Is the Skeptic All Wet?

The Skeptical Environmentalist

Reviewed by Peter H. Gleick

A recent book challenges some of the fundamental understandings of the environmental science community and argues that instead of deteriorating, the world's most critical environmental conditions are improving. *The Skeptical Environmentalist*, by Danish statistician Bjørn Lomborg, is only the latest in a line of similar books, following on the heels of Gregg Easterbrook's *A Moment on the Earth: The Coming Age of Environmental Optimism*, which followed Julian Lincoln Simon's *The Ultimate Resource* and others.[1]

Most of the ideas in Lomborg's book are not new, and those that are new are not correct. Some environmentalists, environmental scientists, and media do indeed overstate bad news or selectively focus on new or remaining problems rather than the considerable progress that has been made in some areas. And, of course, there is a comparable cohort equally guilty of ignoring, understating, and misrepresenting the environmental problems we face. Healthy skepticism is good—it challenges us to rethink our assumptions and arguments and to re-examine data and priorities. These are important points that are worthy of debate and discussion. If they had been the focus of Lomborg's book, it would have been worthwhile.

Unfortunately, to the detriment of his ideas, Lomborg does precisely what he criticizes the environmental community for doing: He misinterprets the scientific literature, simplifies and generalizes about environmental problems, misunderstands environmental science, misuses data, misrepresents the work of others, and draws conclusions based on hidden value judgments or his view of the world rather than on evidence and facts. These are fatal flaws. Examples of each of these flaws can be found in the way Lomborg writes about water resources—my own field. This review will focus on the problems in Lomborg's assessment of the state of the world's water. In recent months, leading environmental scientists have addressed flaws in other fields.[2]

Lomborg's basic assessment of the world's water problems is fairly simple, half true, and wholly deceptive. "True, there may be *regional* and *logistic* problems with water. We will need to get better at using it. But basically we have sufficient water" (p. 149).[3] This kind of formulation of our water problems is the most dangerous of all, consisting of statements that are basically true but completely misleading. There are indeed regional and logistic problems with water; we do need to get better at using it; and we do, globally, have "sufficient" water. Why are these statements misleading? The global supply of water is irrelevant given the gross disparities in local water availability and—more important—use. We do need to use water "better," but there is no guarantee that we will—or that we will quickly enough to prevent continued death, illness, and conflict. Ultimately, the regional and logistic problems that Lomborg notes but then dismisses are the most difficult issues facing water policy makers, planners, and communities.

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The book is filled with similar simplifications and generalizations of complex problems. Regarding hunger and agricultural production, Lomborg states, "the Green Revolution has been victorious" (p. 67), but he ignores the ongoing and unsustainable overpumping of groundwater for agricultural needs in China, India, the United States, and elsewhere.[4] He trivializes the risks of water-related conflicts by debunking the argument that wars will be fought exclusively over water (pp. 156–57). Yet no serious environmental security analyst makes that argument. Lomborg then ignores the hundreds of examples in which water has

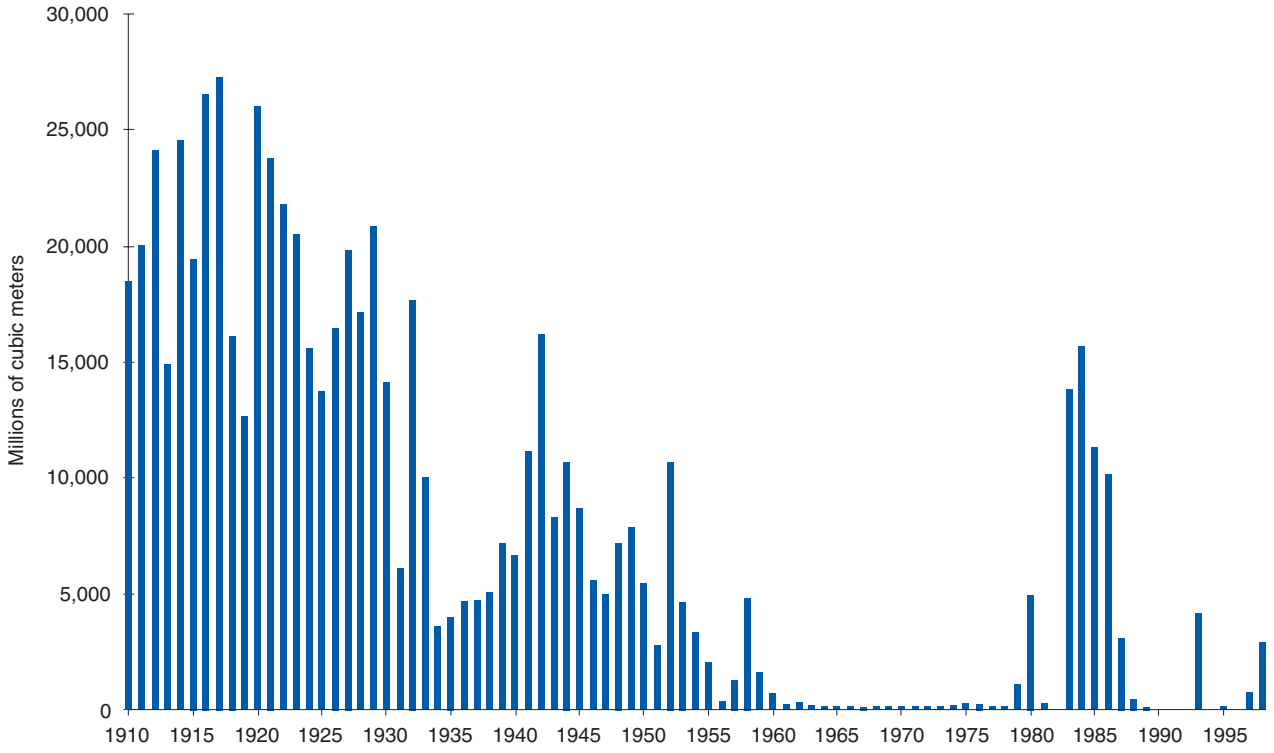
been a tool or target of war or a contributing factor in conflict—as well as the growing risks of water-related terrorism.[5]

Lomborg asserts that we will no longer destroy aquatic ecosystems because "we have learnt the lesson" of the Aral Sea (p. 157). No, we haven't. The destruction of the Aral Sea continues today, with no indication that the countries in that basin have any intention or capacity to address the problem.[6] Inappropriate water management and use threaten other bodies of water, including the Colorado River delta, Lake Chapala in Mexico, and Lake Victoria in central Africa. Figure 1 on this page shows actual flows of water to the Colorado River over the past century. Recently, no water has reached the delta in most years because of upstream diversions. The United States and Mexico have not reached an agreement on providing water to the ecosystems of the delta, which continue to deteriorate.

Lomborg's entire argument about water quality is equally simplistic: "Rivers have generally improved for almost all indicators" (p. 210). Indeed, many rivers, particularly in industrialized nations, have seen improvements in water quality as a result of strong public and legislative efforts in the last few decades. But in most developing countries and even in some richer countries, many water-quality indicators have deteriorated or are not even measured. For example, ambient water quality for Chinese rivers shows substantial degradation since 1990.[7]

More instances of deteriorating quality are evident in one of the only comprehensive global water-quality data sets for organic water pollutants, which provides emissions for 149 countries between 1980 and 1998.[8] For those countries reporting time-series data, emissions of organic pollutants increased for more countries than they decreased, and total global emissions went up, not down. Countries that showed improvements, such as the United States, decreased emissions only modestly (from 2.74 million to 2.58 million kilograms per day), while the other largest emitters, such as China, reported huge increases (from 3.38 million to 8.49 million kilograms per day). Moreover, measuring releases per worker per day revealed that more than twice as many countries had per-capita increases in emissions than per-capita decreases.[9] These data also showed

Figure 1. Recorded flows of water to the Colorado River delta



NOTE: Since the 1960s, all of the water from the Colorado River has been captured and used for irrigation and urban demands in the United States and Mexico. Currently, water reaches the delta only during very high flow years. No international agreement on protecting the delta has yet been reached.

SOURCE: M. J. Cohen, C. Henges-Jeck, and G. Castillo-Moreno, "A Preliminary Water Balance for the Colorado River Delta, 1992–1998," *Journal of Arid Environments* 49 (2001): 35–48.

that emissions are increasing fastest in low- and middle-income countries, although even some wealthy European countries such as Denmark had increases in both total emissions and emissions per worker per day.[10]

Many of the problems in *The Skeptical Environmentalist*'s arguments result from a flawed understanding of basic environmental science concepts. While his training in statistics is extremely valuable for evaluating data, Lomborg repeatedly misunderstands basic concepts and the relevance and application of environmental information.

One of the most important concepts in the water field is that of use. Lomborg fails to consistently apply the different definitions of water availability and use, especially "withdrawal" and "consumption," which are fundamentally different terms. There often is confusion in water literature about terms such as "use," "need," "withdrawal," "consumption," "demand," and "consumptive use." Withdrawal refers to water removed from a source and used for human needs. Some of this water may be returned to the original source with changes in quantity or quality. The terms "consumptive use" and "consumption" properly refer to water withdrawn from a source and made unavailable for reuse in the same basin, such as through irrecoverable losses like evaporation or contamination. The term "water use," while common, often is misleading or at best uninformative, referring at times to consumptive use and at times to withdrawal.

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Lomborg fails to appropriately differentiate among these terms. He initially defines "water use" to mean consumptive use, but he then immediately misuses it when trying to describe trends in per-capita water use. He states, "Per person we have gone from using about 1,000 liters per day to almost 2,000 liters over the past 100 years" (p. 151). This is incorrect—consumptive use over this period has increased from an estimated 700 liters per capita per day (lpcd) to 1,000 lpcd.[11] The estimates cited by Lomborg are for total withdrawals, not consumptive use, and are labeled as such in the original reference.

Lomborg makes many data mistakes despite his training as a statistician. These include selective use of data, misinterpretation of data, and simple errors of fact. Indeed, one of the greatest flaws in the book is his failure to discuss or even acknowledge data problems in general, such as inadequate data collection and dissemination, how to read and understand environmental data, and how to tell good data from bad data.

Almost any conclusion can be supported by selectively using data—an approach for which Lomborg rightly criticizes others. Although he states, "Throughout this book I have tried to present all the facts" (p. 327), Lomborg often chooses just those data that support his position while ignoring those that do not. In addition to his selective use of water-quality data, his discussion of the cost of desalination relies on estimated prices for a single atypical plant that has yet to be built (p. 153) while ignoring the reported costs for average new facilities, which are as much as two times greater.[12]

There are many ways to misuse data. For example, focusing on absolute changes in a statistic may produce a different result than focusing on a relative or percent change. Lomborg notes the difference between proportional and absolute changes in a sidebar, yet, depending on the trend he wishes to highlight, he switches back and forth between the two.[13] Alternatively, carefully choosing a baseline year can disguise or alter a trend. Lomborg uses both techniques when he discusses populations without access to adequate water and sanitation.

He compares current (2000) estimates of unserved populations with data from 1970 or 1980 and optimistically notes that the fraction of people without access decreased during this period. Yet the total number of people lacking access has changed very little and even has grown in some places. In Africa, for example, both the total number and the fraction of the population lacking sanitation services increased between 1990 and 2000. The total fraction of the population without adequate water supply decreased over this period from 43 to 38 percent, yet the population without access to adequate water grew by 34 million.[14] Perhaps more important is that by selecting 1970 as the baseline year, he ignores the fact that there are more people without these basic sanitation services today (2.4 billion) than were alive on the entire planet in the early 1940s (2.3 billion).[15] Are things getting better or worse? It depends on the data presented.

Another classic problem is comparing different types of data that may not be comparable. In Part I of the book, Lomborg combines several data sets on access to drinking water and sanitation that he acknowledges were collected using different definitions, time periods, and combinations of countries—and he then tries to draw a "logistic best fit" to the data (p. 22, Figure 5). No trend can be determined accurately using these data.

Lomborg hides or dismisses problems by looking at global, regional, and national averages. He notes that global average per-capita freshwater availability is very large and concludes that there is plenty of water for all (p. 150). However, the global average is irrelevant to severe and complex regional and local problems. Hundreds of millions of Indian and Chinese citizens lack basic water services, but they are excluded from his estimates of people without enough water because, on average, both countries appear to have adequate supplies (p. 152, Table 4).[16]

Sometimes, Lomborg just gets his facts wrong. He misstates the total amount of water on the planet—approximately 1.36 billion cubic kilometers—by a factor of ten by citing an incorrect source. A source he cites on the next page has the correct number (pp. 149–50). In the same section, Lomborg writes, "Our water consumption has almost quadrupled since 1940" (p. 149). This misquotes a World Resources Institute document published in 1996, which says that from 1940 to 1990, withdrawals increased by more than a factor of four. Even these data are wrong, however, because they extend only to 1980 (an "estimate" in the original source is offered for 1990). Lomborg failed to seek more recent information, which shows that consumption during this period tripled. Water use in regions with the greatest problems increased less quickly or not at all.[17]

When Lomborg states, "Summing up, more than 96 percent of all nations have at present sufficient water resources" (p. 154), he appears to be arguing that only 4 percent of the world's population lives in countries with a level of water availability defined as scarce. This is not a meaningful number because, first, it confuses water availability with water use, and second, it isn't correct. If "sufficient water resources" means access to adequate safe drinking water, 18 percent of the world's population lacks sufficient water; if it means access to adequate sanitation services, 40 percent lacks sufficient water.[18]

The Skeptical Environmentalist ignores a host of water-related problems such as decreasing wetland extent and health, weakening ecological webs, and deteriorating fisheries, which now are considered better indicators of the overall state of water resources than simple measures of scarcity. Lomborg fails to address trends in water-related diseases such as cholera, malaria, and dengue fever. He glosses over unsustainable groundwater use. He trivializes the impacts of climate change on water resources, which now are acknowledged in the scientific literature as some of the most important impacts.[19]

Lomborg consistently misunderstands or misrepresents the work of others. An egregious example concerns my own work, although other authors have pointed out different examples. In writings going back more than a decade, I and others have maintained that the lack of access to adequate water and sanitation services is a particularly disturbing problem that affects billions of people. In my 1993 book, *Water in Crisis*, cited by Lomborg, I explicitly note the connection between population growth and lack of water services, projecting that between 1990 and 2000, nearly 900 million more people would be born in the regions where this lack is the greatest. I describe these data as the "total additional population requiring service by 2000."[20] Yet Lomborg misrepresents (and then criticizes) my work as a prediction that every one of these 900 million people would fail to get access to water and sanitation (p. 21).

The book confuses and misrepresents trends and projections. When past trends show environmental problems worsening, he says that we will do things differently in the future. When past

trends show improvement, he says that they will continue. Using this tactic, any problem can be dismissed out of hand. For example, Lomborg notes that present trends show that the proportion of people in "water stressed" nations will increase from 3.7 to 17.8 percent in 2050. He then minimizes the significance of this increase by stating, "But it is unlikely that we will not become better at utilizing and distributing water" (p. 154). Indeed, many serious environmental problems are dismissed by statements that we will do things better in the future. Readers are told, "Additional dams alone will produce another 1,200 km^3 in accessible runoff," so water scarcity will not be a problem (p. 157). "Global warming. . . will not increase the impact of malaria or indeed cause more deaths" (p. 317). "It is reasonable to expect that the most water-scarce nations will shift their production away from agriculture" (p. 158).

Lomborg denounces letting values distort analysis—a valid concern. Yet his own values regularly taint his conclusions about the severity of problems. For example, he states that "total [water] use is still less than 17 percent of the accessible water and even with the high prediction it will require *just* 22 percent of the readily accessible, annually renewed water in 2025" (p. 150).[21] Similarly, he says, "The total forest loss in the Amazon since the arrival of man has *only* amounted to 14 percent" (p. 10).[22] Even if these numbers were correct or meaningful, his language implies that using 17 percent (or 22 percent) of our total water resources and losing 14 percent of the Amazon forest are not problems. These are value judgments, and they are highly debatable.

Science—even environmental science that crosses traditional disciplinary boundaries—works by some fundamental rules. Those who publish must understand the basic concepts in the fields they tackle, including definitions of fundamental terms. Their work must be open and available for independent peer review. Data cannot be chosen selectively to prove a point. Arguments taken from others must be properly cited and quoted in the appropriate context. Conclusions must be based on evidence, not on suppositions or desires. If I violate these fundamental rules, my work deserves to be criticized and corrected.

But Lomborg is effectively arguing that every environmental scientist writing about serious environmental problems is violating these fundamental rules. As the responses to *The Skeptical Environmentalist* in the scientific community have begun to show in detail, however, Lomborg fails to meet these vital standards.

Lomborg's vision of the future—one in which children born today will live longer and healthier lives, with adequate food, clean water, better education, and a higher standard of living, without destroying the environment—is one we all share. Unfortunately, Lomborg's book muddles public understanding and perceptions of the problems that we face and is a disservice to those trying to move toward that vision.

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NOTES

1. B. Lomborg, *The Skeptical Environmentalist* (Cambridge, U.K.: Cambridge University Press, 2001); G. Easterbrook, *A Moment on the Earth: The Coming Age of Environmental Optimism* (New York: Penguin, 1996); and J. L. Simon, *The Ultimate Resource* (Princeton, N.J.: Princeton University Press, 1981).

2. See "Misleading Math about the Earth," articles by S. Schneider, J. P. Holdren, J. Bongaarts, and T. Lovejoy, *Scientific American*, January 2002; S. Pimm and J. Harvey, "No Need to Worry about the Future," *Nature*, November 2001, 149–50; and M. Grubb, "Relying on Manna from Heaven?" *Science*, 9 November 2001, 1,285–86. Reviews by P. H. Gleick, J. Mahlman, and E. O. Wilson can be found at the Union of Concerned Scientists web site at http://www.ucsusa.org/environment/lomborg.html and http://www.pacinst.org/Lomborg_review.html, accessed on 7 May 2002.

3. Italics in original.

4. Ministry of Water Resources, People's Republic of China, Department of Hydrology, *Water Resources Assessment for China* (Beijing: China Water and Power Press, 1992); F. Ghassemi, A. J. Jakeman, and H. A. Nix, *Salinisation of Land and Water Resources* (Wallingford Oxon, U.K.: CAB International, 1995); and A. D. Gupta, "Strategic Approach Towards Sustainable Groundwater Resources Development and Management," *Water Resources Journal*, United Nations, no. 196 (1998): 1–7.

5. P. H. Gleick, "Water and Conflict," *International Security* 18, no. 1 (1993): 79–112. A comprehensive chronology of these conflicts can be found at the World's Water web site at http://www.worldwater.org/conflictIntro.htm. For a history of water-related conflicts in the Middle East from 3000 B.C. to 300 B.C., see P. H. Gleick, "Water, War, and Peace in the Middle East," *Environment*, April 1994, 6–15, 35–42.

6. M. Glantz, ed., *Creeping Environmental Problems and Sustainable Development in the Aral Sea Basin* (Cambridge, U.K.: Cambridge University Press, 1999), 291.

7. World Bank, "Ambient Water Pollutant Concentrations in Major Chinese Rivers," data from the China Environmental Yearbook of the National Environmental Protection Agency, accessible via http://www.worldbank.org/nipr/data/china/status.htm#Ambient.

8. World Bank, "Table 3.6. Water Pollution: Emissions of Organic Water Pollutants," accessible via http://www.worldbank.org/data/wdi2001/pdfs/tab3_6.pdf; and H. Hettige, M. Mani, and D. Wheeler, "Industrial Pollution in Economic Development: Kusznets Revisited," World Bank, Development Research Group, Report 1876 (Washington, D.C., 1998), available at http://www.worldbank.org/html/dec/Publications/Workpapers/WPS1800series/wps1876/wps1876-abstract.html.

9. Ibid.

10. Denmark reported that total emissions of organic water pollutants rose to 92,700 kilograms per day in 1998 (up from 65,500 kilograms per day in 1990) and that there was an increase from 0.17 to 0.18 kilograms per worker per day over this period. Ibid.

11. I. Shiklomanov, "World Fresh Water Resources," in P. H. Gleick, ed., *Water in Crisis* (New York: Oxford University Press, 1993), 13–24; and I. Shiklomanov, "Appraisal and Assessment of World Water Resources," *Water International* 25, no. 1 (2000): 11–32.

12. P. H. Gleick, *The World's Water 2000–2001* (Washington, D.C.: Island Press, 2000), 108–09.

13. See, for example, pages 7 and 154.

14. World Health Organization (WHO), *Global Water Supply and Sanitation Assessment 2000 Report* (Geneva, 2000), available in full at http://www.who.int/water_sanitation_health/Globassessment/Global1.htm. See Table 2.2 at http://www.who.int/water_sanitation_health/Globassessment/tab2-2.gif.

15. Data on access to sanitation services come from WHO, ibid.; data on global population in the 1940s come from United Nations, *World Population Prospects as Assessed in 1963* (New York, United Nations Publications, 1966).

16. In this table, the global population facing chronic water scarcity excludes all people in India and China (as well as those in Indonesia, Bangladesh, and other countries where national average water availability is above 2,700 liters per capita per day).

17. Shiklomanov, "Appraisal and Assessment of World Water Resources," note 11 above.

18. WHO, note 14 above.

19. Lomborg devotes only four sentences to the impacts of climate change on water resources (see page 152), relies on only one reference, and misquotes its conclusions. For details about climate change and threats to water resources, see Technical Summary of Working Group II of the Intergovernmental Panel on Climate Change (IPCC), J. J. McCarthy, O. F. Canziani, N. A. Leary, D. J. Dokken, and K. S. White, eds., *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of IPCC (Cambridge, U.K.: Cambridge University Press, 2001. This peer-reviewed work also is available at http://www.ipcc.ch/pub/wg2TARtechsum.pdf.

20. P. H. Gleick, ed., *Water in Crisis* (New York: Oxford University Press, 1993). See page 189, Table C.4, and accompanying description.

21. Italics added.

22. Italics added.