

Food Webs and Niche Space

JOEL E. COHEN

MONOGRAPHS IN POPULATION BIOLOGY • 11

Food Webs Niche Space

**Peter C de Ruiter, Volkmar
Wolters, John C Moore**



Food Webs Niche Space:

Food Webs and Niche Space Joel E. Cohen, David W. Stephens, 2020-03-31 What is the minimum dimension of a niche space necessary to represent the overlaps among observed niches This book presents a new technique for obtaining a partial answer to this elementary question about niche space The author bases his technique on a relation between the combinatorial structure of food webs and the mathematical theory of interval graphs Professor Cohen collects more than thirty food webs from the ecological literature and analyzes their statistical and combinatorial properties in detail As a result he is able to generalize within habitats of a certain limited physical and temporal heterogeneity the overlaps among niches along their trophic feeding dimensions can be represented in a one dimensional niche space far more often than would be expected by chance alone and perhaps always This compatibility has not previously been noticed It indicates that real food webs fall in a small subset of the mathematically possible food webs Professor Cohen discusses other apparently new features of real food webs including the constant ratio of the number of kinds of prey to the number of kinds of predators in food webs that describe a community In conclusion he discusses possible extensions and limitations of his results and suggests directions for future research

Community Food Webs Joel E. Cohen, Frédéric Briand, Charles M. Newman, 2012-12-06 Food webs hold a central place in ecology They describe which organisms feed on which others in natural habitats This book describes recently discovered empirical regularities in real food webs it proposes a novel theory unifying many of these regularities as well as extensive empirical data After a general introduction reviewing the empirical and theoretical discoveries about food webs the second portion of the book shows that community food webs obey several striking phenomenological regularities Some of these unify regardless of habitat Others differentiate showing that habitat significantly influences structure The third portion of the book presents a theoretical analysis of some of the unifying empirical regularities The fourth portion of the book presents 113 community food webs Collected from scattered sources and carefully edited they are the empirical basis for the results in the volume The largest available set of data on community food webs provides a valuable foundation for future studies of community food webs The book is intended for graduate students teachers and researchers primarily in ecology The theoretical portions of the book provide materials useful to teachers of applied combinatorics in particular random graphs Researchers in random graphs will find here unsolved mathematical problems

Food Webs S. Pimm, 2012-12-06 Often the meanings of words are changed subtly for interesting reasons The implication of the word community has changed from including all the organisms in an area to only those species at a particular trophic level and often a taxonomically restricted group for example bird community If this observation is correct its probable cause is the dramatic growth in our knowledge of the ecological patterns along trophic levels I call these horizontal patterns and the processes that generate them This book deals with vertical patterns those across trophic levels and tries to compensate for their relative neglect In cataloging a dozen vertical patterns I hope to convince the reader that

species interactions across trophic levels are as patterned as those along trophic levels and demand explanations equally forcefully But this is not the only objective A limited number of processes shape the patterns of species interaction to demonstrate their existence is an essential step in understanding why ecosystems are the way they are To achieve these aims I must resort to both mathematical techniques to develop theories and statistical techniques to decide between rival hypotheses The level of mathematics is likely to offend nearly everyone Some will find any mathematics too much while others will consider the material to be old familiar ground and probably explained with a poor regard for rigour and generality

Food Webs and Biodiversity Axel G. Rossberg, 2013-06-03 Food webs have now been addressed in empirical and theoretical research for more than 50 years Yet even elementary foundational issues are still hotly debated One difficulty is that a multitude of processes need to be taken into account to understand the patterns found empirically in the structure of food webs and communities *Food Webs and Biodiversity* develops a fresh comprehensive perspective on food webs Mechanistic explanations for several known macroecological patterns are derived from a few fundamental concepts which are quantitatively linked to field observables An argument is developed that food webs will often be the key to understanding patterns of biodiversity at community level Key Features Predicts generic characteristics of ecological communities in invasion extirpation equilibrium Generalizes the theory of competition to food webs with arbitrary topologies Presents a new testable quantitative theory for the mechanisms determining species richness in food webs and other new results Written by an internationally respected expert in the field With global warming and other pressures on ecosystems rising understanding and protecting biodiversity is a cause of international concern This highly topical book will be of interest to a wide ranging audience including not only graduate students and practitioners in community and conservation ecology but also the complex systems research community as well as mathematicians and physicists interested in the theory of networks This is a comprehensive work outlining a large array of very novel and potentially game changing ideas in food web ecology Ken Haste Andersen Technical University of Denmark I believe that this will be a landmark book in community ecology it presents a well established and consistent mathematical theory of food webs It is testable in many ways and the author finds remarkable agreements between predictions and reality G za Mesz na E tv s University Budapest

Food Webs John C. Moore, Peter C. de Ruiter, Kevin S. McCann, 2018 This book presents new approaches to studying food webs using practical and policy examples to demonstrate the theory behind ecosystem management decisions

Aquatic Food Webs Andrea Belgrano, Ursula M. Scharler, Jennifer Dunne, Robert E. Ulanowicz, 2005-04-07 This volume provides a current synthesis of theoretical and empirical food web research Whether they are binary systems or weighted networks food webs are of particular interest to ecologists in providing a macroscopic view of ecosystems They describe interactions between species and their environment and subsequent advances in the understanding of their structure function and dynamics are of vital importance to ecosystem management and conservation *Aquatic Food Webs* provides a synthesis of the current issues in food

web theory and its applications covering issues of structure function scaling complexity and stability in the contexts of conservation fisheries and climate Although the focus of this volume is upon aquatic food webs where many of the recent advances have been made any ecologist with an interest in food web theory and its applications will find the issues addressed in this book of value and use This advanced textbook is suitable for graduate level students as well as professional researchers in community ecosystem and theoretical ecology in aquatic ecology and in conservation biology

Food Webs and Container Habitats R. L. Kitching, 2000-08-03 The animal communities in plant held water bodies such as tree holes and pitcher plants have become models for food web studies In this book Professor Kitching introduces us to these fascinating miniature worlds and demonstrates how they can be used to tackle some of the major questions in community ecology Based on thirty years research in many parts of the world this work presents much previously unpublished information in addition to summarising over a hundred years of natural history observations by others The book covers many aspects of the theory of food web formation and maintenance presented with field collected information on tree holes bromeliads pitcher plants bamboo containers and the axils of fleshy plants It is a unique introduction for the field naturalist and a stimulating source treatment for graduate students and professionals working in the fields of tropical and other forest ecology as well as entomology

Energetic Food Webs John C. Moore, Peter C. de Ruiter, 2012-05-31 This novel book bridges the gap between the energetic and species approaches to studying food webs addressing many important topics in ecology Species matter and energy are common features of all ecological systems Through the lens of complex adaptive systems thinking the authors explore how the inextricable relationship between species matter and energy can explain how systems are structured and how they persist in real and model systems Food webs are viewed as open and dynamic systems The central theme of the book is that the basis of ecosystem persistence and stability rests on the interplay between the rates of input of energy into the system from living and dead sources and the patterns in utilization of energy that result from the trophic interactions among species within the system To develop this theme the authors integrate the latest work on community dynamics ecosystem energetics and stability In so doing they present a unified ecology that dispels the categorization of the field into the separate subdisciplines of population community and ecosystem ecology *Energetic Food Webs* is suitable for both graduate level students and professional researchers in the general field of ecology It will be of particular relevance and use to those working in the specific areas of food webs species dynamics material and energy cycling as well as community and ecosystem ecology

Food Webs and the Dynamics of Marine Reefs Tim McClanahan, George Branch, 2008-04-16 Biologists have made significant advances in our understanding of the Earth's shallow subtidal marine ecosystems but the findings on these disparate regions have never before been documented and gathered in a single volume Now in *Food Webs and the Dynamics of Marine Reefs* Tim R McClanahan and George M Branch fill this lacuna with a comparative and comprehensive collection of nine essays written by experts on specific aquatic regions Each essay focuses on the food webs

of a respective ecosystem and the factors affecting these communities from the intense and direct pressure of human influence on fisheries to the multi vector contributors to climate change The book covers nine shallow water marine ecosystems from selected areas throughout the world four coral reef systems three hard bottom systems and two kelp systems In summarizing their organization human influence on them and recent developments in these ecosystems the authors contribute to our understanding of their ecological organization and management Food Webs and the Dynamics of Marine Reefs will be a useful tool for all benthic marine investigators providing an expert comparative view of these aquatic regions Biological Networks François Képès, 2007 This volume presents a timely and comprehensive overview of

biological networks at all organization levels in the spirit of the complex system approach It discusses the transversal issues and fundamental principles as well as the overall structure dynamics and modeling of a wide array of biological networks at the molecular cellular and population levels Anchored in both empirical data and a strong theoretical background the book therefore lends valuable credence to the complex systems approach **Quo Vadis, Graph Theory?** J. Gimbel, J.W.

Kennedy, L.V. Quintas, 1993-03-17 Graph Theory as a recognized discipline is a relative newcomer to Mathematics The first formal paper is found in the work of Leonhard Euler in 1736 In recent years the subject has grown so rapidly that in today's literature graph theory papers abound with new mathematical developments and significant applications As with any academic field it is good to step back occasionally and ask Where is all this activity taking us What are the outstanding fundamental problems What are the next important steps to take In short Quo Vadis Graph Theory The contributors to this volume have together provided a comprehensive reference source for future directions and open questions in the field

Algebraic and Discrete Mathematical Methods for Modern Biology Raina Robeva, 2015-05-09 Written by experts in both mathematics and biology Algebraic and Discrete Mathematical Methods for Modern Biology offers a bridge between math and biology providing a framework for simulating analyzing predicting and modulating the behavior of complex biological systems Each chapter begins with a question from modern biology followed by the description of certain mathematical methods and theory appropriate in the search of answers Every topic provides a fast track pathway through the problem by presenting the biological foundation covering the relevant mathematical theory and highlighting connections between them Many of the projects and exercises embedded in each chapter utilize specialized software providing students with much needed familiarity and experience with computing applications critical components of the modern biology skill set This book is appropriate for mathematics courses such as finite mathematics discrete structures linear algebra abstract modern algebra graph theory probability bioinformatics statistics biostatistics and modeling as well as for biology courses such as genetics cell and molecular biology biochemistry ecology and evolution Examines significant questions in modern biology and their mathematical treatments Presents important mathematical concepts and tools in the context of essential biology Features material of interest to students in both mathematics and biology Presents chapters in modular format so coverage

need not follow the Table of Contents Introduces projects appropriate for undergraduate research Utilizes freely accessible software for visualization simulation and analysis in modern biology Requires no calculus as a prerequisite Provides a complete Solutions Manual Features a companion website with supplementary resources Community Ecology Alan Hastings, 2013-11-11 This book presents the proceedings of a workshop on community ecology organized at Davis in April 1986 sponsored by the Sloan Foundation There have been several recent symposia on community ecology Strong et al 1984 Diamond and Case 1987 which have covered a wide range of topics The goal of the workshop at Davis was more narrow to explore the role of scale in developing a theoretical approach to understanding communities There are a number of aspects of scale that enter into attempts to understand ecological communities One of the most basic is organizational scale Should community ecology proceed by building up from population biology This question and its ramifications are stressed throughout the book and explored in the first chapter by Simon Levin Notions of scale have long been important in understanding physical systems Thus in understanding the interactions of organisms with their physical environment questions of scale become paramount These more physical questions illustrate the role scale plays in understanding ecology and are discussed in chapter two by Akira Okubo **Combinatorial & Computational Mathematics** Sungpyo Hong, 2001 This book describes and summarizes past work in important areas of combinatorics and computation as well as gives directions for researchers working in these areas in the 21st century It contains primarily survey papers and presents original research by Peter Fishburn Jim Ho Kwak Jaeun Lee K H Kim F W Roush and Susan Williams The papers deal with some of the most exciting and promising developments in the areas of coding theory in relation to number theory lattice theory and its applications graph theory and its applications topological techniques in combinatorics symbolic dynamics and mathematical social science Contents Monte Carlo and Quasi Monte Carlo Methods for Numerical Integration H Faure Theoretical Approaches to Judgement and Choice P Fishburn Combinatorial Aspects of Mathematical Social Science K H Kim Twelve Views of Matroid Theory J P S Kung Enumeration of Graph Coverings Surface Branched Coverings and Related Group Theory J H Kwak An Overview of the Poset of Irreducibles G Markowsky Number Theory and Public Key Cryptography D Pointcheval Some Applications of Graph Theory F Roberts Duality and Its Consequences for Ordered Cohomology of Finite Type Subshifts K H Kim et al Simple Maximum Likelihood Methods for the Optical Mapping Problem V Danc k M S Waterman Readership Researchers graduate students and advanced undergraduates in combinatorics and computational mathematics

Dynamic Food Webs Peter C de Ruiter, Volkmar Wolters, John C Moore, 2005-12-20 Dynamic Food Webs challenges us to rethink what factors may determine ecological and evolutionary pathways of food web development It touches upon the intriguing idea that trophic interactions drive patterns and dynamics at different levels of biological organization dynamics in species composition dynamics in population life history parameters and abundances and dynamics in individual growth size and behavior These dynamics are shown to be strongly interrelated governing food web structure and stability and the role of

populations and communities play in ecosystem functioning Dynamic Food Webs not only offers over 100 illustrations but also contains 8 riveting sections devoted to an understanding of how to manage the effects of environmental change the protection of biological diversity and the sustainable use of natural resources Dynamic Food Webs is a volume in the Theoretical Ecology series Relates dynamics on different levels of biological organization individuals populations and communities Deals with empirical and theoretical approaches Discusses the role of community food webs in ecosystem functioning Proposes methods to assess the effects of environmental change on the structure of biological communities and ecosystem functioning Offers an analyses of the relationship between complexity and stability in food webs **Food Webs**

Gary A. Polis,Kirk O. Winemiller,2013-04-17 Reflecting the recent surge of activity in food web research fueled by new empirical data this authoritative volume successfully spans and integrates the areas of theory basic empirical research applications and resource problems Written by recognized leaders from various branches of ecological research this work provides an in depth treatment of the most recent advances in the field and examines the complexity and variability of food webs through reviews new research and syntheses of the major issues in food web research Food Webs features material on the role of nutrients detritus and microbes in food webs indirect effects in food webs the interaction of productivity and consumption linking cause and effect in food webs temporal and spatial scales of food web dynamics applications of food webs to pest management fisheries and ecosystem stress Three comprehensive chapters synthesize important information on the role of indirect effects productivity and consumer regulation and temporal spatial and life history influences on food webs In addition numerous tables figures and mathematical equations found nowhere else in related literature are presented in this outstanding work Food Webs offers researchers and graduate students in various branches of ecology an extensive examination of the subject Ecologists interested in food webs or community ecology will also find this book an invaluable tool for understanding the current state of knowledge of food web research **Extended Abstracts Spring 2013**

Álvaro Corral,Anna Deluca,Francesc Font-Clos,Pilar Guerrero,Andrei Korobeinikov,Francesco Massucci,2014-10-16 The two parts of this volume feature seventeen and six extended conference abstracts corresponding to selected talks given by participants at Joint CRM Imperial College Workshop in Complex Systems and Emergence Spread and Control of Infectious Diseases respectively both held at the Centre de Recerca Matemàtica in Barcelona in spring 2013 Most of them are short articles giving preliminary presentations of new results not yet published in regular research journals The articles are the result from a direct collaboration among active researchers in the area after working in a dynamic and productive atmosphere Almost everything that is interesting and important for society is complex here examples scattered across science are presented in order to illustrate the cross disciplinary richness of state of the art complex systems research fracture avalanches and rain showers that mimic earthquakes highly organized graphs that account for processes in neural networks metabolic networks food webs or language models for DNA dynamics or statistical methods to test complexity in the form of structure along

many different scales The mathematics is put to work for the modeling of the real system and the models are kept at a minimum level to allow the understanding of the essentials of the real system The book is intended for established researchers as well as for PhD and postdoc students who wish to learn more about the latest advances in these active areas of research Community Ecology Peter J. Morin, 2009-04-13 Community ecology the study of the patterns and processes involving two or more species has developed rapidly in the last two decades driven by new and more sophisticated research techniques advances in mathematical theory and modeling and the increasing pressure on the environment wrought by humans Once a purely descriptive science it is now one of the most forward looking areas of scientific inquiry Morin skillfully guides the reader through the main tenets and central concepts of community ecology competition predation food webs indirect effects habitat selection diversity and succession In an attempt to introduce the reader to the most balanced coverage possible Morin includes examples drawn from both the aquatic and terrestrial realm and from both plant and animal species Balancing theory with experimentation and drawing on exciting new studies to complement the historical foundations of the discipline he also stresses that both the empirical and theoretical approaches are necessary to drive ecology forward into the new millenium The final chapter on applied community ecology ably demonstrates how community ecological processes have a wide environmental relevance Although in its infancy the application of community ecology to emerging problems in human dominated ecosystems could mitigate problems as diverse as management strategies for important diseases transmitted by animals and the restoration and reconstruction of viable communities Required reading for all students and practitioners interested in community phenomena Community Ecology marks an important contribution to the development of this protean discipline The first serious textbook for a decade on one of the keystone subdisciplines of ecology Broad taxonomic and habitat coverage Section on implications of community ecology for environmental issues

Ecological Networks Mercedes Pascual, Jennifer A. Dunne, 2006 Food webs are one of the most useful and challenging objects of study in ecology These networks of predator prey interactions conjured in Darwin s image of a tangled bank provide a paradigmatic example of complex adaptive systems This book is based on a February 2004 Santa Fe Institute workshop Its authors treat the ecology of predator prey interactions food web theory structure and dynamics The book explores the boundaries of what is known of the relationship between structure and dynamics in ecological networks and will define directions for future developments in this field Advances in the Biology and Conservation of Marine Turtles Sara M. Maxwell, Peter H. Dutton, Sabrina Fossette-Halot, Mariana M. P. B. Fuentes, Richard D. Reina, 2019-05-15

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