

POPULATION AND COMMUNITY BIOLOGY SERIES 21

SPATIOTEMPORAL MODELS OF POPULATION AND COMMUNITY DYNAMICS

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Spatiotemporal Models Of Population And Community Dynamics

R.S. Ambasht, Navin K. Ambasht



Spatiotemporal Models Of Population And Community Dynamics:

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

Individual Behavior and Community Dynamics John Fryxell, Per Lundberg, 2012-12-06 A book blending evolution and trophic dynamics taking into account recent advances in both behavioral and population ecology is long overdue A central objective of this book is to consider whether adaptive behavioral decisions on the individual organism level might tend to stabilize trophic interactions A second major goal of the book is to explore the implications of presumably adaptive behaviors on trophic dynamics and the implications of trophic dynamics for the evolution of adaptive behaviors All evolutionary biologists ecologists and behavioral ecologists should find this exciting volume essential reading

Spatio-Temporal Models for Ecologists James Thorson, Kasper Kristensen, 2024-02-27 Ecological dynamics are tremendously complicated and are studied at a variety of spatial and temporal scales Ecologists often simplify analysis by describing changes in density of individuals across a landscape and statistical methods are advancing rapidly for studying spatio temporal dynamics However spatio temporal statistics is often presented using a set of principles that may seem very distant from ecological theory or practice This book seeks to introduce a minimal set of principles and numerical techniques for spatio temporal statistics that can be used to implement a wide range of real world ecological analyses regarding animal movement population dynamics community composition causal attribution and spatial dynamics We provide a step by step illustration of techniques that combine core spatial analysis packages in R with low level computation using Template Model Builder Techniques are showcased using real world data from varied ecological systems providing a toolset for hierarchical modelling of spatio temporal processes Spatio Temporal Models for Ecologists is meant for graduate level students alongside applied and academic ecologists Key Features Foundational ecological principles and analyses Thoughtful and thorough ecological examples Analyses conducted using a minimal toolbox and fast computation Code using R and TMB included in the book and available online

Spatiotemporal Models of Population and Community Dynamics Faith Cunningham, 2014-11-01 Numerical Analysis is a way to solve the real life mathematical physical and engineering problems Numerical Analysis can be used to answer the problems for which the analytical solution is not available

Modern Trends in Applied Terrestrial Ecology R.S. Ambasht, Navin K. Ambasht, 2012-12-06 Ecology and economics have Greek roots in oikos for household logos for study and nomics for management Thus ecology and economics should have complemented one another for a proper growth and development without destruction but unfortunately rapid

industrialization lure for fast financial gains and commercialization activities have led to a widespread surge in pollution load environmental degradation habitat destruction rapid loss of biodiversity sudden rise in rate of extinction of many wildlife and wild relatives of domesticated animals and cultivated cereals and other plants global climate changes creating global rise in temperature and CO levels and increased ultraviolet B at ground level Although these threats to human health have led us to look to ecology for their solutions and guidance for sustainable development without destruction the industrial and technology houses are looking for alternative methods of development and resource use methods The two global conferences of the United Nations in 1972 and 1992 and international programs of Man and the Biosphere MAB International Biological Program IBP International Geosphere Biosphere program IGBP and World Conservation Union IUCN of different commissions United Nations Environmental Program UNEP efforts Ramsar Conventions for wetlands and World Wide fund for Nature WWF for nature in general and wildlife in particular have focused attention of ecologists naturalists governments and Non governmental organizations NGOs toward better conservation

Progress in Botany Karl Esser, 2012-12-06 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

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

Ecology of Shallow Lakes Marten Scheffer, 2004-10 Using a combination of empirical studies experimental work and mathematical formulations Scheffer presents a theoretical framework for understanding the dynamics of shallow lake communities

Chaos in Real Data J.N. Perry, R.H. Smith, I.P. Woitwod, D.R. Morse, 2012-12-06 Chaos in Real Data studies the range of data analytic techniques

available to study nonlinear population dynamics for ecological time series Several case studies are studied using typically short and noisy population data from field and laboratory A range of modern approaches such as response surface methodology and mechanistic mathematical modelling are applied to several case studies Experts honestly appraise how well these methods have performed on their data The accessible style of the book ensures its readability for non quantitative biologists The data remain available as benchmarks for future study on the worldwide web *Progress in Botany* 67 Karl Esser,Ulrich Lüttge,Wolfram Beyschlag,Jin Murata,2006-01-27 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 systematics ecology and vegetation science

Dynamical Models in Biology Miklós Farkas,2001-06-15 Dynamic Models in Biology offers an introduction to modern mathematical biology This book provides a short introduction to modern mathematical methods in modeling dynamical phenomena and treats the broad topics of population dynamics epidemiology evolution immunology morphogenesis and pattern formation Primarily employing differential equations the author presents accessible descriptions of difficult mathematical models Recent mathematical results are included but the author's presentation gives intuitive meaning to all the main formulae Besides mathematicians who want to get acquainted with this relatively new field of applications this book is useful for physicians biologists agricultural engineers and environmentalists Key Topics Include Chaotic dynamics of populations The spread of sexually transmitted diseases Problems of the origin of life Models of immunology Formation of animal hide patterns The intuitive meaning of mathematical formulae explained with many figures Applying new mathematical results in modeling biological phenomena Miklos Farkas is a professor at Budapest University of Technology where he has researched and instructed mathematics for over thirty years He has taught at universities in the former Soviet Union Canada Australia Venezuela Nigeria India and Columbia Prof Farkas received the 1999 Bolyai Award of the Hungarian Academy of Science and the 2001 Albert Szentgyorgyi Award of the Hungarian Ministry of Education A down to earth introduction to the growing field of modern mathematical biology Also includes appendices which provide background material that goes beyond advanced calculus and linear algebra **Handbook of Scaling Methods in Aquatic Ecology**

Laurent Seuront,Peter G. Strutton,2003-09-25 The evolution of observational instruments simulation techniques and computing power has given aquatic scientists a new understanding of biological and physical processes that span temporal and spatial scales This has created a need for a single volume that addresses concepts of scale in a manner that builds bridges between experimentalists and *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

Agent-Based and Individual-Based Modeling

Steven F. Railsback, Volker Grimm, 2025-06-03 The essential textbook on agent based modeling now fully updated and expanded Agent Based and Individual Based Modeling has become the standard textbook on the subject for classroom use and self instruction Drawing on the latest version of NetLogo and fully updated with new examples exercises and an enhanced text for easier comprehension this is the essential resource for anyone seeking to understand how the dynamics of biological social and other complex systems arise from the characteristics of the agents that make up these systems Steven Railsback and Volker Grimm lead students stepwise through the processes of designing programming documenting and doing scientific research with agent based models focusing on the adaptive behaviors that make these models necessary They cover the fundamentals of modeling and model analysis introduce key modeling concepts and demonstrate how to implement them using NetLogo They also address pattern oriented modeling an invaluable strategy for modeling real world problems and developing theory This accessible and authoritative book focuses on modeling as a tool for understanding real complex systems It explains how to pose a specific question use observations from actual systems to design models write and test software and more A hands on introduction that guides students from conceptual design to computer implementation to analysis Filled with new examples and exercises and compatible with the latest version of NetLogo Ideal for students and researchers across the natural and social sciences Written by two leading practitioners Supported by extensive instructional materials at www.railsback.grimm.abm-book.com

Encyclopedia of Geography Barney Warf, 2010-09-21 Simply stated geography studies the locations of things and the explanations that underlie spatial distributions Profound forces at work throughout the world have made geographical knowledge increasingly important for understanding numerous human dilemmas and our capacities to address them With more than 1 200 entries the Encyclopedia of Geography reflects how the growth of geography has propelled a demand for intermediaries between the abstract language of academia and the ordinary language of everyday life The six volumes of this encyclopedia encapsulate a diverse array of topics to offer a comprehensive

and useful summary of the state of the discipline in the early 21st century

Key Features Gives a concise historical sketch of geography's long rich and fascinating history including human geography physical geography and GIS Provides succinct summaries of trends such as globalization environmental destruction new geospatial technologies and cyberspace Decomposes geography into the six broad subject areas physical geography human geography nature and society methods models and GIS history of geography and geographer biographies geographic organizations and important social movements Provides hundreds of color illustrations and images that lend depth and realism to the text Includes a special map section

Key Themes Physical Geography Human Geography Nature and Society Methods Models and GIS People Organizations and Movements History of Geography This encyclopedia strategically reflects the enormous diversity of the discipline the multiple meanings of space itself and the diverse views of geographers It brings together the diversity of geographical knowledge making it an invaluable resource for any academic library

Invasive Species and Biodiversity Management Odd Terje Sandlund, Peter Johan Schei, Åslaug Viken, 2001-06-30 Based on a selection of papers presented at the Norway UN Conference on Alien Species Trondheim Norway

Competition P.A. Keddy, 2012-12-06 Competition is one of the most important factors controlling the distribution and abundance of living creatures Sperm cells racing up reproductive tracts beetle larvae battling inside single seeds birds defending territories and trees interfering with the light available to neighbours are all engaged in competition for limited resources Along with predation and mutualism competition is one of the three major biological forces that assemble living communities Recent experimental work much of it only from the last few decades has enhanced human knowledge of the prevalence of competition in nature There are acacia trees that use ants to damage vines beetles that compete in arenas for access to dung balls tadpoles that apparently poison their neighbours birds that smash the eggs of potential competitors and plants that associate with fungi in order to increase access to soil resources While intended as an up to date reference work on the state of this branch of ecology the many non technical examples will make interesting reading for those with a general interest in nature Greatly expanded from the first prize winning edition there are entirely new chapters including one on resources and another on competition gradients in nature The author freely ranges across all major taxonomic groups in search of evidence The question of whether competition occurs is no longer useful the author maintains rather the challenge is to determine when and where each kind of competition is important in natural systems For this reason variants of competition such as intensity asymmetry and hierarchies are singled out for particular attention The book concludes with the difficulties of finding general principles in complex ecological communities and illustrates the limitations on knowledge that arise out of the biased conduct of scientists themselves Competition can be found elsewhere in living systems other than ecological communities at sub microscopic scales in the interactions of enzymes and neural pathways and over large geographic areas in the spread of human populations and contrasting ideas about the world Human societies are therefore also examined for evidence of the kinds of

competition found among other living organisms Using an array of historical examples including Biblical conflicts the use of noblemen's sons in the Crusades the Viking raids in Europe strategic bombing campaigns in the Second World War and ethnic battles of the Balkans the book illustrates how most of the aspects of competition illustrated with plants and animals can be extended to the interactions of human beings and their societies

Cellular Automata

Alejandro Salcido, 2011-04-11 Cellular automata make up a class of completely discrete dynamical systems which have become a core subject in the sciences of complexity due to their conceptual simplicity easiness of implementation for computer simulation and their ability to exhibit a wide variety of amazingly complex behavior The feature of simplicity behind complexity of cellular automata has attracted the researchers attention from a wide range of divergent fields of study of science which extend from the exact disciplines of mathematical physics up to the social ones and beyond Numerous complex systems containing many discrete elements with local interactions have been and are being conveniently modelled as cellular automata In this book the versatility of cellular automata as models for a wide diversity of complex systems is underlined through the study of a number of outstanding problems using these innovative techniques for modelling and simulation

Agent-Based Models of Geographical Systems Alison J. Heppenstall, Andrew T. Crooks, Linda M. See, Michael

Batty, 2011-11-24 This unique book brings together a comprehensive set of papers on the background theory technical issues and applications of agent based modelling ABM within geographical systems This collection of papers is an invaluable reference point for the experienced agent based modeller as well those new to the area Specific geographical issues such as handling scale and space are dealt with as well as practical advice from leading experts about designing and creating ABMs handling complexity visualising and validating model outputs With contributions from many of the world's leading research institutions the latest applied research micro and macro applications from around the globe exemplify what can be achieved in geographical context This book is relevant to researchers postgraduate and advanced undergraduate students and professionals in the areas of quantitative geography spatial analysis spatial modelling social simulation modelling and geographical information sciences

Evolutionary Games and Population Dynamics

Josef Hofbauer, Karl Sigmund, 1998-05-28 Every form of behaviour is shaped by trial and error Such stepwise adaptation can occur through individual learning or through natural selection the basis of evolution Since the work of Maynard Smith and others it has been realised how game theory can model this process Evolutionary game theory replaces the static solutions of classical game theory by a dynamical approach centred not on the concept of rational players but on the population dynamics of behavioural programmes In this book the authors investigate the nonlinear dynamics of the self regulation of social and economic behaviour and of the closely related interactions between species in ecological communities Replicator equations describe how successful strategies spread and thereby create new conditions which can alter the basis of their success i.e. to enable us to understand the strategic and genetic foundations of the endless chronicle of invasions and extinctions which

punctuate evolution In short evolutionary game theory describes when to escalate a conflict how to elicit cooperation why to expect a balance of the sexes and how to understand natural selection in mathematical terms

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