

Niche Partitioning Activity



2015 Holiday Lectures on Science
New Species Created

NICHE PARTITIONING: UPDATING AN OLD PARADIGM

OVERVIEW:
An organism's niche is its place and role in an ecosystem, including where it lives and how it obtains the resources it needs to survive. If competing species use the environment differently, or partition resources, they can coexist in the same area; niche partitioning facilitates coexistence of similar species in a habitat. In this activity, students use data presented in the video 2015 Holiday Lecture, "New Species Created" to explore the concept of niche partitioning, learn about mechanisms of niche partitioning, and consider the classic grasshopper species pairs paradigm in light of new dietary data obtained from DNA microarraying.

KEY CONCEPTS AND LEARNING OBJECTIVES:

- Ecological communities are structured, in part, by interactions between different species.
- Niche and resource partitioning is an example of cooperative behavior between populations that contributes to the survival of populations.

Students will be able to:

- Analyze graphs and explain trends in the data.
- Articulate how an organism's realized niche might differ from its fundamental niche.
- Explain how behavior that benefits populations involves timing and coordination of activity.
- Describe different mechanisms of niche partitioning.
- Evaluate a classical understanding of niche partitioning in light of new data.

CURRICULUM CONNECTIONS:

Curriculum	Standards
NGSS (April 2013)	HS-LS2.B, HS-LS2.C 10P: Analyzing and Interpreting Data
AP Biology (2012-2013)	2.E.3 Science Practices: Data Analysis and Evaluation of Evidence
AP Biology (2018)	6.7.3 Species C

KEY TERMS:
Niche, niche partitioning, fundamental niche and realized niche

TIME REQUIREMENTS:
This lesson was designed to be completed in one or two 50 minute periods.

Niche Partitioning Activity: A Deep Dive into Resource Division in Ecology

Introduction:

Have you ever wondered how so many different species can coexist in the same habitat, seemingly without competition driving one to extinction? The answer often lies in a fascinating ecological process called niche partitioning. This blog post will delve into the intricacies of niche partitioning activity, exploring its various forms, the mechanisms driving it, and its crucial role in maintaining biodiversity. We'll unravel the complexities of resource division, examine real-world examples, and discuss the implications for conservation efforts. Get ready to discover the hidden harmony within seemingly competitive ecosystems.

What is Niche Partitioning Activity?

Niche partitioning, at its core, is the process by which competing species use the environment differently, thus reducing direct competition for resources. It's a fundamental mechanism shaping community structure and biodiversity. Instead of battling head-on for the same resources, species specialize, dividing the available resources among themselves. This specialization can manifest in various ways, leading to a fascinating array of adaptations and behaviors.

Types of Niche Partitioning:

Niche partitioning isn't a one-size-fits-all phenomenon. It manifests in several ways:

Spatial Partitioning: This involves species utilizing different areas within a habitat. For example, different bird species might forage at different heights in a forest canopy, avoiding direct competition for the same insect prey.

Temporal Partitioning: This refers to species using the same resources but at different times. Nocturnal and diurnal animals, for example, can coexist by accessing the same food sources at different times of day.

Dietary Partitioning: This occurs when species consume different parts of the same resource or specialize in different prey items. For instance, different finch species on the Galapagos Islands evolved different beak shapes to exploit different seed sizes, minimizing competition.

Resource Partitioning: This is a broader term encompassing all the above, where species divide available resources based on various factors like size, location, and time.

Mechanisms Driving Niche Partitioning Activity:

Several factors contribute to the evolution and maintenance of niche partitioning:

Competition: The primary driver is interspecific competition. The pressure to avoid direct competition leads to the evolution of specializations that allow species to coexist.

Natural Selection: Individuals with traits that allow them to exploit underutilized resources or access resources at different times or places are more likely to survive and reproduce, leading to the evolution of niche partitioning.

Character Displacement: This occurs when competing species diverge in their morphology, physiology, or behavior due to competition. This divergence can reinforce niche partitioning, preventing direct competition.

Real-World Examples of Niche Partitioning:

Numerous examples showcase the power of niche partitioning in maintaining biodiversity:

Darwin's Finches: As mentioned earlier, the diverse beak shapes of Darwin's finches illustrate dietary partitioning, enabling different species to coexist on the Galapagos Islands.

Warblers in North American Forests: Different warbler species partition the forest canopy, foraging at different heights and specializing in different insect types.

Lizards in the Caribbean: Anolis lizards demonstrate spatial partitioning, occupying different microhabitats within their shared environment.

Implications for Conservation:

Understanding niche partitioning is critical for effective conservation efforts. Protecting the habitats and resources that allow for niche partitioning is essential for maintaining biodiversity. Habitat fragmentation and degradation can disrupt this delicate balance, potentially leading to competitive exclusion and species loss.

Conclusion:

Niche partitioning activity is a fundamental ecological process that allows diverse species to coexist by dividing resources and minimizing competition. It's a testament to the intricate interactions within ecosystems and the remarkable adaptations that allow life to thrive. By understanding the mechanisms and implications of niche partitioning, we can better protect and manage biodiversity for future generations.

FAQs:

1. Can niche partitioning completely eliminate competition? While niche partitioning significantly reduces competition, it doesn't eliminate it entirely. Some degree of competition will always exist, especially when resources are scarce.
2. How can we study niche partitioning in the field? Researchers use various techniques, including observational studies, experimental manipulations, and stable isotope analysis, to understand resource use and partitioning among species.
3. What are the consequences of niche overlap? Niche overlap can lead to increased competition, potentially resulting in competitive exclusion, where one species outcompetes another, leading to its local extinction.
4. Can niche partitioning change over time? Yes, niche partitioning is a dynamic process that can change in response to environmental changes, resource availability, and species interactions.
5. How does climate change affect niche partitioning? Climate change can alter resource availability and distribution, potentially disrupting existing niche partitioning patterns and increasing competition among species.

niche partitioning activity: Carrion Ecology and Management Pedro P. Olea, Patricia Mateo-Tomás, José Antonio Sánchez-Zapata, 2019-07-22 Carrion, or dead animal matter, is an inherent component of aquatic and terrestrial ecosystems worldwide, and is exploited by a wide diversity of organisms from different trophic levels, including microbes, arthropods and vertebrates. Further, carrion consumption by scavengers, i.e. scavenging, supports key ecosystem functions and services such as recycling nutrients and energy, disposing of carcasses and regulating disease spread. Yet, unlike dead plant matter, dead animal decomposition has received little attention in the fields of ecology, wildlife conservation and environmental management, and as a result the management of carrion for maintaining biodiversity and functional ecosystems has been limited. This book addresses the main ecological patterns and processes relating to the generation and consumption of carrion both in terrestrial and aquatic ecosystems. It also discusses a number of conservation concerns and associated management issues, particularly regarding the increasing role of human-mediated carrion in ecosystems. Lastly, the book outlines future research lines in carrion ecology and management, and identifies the major challenges for scavengers and scavenging processes in the Anthropocene.

niche partitioning activity: Activity Patterns in Small Mammals S. Halle, N.C. Stenseth, 2012-12-06 Environmental conditions change considerably in the course of 24 h with respect to abiotic factors and intra- and interspecific interactions. These changes result in limited time windows of opportunity for animal activities and, hence, the question of when to do what is subject to fitness maximisation. This volume gives a current overview of theoretical considerations and empirical findings of activity patterns in small mammals, a group in which the energetic and ecological constraints are particularly severe and the diversity of activity patterns is particularly high. Following a comparative ecological approach, for the first time activity timing is consequently treated in terms of behavioural and evolutionary ecology, providing the conceptual framework for chronoecology as a new subdiscipline within behavioural ecology. An extensive Appendix gives an introduction to methods of activity modelling and to tools for statistical pattern analysis.

niche partitioning activity: Camera Traps in Animal Ecology Allan F. O'Connell, James D. Nichols, K. Ullas Karanth, 2010-10-05 Remote photography and infrared sensors are widely used in the sampling of wildlife populations worldwide, especially for cryptic or elusive species. Guiding the practitioner through the entire process of using camera traps, this book is the first to compile state-of-the-art sampling techniques for the purpose of conducting high-quality science or effective management. Chapters on the evaluation of equipment, field sampling designs, and data analysis methods provide a coherent framework for making inferences about the abundance, species richness, and occupancy of sampled animals. The volume introduces new models that will revolutionize use of camera data to estimate population density, such as the newly developed spatial capture-recapture models. It also includes richly detailed case studies of camera trap work on some of the world's most charismatic, elusive, and endangered wildlife species. Indispensable to wildlife conservationists, ecologists, biologists, and conservation agencies around the world, the text provides a thorough review of the subject as well as a forecast for the use of remote photography in natural resource conservation over the next few decades.

niche partitioning activity: Activity Patterns in Small Mammals S. Halle, N.C. Stenseth, 2000-07-06 Environmental conditions change considerably in the course of 24 h with respect to abiotic factors and intra- and interspecific interactions. These changes result in limited time windows of opportunity for animal activities and, hence, the question of when to do what is subject to fitness maximisation. This volume gives a current overview of theoretical considerations and empirical findings of activity patterns in small mammals, a group in which the energetic and ecological constraints are particularly severe and the diversity of activity patterns is particularly high. Following a comparative ecological approach, for the first time activity timing is consequently treated in terms of behavioural and evolutionary ecology, providing the conceptual framework for chronoecology as a new subdiscipline within behavioural ecology. An extensive Appendix gives an introduction to methods of activity modelling and to tools for statistical pattern analysis.

niche partitioning activity: Species Coexistence M. Tokeshi, 2009-06-22 As a novel endeavour in ecological science, this book focuses on a major issue in organismal life on Earth: species coexistence. The book crosses the usual disciplinary boundaries between palaeobiology, ecology and evolutionary biology and provides a timely overview of the patterns and processes of species diversity and coexistence on a range of spatio-temporal scales. In this unique synthesis, the author offers a critical and penetrating examination of the concepts and models of coexistence and community structure, thus making a valuable contribution to the field of community ecology. There is an emphasis on clarity and accessibility without sacrificing scientific rigour, making this book suitable for both advanced students and individual researchers in ecology, palaeobiology and environmental and evolutionary biology. Comprehensive and contemporary synthesis. Pulls together the aggregate influence of evolution and ecology on patterns in communities. Balanced mix of theory and empirical work. Clearly structured chapters with short introduction and summary.

niche partitioning activity: Ecological Niches Jonathan M. Chase, Mathew A. Leibold, 2003-07 Why do species live where they live? What determines the abundance and diversity of species in a given area? What role do species play in the functioning of entire ecosystems? All of these questions share a single core concept—the ecological niche. Although the niche concept has fallen into disfavor among ecologists in recent years, Jonathan M. Chase and Mathew A. Leibold argue that the niche is an ideal tool with which to unify disparate research and theoretical approaches in contemporary ecology. Chase and Leibold define the niche as including both what an organism needs from its environment and how that organism's activities shape its environment. Drawing on the theory of consumer-resource interactions, as well as its graphical analysis, they develop a framework for understanding niches that is flexible enough to include a variety of small- and large-scale processes, from resource competition, predation, and stress to community structure, biodiversity, and ecosystem function. Chase and Leibold's synthetic approach will interest ecologists from a wide range of subdisciplines.

niche partitioning activity: Biology of the Heteromyidae James H. Brown, Hugh H. Genoways, 1993

niche partitioning activity: Small Carnivores Emmanuel Do Linh San, Jun J. Sato, Jerrold L. Belant, Michael J. Somers, 2022-07-13 Small Carnivores: Evolution, Ecology, Behaviour, and Conservation This book focuses on the 232 species of the mammalian Order Carnivora with an average body mass 21.5 kg. Small carnivores inhabit virtually all of the Earth's ecosystems, adopting terrestrial, semi-fossorial, (semi-)arboreal or (semi-)aquatic lifestyles. They occupy multiple trophic levels and therefore play important roles in the regulation of ecosystems, such as natural pest control, seed dispersal and nutrient cycling. In areas where humans have extirpated large carnivores, small carnivores may become the dominant predators, which may increase their abundance (mesopredator release) to the point that they can sometimes destabilize communities, drive local extirpations and reduce overall biodiversity. On the other hand, one third of the world's small carnivores are threatened or near threatened with extinction. This results from regionally burgeoning human populations' industrial and agricultural activities, causing habitat reduction, destruction, fragmentation and pollution. Overexploitation, persecution and the impacts of introduced predators, competitors, and pathogens have also negatively affected many small carnivore species. Although small carnivores have been intensively studied over the past decades, bibliometric studies showed that they have not received the same attention given to large carnivores. Furthermore, there is huge disparity in how research efforts on small carnivores have been distributed, with some species intensively studied and others superficially or not at all. This book aims at filling a gap in the scientific literature by elucidating the important roles of, and documenting the latest knowledge on, the world's small carnivores. This is a book that has been needed for decades. It is the first compendium of recent research on a group of mammals which has received almost no attention before the early 1970s. This book covers a wide range of subdisciplines and techniques and should be considered a solid baseline for further research on this little-known group of highly interesting mammals. As our knowledge regarding how ecosystems function

increases, then the valuable role of small carnivores and the necessity for their conservation should be regarded as of paramount importance. The topics covered in this book should therefore be of great interest not only to academics and wildlife researchers, but also to the interested layman.

niche partitioning activity: *Free-Ranging Dogs and Wildlife Conservation* Matthew E. Gompper, 2014 This edited volume adopts a global perspective to review how dogs interact with wildlife, how humans perceive these interactions, the potential importance of dog-wildlife interactions, and the scope of the problems.

niche partitioning activity: *Volume 1: Seabird Biodiversity and Human Activities* Jaime A. Ramos, Leonel Pereira, 2022-06-30 Seabirds are global travellers connecting oceans and seas all over the world, and facing multiple threats at local and global scales. Seabirds are long-lived top predators, reflecting changes at lower trophic levels, and are good models to assess ecological changes produced by human societies. Thus, world-wide collaborations are needed to understand seabird ecology and to develop effective conservation measures benefitting both humans and seabird populations. This book provides a modern overview on seabird biodiversity studies: it begins by covering the most up-to-date techniques to study seabirds, and then focus on pragmatic issues related with interactions between seabirds and humans, the use of seabirds as ecological indicators and conservation of seabirds. It gives an updated insight on all these topics and highlights gaps that need further development for a comprehensive understanding of the relationships between seabirds and human actions. This book covers the response of the seabird research community to a biodiversity crisis aiming to contribute towards environmental sustainability. It should provide inspiration to a wide range of professionals and students, including the much needed world-wide collaboration between research groups and practitioners. In this way seabird research and conservation provide an inspiration for the solution of global issues such as climate change.

niche partitioning activity: *Phyllostomid Bats* Theodore H Fleming, Liliana M. Dávalos, Marco A. R. Mello, 2020-10-05 With more than two hundred species distributed from California through Texas and across most of mainland Mexico, Central and South America, and islands in the Caribbean Sea, the Phyllostomidae bat family (American leaf-nosed bats) is one of the world's most diverse mammalian families. From an insectivorous ancestor, species living today, over about 30 million years, have evolved a hyper-diverse range of diets, from blood or small vertebrates, to consuming nectar, pollen, and fruit. Phyllostomid plant-visiting species are responsible for pollinating more than five hundred species of neotropical shrubs, trees, vines, and epiphytes—many of which are economically and ecologically important—and they also disperse the seeds of at least another five hundred plant species. Fruit-eating and seed-dispersing members of this family thus play a crucial role in the regeneration of neotropical forests, and the fruit eaters are among the most abundant mammals in these habitats. Coauthored by leading experts in the field and synthesizing the latest advances in molecular biology and ecological methods, *Phyllostomid Bats* is the first overview in more than forty years of the evolution of the many morphological, behavioral, physiological, and ecological adaptations in this family. Featuring abundant illustrations as well as details on the current conservation status of phyllostomid species, it is both a comprehensive reference for these ecologically vital creatures and a fascinating exploration of the evolutionary process of adaptive radiation.

niche partitioning activity: *The R Book* Michael J. Crawley, 2007-06-13 The high-level language of R is recognized as one of the most powerful and flexible statistical software environments, and is rapidly becoming the standard setting for quantitative analysis, statistics and graphics. R provides free access to unrivalled coverage and cutting-edge applications, enabling the user to apply numerous statistical methods ranging from simple regression to time series or multivariate analysis. Building on the success of the author's bestselling *Statistics: An Introduction using R*, *The R Book* is packed with worked examples, providing an all inclusive guide to R, ideal for novice and more accomplished users alike. The book assumes no background in statistics or computing and introduces the advantages of the R environment, detailing its applications in a wide range of disciplines. Provides the first comprehensive reference manual for the R language, including

practical guidance and full coverage of the graphics facilities. Introduces all the statistical models covered by R, beginning with simple classical tests such as chi-square and t-test. Proceeds to examine more advanced methods, from regression and analysis of variance, through to generalized linear models, generalized mixed models, time series, spatial statistics, multivariate statistics and much more. The R Book is aimed at undergraduates, postgraduates and professionals in science, engineering and medicine. It is also ideal for students and professionals in statistics, economics, geography and the social sciences.

niche partitioning activity: *Resource partitioning among woodpeckers in northeastern Oregon* Evelyn L. Bull, Steven R. Peterson, Jack Ward Thomas, 1986

niche partitioning activity: The Atlantic Meridional Transect Programme (1995-2023) Andrew Paul Rees, Vanda Brotas, Timothy James Smyth, 2024-01-26 Since 1995 the Atlantic Meridional Transect program (AMT - www.amt-uk.org) has undertaken extensive measurements of oceanographic and atmospheric variables on a passage between the UK and destinations in the South Atlantic (Falkland Islands, Chile, Uruguay and South Africa). This program, which spans up to 100° of latitude, crosses a range of ecosystems from sub-polar to tropical, from eutrophic shelf seas and upwelling systems, to oligotrophic mid-ocean gyres. The AMT was originally conceived to utilise the bi-annual passage of the RRS James Clark Ross (JCR) between its home-base in the UK and its field-base in the Falklands. In 2008, cruises switched from bi-annual to annual, taking place during the boreal autumn (austral spring). Throughout the lifetime of the AMT program, the objectives have evolved to address topical research questions whilst enabling the maintenance of a continuous set of observations relevant to global environmental issues.

niche partitioning activity: *Circular Statistics in R* Arthur Pewsey, Markus Neuhauser, Graeme D Ruxton, 2013-09-26 Circular Statistics in R provides the most comprehensive guide to the analysis of circular data in over a decade. Circular data arise in many scientific contexts whether it be angular directions such as: observed compass directions of departure of radio-collared migratory birds from a release point; bond angles measured in different molecules; wind directions at different times of year at a wind farm; direction of stress-fractures in concrete bridge supports; longitudes of earthquake epicentres or seasonal and daily activity patterns, for example: data on the times of day at which animals are caught in a camera trap, or in 911 calls in New York, or in internet traffic; variation throughout the year in measles incidence, global energy requirements, TV viewing figures or injuries to athletes. The natural way of representing such data graphically is as points located around the circumference of a circle, hence their name. Importantly, circular variables are periodic in nature and the origin, or zero point, such as the beginning of a new year, is defined arbitrarily rather than necessarily emerging naturally from the system. This book will be of value both to those new to circular data analysis as well as those more familiar with the field. For beginners, the authors start by considering the fundamental graphical and numerical summaries used to represent circular data before introducing distributions that might be used to model them. They go on to discuss basic forms of inference such as point and interval estimation, as well as formal significance tests for hypotheses that will often be of scientific interest. When discussing model fitting, the authors advocate reduced reliance on the classical von Mises distribution; showcasing distributions that are capable of modelling features such as asymmetry and varying levels of kurtosis that are often exhibited by circular data. The use of likelihood-based and computer-intensive approaches to inference and modelling are stressed throughout the book. The R programming language is used to implement the methodology, particularly its circular package. Also provided are over 150 new functions for techniques not already covered within R. This concise but authoritative guide is accessible to the diverse range of scientists who have circular data to analyse and want to do so as easily and as effectively as possible.

niche partitioning activity: The Digestive System in Mammals D. J. Chivers, P. Langer, 1994-07-21 Biochemical, physiological and morphological aspects of mammalian digestive systems.

niche partitioning activity: The Neurobiology of Circadian Timing A. Kalsbeek, 2012-09-21 Leading authors review the state-of-the-art in their field of investigation, and provide their views and

perspectives for future research Chapters are extensively referenced to provide readers with a comprehensive list of resources on the topics covered All chapters include comprehensive background information and are written in a clear form that is also accessible to the non-specialist Leading authors review the state-of-the-art in their field of investigation, and provide their views and perspectives for future research Chapters are extensively referenced to provide readers with a comprehensive list of resources on the topics covered All chapters include comprehensive background information and are written in a clear form that is also accessible to the non-specialist

niche partitioning activity: *NULL MODELS IN ECOLOGY* GOTELLI NICHOLAS J, Gary R. Graves, 1996-04-17 The first detailed overview of the subject, Null Models in Ecology explains the conceptual and mathematical bases of various null models, addressing as well the significant areas of research to which null model analysis has been applied -- niche overlap, community assembly, the species area relationship, and food web structure.

niche partitioning activity: Oaks Physiological Ecology. Exploring the Functional Diversity of Genus Quercus L. Eustaquio Gil-Pelegrín, José Javier Peguero-Pina, Domingo Sancho-Knapik, 2017-12-12 With more than 500 species distributed all around the Northern Hemisphere, the genus Quercus L. is a dominant element of a wide variety of habitats including temperate, tropical, subtropical and mediterranean forests and woodlands. As the fossil record reflects, oaks were usual from the Oligocene onwards, showing the high ability of the genus to colonize new and different habitats. Such diversity and ecological amplitude makes genus Quercus an excellent framework for comparative ecophysiological studies, allowing the analysis of many mechanisms that are found in different oaks at different level (leaf or stem). The combination of several morphological and physiological attributes defines the existence of different functional types within the genus, which are characteristic of specific phytoclimates. From a landscape perspective, oak forests and woodlands are threatened by many factors that can compromise their future: a limited regeneration, massive decline processes, mostly triggered by adverse climatic events or the competence with other broad-leaved trees and conifer species. The knowledge of all these facts can allow for a better management of the oak forests in the future.

niche partitioning activity: American and Australasian Marsupials Nilton C. Cáceres, Christopher R. Dickman, 2023-06-30 This book focuses on the evolution, biogeography, systematics, taxonomy, and ecology of New World and Australasian marsupials, greatly expanding the current knowledge base. There are roughly 140 species of New World marsupials, of which the opossum is the best known. Thanks to recent research, there is now an increasing amount of understanding about their evolution, biogeography, systematics, ecology, and conservation in the Americas, especially in South America. There are also some 270 marsupial species in the Australasian region, many of which have been subject to research only in recent years. Based on this information and the authors' extensive research, this book provides comprehensive insights into the world's marsupials. It will appeal to academics and specialized researchers, students of zoology, paleontology, evolutionary biology, ecology, physiology and conservation as well as interested non-experts.

niche partitioning activity: *Null Models in Ecology* Nicholas J. Gotelli, 1996

niche partitioning activity: Animal Communication and Noise Henrik Brumm, 2013-12-16 The study of animal communication has led to significant progress in our general understanding of motor and sensory systems, evolution, and speciation. However, one often neglected aspect is that signal exchange in every modality is constrained by noise, be it in the transmission channel or in the nervous system. This book analyses whether and how animals can cope with such constraints, and explores the implications that noise has for our understanding of animal communication. It is written by leading biologists working on different taxa including insects, fish, amphibians, lizards, birds, and mammals. In addition to this broad taxonomic approach, the chapters also cover a wide array of research disciplines: from the mechanisms of signal production and perception, to the behavioural ecology of signalling, the evolution of animal communication, and conservation issues. This volume promotes the integration of the knowledge gained by the diverse approaches to the study of animal communication and, at the same time, highlights particularly interesting fields of current and future

research.

niche partitioning activity: Cephalopod Behaviour Roger T. Hanlon, John B. Messenger, 2018-03-22 A fully updated overview of the causation, function, development and evolution of cephalopod behaviour, richly illustrated in full colour.

niche partitioning activity: *Managing Natural Resources for Development in Africa* Washington Odongo Ochola, P. C. Sanginga, Isaac Bekalo, 2010 The complex and dynamic interlinks between natural resource management (NRM) and development have long been recognized by national and international research and development organizations and have generated voluminous literature. However, much of what is available in the form of university course books, practical learning manuals and reference materials in NRM is based on experiences from outside Africa. *Managing Natural Resources for Development in Africa: A Resource Book* provides an understanding of the various levels at which NRM issues occur and are being addressed scientifically, economically, socially and politically. The book's nine chapters present state-of-the-art perspectives within a holistic African context. The book systematically navigates the tricky landscape of integrated NRM, with special reference to Eastern and Southern Africa, against the backdrop of prevailing local, national, regional and global social, economic and environmental challenges. The authors' wide experience, the rich references made to emerging challenges and opportunities, and the presentation of different tools, principles, approaches, case studies and processes make the book a rich and valuable one-stop resource for postgraduate students, researchers, policymakers and NRM practitioners. The book is designed to help the reader grasp in-depth NRM perspectives and presents innovative guidance for research design and problem solving, including review questions, learning activities and recommended further reading. The book was developed through a writeshop process by a multi-disciplinary team of lecturers from the University of Nairobi, Egerton University, Kenyatta University, the University of Zimbabwe, the University of Malawi, Makerere University and the University of Dar es Salam. In addition, selected NRM experts from regional and international research organizations including the World Agroforestry Center (ICRAF), the Africa Forest Forum, RUFORUM, IIRR and the International Development Research Centre (IDRC) participated in the writeshop and contributed material to the book.

niche partitioning activity: *Evolutionary Ecology*, 2011 Finally, an eBook version of this now classic textbook has become available. Largely based on the 6th edition, published in 2000, this version is competitively priced. Written by well-known ecologist Eric R. Pianka, a student of the late Robert H. MacArthur, this timeless treatment of evolutionary ecology, first published in 1974, will endure for many decades to come. Basic principles of ecology are framed in an evolutionary perspective.

niche partitioning activity: *Antelope Conservation* Jakob Bro-Jorgensen, David P. Mallon, 2016-06-08 Antelopes constitute a fundamental part of ecosystems throughout Africa and Asia where they act as habitat architects, dispersers of seeds, and prey for large carnivores. The fascination they hold in the human mind is evident from prehistoric rock paintings and ancient Egyptian art to today's wildlife documentaries and popularity in zoos. In recent years, however, the spectacular herds of the past have been decimated or extirpated over wide areas in the wilds, and urgent conservation action is needed to preserve this world heritage for generations to come. As the first book dedicated to antelope conservation, this volume sets out to diagnose the causes of the drastic declines in antelope biodiversity and on this basis identify the most effective points of action. In doing so, the book covers central issues in the current conservation debate, especially related to the management of overexploitation, habitat fragmentation, disease transmission, climate change, populations genetics, and reintroductions. The contributions are authored by world-leading experts in the field, and the book is a useful resource to conservation scientists and practitioners, researchers, and students in related disciplines as well as interested lay people.

niche partitioning activity: *Bat Ecology* Thomas H. Kunz, M. Brock Fenton, 2005 In recent years researchers have discovered that bats play key roles in many ecosystems as insect predators, seed dispersers, and pollinators. Bats also display astonishing ecological and evolutionary diversity

and serve as important models for studies of a wide variety of topics, including food webs, biogeography, and emerging diseases. In *Bat Ecology*, world-renowned bat scholars present an up-to-date, comprehensive, and authoritative review of this ongoing research. The first part of the book covers the life history and behavioral ecology of bats, from migration to sperm competition and natural selection. The next section focuses on functional ecology, including ecomorphology, feeding, and physiology. In the third section, contributors explore macroecological issues such as the evolution of ecological diversity, range size, and infectious diseases (including rabies) in bats. A final chapter discusses conservation challenges facing these fascinating flying mammals. *Bat Ecology* is the most comprehensive state-of-the-field collection for scientists and researchers. Contributors: John D. Altringham, Robert M. R. Barclay, Tenley M. Conway, Elizabeth R. Dumont, Peggy Eby, Abigail C. Entwistle, Theodore H. Fleming, Patricia W. Freeman, Lawrence D. Harder, Gareth Jones, Linda F. Lumsden, Gary F. McCracken, Sharon L. Messenger, Bruce D. Patterson, Paul A. Racey, Jens Rydell, Charles E. Rupprecht, Nancy B. Simmons, Jean S. Smith, John R. Speakman, Richard D. Stevens, Elizabeth F. Stockwell, Sharon M. Swartz, Donald W. Thomas, Otto von Helversen, Gerald S. Wilkinson, Michael R. Willig, York Winter

niche partitioning activity: Game Physics Engine Development Ian Millington, 2010-07-23 Physics is really important to game programmers who need to know how to add physical realism to their games. They need to take into account the laws of physics when creating a simulation or game engine, particularly in 3D computer graphics, for the purpose of making the effects appear more real to the observer or player. The game engine ne

niche partitioning activity: Behaviour and Ecology of Spiders Carmen Viera, Marcelo O. Gonzaga, 2017-11-02 Within the last few decades, arachnology in the Neotropical region has experienced a great development filling the knowledge gap in one of the most diverse regions of the world. Nevertheless, large geographical areas remain poorly sampled, especially within the Amazon, and new genera and species have been continuously discovered, even in urban areas. In congruence with the recent improvements in research, several aspects of the ecology, behaviour and natural history of spiders, such as interactions with other predators and parasitoids, social interactions, dispersal patterns, habitat requirements, mating behaviors, among others, are being carefully investigated. These recent contributions incorporate substantial information on the preexisting knowledge on these subjects every year. Our main objective with this book is to present a summary on these new researches and on the currently knowledge on the main subjects involved in the general theme, emphasizing the contribution of the rich fauna of the Neotropical region to the research of behaviour and ecology of the spiders.

niche partitioning activity: Science, 2011

niche partitioning activity: Teaching Engineering, Second Edition Phillip C. Wankat, Frank S. Oreovicz, 2015-01-15 The majority of professors have never had a formal course in education, and the most common method for learning how to teach is on-the-job training. This represents a challenge for disciplines with ever more complex subject matter, and a lost opportunity when new active learning approaches to education are yielding dramatic improvements in student learning and retention. This book aims to cover all aspects of teaching engineering and other technical subjects. It presents both practical matters and educational theories in a format useful for both new and experienced teachers. It is organized to start with specific, practical teaching applications and then leads to psychological and educational theories. The practical orientation section explains how to develop objectives and then use them to enhance student learning, and the theoretical orientation section discusses the theoretical basis for learning/teaching and its impact on students. Written mainly for PhD students and professors in all areas of engineering, the book may be used as a text for graduate-level classes and professional workshops or by professionals who wish to read it on their own. Although the focus is engineering education, most of this book will be useful to teachers in other disciplines. Teaching is a complex human activity, so it is impossible to develop a formula that guarantees it will be excellent. However, the methods in this book will help all professors become good teachers while spending less time preparing for the classroom. This is a

new edition of the well-received volume published by McGraw-Hill in 1993. It includes an entirely revised section on the Accreditation Board for Engineering and Technology (ABET) and new sections on the characteristics of great teachers, different active learning methods, the application of technology in the classroom (from clickers to intelligent tutorial systems), and how people learn.

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