design models that are as simple as possible while still allowing specific problems to be solved and how to move efficiently through a cycle of pattern oriented model design implementation and analysis Next they address the problems of theory and conceptual framework for individual based ecology What is theory That is how do we develop reusable models of how system dynamics arise from characteristics of individuals What conceptual framework do we use when the classical differential equation framework no longer applies An extensive review illustrates the ecological problems that have been addressed with individual based models The authors then identify how the mechanics of building and using individual based models differ

from those of traditional science and provide guidance on formulating programming and analyzing models This book will be helpful to ecologists interested in modeling and to other scientists interested in agent based modeling

Decoding **Modelling Biological Populations In Space And Time**: Revealing the Captivating Potential of Verbal Expression

In a period characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its power to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**Modelling Biological Populations In Space And Time**," a mesmerizing literary creation penned with a celebrated wordsmith, readers attempt an enlightening odyssey, unraveling the intricate significance of language and its enduring effect on our lives. In this appraisal, we shall explore the book's central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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Table of Contents Modelling Biological Populations In Space And Time

1. Understanding the eBook Modelling Biological Populations In Space And Time
 - The Rise of Digital Reading Modelling Biological Populations In Space And Time
 - Advantages of eBooks Over Traditional Books
2. Identifying Modelling Biological Populations In Space And Time
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Modelling Biological Populations In Space And Time
 - User-Friendly Interface
4. Exploring eBook Recommendations from Modelling Biological Populations In Space And Time
 - Personalized Recommendations

- Modelling Biological Populations In Space And Time User Reviews and Ratings
- Modelling Biological Populations In Space And Time and Bestseller Lists
- 5. Accessing Modelling Biological Populations In Space And Time Free and Paid eBooks
 - Modelling Biological Populations In Space And Time Public Domain eBooks
 - Modelling Biological Populations In Space And Time eBook Subscription Services
 - Modelling Biological Populations In Space And Time Budget-Friendly Options
- 6. Navigating Modelling Biological Populations In Space And Time eBook Formats
 - ePub, PDF, MOBI, and More
 - Modelling Biological Populations In Space And Time Compatibility with Devices
 - Modelling Biological Populations In Space And Time Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Modelling Biological Populations In Space And Time
 - Highlighting and Note-Taking Modelling Biological Populations In Space And Time
 - Interactive Elements Modelling Biological Populations In Space And Time
- 8. Staying Engaged with Modelling Biological Populations In Space And Time
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Modelling Biological Populations In Space And Time
- 9. Balancing eBooks and Physical Books Modelling Biological Populations In Space And Time
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Modelling Biological Populations In Space And Time
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Modelling Biological Populations In Space And Time
 - Setting Reading Goals Modelling Biological Populations In Space And Time
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Modelling Biological Populations In Space And Time
 - Fact-Checking eBook Content of Modelling Biological Populations In Space And Time

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

Modelling Biological Populations In Space And Time Introduction

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