

see list of all reviews from this issue: March-April 2002

## THE ENVIRONMENT

### Skewed Skepticism

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*The Skeptical Environmentalist: Measuring the Real State of the World.* Bjørn Lomborg. xxiv + 515 pp. Cambridge University Press, 2001. \$27.95.

Every few years, someone who's not an environmental scientist announces that there is no environmental crisis, that the state of the Earth is improving, and that the future looks so rosy that our treatment of environmental resources requires—at most—minor adjustments. Notable examples are reporter Gregg Easterbrook's *A Moment on the Earth: The Coming Age of Environmental Optimism* (1996) and economist Julian Simon's *The Ultimate Resource* (1996). *The Skeptical Environmentalist*, by political scientist and statistician Bjørn Lomborg, is a similar but more expansive effort. In 515 pages that include 2,930 endnotes, he deals to a greater or lesser extent with most major environmental issues—waste, pollution, biodiversity, global warming, energy—with the unrelenting message that each is a relatively minor problem greatly exaggerated by scientists abetted by politicians and environmental organizations, all of whom benefit from scaring the public.

This startling claim, and some favorable notice from the lay press, has so alarmed environmental scientists that they have generated Web sites and publications where they review, in detail, Lomborg's treatment of various topics in which they have expertise. Among the most informative are a collection of reviews in *Scientific American* (January 2002), an ongoing series of reviews that the Union of Concerned Scientists has solicited, and reviews of many of the chapters in the online publication *Grist Magazine*. Lomborg also has defenders, although few among environmental scientists. The broad scope of *The Skeptical Environmentalist* means that even reviewers of the entire book (for example, Stuart Pimm and Jeff Harvey in *Nature* [414:149–150]) must concentrate on those areas in which they have the most expertise, as I will here.

The main focus of my own work is biodiversity and the forces affecting it. Lomborg discusses biodiversity at many points and devotes an entire chapter to it, but a very short one—nine pages (in contrast to 65 pages on global warming). This brevity makes it difficult for him to deal adequately with a complicated subject and may reflect a different mind-set from that of most authorities in the area.

Lomborg sees the importance of other species wholly in terms of how they can serve humans. The service can simply be providing a sense of well-being by their existence, or it can consist of fostering human wealth or welfare, but Lomborg's measure of value is always dollar value to humans. Thus, the loss of individuals or species is not of great concern so long as net dollar loss to humans is nil. As an example, the increasing "dead zone" caused by fertilizer-fed hypoxia in the Gulf of Mexico is the price we let some marine organisms pay for our success in feeding a burgeoning humanity, and Lomborg sees the benefit to people as far greater than the cost. This is not a heretical stance, of course; many cost-benefit analyses of resource issues rest on the assumption (usually unstated) that dollar value to humans is the universal measure. However, one can imagine that current and future valuations, and confidence limits around them, would foster great disagreement between Lomborg and many environmental scientists.

The gist of the biodiversity chapter is that extinction rates, and their likely cost to humanity, have been greatly overestimated. The chapter is a disappointment. Lomborg begins with a few partially valid but well-worn criticisms. For example, he is correct that Norman Myers's estimate in 1979 that 40,000 species are disappearing annually was based on no more than a hunch; this fact has been widely cited. He is also correct that some estimates of the total dollar value of biodiversity are highly questionable because they tacitly assume that ecosystem processes are maximized by maximal biodiversity, when in fact many ecosystem functions may rest on activities of a small subset of species. Again, this criticism has been voiced repeatedly by others. It is the basis for one of the major research programs (uncited by Lomborg) in biodiversity and ecology, on the significance of number of species to ecosystem function (see S. Naeem *et al.*, Fall 1999, *Issues in Ecology*. 4:1–12).

However, Lomborg's *modus operandi* is that of a polemic rather than a good-faith attempt at the stated goal of "Measuring the Real State of the World." First, he cites some extreme and poorly documented statements (in this chapter, primarily Myers's estimate of extinction rate). Next, he uses these statements to

caricature what is really a large, complicated, improving literature. He assiduously ignores research not buttressing his thesis, occasionally misinterprets published data and some of the arguments that he does cite, and judiciously omits context so as to warp a conclusion or even becloud an issue. He veers toward ad hominem attacks; in this chapter, his major bêtes noires are Myers and E. O. Wilson (in others, Lester Brown, Paul Ehrlich and Al Gore are repeatedly targeted). Lomborg concludes that extinction rates for animals will likely remain below 0.2 percent per decade (which works out to about 11,000 species per decade if we accept R. M. May's estimate [in P. H. Raven (ed.), *Nature and Human Society*, 1999] that there are 5.57 million species of animals).

Lomborg's coverage of extinctions associated with deforestation in North America and Puerto Rico exemplifies his approach. He notes that in eastern North America the loss of 98 to 99 percent of primary forest over two centuries caused the extinction of one forest bird species. What he does not mention is that secondary forest, some of it very substantial, replaced much of the primary forest so that at any one time about half of all previously forested area was forested, providing habitat for some forest birds. Also highly relevant but unstated is that in tropical forests, where the main loss of species is anticipated, many bird species have very small geographic ranges, whereas those of eastern North American forest almost all have large ones. Thus destruction of a large swath of tropical forest habitat is far more likely to encompass all or most of the range of a bird species than is analogous destruction in eastern North America.

For Puerto Rico, Lomborg observes that a 99 percent reduction of primary forest over 400 years led to the extinction of 7 out of 60 bird species and the addition of 44 species. He does acknowledge that the overall forest area of Puerto Rico never fell below 10 to 15 percent (thanks to the presence of secondary forests and coffee shade trees that served as habitat for some forest birds). However, he fails to mention that the species increase is due to introductions (even though this fact is noted in the source he cites) and that several forest birds, such as the Puerto Rican parrot, are hanging on by a thread. Islands worldwide are plagued by the establishment of cosmopolitan, introduced species, which often thrive in the same modified habitat that is inimical to the natives. Some introduced species even directly harm dwindling native forest species; the pearly-eyed thrasher is a key threat to all three highly endangered Puerto Rican bird species. The important point is that extinct species are lost forever, not that a modified landscape abounds in birds that are common elsewhere.

Lomborg seems oblivious to the mechanics of extinction. By far

the major single cause of recent species extinction and current endangerment is habitat destruction. For example, habitat destruction contributes to the threat to 85 percent of all imperiled and federally listed species in the United States, and contributes similarly to the threat to imperiled birds alone. One main finding of evolving research in ecology and conservation biology over the last half century has been the exquisite and often subtle habitat specificity of many species. It is thus not surprising that massive habitat modification should lead to great numbers of extinctions. Nor would such extinctions be expected to be instantaneous; research in paleobiology, palynology and conservation biology abounds with examples of species doomed to extinction by habitat change but persisting for extended periods before the death of the last individual.

The second greatest cause of recent species endangerment and extinction is the impact of introduced species, a rapidly growing phenomenon fostered by burgeoning trade and travel, which is nowhere mentioned by Lomborg. Of all imperiled U.S. species, 49 percent are threatened at least partly by introduced species, a figure greater than the proportion threatened by pollution and/or overexploitation (issues Lomborg addresses). Lomborg may not be distressed at the prospect of a "planet of weeds" (to borrow David Quammen's phrase), so long as diverse weeds everywhere provide energy, food and other human goods and services, but he should acknowledge that extinctions and invasions are advancing us in this direction.

Estimating the rate at which species are going extinct is a difficult matter, as so many taxa are so poorly studied that unnamed species are estimated to account for about 80 percent of all species (R. M. May in P. H. Raven [ed.], *Nature and Human Society*, 1999), and few if any nations have adequate systematic monitoring programs to establish the status of named species. Species-area relationships predict substantial extinction, but they say nothing about when these extinctions will occur, and, in any event, such relationships typically account for only half the variation in number of species. Scientists are therefore forced to rely partly on taxon-by-taxon accounts. Some of these are anecdotal, others are quite systematic, and very many of them indicate recent extinctions or great danger to existing species. It is unfortunate that no common repository exists, but that does not mean these accounts are invalid.

Lomborg pillories Wilson for asserting much ongoing extinction from hundreds of such reports, but, in sum, they paint a dismal picture. For birds, for example, at least 103 species have disappeared since 1800, and careful examination of range and biology of the survivors suggests that at least 1,186 (12 percent

of all birds) are threatened, of which well over 400 are unlikely to survive a century (BirdLife International, 2000, *Threatened Birds of the World*). Such a loss would translate to an extinction rate of about 0.4 percent per decade, twice Lomborg's estimate for animals. For parts of the Earth, similar and even more alarming detailed studies are available for other taxa such as mollusks and fish. Systematic data are very scarce for insects and plants, which each make up a far greater fraction of biodiversity than vertebrates and mollusks combined, and which are, on the whole, likely to include a far higher proportion of threatened species than vertebrates do, because of small geographic ranges (especially in the tropics). However, it is true, just as Wilson says, that most longtime students of particular groups and regions can point to at least a few species that have not been seen for a long time and whose habitat is destroyed in its historic range. These add up to a large number of species.

Forests have a chapter of their own—eight pages—and again the treatment is sketchy and misleading. Relying on data from the Food and Agriculture Organization of the United Nations (FAO), Lomborg depicts a slight change in total global forest area and not much loss of species-rich tropical forests. Problems with this scenario are barely acknowledged. First, many of the FAO data are unreliable estimates provided by individual nations. (Lomborg recognizes the inaccuracy of FAO data but relegates his acknowledgment of this problem to the endnotes.) Second, the FAO has changed its accounting procedures so significantly that an accurate time series of their data is impossible. Third, the FAO has consistently considered even highly damaged forest still to be forest, whereas to many previously resident species, many damaged forests are uninhabitable (BirdLife International, 2000, *Threatened Birds of the World*). The FAO even tallies clear-cuts as forest, so long as they are planned for reforestation; they are characterizing land use, not habitat.

Two other major global changes that impinge on biodiversity are the destruction of wetlands, which is untreated by Lomborg, and fisheries, to which he devotes about two pages. The omission of wetlands is a surprise, as much of the concern about this loss has been for the services wetlands provide to humans (such as flood control and pollutant filtration), Lomborg's key value. In many areas, an even higher fraction of wetlands has been lost than of forests, with little replacement. In the coterminous United States, 53 percent of wetlands was destroyed between 1780 and 1980 (M. T. Bryer *et al.* in B. A. Stein *et al.* [eds.], 2000, *Precious Heritage: The Status of Biodiversity in the United States*). It is lamentable that there has been no systematic survey of the number of species that depend on these wetlands directly as habitat or indirectly for services, but perusal of data on individual

taxa shows that it is large.

Fish, which make up the majority of vertebrate species, are one taxon in which many species rely heavily on intact wetlands. Lomborg's entire treatment of fish focuses, perhaps unsurprisingly, on their value as food for humans, and he sees no substantial problem, based on two arguments. First, fish are a small part of total human caloric and protein intake. Second, he claims that the total catch of fish per capita increased greatly from 1950 through 1990 and then held almost level in the 1990s. One wonders about his latter assertion in light of the recent analysis by Reg Watson and Daniel Pauly (*Nature* 414:534–536) indicating that Chinese officials systematically exaggerated catches through the 1990s to meet rising government targets, with the upshot that, instead of rising over the last decade by 330,000 tons per year, the global catch has actually fallen by 360,000 tons per year.

With respect to biodiversity, the recent history of fishing has been the depletion of one species after another as fishing focuses increasingly on less desirable species, lower trophic levels and residents of deeper habitats. For some species, such as the Atlantic halibut, there has yet to be substantial recovery since pressure was eased. Globally, about 30 percent of individual fishery stocks are overfished, depleted or recovering (National Research Council, 1999, *Sustaining Marine Fisheries*). The incidental loss of other species (including mammals, birds, invertebrates and plants) associated with much fishing is often a horrendous problem. Further, as fishing comes to target bottom-dwelling species (such as scallops) and deep-sea species (such as orange roughy), trawls, dredges and traps are devastating benthic habitats (P. K. Dayton *et al.*, 1995, *Aquatic Conservation: Marine and Freshwater Ecosystems* 5[3]:250).


Lomborg's solution to the leveling (actually, decline) of catch is fish farms, where he cites a quintupling in production since 1984, led by China. He does not address the two main environmental impacts of aquaculture, both of which can greatly damage at least local biodiversity. First, aquaculture is often highly polluting (National Research Council, 1999, *Sustaining Marine Fisheries*). Second, for cultured carnivores such as salmon or shrimp, aquaculture can require enormous amounts of other species as food (R. Naylor *et al.*, 1998, *Science* 282:883–884).

Reviews by experts focusing on other chapters suggest that the sorts of deficiencies that plague Lomborg's treatment of biodiversity, forests and fisheries—failure to cite relevant countervailing literature, omission of context, occasional misstatement of fact and neglect of entire issues—are not

anomalies. That such a polemic could get through the review process of a respected academic press amazes me. There are enough controversial aspects of environmental forecasting, particularly at the global level, that a conscientious, comprehensive, authoritative examination would be a valuable contribution, but *The Skeptical Environmentalist* is not such a book.—Daniel Simberloff, *Ecology and Evolutionary Biology*, University of Tennessee


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