

A Practical To Ecological Modelling Using R As A Simulation Platform

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R for Data Science - Hadley Wickham 2016-12-12
Learn how to use R to turn raw data into insight, knowledge, and understanding. This book introduces you to R, RStudio, and the tidyverse, a collection of R packages designed to work together to make data science fast, fluent, and fun. Suitable for readers with no previous programming experience, R for

Data Science is designed to get you doing data science as quickly as possible. Authors Hadley Wickham and Garrett Golemund guide you through the steps of importing, wrangling, exploring, and modeling your data and communicating the results. You'll get a complete, big-picture understanding of the data science cycle, along with

basic tools you need to manage the details. Each section of the book is paired with exercises to help you practice what you've learned along the way. You'll learn how to:

Wrangle—transform your datasets into a form convenient for analysis
Program—learn powerful R tools for solving data problems with greater clarity and ease

Explore—examine your data, generate hypotheses, and quickly test them

Model—provide a low-dimensional summary that captures true "signals" in your dataset
Communicate—learn R Markdown for integrating prose, code, and results

Introduction to WinBUGS for Ecologists - Marc Kery
2010-07-19

Introduction to WinBUGS for Ecologists introduces applied Bayesian modeling to ecologists using the highly acclaimed, free WinBUGS software. It offers an understanding of statistical models as abstract representations of the various processes that give rise to a data set. Such an

understanding is basic to the development of inference models tailored to specific sampling and ecological scenarios. The book begins by presenting the advantages of a Bayesian approach to statistics and introducing the WinBUGS software. It reviews the four most common statistical distributions: the normal, the uniform, the binomial, and the Poisson. It describes the two different kinds of analysis of variance (ANOVA): one-way and two- or multiway. It looks at the general linear model, or ANCOVA, in R and WinBUGS. It introduces generalized linear model (GLM), i.e., the extension of the normal linear model to allow error distributions other than the normal. The GLM is then extended to contain additional sources of random variation to become a generalized linear mixed model (GLMM) for a Poisson example and for a binomial example. The final two chapters showcase two fairly novel and nonstandard versions of a GLMM. The first is the site-occupancy model for species

distributions; the second is the binomial (or N-) mixture model for estimation and modeling of abundance. Introduction to the essential theories of key models used by ecologists Complete juxtaposition of classical analyses in R and Bayesian analysis of the same models in WinBUGS Provides every detail of R and WinBUGS code required to conduct all analyses Companion Web Appendix that contains all code contained in the book and additional material (including more code and solutions to exercises)

Model Selection and Multimodel Inference -

Kenneth P. Burnham
2007-05-28

A unique and comprehensive text on the philosophy of model-based data analysis and strategy for the analysis of empirical data. The book introduces information theoretic approaches and focuses critical attention on a priori modeling and the selection of a good approximating model that best represents the inference

supported by the data. It contains several new approaches to estimating model selection uncertainty and incorporating selection uncertainty into estimates of precision. An array of examples is given to illustrate various technical issues. The text has been written for biologists and statisticians using models for making inferences from empirical data.

A Practical Guide to Ecological Modelling - Karlina Soetaert 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.

[Mathematical Foundations of Data Science Using R](#) - Frank Emmert-Streib 2022-10-24

The aim of the book is to help students become data scientists. Since this requires a series of courses over a considerable period of time, the book intends to accompany students from the beginning to an advanced understanding of the knowledge and skills that define a modern data scientist. The book presents a comprehensive overview of the mathematical foundations of the programming language R and of its applications to data science.

[Spatial Ecology and Conservation Modeling](#) - Robert Fletcher 2019-02-15

This book provides a foundation for modern applied ecology. Much of current ecology research and conservation addresses problems across landscapes and regions, focusing on spatial patterns and processes. This book is aimed at teaching fundamental

concepts and focuses on learning-by-doing through the use of examples with the software R. It is intended to provide an entry-level, easily accessible foundation for students and practitioners interested in spatial ecology and conservation.

A Practical Guide to Ecological Modelling - Karline

Soetaert 2008-10-21

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.

Integrated Population

Models - Michael Schaub
2021-11-23

Integrated Population Models: Theory and Ecological Applications with R and JAGS is the first book on integrated population models, which constitute a powerful framework for combining multiple data sets from the population and the individual levels to estimate demographic parameters, and population size and trends. These models identify drivers of population dynamics and forecast the composition and trajectory of a population. Written by two population ecologists with expertise on integrated population modeling, this book provides a comprehensive synthesis of the relevant theory of integrated population models with an extensive overview of practical applications, using Bayesian methods by means of case studies. The book contains fully-documented, complete code for fitting all models in the free software, R and JAGS. It also includes all required code for pre- and post-model-fitting analysis. Integrated Population

Models is an invaluable reference for researchers and practitioners involved in population analysis, and for graduate-level students in ecology, conservation biology, wildlife management, and related fields. The text is ideal for self-study and advanced graduate-level courses. Offers practical and accessible ecological applications of IPMs (integrated population models) Provides full documentation of analyzed code in the Bayesian framework Written and structured for an easy approach to the subject, especially for non-statisticians

Using Ecological Models to Support and Shape Environmental Policy

Decisions - Chiara Piroddi
2022-02-10

Practical R for Biologists - Donald L.J. Quicke 2020-12-21
R is a freely available, open-source statistical programming environment which provides powerful statistical analysis tools and graphics outputs. R is now used by a very wide range of people; biologists (the

primary audience of this book), but also all other scientists and engineers, economists, market researchers and medical professionals. R users with expertise are constantly adding new associated packages, and the range already available is immense. This text works through a set of studies that collectively represent almost all the R operations that biology students need in order to analyse their own data. The material is designed to serve students from first year undergraduates through to those beginning post graduate levels. Chapters are organized around topics such as graphing, classical statistical tests, statistical modelling, mapping, and text parsing. Examples are based on real scientific studies, and each one covers the use of more R functions than those simply necessary to get a p-value or plot.

Numerical Ecology - P.

Legendre 1998-11-25

The book describes and discusses the numerical methods which are successfully being used for analysing

ecological data, using a clear and comprehensive approach. These methods are derived from the fields of mathematical physics, parametric and nonparametric statistics, information theory, numerical taxonomy, archaeology, psychometry, sociometry, econometry and others.

Compared to the first edition of *Numerical Ecology*, this second edition includes three new chapters, dealing with the analysis of semiquantitative data, canonical analysis and spatial analysis. New sections have been added to almost all other chapters. There are sections listing available computer programs and packages at the end of several chapters. As in the previous English and French editions, there are numerous examples from the ecological literature, and the choice of methods is facilitated by several synoptic tables.

Environmental Modelling - John Wainwright 2005-04-08

Simulation models are increasingly used to investigate processes and solve practical

problems in a wide variety of disciplines eg. climatology, ecology, hydrology, geomorphology, engineering. Environmental Modelling: A Practical Approach addresses the development, testing and application of such models, which apply across traditional boundaries, and demonstrate how interactions across these boundaries can be beneficial. Provides a general overview of methods and approaches as well as focusing on key subject areas written by leading practitioners in the field Assesses the advantages and disadvantages of different models used and provides case studies supported with data, output, tutorial exercises and links to the model and/or model applications via the book's website Covers major developments in the field, eg. the use of GIS and remote sensing techniques, and scaling issues As associated website contains colour images, as well as links to www resources

Hands-On Matrix Algebra Using R - Hrishikesh D Vinod
2011-03-28

This is the first book of its kind which teaches matrix algebra, allowing the student to learn the material by actually working with matrix objects in modern computer environment of R. Instead of a calculator, R is a vastly more powerful free software and graphics system. The book provides a comprehensive overview of matrix theory without being bogged down in proofs or tedium. The reader can check each matrix result with numerical examples of exactly what they mean and understand their implications. The book does not shy away from advanced topics, especially the ones with practical applications. Errata(s) Errata

Analyzing Ecological Data - Alain Zuur 2007-08-29

This book provides a practical introduction to analyzing ecological data using real data sets. The first part gives a largely non-mathematical introduction to data exploration, univariate methods (including GAM and mixed modeling techniques),

multivariate analysis, time series analysis, and spatial statistics. The second part provides 17 case studies. The case studies include topics ranging from terrestrial ecology to marine biology and can be used as a template for a reader's own data analysis. Data from all case studies are available from www.highstat.com. Guidance on software is provided in the book.

The Routledge Handbook of Research Methods for

Social-Ecological Systems -
Reinette Biggs 2021-07-29

The Routledge Handbook of Research Methods for Social-Ecological Systems provides a synthetic guide to the range of methods that can be employed in social-ecological systems (SES) research. The book is primarily targeted at graduate students, lecturers and researchers working on SES, and has been written in a style that is accessible to readers entering the field from a variety of different disciplinary backgrounds. Each chapter discusses the types of SES

questions to which the particular methods are suited and the potential resources and skills required for their implementation, and provides practical examples of the application of the methods. In addition, the book contains a conceptual and practical introduction to SES research, a discussion of key gaps and frontiers in SES research methods, and a glossary of key terms in SES research.

Contributions from 97 different authors, situated at SES research hubs in 16 countries around the world, including South Africa, Sweden, Germany and Australia, bring a wealth of expertise and experience to this book. The first book to provide a guide and introduction specifically focused on methods for studying SES, this book will be of great interest to students and scholars of sustainability science, environmental management, global environmental change studies and environmental governance. The book will also be of interest to upper-level undergraduates

and professionals working at the science-policy interface in the environmental arena.

Ecological Models and Data

in R - Benjamin M. Bolker

2008-07-21

Introduction and background; Exploratory data analysis and graphics; Deterministic functions for ecological modeling; Probability and stochastic distributions for ecological modeling; Stochastic simulation and power analysis; Likelihood and all that; Optimization and all that; Likelihood examples; Standard statistics revisited; Modeling variance; Dynamic models.

Introduction to Hierarchical Bayesian Modeling for Ecological Data

- Eric Parent

2012-08-21

Making statistical modeling and inference more accessible to ecologists and related scientists, *Introduction to Hierarchical Bayesian Modeling for Ecological Data* gives readers a flexible and effective framework to learn about complex ecological processes from various sources of data. It also helps readers get started

on building their own statistical models. The text begins with simple models that progressively become more complex and realistic through explanatory covariates and intermediate hidden states variables. When fitting the models to data, the authors gradually present the concepts and techniques of the Bayesian paradigm from a practical point of view using real case studies. They emphasize how hierarchical Bayesian modeling supports multidimensional models involving complex interactions between parameters and latent variables. Data sets, exercises, and R and WinBUGS codes are available on the authors' website. This book shows how Bayesian statistical modeling provides an intuitive way to organize data, test ideas, investigate competing hypotheses, and assess degrees of confidence of predictions. It also illustrates how conditional reasoning can dismantle a complex reality into more understandable pieces. As conditional reasoning is

intimately linked with Bayesian thinking, considering hierarchical models within the Bayesian setting offers a unified and coherent framework for modeling, estimation, and prediction.

Ecological Modeling in Risk Assessment - Robert A.

Pastorok 2016-04-19

Toxic chemicals can exert effects on all levels of the biological hierarchy, from cells to organs to organisms to populations to entire ecosystems. However, most risk assessment models express their results in terms of effects on individual organisms, without corresponding information on how populations, groups of species, or whole ecosystems may respond to chemical stressors. Ecological Modeling in Risk Assessment: Chemical Effects on Populations, Ecosystems, and Landscapes takes a new approach by compiling and evaluating models that can be used in assessing risk at the population, ecosystem, and landscape levels. The authors give an overview of the current

process of ecological risk assessment for toxic chemicals and of how modeling of populations, ecosystems, and landscapes could improve the status quo. They present a classification of ecological models and explain the differences between population, ecosystem, landscape, and toxicity-extrapolation models. The authors describe the model evaluation process and define evaluation criteria. Finally, the results of the model evaluations are presented in a concise format with recommendations on modeling approaches to use now and develop further. The authors present and evaluate various models on the basis of their realism and complexity, prediction of relevant assessment endpoints, treatment of uncertainty, regulatory acceptance, resource efficiency, and other criteria. They provide models that will improve the ecological relevance of risk assessments and make data collection more cost-effective. Ecological Modeling in Risk Assessment serves as a reference for

selecting and applying the best models when performing a risk assessment.

Solving Differential

Equations in R - Karline

Soetaert 2012-06-06

Mathematics plays an important role in many scientific and engineering disciplines. This book deals with the numerical solution of differential equations, a very important branch of mathematics. Our aim is to give a practical and theoretical account of how to solve a large variety of differential equations, comprising ordinary differential equations, initial value problems and boundary value problems, differential algebraic equations, partial differential equations and delay differential equations. The solution of differential equations using R is the main focus of this book. It is therefore intended for the practitioner, the student and the scientist, who wants to know how to use R for solving differential equations. However, it has been our goal that non-mathematicians should at least understand the basics of the

methods, while obtaining entrance into the relevant literature that provides more mathematical background.

Therefore, each chapter that deals with R examples is preceded by a chapter where the theory behind the numerical methods being used is introduced. In the sections that deal with the use of R for solving differential equations, we have taken examples from a variety of disciplines, including biology, chemistry, physics, pharmacokinetics. Many examples are well-known test examples, used frequently in the field of numerical analysis.

Simulation of Ecological and Environmental Models -

Miguel F. Acevedo 2016-04-19

Given the importance of interdisciplinary work in sustainability, Simulation of Ecological and Environmental Models introduces the theory and practice of modeling and simulation as applied in a variety of disciplines that deal with earth systems, the environment, ecology, and human-nature interactions.

Based on the author's many

years of teaching g

Ecological Niches and Geographic Distributions

(MPB-49) - A. Townsend

Peterson 2011-11-20

Terminology, conceptual overview, biogeography, modeling.

Spatio-Temporal Methods in Environmental Epidemiology

- Gavin Shaddick 2015-06-17

Teaches Students How to Perform Spatio-Temporal Analyses within Epidemiological Studies Spatio-Temporal Methods in Environmental Epidemiology is the first book of its kind to specifically address the interface between environmental epidemiology and spatio-temporal modeling. In response to the growing need for collaboration between statisticians and environmental epidemiologists, the book links recent developments in spatio-temporal methodology with epidemiological applications. Drawing on real-life problems, it provides the necessary tools to exploit advances in methodology when assessing the health risks associated with environmental hazards. The

book's clear guidelines enable the implementation of the methodology and estimation of risks in practice. Designed for graduate students in both epidemiology and statistics, the text covers a wide range of topics, from an introduction to epidemiological principles and the foundations of spatio-temporal modeling to new research directions. It describes traditional and Bayesian approaches and presents the theory of spatial, temporal, and spatio-temporal modeling in the context of its application to environmental epidemiology. The text includes practical examples together with embedded R code, details of specific R packages, and the use of other software, such as WinBUGS/OpenBUGS and integrated nested Laplace approximations (INLA). A supplementary website provides additional code, data, examples, exercises, lab projects, and more. Representing a major new direction in environmental epidemiology, this book—in full color throughout—underscores

the increasing need to consider dependencies in both space and time when modeling epidemiological data. Students will learn how to identify and model patterns in spatio-temporal data as well as exploit dependencies over space and time to reduce bias and inefficiency.

Numerical Ecology with R -

Daniel Borcard 2018-03-19

This new edition of Numerical Ecology with R guides readers through an applied exploration of the major methods of multivariate data analysis, as seen through the eyes of three ecologists. It provides a bridge between a textbook of numerical ecology and the implementation of this discipline in the R language. The book begins by examining some exploratory approaches. It proceeds logically with the construction of the key building blocks of most methods, i.e. association measures and matrices, and then submits example data to three families of approaches: clustering, ordination and canonical ordination. The last two

chapters make use of these methods to explore important and contemporary issues in ecology: the analysis of spatial structures and of community diversity. The aims of methods thus range from descriptive to explanatory and predictive and encompass a wide variety of approaches that should provide readers with an extensive toolbox that can address a wide palette of questions arising in contemporary multivariate ecological analysis. The second edition of this book features a complete revision to the R code and offers improved procedures and more diverse applications of the major methods. It also highlights important changes in the methods and expands upon topics such as multiple correspondence analysis, principal response curves and co-correspondence analysis. New features include the study of relationships between species traits and the environment, and community diversity analysis. This book is aimed at professional researchers, practitioners, graduate students and teachers

in ecology, environmental science and engineering, and in related fields such as oceanography, molecular ecology, agriculture and soil science, who already have a background in general and multivariate statistics and wish to apply this knowledge to their data using the R language, as well as people willing to accompany their disciplinary learning with practical applications. People from other fields (e.g. geology, geography, paleoecology, phylogenetics, anthropology, the social and education sciences, etc.) may also benefit from the materials presented in this book. Users are invited to use this book as a teaching companion at the computer. All the necessary data files, the scripts used in the chapters, as well as extra R functions and packages written by the authors of the book, are available online (URL: <http://adn.biol.umontreal.ca/~numercal/ecology/numecolR/>).
Multivariate Analysis of Ecological Data - Michael Greenacre 2014-01-09
La diversidad biológica es fruto

de la interacción entre numerosas especies, ya sean marinas, vegetales o animales, a la par que de los muchos factores limitantes que caracterizan el medio que habitan. El análisis multivariante utiliza las relaciones entre diferentes variables para ordenar los objetos de estudio según sus propiedades colectivas y luego clasificarlos; es decir, agrupar especies o ecosistemas en distintas clases compuestas cada una por entidades con propiedades parecidas. El fin último es relacionar la variabilidad biológica observada con las correspondientes características medioambientales. *Multivariate Analysis of Ecological Data* explica de manera completa y estructurada cómo analizar e interpretar los datos ecológicos observados sobre múltiples variables, tanto biológicos como medioambientales. Tras una introducción general a los datos ecológicos multivariantes y la metodología estadística, se abordan en capítulos

específicos, métodos como aglomeración (clustering), regresión, biplots, escalado multidimensional, análisis de correspondencias (simple y canónico) y análisis log-ratio, con atención también a sus problemas de modelado y aspectos inferenciales. El libro plantea una serie de aplicaciones a datos reales derivados de investigaciones ecológicas, además de dos casos detallados que llevan al lector a apreciar los retos de análisis, interpretación y comunicación inherentes a los estudios a gran escala y los diseños complejos.

Physics and Ecology in

Fluids - Marek Stastna

2023-02-17

Physics and Ecology in Fluids: Modeling and Numerical Experiments develops mathematical and numerical modeling methodologies for coupled biological-hydrodynamic problems with a focus on process studies. The modeling is presented in a way that discusses mathematical background but does not depend on a large body of

mathematical pre-requisites or experience. Models are built up from simple, to complex. This includes discussion of approximations and shortcuts commonly made by large computational models for natural bodies of water. Computational approaches are presented using conceptual explanations and pseudo-code along with well-documented, open-source code. Over a dozen codes that run locally on the reader's laptop provide hands on experience with various aspects of the modeling process and its scientific results. One large-scale code for basin scale modeling based on the Discontinuous Galerkin methodology is presented, along with a self-contained discussion of theoretical background and implementation details. Physics and Ecology in Fluids is written for graduate students, academic researchers and government scientists. Professors can use the book as a stand-alone resource for a one term graduate course, or to supplement teaching of their

own graduate courses. All readers may also use the book as background/user's guide for the software included with the book. Presents accessible codes along with clear explanations of the mathematical modeling process that leads up to the code Provides a consistent development of the mathematical models for hydrodynamic and biological modeling, which are rarely covered together Includes an informal, discussion-style tone throughout, but with serious applied mathematics content, allowing a level of detail relevant for multiple reader types

Environmental and Ecological Statistics with R - Song S. Qian
2016-11-03

Emphasizing the inductive nature of statistical thinking, *Environmental and Ecological Statistics with R*, Second Edition, connects applied statistics to the environmental and ecological fields. Using examples from published works in the ecological and environmental literature, the book explains the approach to

solving a statistical problem, covering model specification, parameter estimation, and model evaluation. It includes many examples to illustrate the statistical methods and presents R code for their implementation. The emphasis is on model interpretation and assessment, and using several core examples throughout the book, the author illustrates the iterative nature of statistical inference. The book starts with a description of commonly used statistical assumptions and exploratory data analysis tools for the verification of these assumptions. It then focuses on the process of building suitable statistical models, including linear and nonlinear models, classification and regression trees, generalized linear models, and multilevel models. It also discusses the use of simulation for model checking, and provides tools for a critical assessment of the developed models. The second edition also includes a complete critique of a threshold model.

Environmental and Ecological Statistics with R, Second Edition

focuses on statistical modeling and data analysis for environmental and ecological problems. By guiding readers through the process of scientific problem solving and statistical model development, it eases the transition from scientific hypothesis to statistical model.

Models for Ecological Data - James S. Clark 2020-10-06

The environmental sciences are undergoing a revolution in the use of models and data. Facing ecological data sets of unprecedented size and complexity, environmental scientists are struggling to understand and exploit powerful new statistical tools for making sense of ecological processes. In *Models for Ecological Data*, James Clark introduces ecologists to these modern methods in modeling and computation. Assuming only basic courses in calculus and statistics, the text introduces readers to basic maximum likelihood and then works up to more advanced topics in Bayesian modeling and computation. Clark covers both classical statistical

approaches and powerful new computational tools and describes how complexity can motivate a shift from classical to Bayesian methods. Through an available lab manual, the book introduces readers to the practical work of data modeling and computation in the language R. Based on a successful course at Duke University and National Science Foundation-funded institutes on hierarchical modeling, *Models for Ecological Data* will enable ecologists and other environmental scientists to develop useful models that make sense of ecological data. Consistent treatment from classical to modern Bayes Underlying distribution theory to algorithm development Many examples and applications Does not assume statistical background Extensive supporting appendixes Lab manual in R is available separately

Environmental Bioenergetics - Anke Marianne Herrmann 2020-01-10

Population Ecology in Practice -

Dennis L. Murray 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.

Data-driven Modelling of Structured Populations -

Stephen P. Ellner 2016-05-13
This book is a "How To" guide for modeling population dynamics using Integral Projection Models (IPM) starting from observational data. It is written by a leading research team in this area and includes

code in the R language (in the text and online) to carry out all computations. The intended audience are ecologists, evolutionary biologists, and mathematical biologists interested in developing data-driven models for animal and plant populations. IPMs may seem hard as they involve integrals. The aim of this book is to demystify IPMs, so they become the model of choice for populations structured by size or other continuously varying traits. The book uses real examples of increasing complexity to show how the life-cycle of the study organism naturally leads to the appropriate statistical analysis, which leads directly to the IPM itself. A wide range of model types and analyses are presented, including model construction, computational methods, and the underlying theory, with the more technical material in Boxes and Appendices. Self-contained R code which replicates all of the figures and calculations within the text is available to readers on GitHub. Stephen P. Ellner is

Horace White Professor of Ecology and Evolutionary Biology at Cornell University, USA; Dylan Z. Childs is Lecturer and NERC Postdoctoral Fellow in the Department of Animal and Plant Sciences at The University of Sheffield, UK; Mark Rees is Professor in the Department of Animal and Plant Sciences at The University of Sheffield, UK.

Encyclopedia of Ecology - Brian D. Fath 2018-08-23
Encyclopedia of Ecology, Second Edition 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 [Spatial Data Analysis in Ecology and Agriculture Using R](#) - Richard E. Plant 2018-12-07 Key features: Unique in its combination of serving as an introduction to spatial statistics and to modeling agricultural and ecological data using R Provides exercises in each chapter to facilitate the book's use as a course textbook or for

self-study Adds new material on generalized additive models, point pattern analysis, and new methods of Bayesian analysis of spatial data. Includes a completely revised chapter on the analysis of spatiotemporal data featuring recently introduced software and methods Updates its coverage of R software including newly introduced packages Spatial Data Analysis in Ecology and Agriculture Using R, 2nd Edition provides practical instruction on the use of the R programming language to analyze spatial data arising from research in ecology, agriculture, and environmental science. Readers have praised the book's practical coverage of spatial statistics, real-world examples, and user-friendly approach in presenting and explaining R code, aspects maintained in this update. Using data sets from cultivated and uncultivated ecosystems, the book guides the reader through the analysis of each data set, including setting research objectives, designing the sampling plan, data quality

control, exploratory and confirmatory data analysis, and drawing scientific conclusions. Additional material to accompany the book, on both analyzing satellite data and on multivariate analysis, can be accessed at <https://www.plantsciences.ucdavis.edu/plant/additionaltopics.htm>.

Spatial Modeling in GIS and R for Earth and Environmental Sciences - Hamid Reza

Pourghasemi 2019-01-18

Spatial Modeling in GIS and R for Earth and Environmental Sciences offers an integrated approach to spatial modelling using both GIS and R. Given the importance of Geographical Information Systems and geostatistics across a variety of applications in Earth and Environmental Science, a clear link between GIS and open source software is essential for the study of spatial objects or phenomena that occur in the real world and facilitate problem-solving. Organized into clear sections on applications and using case studies, the book helps researchers to more

quickly understand GIS data and formulate more complex conclusions. The book is the first reference to provide methods and applications for combining the use of R and GIS in modeling spatial processes. It is an essential tool for students and researchers in earth and environmental science, especially those looking to better utilize GIS and spatial modeling. Offers a clear, interdisciplinary guide to serve researchers in a variety of fields, including hazards, land surveying, remote sensing, cartography, geophysics, geology, natural resources, environment and geography. Provides an overview, methods and case studies for each application. Expresses concepts and methods at an appropriate level for both students and new users to learn by example. **Environmental Modeling with Stakeholders** - Steven Gray 2016-12-16

This volume brings together, in a central text, chapters written by leading scholars working at the intersection of modeling, the natural and social sciences,

and public participation. This book presents the current state of knowledge regarding the theory and practice of engaging stakeholders in environmental modeling for decision-making, and includes basic theoretical considerations, an overview of methods and tools available, and case study examples of these principles and methods in practice. Although there has been a significant increase in research and development regarding participatory modeling, a unifying text that provides an overview of the different methodologies available to scholars and a systematic review of case study applications has been largely unavailable. This edited volume seeks to address a gap in the literature and provide a primer that addresses the growing demand to adopt and apply a range of modeling methods that includes the public in environmental assessment and management. The book is divided into two main sections. The first part of the book covers basic considerations for including stakeholders in the

modeling process and its intersection with the theory and practice of public participation in environmental decision-making. The second part of the book is devoted to specific applications and products of the various methods available through case study examination. This second part of the book also provides insight from several international experts currently working in the field about their approaches, types of interactions with stakeholders, models produced, and the challenges they perceived based on their practical experiences.

Using R for Numerical Analysis in Science and Engineering - Victor A.

Bloomfield 2018-09-03

Instead of presenting the standard theoretical treatments that underlie the various numerical methods used by scientists and engineers, *Using R for Numerical Analysis in Science and Engineering* shows how to use R and its add-on packages to obtain numerical solutions to the complex

mathematical problems commonly faced by scientists and engineers. This practical guide to the capabilities of R demonstrates Monte Carlo, stochastic, deterministic, and other numerical methods through an abundance of worked examples and code, covering the solution of systems of linear algebraic equations and nonlinear equations as well as ordinary differential equations and partial differential equations. It not only shows how to use R's powerful graphic tools to construct the types of plots most useful in scientific and engineering work, but also: Explains how to statistically analyze and fit data to linear and nonlinear models Explores numerical differentiation, integration, and optimization Describes how to find eigenvalues and eigenfunctions Discusses interpolation and curve fitting Considers the analysis of time series Using R for Numerical Analysis in Science and Engineering provides a solid introduction to the most useful numerical

methods for scientific and engineering data analysis using R.

Individual-based Modeling and Ecology - Volker Grimm

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.

Simultaneous Mass Transfer and Chemical Reactions in Engineering Science - Bertram K. C. Chan 2023-02-01
Simultaneous Mass Transfer and Chemical Reactions in Engineering Science A

comprehensive look at the basic science of diffusional process and mass transfer Mass transfer as a principle is an essential part of numerous unit operations in biomolecular, chemical, and process engineering; crystallization, distillation, and membrane separation processes, for example, use this important method. Given this significance - particularly in engineering design where these processes occur - understanding the design and analysis of such unit operations must begin with a basic understanding of how simultaneous mass transfer and the chemical reactions that influence these occurrences. It is also vital to be aware of the most up-to-date technologies for analyzing and predicting the phenomena. Given the significance of this process, Simultaneous Mass Transfer and Chemical Reactions in Engineering Science is an important resource as it introduces the reader to the complex subject of simultaneous mass transfer with biochemical and chemical

reactions and gives them the tools to develop an applicable design. Analyzing the systems of simultaneous mass transfer and reactions is at the core of this book, as all known design approaches are carefully examined and compared. The volume also provides the reader with a working knowledge of the latest technologies - with a special focus on the open-sourced computer programming language R - and how these tools are an essential resource in quantitative assessment in analysis models. *Simultaneous Mass Transfer and Chemical Reactions in Engineering Science* provides a working knowledge of the latest information on simultaneous mass transfer and reactions by focusing on the analysis of this process, as well as discussing the existence and distinctive quality of the solutions to the *Simultaneous Mass Transfer and Chemical Reactions in Engineering Science* readers will also find: A theoretical basis of each design model that is carefully stated, compared, and

assessed Carefully developed and established Existence and Uniqueness Theorems for a general design model Comprehensive coverage of how the programming language R may be used to analyze models Numerous examples and case studies that provide a working knowledge of simultaneous mass transfer and reactions *Simultaneous Mass Transfer and Chemical Reactions in Engineering Science* is a useful reference for students in chemical engineering, biotechnology, or chemistry, as well as professional process and chemical engineers.

A Primer of Ecology with R - M. Henry Stevens 2009-06-02

Provides simple explanations of the important concepts in population and community ecology. Provides R code throughout, to illustrate model development and analysis, as well as appendix introducing the R language. Interweaves ecological content and code so that either stands alone. Supplemental web site for additional code.

Statistical Computation for Environmental Sciences in R -

James S. Clark 2007-06-03

The environmental sciences are undergoing a revolution in the use of models and data. Facing ecological data sets of unprecedented size and complexity, environmental scientists are struggling to understand and exploit powerful new statistical tools for making sense of ecological processes. In *Models for Ecological Data*, James Clark introduces ecologists to these modern methods in modeling and computation. Assuming only basic courses in calculus and statistics, the text introduces readers to basic maximum likelihood and then works up to more advanced topics in Bayesian modeling and computation. Clark covers both classical statistical approaches and powerful new computational tools and describes how complexity can motivate a shift from classical to Bayesian methods. Through an available lab manual, the book introduces readers to the practical work of data modeling

and computation in the language R. Based on a successful course at Duke University and National Science Foundation-funded institutes on hierarchical modeling, *Models for Ecological Data* will enable ecologists and other environmental scientists to develop useful models that make sense of ecological data. Consistent treatment from classical to modern Bayesian underlying distribution theory to algorithm development. Many examples and applications. Does not assume statistical background. Extensive supporting appendixes. Accompanying lab manual in *R Data Analysis and Statistics for Geography, Environmental Science, and Engineering* - Miguel F. Acevedo 2012-12-07. Providing a solid foundation for twenty-first-century scientists and engineers, *Data Analysis and Statistics for Geography, Environmental Science, and Engineering* guides readers in learning quantitative methodology, including how to implement data analysis methods using open-source

software. Given the importance of interdisciplinary work in sustain