

Nicolas Bacaër

# A Short History of Mathematical Population Dynamics

 Springer

# A Short History Of Mathematical Population Dynamics

**Roger Detels, Quarraisha Abdool  
Karim, Fran Baum, Liming Li, Alastair H.  
Leyland**

## **A Short History Of Mathematical Population Dynamics:**

*A Short History of Mathematical Population Dynamics* Nicolas Bacaër, 2011-02-01 As Eugene Wigner stressed mathematics has proven unreasonably effective in the physical sciences and their technological applications The role of mathematics in the biological medical and social sciences has been much more modest but has recently grown thanks to the simulation capacity offered by modern computers This book traces the history of population dynamics a theoretical subject closely connected to genetics ecology epidemiology and demography where mathematics has brought significant insights It presents an overview of the genesis of several important themes exponential growth from Euler and Malthus to the Chinese one child policy the development of stochastic models from Mendel's laws and the question of extinction of family names to percolation theory for the spread of epidemics and chaotic populations where determinism and randomness intertwine The reader of this book will see from a different perspective the problems that scientists face when governments ask for reliable predictions to help control epidemics AIDS SARS swine flu manage renewable resources fishing quotas spread of genetically modified organisms or anticipate demographic evolutions such as aging

**A Short History of Mathematical Population Dynamics** Nicolas Bacaër, 2011-04-08 Mathematical Modeling in Economics, Ecology and the Environment

Natali Hritonenko, Yuri Yatsenko, 2014-01-08 Updated to textbook form by popular demand this second edition discusses diverse mathematical models used in economics ecology and the environmental sciences with emphasis on control and optimization It is intended for graduate and upper undergraduate course use however applied mathematicians industry practitioners and a vast number of interdisciplinary academics will find the presentation highly useful Core topics of this text are Economic growth and technological development Population dynamics and human impact on the environment Resource extraction and scarcity Air and water contamination Rational management of the economy and environment Climate change and global dynamics The step by step approach taken is problem based and easy to follow The authors aptly demonstrate that the same models may be used to describe different economic and environmental processes and that similar investigation techniques are applicable to analyze various models Instructors will appreciate the substantial flexibility that this text allows while designing their own syllabus Chapters are essentially self contained and may be covered in full in part and in any order Appropriate one and two semester courses include but are not limited to Applied Mathematical Modeling Mathematical Methods in Economics and Environment Models of Biological Systems Applied Optimization Models and Environmental Models Prerequisites for the courses are Calculus and preferably Differential Equations

**Oxford Textbook of Global Public Health** Roger Detels, Quarraisha Abdool Karim, Fran Baum, Liming Li, Alastair H. Leyland, 2022 Invaluable for all practitioners trainees and students of public health and epidemiology the Oxford Textbook of Global Public Health covers the scope methods and practice of public health and has been comprehensively updated for its seventh edition The Top Ten Diseases of All Time Stacey Smith?, 2023-10-24 Infectious diseases have been with us for millennia and continue to pose a

threat from the irritation of flu season to the potential extinction of our species We instinctively fear them and alter our behaviour as a result The reason we bury bodies six feet deep is because that was the depth that stopped plague transmission from the dead in the Middle Ages Many religious practices such as avoiding certain meats were established because of foodborne disease transmission In The Top Ten Diseases of All Time Stacey Smith presents the top ten deadliest diseases and their effects on society providing a wealth of information about the trajectory and terrible impact of each disease and humanity's reaction to these diseases throughout the millennia Did you know for example that The medical symbol evolved from the worms wrapped around a stick because that was the only way to remove Guinea worms from the body so having a stick meant you were a doctor Smallpox is the third worst disease ever yet it remains the only successfully eradicated human disease but not for long thanks in part to a successful vaccine in part to photographic recognition cards and in part due to helicopter led forced vaccinations of whole villages in the former Yugoslavia This brings up issues of individual rights versus public good that remain relevant today Four diseases were targeted for eradication in the 20th century the failure to do so led directly to the creation of the environmental movement The inability of priests to explain how to stop the plague in the Middle Ages broke the back of the church as an all powerful and all knowing institution and led to colonialism and slavery The Top Ten Diseases of All Time offers a fascinating overview of the deadliest diseases to spread throughout the world including HIV AIDS Spanish Flu Measles The Black Death Smallpox and others [Biomathematical Modeling](#) Olcay Akman, Christopher Hay-Jahans, 2025-05-19 Welcome to the fascinating intersection of mathematics biology and ecology This book is intended primarily as a resource for teachers planning to teach their first introductory course on modeling in mathematical biology and or ecology This being said it can also be used by students preparing to embark on an independent studies project in one of these fields or by researchers unfamiliar with the methods or software introduced who are seeking an accessible and quick introduction to one of the methods and or software presented here or by curious biologists ecologists or mathematicians who may be unfamiliar with the other side or maybe by the perpetual learner who is intrigued by the dynamics of living ecosystems For each of the above this book is designed to be an accessible introduction to the captivating landscape of biomathematics The approach used in this book takes advantage of technology in leading readers on a journey that bridges seemingly distinct fields through introductions to three methods and software platforms Compartmental models with Berkeley Madonna agent based models with NetLogo and cluster analysis through selforganizing maps using an R Shiny app This is not intended to be a textbook though it may be used as one nor is it a purely mathematics book or one purely about deeper aspects of biology or ecology It focuses on three selected ways in which the intersection of mathematics and biology and mathematics and ecology can be explored with the help of software Moreover the manner in which the content is presented makes it possible to use this book to help prepare for an introductory course at a wide range of levels depending on the discipline within which the course is taught and the mathematical prerequisites for the course There are four chapters

the first of which presents the reader with a bit of background information followed by suggestions on how to get the most out of this book. The three core chapters introduce the three previously mentioned methods and software in a manner envisioned to be accessible to most.

*The Routledge Handbook of Philosophy of Scientific Modeling* Tarja Knuuttila, Natalia Carrillo, Rami Koskinen, 2024-09-05. Models and modeling have played an increasingly important role in philosophy going back to the nineteenth century. While philosophical interest in models has been remarkably lively over the last two decades, there are still many underexplored questions. *The Routledge Handbook of Philosophy of Scientific Modeling* is an outstanding reference source and guide to this fast-growing area and is the first volume of its kind. Comprised of 40 specially commissioned chapters by an international team of contributors, the Handbook is organized into five clear parts: Historical and General Perspectives; Philosophical Accounts of Modeling; Methodological Aspects; Model Construction; Evaluation and Calibration; Related Topics. Modeling in the Wild. Within these parts, the Handbook covers a diverse range of topics, including historical perspectives on modeling, the relationship between models, theories, representation, idealization, and understanding, and related topics like big data, simulation, and statistical and computational modeling. Different kinds of models are discussed, for example, network models, financial models, and climate and synthetic models. *The Routledge Handbook of Philosophy of Scientific Modeling* is essential reading for students and scholars of philosophy of science, formal epistemology, and philosophy of social sciences. It is also a valuable resource for those in related fields such as computer science and information technology.

*Mathematical Methods for Engineering Applications* Fatih Yilmaz, Araceli Queiruga-Dios, María Jesús Santos Sánchez, Deolinda Rasteiro, Víctor Gayoso Martínez, Jesús Martín Vaquero, 2022-04-15. This proceedings volume gathers selected peer-reviewed papers presented at the 2nd International Conference on Mathematics and its Applications in Science and Engineering (ICMASE 2021), which was virtually held on July 1-2, 2021, by the University of Salamanca, Spain. Works included in this book cover applications of mathematics both in engineering research and in real-world problems, touching topics such as difference equations, number theory, optimization, and more. The list of applications includes the modeling of mechanical structures, the shape of machines, and the growth of a population, expanding to fields like information security and cryptography. Advances in teaching and learning mathematics in the context of engineering courses are also covered. This volume can be of special interest to researchers in applied mathematics and engineering fields, as well as practitioners seeking studies that address real-life problems in engineering.

*Progress in Industrial Mathematics at ECMI 2021* Matthias Ehrhardt, Michael Günther, 2022-11-25. This book gathers peer-reviewed contributions submitted to the 21st European Conference on Mathematics for Industry (ECMI 2021), which was virtually held online, hosted by the University of Wuppertal, Germany, from April 13th to April 15th, 2021. The works explore mathematics in a wide variety of applications, ranging from problems in electronics, energy, and the environment to mechanics and mechatronics. Topics covered include Applied Physics, Biology, and Medicine, Cybersecurity, Data Science, Economics, Finance, and Insurance, Energy Production,

Systems Social Challenges and Vehicles and Transportation The goal of the European Consortium for Mathematics in Industry ECMI conference series is to promote interaction between academia and industry leading to innovations in both fields These events have attracted leading experts from business science and academia and have promoted the application of novel mathematical technologies to industry They have also encouraged industrial sectors to share challenging problems where mathematicians can provide fresh insights and perspectives Lastly the ECMI conferences are one of the main forums in which significant advances in industrial mathematics are presented bringing together prominent figures from business science and academia to promote the use of innovative mathematics in industry *X-Risk* Thomas Moynihan,2020-11-03

How humanity came to contemplate its possible extinction From forecasts of disastrous climate change to prophecies of evil AI superintelligences and the impending perils of genome editing our species is increasingly concerned with the prospects of its own extinction With humanity's future on this planet seeming more insecure by the day in the twenty first century existential risk has become the object of a growing field of serious scientific inquiry But as Thomas Moynihan shows in *X Risk* this preoccupation is not exclusive to the post atomic age of global warming and synthetic biology Our growing concern with human extinction itself has a history Tracing this untold story Moynihan revisits the pioneers who first contemplated the possibility of human extinction and stages the historical drama of this momentous discovery He shows how far from being a secular reprise of religious prophecies of apocalypse existential risk is a thoroughly modern idea made possible by the burgeoning sciences and philosophical tumult of the Enlightenment era In recollecting how we first came to care for our extinction Moynihan reveals how today's attempts to measure and mitigate existential threats are the continuation of a project initiated over two centuries ago which concerns the very vocation of the human as a rational responsible and future oriented being

**Intelligent Systems Modeling and Simulation III** Samsul Ariffin Abdul Karim,2024-09-21 This book continues the previous edition Samsul Ariffin Abdul Karim 2022 *Intelligent Systems Modeling and Simulation II* Machine Learning Neural Networks Efficient Numerical Algorithm and Statistical Methods Studies in Systems Decision and Control SSDC volume 444 22k Access After two years *Intelligent Systems Modeling and Simulation* have evolved tremendously through the latest and advanced emergence technologies and many highly sophisticated algorithms have been developed by blending artificial intelligence AI and mathematics statistics data modelling and other related research areas These blends offer many opportunities and further investigations into the overlap and equality between these areas It is a well known fact that most industries and companies have utilized this IR4.0 architecture in various levels of manufacturing and decision processes Besides nowadays IR5.0 or Society5.0 has also been embedded into various systems in industries as well as in Teaching and Learning TL The combination of IR4.0 and Society 5.0 may result in more impactful outcomes especially in automated decision making and reliable simulations based modelling Furthermore IR4.0 and Society5.0 through Data Driven have made a significant contribution to the government and companies to analyse big data via predictive analytics Cyber

security firewalls on all systems must be up to date to prevent any malicious attacks by hackers Otherwise our citizens might be scammed and according to NBC News the total loss for 2022 is around USD 8 8 billion These are very huge amount Just recently COVID 19 has been spreading all over the world again To assist the Ministry of Health MOH and other government agencies it is very crucial to identify predict detect and quarantine the COVID 19 on the susceptible persons soonest possible Intelligent Image Processing techniques are very demanding here This is to ensure that we can control and minimise the spread Inspire by these latest developments in this book various experts in the areas of Artificial Intelligence Machine Learning Deep Learning Neural Networks Modeling and Simulation Cyber Security and Awareness Intelligent Statistical Methods Big Data Analytics Sentiment Analytics Intelligent Function Approximation Image Processing in medical imaging especially on COVID 19 AI in Teaching and Learning and Computational Intelligence will share their latest studies and experiences Their finding is in line with United Nations Sustainable Development Goals SDGs such as No 9 Industry Innovation and Infrastructure particularly Target 9 4 9 5 9 a 9 b and 9 c No 11 Sustainable Cities and Communities particularly Target 11 b and Indicators 11 b 1 and 11 b 2 and SDG No 4 Quality Education particularly Target 4 7 and Indicator 4 7 1 This book is highly suitable for postgraduate students and researchers to get the state of the art current research directions as well as for the scientists that have an interest and working in intelligent numerical modelling and simulations through AI Machine Learning Neural Networks and its related counterparts

**Mathematical Modeling the Life Sciences** N. G. Cogan, 2022-09-09 The purpose of this unique textbook is to bridge the gap between the need for numerical solutions to modeling techniques through computer simulations to develop skill in employing sensitivity analysis to biological and life sciences applications The underpinning mathematics is minimized The focus is on the consequences implementation and application Historical context motivates the models An understanding of the earliest models provides insight into more complicated ones While the text avoids getting mired in the details of numerical analysis it demonstrates how to use numerical methods and provides core codes that can be readily altered to fit a variety of situations Numerical scripts in both Python and MATLAB are included Python is compiled in Jupyter Notebook to aid classroom use Additionally codes are organized and available online One of the most important skills requiring the use of computer simulations is sensitivity analysis Sensitivity analysis is increasingly used in biomathematics There are numerous pitfalls to using sensitivity analysis and therefore a need for exposure to worked examples in order to successfully transfer their use from mathematicians to biologists The interconnections between mathematics and the life sciences have an extensive history This book offers a new approach to using mathematics to model applications using computers to employ numerical methods and takes students a step further into the realm of sensitivity analysis With some guidance and practice the reader will have a new and incredibly powerful tool to use <https://www.math.fsu.edu/cogan/Book/Codes/Codes.html>

**Advances in Mathematical and Computational Sciences** Manoj Kumar Patel, Triloki Nath, Ram Kishor Pandey, Diwakar Shukla, 2024-11-04

This volume documents the contributions presented at The ICRTMPCS II International Conference on Advances in Mathematical and Computational Sciences Entries focus on modern trends and techniques in branches of pure and applied mathematics statistics and computer science Highlighting applications in coding theory cryptography graph theory fuzzy theory variance analysis data analysis and sampling theory

**Encyclopedia of Mathematical Geosciences** B. S. Daya Sagar, Qiuming Cheng, Jennifer McKinley, Frits Agterberg, 2023-07-13 The Encyclopedia of Mathematical Geosciences is a complete and authoritative reference work It provides concise explanation on each term that is related to Mathematical Geosciences Over 300 international scientists each expert in their specialties have written around 350 separate articles on different topics of mathematical geosciences including contributions on Artificial Intelligence Big Data Compositional Data Analysis Geomathematics Geostatistics Geographical Information Science Mathematical Morphology Mathematical Petrology Multifractals Multiple Point Statistics Spatial Data Science Spatial Statistics and Stochastic Process Modeling Each topic incorporates cross referencing to related articles and also has its own reference list to lead the reader to essential articles within the published literature The entries are arranged alphabetically for easy access and the subject and author indices are comprehensive and extensive

**Agricultural Management Strategies in a Changing Economy** Popescu, Gabriel, Jean-Vasile, Andrei, 2015-01-31 Research and development in agriculture is a very relevant topic in today's society especially given the evolution of land ownership structures and resources exploitation These transformations have paved the way for new approaches in the allocation and management of agricultural systems Agricultural Management Strategies in a Changing Economy brings together emergent research and best practices in the area of agricultural management policy and structures Highlighting theoretical concepts and empirical research this book will be an all encompassing reference source for professionals researchers academicians practitioners and students in the field of agricultural economics and sustainable development as well as in related disciplines

Infectious Diseases and Our Planet Miranda I. Teboh-Ewungkem, Gideon Akumah Ngwa, 2021-01-15 This book features recent research in mathematical modeling of indirectly and directly transmitted infectious diseases in humans animals and plants It compiles nine not previously published studies that illustrate the dynamic spread of infectious diseases offering a broad range of models to enrich understanding It demonstrates the capability of mathematical modeling to capture disease spread and interaction dynamics as well as the complicating factors of various evolutionary processes In addition it presents applications to real world disease control by commenting on key parameters and dominant pathways related to transmission While aimed at early graduate level students the book can also provide insights to established researchers in that it presents a survey of current topics and methodologies in a constantly evolving field

**Differential Equations and Data Analysis** Aleksei Beltukov, 2024-11-12 This book is focused on modeling with linear differential equations with constant coefficients The author starts with the elementary natural growth equation and ends with the heat equation on the real line The emphasis is on linear algebra Fourier theory and specifically data



analysis which is given a very prominent role and is often the book's main driving force. All aspects of modeling with linear differential equations are illustrated by analyzing real and simulated data in MATLAB. These modeling case studies are of particular interest to students who anticipate having to use differential equations in their fields. The book is self-contained and is appropriate as a supplement for a first course in differential equations whose prerequisites include proficiency in multivariate calculus and MATLAB literacy.

Theoretical Ecology Ryan Chisholm, 2025-09-09. An accessible and wide-ranging introduction to the concepts and tools of theoretical ecology. Theoretical ecology explores the mechanisms that structure ecological communities using a variety of mathematical and computational tools. Theoretical Ecology shows you how to translate ecological problems into mechanistic models using both mathematics and the programming language R. The book teaches key concepts and core quantitative skills while also devoting significant attention to the reasons for building mathematical ecological models. Why do species populations fluctuate over time and space? How do multiple species coexist? What forces drive nutrient and carbon cycles? Does higher species diversity lead to higher biomass? Each chapter in this incisive and informative book is motivated by questions like these and every chapter includes boxes that delve into mathematical details and provide coding examples in R. Focuses on mathematical and computational methods while also drawing on conceptual and graphical approaches and explores how the various approaches complement one another. Teaches students the skills they need to implement and analyze ecological models in R. Covers topics ranging from single species competition and predator-prey models to community ecology, island biogeography, and nutrient flux models. Provides exercises of graduated difficulty at the end of every chapter. Ideal for advanced undergraduate and graduate classrooms and for independent study. Includes a road map for class planning and self study.

**Population Genetics in the Neotropics**

Marcos Vinícius Bohrer Monteiro Siqueira, Enéas Ricardo Konzen, Pedro Manoel Galetti Junior, 2025-04-23. The Neotropics hold high levels of biodiversity, figuring among the essential hotspots for conservation on Earth. Invaluable genetic resources of this biogeographic dominion must deserve attention of conservationists as well as of breeders. This project is aimed at producing a book on population genetics directed to an audience of undergraduate and graduate students but not limited to those. In a distinct approach we seek to develop a material devoted to population genetics in the Neotropics, contextualizing examples of several animal and plant species belonging to this highly diverse dominion. Traditional books available in the subject of population genetics commonly deal with organisms that are native to North America and Europe while neotropical organisms are lacking in the context so our book comes forth as an initiative towards covering that. Among several subjects this textbook addresses studies on molecular evolution and phylogenetics, genetic structure at broad and fine spatial scales, landscape genetics, niche modeling and climate change, conservation genetics and quantitative variation and its genetic components in hotspots of biodiversity such as the Amazon, the Brazilian Savanna and the Atlantic Rain Forest. It should provide an easy-going reading with the main concepts being presented and contextualized within the Neotropical dynamics.

of plants and animal populations Basic mathematical foundations of population genetics theory are provided but no further details on deductions and advanced algebra are given for the purpose of simplicity The application of the studies on conservation and breeding is also addressed The chapters were planned to be brief describing the main concepts processes and case studies Invited authors were encouraged to describe examples from their own research in the Neotropics Altogether this project may offer students with a textbook with concepts and ideas of the Neotropical genetic diversity bringing awareness and stimulating endeavors towards the continuance of conservation of endangered species in their environments of origin

**Recent Advances in Intelligent Information Systems and Applied Mathematics** Oscar Castillo, Dipak Kumar Jana, Debasis Giri, Arif Ahmed, 2020-01-31 This book describes the latest advances in intelligent techniques such as fuzzy logic neural networks and optimization algorithms and their relevance in building intelligent information systems in combination with applied mathematics The authors also outline the applications of these systems in areas like intelligent control and robotics pattern recognition medical diagnosis time series prediction and optimization of complex problems By sharing fresh ideas and identifying new targets problems it offers young researchers and students new directions for their future research The book is intended for readers from mathematics and computer science in particular professors and students working on theory and applications of intelligent systems for real world applications

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### A Short History Of Mathematical Population Dynamics Introduction

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