

Conserving and Valuing Ecosystem Services and Biodiversity: Economic, Institutional and Social Challenges.

Author: Conte, Marc N.

Source: BioScience, 60(9) : 760-762

Published By: American Institute of Biological Sciences

URL: <https://doi.org/10.1525/bio.2010.60.9.14>

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is a significant risk of bioterrorism—or if there will be by the time the medical countermeasures these labs are researching make it through development, testing, and regulatory approval, many years from now—the risks these laboratories generate must be weighed against the greater risk of remaining defenseless. After all, we face a similar threat every time we give a police officer a gun. Most citizens willingly accept the possibility of unauthorized police shootings because the alternative, not having anyone between them and dangerous criminals, is unacceptable. In the case of the police, as with biodefense researchers, risks can be minimized by careful attention to personnel screening and training, job performance monitoring, oversight, and systems design.

These factors are the subject of considerable discussion in this book, with the authors suggesting how biodefense research programs should be structured, what kind of oversight they should receive, and what kind of protections should be put in place to secure dangerous pathogens and vet the personnel who have access to them. In some cases, the authors' recommendations will win the agreement even of those who may disagree with their view of the threat. Both biodefense critics and supporters, for example, would support searching for "broad-spectrum" medical countermeasures that can deal with a wide variety of naturally occurring diseases as well as with those more specifically associated with potential acts of bioterrorism. Similarly, many readers will agree that security measures applied to the so-called select agents—pathogens deemed to pose particular security risks—are counterproductive if they force researchers to abandon their studies.

Unfortunately, the book has a major error in its discussion of secrecy. Klotz and Sylvester decry "our massive and mostly secret biodefense program" (p. 157), which they assert induces suspicion among our allies, defies citizen oversight, and frustrates the ability of scientists to learn from their peers and

contribute to the literature. In reality, almost none of our biodefense program is secret. The vast majority of the government's biodefense research is funded through the National Institutes of Health (NIH), which does no classified work at all; very little of the non-NIH program is classified, either. But this is not to say that all of Klotz and Sylvester's concerns in this area are unwarranted. For example, they appropriately flag the Department of Homeland Security's (DHS's) National Biodefense Analysis and Countermeasures Center (NBACC), which has the mission of resolving scientific uncertainty regarding our ability to anticipate future biological threats. This lab's work plan must navigate the boundary between protective or prophylactic activities, which are explicitly permitted under the international Biological Weapons Convention, and the development of biological weapons agents, which is banned. Klotz and Sylvester appear satisfied with a statement by the NBACC's director that the lab will not dream up and build hypothetical genetically engineered threat organisms just to find out whether such threats are possible. However, this discussion would have been improved had it referred to the DHS compliance review process, which is applied to all the department's biodefense activities to ensure they comply with applicable treaty commitments, laws, regulations, and policies.

One of the book's later chapter headings—"All Roads Must Lead to Public Health"—reveals a bias by Klotz and Sylvester that colors much of their analysis. If, as they argue, "our biggest need is for a large increase in funding for annual and emerging infectious disease" (p. 167), biodefense spending is not the cause and should not be the remedy. Rather than raiding the public health budget, biodefense has supported it by raising its visibility to senior policymakers and by contributing directly relevant capabilities and tools. Moreover, it is worth remembering that the more than \$1-billion increase in 2002 in annual biodefense research and development was an addition to the NIH budget, not a carve-out from it.

Klotz and Sylvester are not the first to argue that national security spending should be redirected toward social objectives. However, the similarity between some aspects of biodefense and some aspects of public health does not make their funding fungible.

GERALD L. EPSTEIN

Gerald L. Epstein (gepstein@aaas.org) is with the American Association for the Advancement of Science in Washington, DC.

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VALUING AND PRESERVING NATURE'S BOUNTY

Conserving and Valuing Ecosystem Services and Biodiversity: Economic, Institutional and Social Challenges. Edited by K. N. Ninan. Earthscan, 2009. 402 pp. (ISBN 9781844076512 hardcover).

Societies around the world are increasingly reminded of the links among ecosystem function, ecosystem health, and social welfare. In the Central Valley of California, almond farmers are exploring ways to revitalize local populations of native honeybees to ensure pollination in the face of widespread colony collapse disorder among managed bees. Along the Yellow River in China, issues of nutrient loading and sedimentation confront rural and urban populations regularly. Payments for ecosystem services (PES) programs, including the Grain-to-Green program,

doi:10.1525/bio.2010.60.9.14

have been recently instituted in China to help improve water quality and decrease erosion. In the Maldives, an archipelago whose maximum elevation is less than three meters above sea level, the government is very aware that carbon sequestration and storage provided by the world's forests might help prevent sea-level rise associated with climate change. To ensure desired levels of different ecosystem services, governments must better understand the biophysical processes that underlie their provision, the policy mechanisms available to promote provision by private landowners, and the institutions required to ensure the successful implementation of these policies.

In economic terms, efficient natural-resource-use decisions occur when the marginal benefits from additional intensive resource use are equal to its marginal costs. The reckoning of those costs should, naturally, include the forgone benefits associated with the provision of ecosystem services by extant marine or terrestrial habitat. Challenges to efficient resource use include assessing such external costs; accounting for the public nature of several often-used ecosystem services, insecure property rights, and insufficient institutions. *Conserving and Valuing Ecosystem Services and Biodiversity: Economic, Institutional, and Social Challenges* demonstrates the challenges posed by these characteristics, the need to overcome them, and the outcomes of different approaches being implemented in communities around the globe to address them.

The book is organized into five sections, each focusing on key economic and social issues. The first three sections introduce vital components in the design and successful implementation of policies to ensure biodiversity and the provision of different ecosystem services: the valuation and use of biodiversity and ecosystem services, policy mechanism design and incentives, and governance. The final two sections touch on indigenous knowledge and adaptation to climate change, respectively.

The social values of biodiversity and ecosystem services are useful in

identifying the level of provision at which the marginal benefits are just equal to the marginal costs, which is defined as the optimal level of service provision. The policy design choices and the challenges resulting from the characteristics listed above determine whether the targeted level of provision is optimal. The private cost of service provision, which should be based on the opportunity cost of forgone intensive land use, is useful in determining the pattern and amount of service provision under market-based policy mechanisms or PES programs. Furthermore, it is essential to understand the trade-offs between the value of intensive land use and land's value for the provision of biodiversity and ecosystem services, given how these values are distributed across different segments of society.

Within the framework described above, the first section of this volume includes pieces that demonstrate the importance of ecosystem services to impoverished communities around the world, and offers methodological insights into estimating the social value of different ecosystem services. A case study from Laos by Lucy Emerton introduces the concept of joint conservation and development programs to account for the reliance of rural communities on goods and services from the surrounding vegetation. Notable within this section is the contribution of Randall Kramer and colleagues, which describes methods to explore the willingness to pay for integrated conservation and development projects in Sumatra and Nusa Tenggara Timur, Indonesia. This case study is based on explicit acknowledgement of the trade-offs that exist between resource use and conservation, which should influence the design of future conservation efforts.

Ecosystem services and biodiversity have several features that should theoretically lead to inefficient production and consumption outcomes in the absence of regulation, including external costs, underprovision of public goods, and information asymmetry. Several policy mechanisms have been

designed to improve efficiency. The second section of the book explores policy mechanisms that have been applied to these problems in practice and reinforces the theoretical motivation for different mechanisms. The chapter by Unai Pascual and Charles Perrings, although focused on agricultural landscapes, provides a general overview of theoretically viable policy mechanisms in addition to examples of their implementation.

Clem Tisdell's chapter explores how fundraising needs might affect the conservation choices of nongovernmental organizations (NGOs) and potential optimal organizational forms for such an enterprise, noting how competition between NGOs may have an impact on conservation outcomes. This chapter, influenced by the work of Oliver Williamson, is provocative and theoretically intriguing. *Conserving and Valuing Ecosystem Services and Biodiversity* could also have benefited from a section based on work by Elinor Ostrom, who shared the Nobel Memorial Prize in Economics with Williamson in 2009. Ostrom's research has provided insights into the community and resource characteristics that allow for efficient resource use in systems that lack well-defined property rights or regulation. These conditions are found in many areas of the world currently confronting the trade-offs between intensive land use and ecosystem service provision.

The chapters in the third section of the volume address real-world conditions that must be accounted for to achieve successful regulation of habitat. At the heart of this section is the idea of incentive compatibility. Policies can diverge from their intended outcomes in myriad ways if stakeholders do not participate in their design, if there are insufficient funds for enforcement and monitoring of a chosen policy, or if regulatory bodies act to achieve self-preservation instead of positive ecosystem outcomes. Detailed household surveys from Indonesia, analyzed in a chapter by Regina Birner and Marhawati Mappatoba, highlight the

importance of community involvement in the development of regulations that result in limited access to land or that modify property rights. In areas with imperfect enforcement and monitoring, the implementation of conservation programs that fail to acknowledge existing areas of use or de facto property rights may be ineffective.

Indigenous knowledge about the characteristics of local flora and fauna has accrued over centuries, and this information is often of value to pharmaceutical firms in their research and development of commercial drugs. Krystyna Swiderska discusses traditional knowledge and resource use, focusing more on the impacts of conservation planning on the access afforded to indigenous peoples than on intellectual property rights and traditional knowledge. Though not explicitly mentioned in the book, this issue is of direct relevance to REDD (reduced emissions from deforestation and degradation) projects. Jane Kabubo-Mariara and Ernest L. Molua discuss in separate chapters the difficulty of adapting to climate change in ecosystems that are highly sensitive to physical conditions, such as estuaries, and in social systems in which the resources necessary for adaptation may be limited.

Although the potential development of payment programs for carbon sequestration and storage by forests is not explicitly covered, the importance of institutions and stakeholder involvement in the policymaking process, as described in the chapters in the first three sections of the book, should be acknowledged in the design of these programs. Reduced emissions from REDD projects and other successes are creating significant excitement among stakeholders. However, these programs can lead to undesirable outcomes, resulting from information asymmetry, a lack of required enforcement and monitoring infrastructure, insufficient stakeholder involvement, or an absence of institutions to ensure that national agreements provide incentives for behavioral change.

The chapters that K. N. Ninan has assembled from well-known economists serve as a solid introduction to the socioeconomic concepts fundamental to the valuation and provision of biodiversity and ecosystem services. The theoretical discussions provide nice summaries of the necessary background on many of these issues. The case studies help transform economic theory into meaningful application, allowing policymakers and readers from other disciplines to learn from the experience of others.

MARC N. CONTE

Marc N. Conte (mconte@stanford.edu) is an environmental economist and a postdoctoral fellow at the Woods Institute for the Environment at Stanford University, where he contributes to the Natural Capital Project.

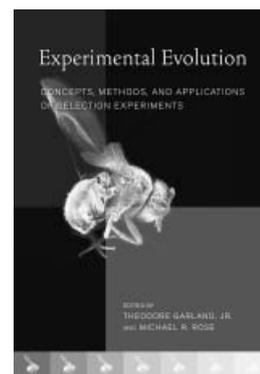
BRINGING EVOLUTION INTO THE LAB

Experimental Evolution: Concepts, Methods, and Applications of Selection Experiments. Theodore Garland Jr. and Michael R. Rose, eds. University of California Press, 2009. 752 pp., illus. \$45.00 (ISBN 9780520261808 paper).

Evolutionary change is usually too slow for us to detect on the timescales in which we live—hours, days, even months. To illustrate selection in action, Darwin turned to domesticated species, which act as a kind of temporal microscope, magnifying patterns of phenotypic and genetic variation within a population. *On the Origin of Species* does not begin with a description of the fantastic organisms that Darwin observed on his travels through South America, but rather with a description of the humble domestic pigeon. Darwin pointed out that by applying the same principles of selection that exist in nature, humans have been able to generate incredible variety in

domesticated species—fantails, frillbacks, Jacobins—and do so relatively quickly.

For millennia, humans have used artificial selection to create desirable traits: edible plants, useful animals, and aesthetic curiosities. In the edited volume *Experimental Evolution: Concepts, Methods, and Applications of Selection Experiments*, researchers review the enormous range of ways artificial selection can be used to test hypotheses that are of central interest and importance to evolutionary biologists. The book explores the methods that underlie experimental evolution and the breadth of concep-



tual topics that have been explored using this approach, from anatomy to altruism, sex to speciation, physiology to phages, and more.

The authors in this volume take a broad view of experimental evolution, defining it as any study that exposes a genetically variable population to some selective pressure. This selection could be deliberate (such as selection for flies with a particular wing shape) or inadvertent, as happens simply by bringing a wild species into the laboratory (discussed in detail in the chapter by Simões and colleagues). In either case, the response to these selective pressures can then be used to address evolutionary questions.

This book will surely be of interest to researchers looking for new ways to ask evolutionary questions. But the careful reader is advised to read the last chapter

doi:10.1525/bio.2010.60.9.15