

## **Is a Little Pollution Good for You? Incorporating Societal Values in Environmental Research**

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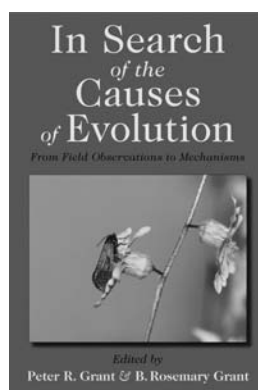
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bill traits, which, when combined with the measures of natural selection made in the wild, roughly predicted the net change in bill morphology seen in their data. More recently, the Grants have been investigating the genetic and genomic basis of variation in bill morphology and, perhaps the icing on the cake, have begun documenting the first stages of the origins of a new lineage of Darwin's finch.

*In Search of the Causes of Evolution* brings together just a small fraction of the biologists who have felt the Grants' influence in their own work. Composed of four related parts, the book covers a breadth of subdisciplines within evolutionary biology: life's origins and macroevolution, the molecular mechanisms that underlie evolutionary change, patterns of behavioral and morphological evolution, and the action and adventure stories of evolutionary field ecology. The book necessarily leaves out large chunks of evolutionary thinking; the specific fields that fail to make the cut include population genetics (except for brief coverage in section four), the statistical measurement of selection, and adaptive landscape theory. But the book is not intended to provide a comprehensive survey of the discipline. Rather, each of the four sections gives the contributors an opportunity to explore the influence that the Grants have had on their research programs and to highlight some of the Grants' own favorite fields of inquiry.

*In Search of the Causes of Evolution* will inspire biologists in the field, at the laboratory bench, and in the classroom. Many of the individual chapters are gems of evolutionary thought. High points include an exploration of classical ideas from novel perspectives, touching on the authors' work, but they often delve into the historical, the whimsical, or just thoughtful speculation. Like any edited volume, however, the book also suffers from a handful of weaker chapters that are comparatively lacking in novelty and insight. Fortunately, these sections are outnumbered by their more thought-provoking counterparts.

Although the individual chapters of an edited volume will often stand alone on their own merit, a volume that is composed of four disparate parts, with topics ranging from life's origins



to the morphology–performance relationships of algae and flying frogs, might easily seem disjointed. In this case, most of the chapters are written without a clear attempt to link the authors' research with other contributions in the book. To ameliorate this issue, Peter and Rosemary Grant introduce each section with a short essay highlighting the central themes contained within each of the four parts—and this is where the book truly shines. The Grants' commentaries weave the sections into a cohesive unit that will make excellent fodder for graduate student reading groups, classroom discussions, and personal consideration.

While reading this book and preparing this review, I had the good fortune of sitting in the audience at a seminar presented jointly by Peter and Rosemary Grant. Their seminar, a team effort like the rest of their endeavors, closely reflected the sentiment captured in the book's final chapter, written by the Grants and in a closing commentary by evolutionary biologist David Wake. Together, these two contributions paint a picture of a research program that will continue to inspire long after their retirement. With their appreciation for the changing toolkit available to evolutionary biologists, the Grants relish opportunities to explore evolution at the level of genes and genomes, but also at the level of individuals and populations. They encourage their fellow biologists

to seek to explain biological diversity at multiple levels, both inside and outside the cell. The interdisciplinary approach advocated by these two masters of their craft is well represented by this celebration of their careers. I heartily recommend *In Search of the Causes of Evolution* as a worthwhile addition to every biologist's bookshelf. Some may prefer to pick and choose the chapters of greatest relevance to their own careers, but all will appreciate the insights gleaned from the Grants' perspective.

The greats are often loath to retire. At the conclusion of the seminar, the Grants announced that they were off to the islands in just a few days. They were eager to see if the new finch lineage was still breeding. Therefore, although they have “formally” retired, their work continues, and thankfully we can look forward to more of their inspirational work in the future.

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## POLLUTION IS NOT GOOD FOR YOU

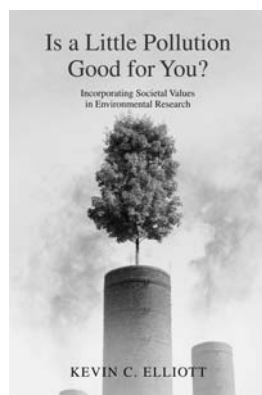
**Is a Little Pollution Good for You? Incorporating Societal Values in Environmental Research.** Kevin C. Elliot. Oxford University Press, 2011. 264 pp., \$65.00 (ISBN 9780199755622 cloth).

Author Kevin C. Elliot, an associate professor of philosophy at the University of South Carolina, is interested in how the philosophy of science and practical ethics interconnect and how they are involved in controversial research topics in contemporary pollution research that are relevant to public policy. His book, *Is a Little Pollution Good for You? Incorporating Societal Values in Environmental Research*, follows his

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philosophical leanings. The primary purpose of this volume is to improve the analysis of methodological and interpretive judgments of *hormesis*, which “consists of instances in which the direction of some biological response (e.g., growth, disease incidence, enzyme activity) changes with decreasing dose [of a toxin] as a result of biological feedback mechanisms” (p. 18). A secondary objective is to espouse a transdisciplinary synthesis involving social value, ethics, economic and political interests, and the general public.

I find the chosen title unfortunate, because special-interest groups will almost certainly use it to further weaken federal and state regulations



on pollution controls. The author recognizes the serious problem that “powerful stakeholders with deep pockets can pursue a variety of strategies to obtain research results that serve their interests in policy-relevant cases like hormesis” (p. 189). A handful of scientists (and many nonscientists) have obscured the truth about tobacco smoke and global warming (Oreskes and Conway 2010), although the preponderance of scientific evidence supports the assertion that tobacco smoke and anthropogenic greenhouse gas emissions are harmful. Consequently, the general public is still doubtful, as are its political representatives. The evidence for hormesis is far less robust, because “interpreting the significance of hormesis for even a single species in an ecological risk assessment can be complicated by competition with other species, predation effects, etc. In

addition, ecological risk assessments may involve communities of hundreds or thousands of species as well as a range of ecological processes” (Gentile and van der Schalie 2000, p. 227).

The most serious deficiency with hormesis is the lack of research on its effects at higher levels of biological organization (e.g., communities, ecosystems). A second deficiency is that increased environmental realism in test conditions increases the difficulty of replication, which then becomes a serious problem for statistical analysis. In addition, the validation of laboratory test results would be more persuasive if long-term monitoring of natural systems were to identify responses not merely evident at the single-species level. If I were performing an opportunity–cost analysis on the distribution of research funding for environmental studies, tipping-point studies would be assigned a high priority, and hormesis would be assigned a low priority on the list. When a tipping point is passed, irreversible change occurs in an ecological or societal system. Moreover, tipping-point thresholds can only be determined in retrospect. The case for hormesis is much weaker; it typically involves individuals of relatively few species, whereas tipping points occur in large systems, both ecological and societal, and are fairly robust.

Although special-interest science is covered briefly in this volume, as are financial conflicts of interest in the related scientific debates, no substantive attention is given to the successful attempts of individuals who have few or no scientific credentials to cast doubt on scientific evidence. The notorious “Climategate” scandal involved a few pirated personal e-mails out of thousands. Two or three of these e-mails were injudicious, and they were not, by any stretch of the imagination, from peer-reviewed publications. Yet the news media treated the event as a scandal, and so did the general public. An equally valuable example concerning dioxin exposure is given on page 132 of *Is a Little Pollution Good for You?*, but when a threat of libel arose in this case, the media coverage dried up.

Most scientists, especially those with substantial research programs, simply lack the time and inclination to remain involved in such situations; at the very least, their research would suffer. Although I especially enjoyed the sections of the book on ethics and value judgments and those on safeguarding science (the coverage of Edward Calabrese’s research and publications is superb), I would have liked more coverage on the central issue of coping with special-interest groups, because they are questioning both the integrity of scientists and that of their evidence.

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*The discussion of ethics for experts is especially well done, but what is left unanswered is this: How can scientists and the general public deal with unethical “experts” who often lack any scientific credentials when the news media give them equal or more time?*

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As the author notes, Calabrese has made a major contribution by acknowledging “that hormetic effects may often be harmful rather than beneficial” (p. 152). Reasonable people would applaud such action, but imagine how unscrupulous opponents of hormesis would use such an ethical and appropriate statement. Ideally, objective analyses should include all options and should include a risk–benefit analysis. Most people want to believe that what they are drinking, eating, breathing, or doing is “safe,” but US government regulations are viewed with suspicion, and funds for regulators have been reduced. This problem could be eliminated by having a single standard of risk—for all sources of electricity, for example. Certain levels of risk would be prohibited by federal law. However, the question of scientific advocacy (p. 184) is certain to arise on issues in which the precautionary principle is invoked; namely, action is justified even

when the evidence available at the time is not robust if the consequences of inaction are likely to be catastrophic. Would informed consent (p. 137) be as appropriate for environmental risks and benefits as it is in biomedical ethics, especially when intergenerational ethics are involved?

Elliot has covered a broad range of literature on hormesis and related fields but primarily at a single-species (*Homo sapiens*) level. The word *pollution* in the title (suggesting hormesis) deserves scrutiny at higher levels of biological organization—even though the value of this concept is not clearly shown. I applaud the author's efforts to bring about consilience (literally “leaping together”) between societal values and policy-relevant environmental research. However, synthesis requires a great deal of time, and its importance is difficult to communicate to the news media and the general public, since, at present, environmental literacy in both groups is inadequate to address a complex subject such as hormesis. Knowing about the problem is a superb first step, but it is not enough.

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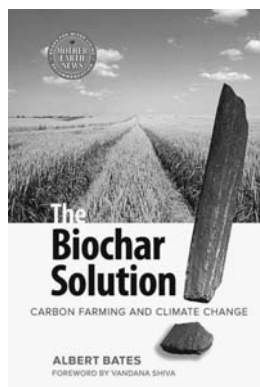
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## ADAPTATION THAT CONTRIBUTES TO MITIGATION

**The Biochar Solution: Carbon Farming and Climate Change.** Albert K. Bates. New Society Publishers, 2010. 208 pp., \$17.95 (ISBN 9780865716773 paper).

Climate change mitigation and adaptation are major topics in related international negotiations to save the human enterprise from barreling full speed through a still unknown tipping point into irreversible global heating. Last October, *BioScience* offered a special section on biological carbon sequestration with a range of arboricultural and agricultural options. One option that was mentioned but not analyzed in depth is *biochar*, which is charred organic matter that could be used for agricultural soil enhancement or bioremediation. *BioScience* contributor Rattan Lal (2010) considers biochar a viable but not major component of mitigation through the sequestration of carbon



in soil (the major terrestrial sink), partially because the science of biochar is still in its infancy. Not cited in his article were Lehmann and Joseph's (2009) book on the state of the science and Bruges's (2009) more popular volume.

A month after *BioScience's* special section, *The Biochar Solution: Carbon Farming and Climate Change* was published. This book is an overview, intended for a more general audience, with an impressive summary of much of the pertinent science and a careful inclusion of biochar in the call for greater adaptation and sustainability in farming practices. Although he always considers mitigation, author Albert K. Bates is more concerned with adaptations that will contribute to both mitigation and improved food security (something Lal is also concerned about) within a more organic,

biodynamic, and permanent agricultural landscape.

*The Biochar Solution* is divided into five sections, after a foreword by Vandana Shiva, longtime critic of the current global political economic system that is the root cause of climate change. She cautions us to avoid a fixation on biochar-only solutions and to embrace ethically and ecologically sound changes in agriculture in order to contribute to a more just and sustainable global society. Bates gives consideration to her warning by maintaining objectivity as he outlines the origins of the current scientific interest in biochar, examines some of modern agriculture's failings, surveys options and especially technologies for capturing carbon with biochar, examines more sustainable traditional agricultural systems and how these are being used to heal degraded agroecosystems, and finally discusses the politics surrounding biochar and the creation of carbon-neutral and carbon-negative communities.

The first section (Losing the Recipe) is a broad mix of quick reviews of agricultural origins and includes a discussion of the major twentieth-century figure of Amazonian dark earth (ADE) research, Dutchman Wim Sombroek, who organized the now-international effort to study ADE. This section also covers the first Europeans' experiences in Amazonia, during which they were impressed by the healthy, well-fed native populations in a region now known for its poor soils. Bates is a great fan of Gaspar de Carvajal, the first European chronicler of the Amazon River, but does not use enough caution when retelling his tales—something I've learned over the last two decades but failed to pass on to Bates when he interviewed me a few years ago.

Nonetheless, modern archaeological work is confirming that there is enough ADE to have supported very large populations along the major whitewater rivers, such as the Madeira and the Amazon, and that these ADE

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