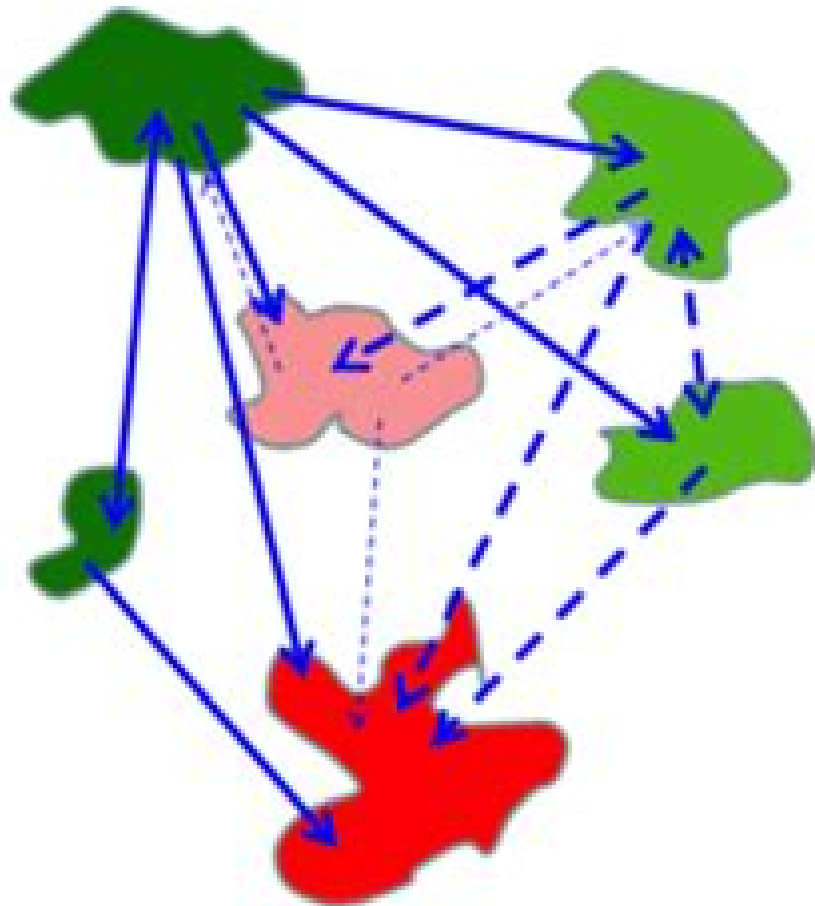


# Metapopulation Dynamics

Some patches may be *usually good* and others may be *usually bad* (and others *sometimes good* and *sometimes bad*)



**source sub-populations**  
 $b \gg d$  produce lots of  
dispersing individuals

**sink sub-populations**  
 $b \ll d$  produce few or  
no dispersing individuals

# Metapopulation Ecology

**Ilkka Hanski**



## **Metapopulation Ecology:**

*Metapopulation Ecology* Ilkka Hanski, 1999-03-18 Written by a world renowned biologist this volume offers a comprehensive synthesis of current research in this rapidly expanding area of population biology It covers both the essential theory and a wide range of empirical studies including the author's groundbreaking work on the Glanville fritillary butterfly It also includes practical applications to conservation biology The book describes theoretical models for metapopulation dynamics in highly fragmented landscapes and emphasizes spatially realistic models It presents the incidence function model and includes several detailed examples of its application Accessible to advanced undergraduate and graduate students

*Metapopulation Ecology* will be a valuable resource for researchers in population biology conservation biology and landscape ecology

**Ecology, Genetics and Evolution of Metapopulations** Ilkka A. Hanski, Oscar E. Gaggiotti, 2004-05-17 Ecology Genetics and Evolution of Metapopulations is a collection of specially commissioned articles that looks at fragmented habitats bringing together recent theoretical advances and empirical studies applying the metapopulation approach Several chapters closely integrate ecology with genetics and evolutionary biology and others illustrate how metapopulation concepts and models can be applied to answer questions about conservation epidemiology and speciation The extensive coverage of theory from highly regarded scientists and the many substantive applications in this one of a kind work make it invaluable to graduate students and researchers in a wide range of disciplines Provides a comprehensive and authoritative account of all aspects of metapopulation biology integrating ecology genetics and evolution Developed by recognized experts including Hanski who won the Balzan Prize for Ecological Sciences Covers novel applications of the metapopulation approach to conservation

**The Ecology of Fungal Entomopathogens** Helen E. Roy, Fernando E. Vega, Mark S. Goettel, Dave Chandler, Judith K. Pell, Eric Wajnberg, 2010-02-04 Understanding of the ecology of fungal entomopathogens has vastly increased since the early 1800s but remains challenging The often complex interactions between pathogen and host are being unravelled through eloquent research and the importance of the often subtle interactions in determining the success or failure of biological control cannot be underplayed The realm of ecology is vast and deciphering insect fungal pathogen interactions within an ecological context will take us on voyages beyond our imagination This book brings together the work of renowned scientists to provide a synthesis of recent research on the ecology of fungal entomopathogens exploring host pathogen dynamics from the context of biological control and beyond Dr Helen Roy leads zoological research in the Biological Records Centre at the NERC Centre for Ecology this continues to be a source of fascination She has been an associate editor of *BioControl* since 2006 Dr Dave Chandler is an insect pathologist at the University of Warwick UK He has studied entomopathogenic fungi for just over 20 years He has particular interests in entomopathogenic fungi as biocontrol agents of horticultural crops fungal physiology and ecology and the pathogens of honeybees Dr Mark Goettel is an insect pathologist at the Lethbridge Research Centre of Agriculture the relationships between guild diversity habitat diversity and

ecosystem function pathogen induced host behavioural change Dr Eric Wajnberg is a population biologist specialising in behavioural ecology statistical modelling and population genetics He is also an expert in biological control with more than 20 years experience of working with insect parasitoids He has been the Editor in Chief of BioControl since 2006 Dr Fernando E Vega is an entomologist with the United States Department of Agriculture Agricultural Research Service in Beltsville Maryland USA He conducts research on biological methods to control the coffee berry borer the most important insect pest of coffee throughout the world He is co editor with Meredith Blackwell of Insect Fungal Associations Ecology and Evolution published by Oxford University Press in 2005 and serves as an Editorial Board Member for Fungal Ecology

**Marine Metapopulations** Jacob P. Kritzer, Peter F. Sale, 2010-07-20 Technological improvements have greatly increased the ability of marine scientists to collect and analyze data over large spatial scales and the resultant insights attainable from interpreting those data vastly increase understanding of population dynamics evolution and biogeography Marine Metapopulations provides a synthesis of existing information and understanding and frames the most important future directions and issues First book to systematically apply metapopulation theory directly to marine systems Contributions from leading international ecologists and fisheries biologists Perspectives on a broad array of marine organisms and ecosystems from coastal estuaries to shallow reefs to deep sea hydrothermal vents Critical science for improved management of marine resources Paves the way for future research on large scale spatial ecology of marine systems

**Metapopulation Ecology, Genetics, and Viability of Polygonella Basiramia, an Endangered Plant of Florida Scrub** Owen D. Boyle, 2004

**Encyclopedia of Ecology** Brian D. Fath, 2014-11-03 The groundbreaking Encyclopedia of Ecology provides an authoritative and comprehensive coverage of the complete field of ecology from general to applied It includes over 500 detailed entries structured to provide the user with complete coverage of the core knowledge accessed as intuitively as possible and heavily cross referenced Written by an international team of leading experts this revolutionary encyclopedia will serve as a one stop shop to concise stand alone articles to be used as a point of entry for undergraduate students or as a tool for active researchers looking for the latest information in the field Entries cover a range of topics including Behavioral Ecology Ecological Processes Ecological Modeling Ecological Engineering Ecological Indicators Ecological Informatics Ecosystems Ecotoxicology Evolutionary Ecology General Ecology Global Ecology Human Ecology System Ecology The first reference work to cover all aspects of ecology from basic to applied Over 500 concise stand alone articles are written by prominent leaders in the field Article text is supported by full color photos drawings tables and other visual material Fully indexed and cross referenced with detailed references for further study Writing level is suited to both the expert and non expert Available electronically on ScienceDirect shortly upon publication

**Introduction to Population Ecology** Larry L. Rockwood, 2015-06-15 Introduction to Population Ecology 2nd Edition is a comprehensive textbook covering all aspects of population ecology It uses a wide variety of field and laboratory examples botanical to zoological from the tropics to the

tundra to illustrate the fundamental laws of population ecology Controversies in population ecology are brought fully up to date in this edition with many brand new and revised examples and data Each chapter provides an overview of how population theory has developed followed by descriptions of laboratory and field studies that have been inspired by the theory Topics explored include single species population growth and self limitation life histories metapopulations and a wide range of interspecific interactions including competition mutualism parasite host predator prey and plant herbivore An additional final chapter new for the second edition considers multi trophic and other complex interactions among species Throughout the book the mathematics involved is explained with a step by step approach and graphs and other visual aids are used to present a clear illustration of how the models work Such features make this an accessible introduction to population ecology essential reading for undergraduate and graduate students taking courses in population ecology applied ecology conservation ecology and conservation biology including those with little mathematical experience

*Quantitative Ecology and Evolutionary Biology* Otso Ovaskainen, Henrik Johan de Knecht, Maria del Mar Delgado, 2016-09-01 This novel interdisciplinary text achieves an integration of empirical data and theory with the aid of mathematical models and statistical methods The emphasis throughout is on spatial ecology and evolution especially on the interplay between environmental heterogeneity and biological processes The book provides a coherent theme by interlinking the modelling approaches used for different subfields of spatial ecology movement ecology population ecology community ecology and genetics and evolutionary ecology each being represented by a separate chapter Each chapter starts by describing the concept of each modelling approach in its biological context goes on to present the relevant mathematical models and statistical methods and ends with a discussion of the benefits and limitations of each approach The concepts and techniques discussed throughout the book are illustrated throughout with the help of empirical examples This is an advanced text suitable for any biologist interested in the integration of empirical data and theory in spatial ecology evolution through the use of quantitative statistical methods and mathematical models The book will also be of relevance and use as a textbook for graduate level courses in spatial ecology ecological modelling theoretical ecology and statistical ecology

*Metapopulation Biology* Ilkka Hanski, Michael E. Gilpin, 1997 This volume presents a review of metapopulation biology It describes key theories of study and applies the best field studies to the conservation of species in fragmented landscapes The work explains and critically assesses the value of the metapopulation concept for field studies and conservation

*Urban Landscape Ecology* Robert A. Francis, James D.A. Millington, Michael A. Chadwick, 2016-04-14 The growth of cities poses ever increasing challenges for the natural environment on which they impact and depend not only within their boundaries but also in surrounding peri urban areas Landscape ecology the study of interactions across space and time between the structure and function of physical biological and cultural components of landscapes has a pivotal role to play in identifying sustainable solutions This book brings together examples of research at the cutting edge of urban landscape ecology across multiple contexts that

investigate the state maintenance and restoration of healthy and functional natural environments across urban and peri urban landscapes An explicit focus is on urban landscapes in contrast to other books which have considered urban ecosystems and ecology without specific focus on spatial connections It integrates research and perspectives from across academia public and private practitioners of urban conservation planning and design It provides a much needed summary of current thinking on how urban landscapes can provide the foundation of sustained economic growth prospering communities and personal well being

*Wildlife and Landscape Ecology* John A. Bissonette, 2012-12-06 Ecologists increasingly recognize the importance of scale in our understanding of nature Landscape ecology in particular emphasizes temporal and spatial scales While research and management of wildlife has traditionally emphasized studies at smaller scales it is now acknowledged that larger landscape level patterns strongly influence demographic processes in wild animal species This book is the first to provide the conceptual basis for learning how larger scale patterns and processes can influence the biology and management of wildlife species It is divided into three sections Underlying Concepts Landscape Metrics Applications and Large Scale Management *Wildlife and Landscape Ecology* will be welcomed by scientists and managers with interest in and responsibility for the health of wild populations and their role in ecosystems

**Theoretical Ecology** Robert May, Angela R. McLean, 2007-02-15 Robert May's seminal book has played a central role in the development of ecological science Originally published in 1976 this influential text has overseen the transition of ecology from an observational and descriptive subject to one with a solid conceptual core Indeed it is a testament to its influence that a great deal of the novel material presented in the earlier editions has now been incorporated into standard undergraduate textbooks It is now a quarter of a century since the publication of the second edition and a thorough revision is timely *Theoretical Ecology* provides a succinct up to date overview of the field set in the context of applications thereby bridging the traditional division of theory and practice It describes the recent advances in our understanding of how interacting populations of plants and animals change over time and space in response to natural or human created disturbance In an integrated way initial chapters give an account of the basic principles governing the structure function and temporal and spatial dynamics of populations and communities of plants and animals Later chapters outline applications of these ideas to practical issues including fisheries infectious diseases tomorrow's food supplies climate change and conservation biology Throughout the book emphasis is placed on questions which as yet remain unanswered The editors have invited the top scientists in the field to collaborate with the next generation of theoretical ecologists The result is an accessible advanced textbook suitable for senior undergraduate and graduate level students as well as researchers in the fields of ecology mathematical biology environment and resources management It will also be of interest to the general reader seeking a better understanding of a range of global environmental problems

Population Dynamics in Ecological Space and Time Olin E. Rhodes, Ronald K. Chesser, Michael H. Smith, 1996-08 As profound threats to ecosystems increase worldwide ecologists must move beyond

studying single communities at a single point in time All of the dynamic interconnected spatial and temporal processes that determine the distribution and abundance of species must be understood in order to develop new conservation and management strategies This volume is the first to integrate mathematical and biological approaches to these crucial topics The editors include not only a wide variety of theoretical approaches but also a broad range of experimental and field studies with chapters written by renowned experts in community ecology ecological modeling population genetics and conservation biology In addition to providing new insights into well known topics such as migration the authors also introduce some less familiar subjects including bacterial population genetics and ecotoxicology For anyone interested in the study management and conservation of populations this book will prove to be a valuable resource

**Restoration Ecology** Jelte van Andel, James Aronson, 2009-03-12 Aimed at Masters and PhD students teachers researchers and natural resource managers this book explores the interface between restoration ecology and ecological restoration Covers both the ecological concepts involved in restoration ecology and their practical applications Written by an excellent group of ecologists from centres across Europe with a strong reputation for restoration ecology Only textbook around aimed specifically at advanced undergraduate courses and postgraduate study programmes

**Metapopulation Dynamics: Empirical and Theoretical Investigations** Michael Gilpin, 2012-12-02 Metapopulation Dynamics Empirical and Theoretical Investigations covers the 1989 proceedings of a metapopulation dynamics workshop held at Lammi Biological Station Helsinki Finland It is divided into 18 chapters that cover various approaches to spatially structured population and community dynamics After briefly discussing the history of metapopulation ideas and the major conceptual links the book covers types of studies that have been conducted on single species and multispecies metapopulations Then it examines the relationships between metapopulation dynamics the equilibrium theory of island biogeography and the dynamics of populations living in patchy environments It further tackles practical issues and the links between metapopulation dynamics and landscape ecology and between metapopulation dynamics and conservation biology Chapters 4 and 5 present structured models describing changes in the number of individuals within patches and an empirical evaluation of local extinction in metapopulation studies The subsequent chapters discuss several aspects of metapopulation including dispersal and connectivity colonization conspecific attraction extinction and isolation and forest fragmentation The latter chapters describe the concept of habitat fragmentation the diversity and competition in metapopulations the community collapse and the effects of metapopulation studies in predator prey systems

**Complex Population Dynamics: Nonlinear Modeling In Ecology, Epidemiology And Genetics** Bernd Blasius, Juergen Kurths, Lewi Stone, 2007-09-24 This collection of review articles is devoted to the modeling of ecological epidemiological and evolutionary systems Theoretical mathematical models are perhaps one of the most powerful approaches available for increasing our understanding of the complex population dynamics in these natural systems Exciting new techniques are currently being developed to meet this challenge such as generalized or structural modeling

adaptive dynamics or multiplicative processes Many of these new techniques stem from the field of nonlinear dynamics and chaos theory where even the simplest mathematical rule can generate a rich variety of dynamical behaviors that bear a strong analogy to biological populations      Multitrophic Level Interactions Teja Tschamntke,Bradford A. Hawkins,2002-03-21

The multitrophic level approach to ecology addresses the complexity of food webs much more realistically than the traditional focus on simple systems and interactions Only in the last few decades have ecologists become interested in the nature of more complex systems including tritrophic interactions between plants herbivores and natural enemies Plants may directly influence the behaviour of their herbivores natural enemies ecological interactions between two species are often indirectly mediated by a third species landscape structure directly affects local tritrophic interactions and below ground food webs are vital to above ground organisms The relative importance of top down effects control by predators and bottom up effects control by resources must also be determined These interactions are explored in this exciting volume by expert researchers from a variety of ecological fields This book provides a much needed synthesis of multitrophic level interactions and serves as a guide for future research for ecologists of all descriptions      Population Dynamics and Laboratory Ecology Robert Desharnais,2005-08-04 Population Dynamics and Laboratory Ecology highlights the contributions laboratory studies are making to our understanding of the dynamics of ecological and evolutionary systems Chapters address the scientific rationale for laboratory ecology its historical role within the broader discipline and recent advances in research The book presents results from a wide range of laboratory systems including insects mites plankton protists and microbes A common theme throughout the book is the value of microcosm studies in advancing our knowledge of ecological and evolutionary principles Each chapter is authored by scientists who are leading experts in their fields The book addresses fundamental questions that are of interest to biologists whether they work in the laboratory or field or whether they are primarily empiricists or theorists Details a scientific rationale for laboratory systems in ecological and evolutionary studies Offers a view on historical role of laboratory studies Includes examples of recent research advances in ecology and evolution using laboratory systems ranging from insects to microbes Integrates mathematics statistics and experimental studies

**Applying Landscape Ecology in Biological Conservation** Kevin Gutzwiller,2011-06-27 Landscape ecology and conservation biology are rapidly developing disciplines and a current synthesis of principles and applications in these two fields is needed under one cover Many managers are not applying principles of landscape ecology in efforts to conserve biota yet the loss of biological diversity could be reduced if broad scale processes and patterns were consistently considered in management and conservation decisions Bringing together insights from leaders in landscape ecology and conservation biology this book explains how our knowledge about landscape ecology can help us understand manage and maintain biodiversity Beyond explaining pertinent concepts of landscape ecology and biological conservation and describing examples of their use in management research and planning this book also distills principles for applying landscape ecology in



conservation identifies gaps in current knowledge and provides research approaches to fill those voids The book is divided into five parts the first part introduces the book and discusses what landscape ecology is and why it is important to biological conservation The second deals with multiple scales connectivity and organism movement The third part discusses landscape change and how this affects biodiversity and the fourth part covers conservation planning The final part presents a synthesis that identifies overarching principles pervasive constraints and realistic prospects for applying landscape ecology in biological conservation Conservationists land use planners and ecologists will find this book to be an essential resource

Foreword by Richard T T Forman      *On the Wings of Checkerspot* Paul R. Ehrlich, Ilkka Hanski, 2004-03-18 Hanski a leading thinker in metapopulation ecology studies checkerspot butterfly populations in Finland Ehrlich one of the leading ecologists and conservation biologist investigates checkerspot butterfly populations in California This book reports on and synthesizes the major long term research of both workers careers on the population biology of checkerspot butterflies

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