Bumblebee Economics

Human genetics has changed little over the past 20,000 years, but human economic behaviour has changed a lot. These changes are probably due to human cultural evolution. But studies of human hunter-gatherers, and of a variety of other animal species, show that their micro-economic behaviour is much the same. Whereas the standard economic analysis focuses on money, the biological approach brings time and energy into the analysis. Moreover, humans and other animals tested under laboratory conditions do not exhibit the complexity of the results of field studies. In other words, results obtained in the real world are not the same as those obtained in the laboratory. The Biological Bases of Economic Behaviour invites readers to approach micro-economics from a biological viewpoint, in a clear and introductory manner.
In this revised second edition, Hans Jansson develops and applies an international business strategy framework to contemporary complex global markets. This cutting-edge textbook explores the major challenges associated with doing business in complex and turbulent emerging markets and how MNCs in mature markets execute strategies to meet these challenges.
Omnipresent in virtually all terrestrial ecosystems and of undisputed ecological and economical importance, the study of social insects is an area that continues to attract a vast number of researchers. As a consequence, a huge amount of information about their biology and ecology has accumulated. Distilling this scattered information into a highly focused reference, Food Exploitation by Social Insects: Ecological, Behavioral, and Theoretical Approaches unites traditional behavioral and ecological studies with theoretical and mathematical models. The book covers foraging ecology and behavior of social insects, their communication mechanisms, and theoretical models of important aspects. It examines two different but inseparably interlaced levels of social insect foraging: the macroscopic or colony level and the microscopic or individual level. The chapters include discussions of foraging decisions, patterns and strategies of social insect colonies, and information use and information transfer between workers. The book provides examples of how this biological knowledge can be used as a basis for the construction of mathematical and neural network models that in return may increase understanding of social insect foraging. The contributors provide a fresh look on their topics, covering a wide range of subjects and recent scientific developments that are unprecedented in breadth and depth. The coverage of ants, bees, and wasps in one resource is a unique feature of the book. This taxonomic content combined with the variety of research approaches, allows the book to provide deeper insight into the subject.
The bumblebee spends its days gathering the resources needed by the hive -- honey for energy and pollen for protein. The author examines the intricate processes that make up this behavior, including discussions of thermoregulation and its behavioral application, and the way bumblebees choose flowers to harvest.
One of the world’s great naturalists and nature writers, Bernd Heinrich shows us how the sensual beauty of birds can open our eyes to a hidden evolutionary process.
This engaging chronicle of how the author and the great horned owl "Bubo" came to know one another over three summers spent in the Maine woods--and of how Bubo eventually grew into an independent hunter--is now available in an edition that has been abridged and revised so as to be more accessible to the general reader.
The essential guide for identifying the bumble bees of North America More than ever before, there is widespread interest in studying bumble bees and the critical role they play in our ecosystems. Bumble Bees of North America is the first comprehensive guide to North American bumble bees to be published in more than a century. Richly illustrated with color photographs, diagrams, range maps, and graphs of seasonal activity patterns, this guide allows amateur and professional naturalists to identify all 46 bumble bee species found north of Mexico and to understand their ecology and changing geographic distributions. The book draws on the latest molecular research, shows the enormous color variation within species, and guides readers through the many confusing convergences between species. It draws on a large repository of data from museum collections and presents state-of-the-art results on evolutionary relationships, distributions, and ecological roles. Illustrated keys allow identification of color morphs and social castes. A landmark publication, Bumble Bees of North America sets the standard for guides and the study of these important insects. The best guide yet to the 46 recognized bumble bee species in North America north of Mexico Up-to-date taxonomy includes previously unpublished results Detailed distribution maps Extensive keys identify the many color patterns of species
This collection of more than 30 peer-reviewed papers focuses on the diversity and conservation of arthropods, whose species inhabit virtually every recess and plane – and feature in virtually every food web – on the planet. Highlighting issues ranging from large-scale disturbance to local management, from spatial heterogeneity to temporal patterns, these papers reflect exciting new research – and take the reader to some of the most biodiverse corners of the planet.
How happy it is to recall Imre Lakatos. Now, fifteen years after his death, his intelligence, wit, generosity are vivid. In the Preface to the book of Essays in Memory of Imre Lakatos (Boston Studies, 39, 1976), the editors wrote: ... Lakatos was a man in search of rationality in all of its forms. He thought he had found it in the historical development of scientific knowledge, yet he also saw rationality endangered everywhere. To honor Lakatos is to honor his sharp and aggressive criticism as well as his humane warmth and his quick wit. He was a person to love and to struggle with. The book before us carries old and new friends of that Lakatosian spirit further into the issues which he wanted to investigate. That the new friends include a dozen scientific, historical and philosophical scholars from Greece would have pleased Lakatos very much, and with an essay from China, he would have smiled all the more. But the key lies in the quality of these papers, and in the imaginative organization of the conference at Thessaloniki in summer 1986 which worked so well.
Heinrich, author of Bumblebee Ecology (Harvard, 1979) presents an overview of what is now known about thermoregulation in all of the major insect groups, illustrated by his own detailed sketches. By describing the environmental opportunities and challenges faced by moths and butterflies, grasshoppers and locusts, dungball rollers and other beetles, a wide range of bees, and other insects, Heinrich explains their remarkable variety of physiological and behavioral adaptations to what, for them, is a world of violent extremes of temperature. A must for biologists, but also accessible to informed readers interested in general science. Annotation copyright by Book News, Inc., Portland, OR
Many bumblebee species have experienced severe population declines in response to the use of intensive land management practices

throughout the UK and western Europe during the latter half of the twentieth century. The loss of wildflower-rich unimproved lowland grasslands has been particularly detrimental and, as a result, in the UK two bumblebee species are now extinct, seven are listed on the UK Biodiversity Action Plan (BAP), and only six extant species remain common and ubiquitous. Populations of the rarer species are often fragmented and restricted to isolated areas, such as the crofting regions of northwest Scotland, in which the use of intensive farming practices has remained relatively limited. Consequently, in this study I primarily focus on the conservation of B. distinguendus and B. muscorum, two of the UK?s rarest species which have strongholds in the Outer Hebrides. In this region crofting is the dominant form of agriculture, and is traditionally typified by small-scale mixed livestock production accompanied by rotational cropping activities. With the use of very few artificial inputs, traditional crofting activities are environmentally sensitive and promote the diverse wildflower assemblages characteristic of the machair which provide suitable forage for bumblebees. However, the changing demographic structure of the islands, in conjunction with a range of other socio-economic factors, is resulting in the adoption of more intensive land management practices by crofters and changing the nature of the crofted landscape. These changes are likely to have a detrimental impact on the rare bumblebee populations that rely on crofting to provide suitable foraging habitats. Neglecting to examine the socio-economic issues behind the decline in crofting activities, and failure to develop a means of making the system economically viable and sustainable, is likely to reduce the effectiveness of any bumblebee conservation measures introduced in the region. Through my research I address this socio-ecological problem by taking an interdisciplinary approach, and combine the two disciplines of ecology and economics to find a way to ensure crofting is sustainable whilst promoting sympathetic land management practices to aid bumblebee conservation. The results of my research demonstrate that current croft land management practices do not support high abundances of foraging bumblebees in the Outer Hebrides, and that sheep grazing during the summer has a particularly negative impact on bumblebee abundance on croft land. My research also highlights the importance of non-agricultural habitats for foraging long-tongued bumblebee species in agricultural landscapes. Grazing management can promote bumblebee abundance, with cattle grazing providing a valuable foraging habitat for short-tongued bumblebees in southwest England. Therefore, to conserve bumblebees in agricultural landscapes the type of farming system needs to be taken into account in developing grazing management regimes, whilst non-agricultural habitats need to be integrated into local land management plans to ensure the provision of forage for bumblebees throughout the flight period. The outputs of the ecological-economic models show that compensation payments are not always required to encourage beneficial land management practices to enhance bumblebee populations in crofted areas. However, crofting is a marginal farming system that is heavily influenced by socio-economic factors, and this should be taken into consideration in the development of future agricultural policy for the region.

How ethnic kin-based trading networks can rely on trust when a well-developed framework of contract laws is missing

A collection of quotations for use in speeches, reports, articles, or simply to spice conversation over lunch

This is a book about proximate mechanisms. Although some theoreti cal structure is used to introduce the subject, the intent is to offer a comprehensive view of the mechanistic side of searching (or foraging) so as to balance the current emphasis of books on mathematical and functional models. It seems to me that the pendulum needs to swing back to studies of how animals behave, and that maybe in so doing models will become valuable again in driving experimentation. I have probably included too many examples in this book, and some are even presented in great detail. Hopefully, they provide a complete picture of the kind of animals used, the experimental setup, the kinds of data yielded, and how the data were analysed. I have done this in response to frustrating experiences of reading chapters in behavioural ecobgy books that provide insufficient information with which to evaluate an author's conclusion.

Many people will remember that Rachel Carson predicted a silent spring, but she also warned of a fruitless fall, a time with no pollination and no fruit. The fruitless fall nearly became a reality when, in 2007, beekeepers watched thirty billion bees mysteriously die. And they continue to disappear. The remaining pollinators, essential to the cultivation of a third of American crops, are now trucked across the country and flown around the world, pushing them ever closer to collapse. Fruitless Fall does more than just highlight this growing agricultural catastrophe. It emphasizes the miracle of flowering plants and their pollination partners, and urges readers not to take the abundance of our Earth for granted. A new afterword by the author tracks the most recent developments in this ongoing crisis.

In 1981 David Quammen began what might be every freelance writer's dream: a monthly column for Outside magazine in which he was given free rein to write about anything that interested him in the natural world. His column was called "Natural Acts," and for the next fifteen years he delighted Outside's readers with his fascinating ruminations on the world around us. The Boilerplate Rhino brings together twenty-six of Quammen's most thoughtful and engaging essays from that column, none previously printed in any of his earlier books. In lucid, penetrating, and often quirkily idiosyncratic prose, David Quammen takes his readers with him as he explores the world. His travels lead him to rattlesnake handlers in Texas; a lizard specialist in Baja; the dinosaur museum in Jordan, Montana; and halfway across Indonesia in search of the perfect Durian fruit. He ponders the history of nutmeg in the southern Moluccas, meditates on bioluminescent beetles while soaking in the waters of the Amazon, and delivers "The Dope on Eggs" from a chicken ranch near his hometown in Montana. Quammen's travels are always jumping-off points to explore the rich and sometimes horrifying tension between humankind and the natural world, in all its complexity and ambivalence. The result is another irrepressible assortment of ideas to explore, conundrums to contemplate, and wondrous creatures to behold.

Bumblebee EconomicsHarvard University Press

This book shows, from start to finish, how microeconomics can and should be used in the analysis of public policy problems. It is an exciting new way to learn microeconomics, motivated by its application to important, real-world issues. Lee Friedman's modern replacement for his influential 1984 work not only brings the issues addressed into the present but develops all intermediate microeconomic theory to make this book accessible to a much wider audience. Friedman offers the microeconomic tools necessary to understand policy analysis of a wide range of matters of public concern--including the recent California electricity crisis, welfare reform, public school finance, global warming, health insurance, day care, tax policies, college loans, and mass transit pricing. These issues are scrutinized through microeconomic models that identify policy strengths, weaknesses, and ideas for improvements. Each chapter begins with explanations of several fundamental microeconomic principles and then develops models that use and probe them in analyzing specific public policies. The book has two primary and complementary goals. One is to develop skills of economic policy analysis: to design, predict the effects of, and evaluate public policies. The other is to develop a deep understanding of microeconomics as an analytic tool for application--its strengths and extensions into such advanced techniques as general equilibrium models and pricing methods for natural monopolies and its weaknesses, such as behavioral inconsistencies with utility-maximization models and its limits in comparing institutional alternatives. The result is an invaluable professional and academic reference, one whose clear explanation of principles and analytic techniques, and wealth of constructive applications, will ensure it a prominent place not only on the bookshelves but also on the desks of students and professionals alike.

“One of the most interesting discoveries I’ve seen in animal sociobiology in years.” —E.O. Wilson Why do ravens, generally understood to be solitary creatures, share food between each other during winter? On the surface, there didn’t appear to be any biological or evolutionary imperative behind the raven’s willingness to share. The more Bernd Heinrich observed their habits, the more odd the bird’s behavior became. What started as mere curiosity turned into an impassioned research project, and Ravens In Winter, the first research of its kind, explores the fascinating biological puzzle of the raven’s rather unconventional social habits. “Bernd Heinrich is no ordinary biologist. He’s the sort who combines formidable scientific rigor with a sense of irony and an unslaked, boyish enthusiasm for his subject, and who even at his current professorial age seems to do a lot of tree climbing in the line of research.” —David Quammen, The New York Times

Interest in insect behavior is growing rapidly, as reflected both in courses devoted fully to the topic and in its inclusion in general biology, ecology, invertebrate zoology, and animal behavior--as well as general entomology--curricula. Instructors and students find that insects are in many ways uniquely suitable animals for behavioral study: the

This book has a wider approach not strictly focused on crop production compared to other books that are strictly oriented towards bees, but has a generalist approach to pollination biology. It also highlights relationships between introduced and wild pollinators and consequences of such introductions on communities of wild pollinating insects. The chapters on biochemical basis of plant-pollination interaction, pollination energetics, climate change and pollinators and pollinators as bioindicators of ecosystem functioning provide a base for future insights into pollination biology. The role of honeybees and wild bees on crop pollination, value of bee pollination, planned honeybee pollination, non-bee pollinators, safety of pollinators, pollination in cages, pollination for hybrid seed production, the problem of diseases, genetically modified plants and bees, the role of bees in improving food security and livelihoods, capacity building and awareness for pollinators are also discussed.

Why would a grown man chase hornets with a thermometer, paint whirligig beetles bright red, or track elephants through the night to fill trash bags with their prodigious droppings? Some might say--to advance science. Heinrich says--because it's fun. Bernd Heinrich, author of the much acclaimed Bumblebee Economics, has been playing in the wilds of one continent or another all his life. In the process, he has become one of the world's foremost physiological ecologists. With In a Patch of Fireweed, he will undoubtedly become one of our foremost writers of popular science. Part autobiography, part case study in the ways of field biology, In a Patch of Fireweed is an endlessly fascinating account of a scientist's life and work. For the author, it is an opportunity to report not just his results but the curiosity, humor, error, passion, and competitiveness that feed into the process of discovery. For the reader, it is simply a delight, a rare chance to share the perceptions of an unusual mind fully in tune with the inner workings of nature. Before his years of research in the woodlands and deserts of North America, the New Guinea highlands, and the plains of East Africa, Heinrich had a sense of the wild that few people in this century can know. He tells the whole story, from his refugee childhood hidden in a German forest, eating mice fried in boar fat, to his ongoing research in the woods surrounding his cabin in Maine.

Calling for a fundamental rethinking of economics, this book aregues that a market economy is best understood as a living, evolving ecosystem.

Aimed primarily at advanced graduate students and professional biologists, this book explores the degree to which animal*b1plant interactions are determined by plant and animal variability. Many of the patterns seen in natural communities appear to result from cascading effects up as well as down the trophic system. Variability among primary producers can influence animal and plant population quality and dynamics, community structure, and the evolution of animal*b1plant interations.

In recent years, evolutionary theorists have come to recognize that the reductionist, individualist, gene-centered approach to evolution cannot sufficiently account for the emergence of complex biological systems over time. Peter A. Corning has been at the forefront of a new generation of complexity theorists who have been working to reshape the foundations of evolutionary theory. Well known for his Synergism Hypothesis—a theory of complexity in evolution that assigns a key causal role to various forms of functional synergy—Corning puts this theory into a much broader framework in Holistic Darwinism, addressing many of the issues and concepts associated with the evolution of complex systems. Corning's paradigm embraces and integrates many related theoretical developments of recent years, from multilevel selection theory to niche construction theory, gene-culture coevolution theory, and theories of self-organization. Offering new approaches to thermodynamics, information theory, and economic analysis, Corning suggests how all of these domains can be brought firmly within what he characterizes as a post–neo-Darwinian evolutionary synthesis.

The book contains thirty original articles dealing with important aspects of theoretical as well as applied economic theory. While the principal focus is on: the computational and algorithmic nature of economic dynamics; individual as well as collective decision process and rational behavior, some contributions emphasize also the importance of classical recursion theory and constructive mathematics for dynamical systems, business cycles theories, growth theories, and others are in the area of history of thought, methodology and behavioural economics. The contributors range from Nobel Laureates to the promising new generation of innovative thinkers. This volume is also a Festschrift in honour of Professor Kumaraswamy Vela Velupillai, the founder of Computable Economics, a growing field of research where important results stemming from classical recursion theory and constructive mathematics are applied to economic theory. The aim and hope is to provide new tools for economic modelling. This book will be of particular appeal to postgraduate students and scholars in one or more of the following fields: computable economics, business cycles, macroeconomics, growth theories, methodology, behavioural economics, financial economics, experimental and agent based economics. It might be also of importance to those interested on the general theme of algorithmic foundations for social sciences.

"From one man's persistent and elegant probing of the temperature biology of bees, we have been led to a deeper understanding of the whole biology of many insect taxa, and of their interactions with ecological and environmental stresses: all who work at the interfaces of physiology, ecology and behaviour have cause to be grateful, and all should certainly read this book." (Trends in Ecology & Evolution) "An outstanding source of information, and can be read with profit and satisfaction by the professional biologist and interested amateur alike." (Nature)

Bumblebees are undergoing a widespread decline, but this has not yet caught the attention of the general public to the same extent as, for example, the plight of rare butterflies or birds.

The aim of Advances in the Study of Behavior is to serve scientists engaged in the study of animal behavior, including psychologists, neuroscientists, biologists, ethologists, pharmacologists, endocrinologists, ecologists, and geneticists. Articles in the series present critical reviews of significant research programs with theoretical syntheses, reformulation of persistent problems, and/or highlighting new and exciting research concepts. Advances in the Study of Behavior is now available online at ScienceDirect — full-text online of volumes 30 onwards. Elsevier book series on ScienceDirect gives multiple users throughout an institution simultaneous online access to an important compliment to primary research. Digital delivery ensures users reliable, 24-hour access to the latest peer-reviewed content. The Elsevier book series are compiled and written by the most highly regarded authors in their fields and are selected from across the globe using Elsevier's extensive researcher network. For more information about the Elsevier Book Series on ScienceDirect Program, please visit: http://www.info.sciencedirect.com/bookseries/ Published continuously since 1965 Multidisciplinary across social and life science subject areas Volume 36 addresses current themes in animal behavior

Author Jansson merges different perspectives and ideas into a powerful theory on international marketing of industrial products, mainly modern approaches from marketing, organization theory, and institutional economic theory. He combines micro and macro approaches, which is rarely done in marketing and economics. Industrial Products illustrates this new framework with a detailed account of the experiences of thirteen West-European Transnational Corporations in industrial markets in South East Asia.

This book focuses on entomovectoring, also known as apivectoring, the method used for managing pollinators to increase crop yields and employ strategies of biocontrol in greenhouses and open fields. It is written by experts working in academia and industry from the different continents of the world. Over the past 25 years Research and Development has successfully investigated the potential of pollinators to perform two tasks: dispersal of biological control agents (BCOs) and their pollination service. This book provides a basic overview of the current literature on the different aspects and factors of this novel technology. It explains and presents practical cases of enhancing pollination coupled with the suppression of plant pathogens and pests under various agricultural production practices from greenhouse to open field conditions and crops ranging from orchard fruits, to small and tender berries, vegetables and oil seeds

Pollinators--insects, birds, bats, and other animals that carry pollen from the male to the female parts of flowers for plant reproduction--are an essential part of natural and agricultural ecosystems throughout North America. For example, most fruit, vegetable, and seed crops and some crops that provide fiber, drugs, and fuel depend on animals for pollination. This report provides evidence for the decline of some pollinator species in North America, including America's most important managed pollinator, the honey bee, as well as some butterflies, bats, and hummingbirds. For most managed and wild pollinator species, however, population trends have not been assessed because populations have not been monitored over time. In addition, for wild species with demonstrated declines, it is often difficult to determine the causes or consequences of their decline. This report outlines priorities for research and monitoring that are needed to improve information on the status of pollinators and establishes a framework for conservation and restoration of pollinator species and communities.

Important breakthroughs have recently been made in our understanding of the cognitive and sensory abilities of pollinators: how pollinators perceive, memorise and react to floral signals and rewards; how they work flowers, move among inflorescences and transport pollen. These new findings have obvious implications for the evolution of floral display and diversity, but most existing publications are scattered across a wide range of journals in very different research traditions. This book brings together for the first time outstanding scholars from many different fields of pollination biology, integrating the work of neuroethologists and evolutionary ecologists to present a multi-disciplinary approach. Aimed at graduates and researchers of behavioural and pollination ecology, plant evolutionary biology and neuroethology, it will also be a useful source of information for anyone interested in a modern view of cognitive and sensory ecology, pollination and floral evolution.

For many agricultural crops, bees play a vital role as pollinators, and this book discusses the interplay among bees, agriculture, and the environment. Although honey bees are well recognized as pollinators, managed bumble bees and solitary bees are also critical for the successful pollination of certain crops, while wild bees provide a free service. As bees liberally pass pollen from one plant to the next, they also impact the broader ecosystem, and not always to the benefit of humankind. Bees can enhance the unintentional spread of genes from genetically engineered plants, and may increase the spread of invasive weeds. Conversely, genetically engineered plants can impact pollinators, and invasive weeds can supply new sources of food for these insects. Bees' flower-visiting activities also can be exploited to help spread biological control agents that control crop pests, and they are important for native plant reproduction. Managing bees for pollination is complex and the factors that must be taken into consideration are treated here, including bee natural history, physiology, pathology, and behavior. Furthermore, transporting bees from native ranges to new areas for pollination services can be controversial, and needs to be done only after assuring that it will not disrupt various ecosystems. Even though bees are small, unobtrusive creatures, they play large roles in the ecosystem. The connection between bees and humankind also is symbolic of a broader interconnection between humans and the natural world.

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More than twenty years ago, the Food and Agriculture Organization of the United Nations contributed to the growing recognition of the role of pollination in agricultural production, with the publication of "The Pollination of Cultivated Plants in the Tropics". Since that time, the appreciation of pollinators has grown, alongside the realization that we stand to lose them. But our knowledge and understanding of crop pollination, pollinator biology, and best management practices has

also expanded over this time. This volume is the second of two “compendiums for practitioners”, sharing expert knowledge on all dimensions of crop pollination in both temperate and tropical zones. The focus in this second volume is on management, study and research tools and techniques.