Where's Waldo?

A Review of The Skeptical Environmentalist *(Bjørn Lomborg)*

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Every few years, a new book comes out purporting to debunk the myth of the world's environmental problems. These books meet with substantial acclaim from some members of the media and a subset of analysts who make a career out of promoting anti-environmentalism or unrestrained economic markets, as though their message is new and newsworthy. *The Skeptical Environmentalist* by Bjørn Lomborg, a Danish statistician, is just the latest example, but it follows on the heels of Easterbrook's *The Coming Age of Environmental Optimism*, which followed Simon's *The Ultimate Resource*, which followed comparable books by Beckerman, Kahn, Maddox, and others. Their message is simple: those scientists, policymakers, and NGOs concerned about the environment have it wrong. The world is getting better all the time and will continue to get better.

There is nothing original or unique in Lomborg's book. Many of his criticisms have appeared in these previous works—and even in the work of environmental scientists themselves. What is new, perhaps, is the scope and variety of errors he makes. Because of Lomborg's background in statistics, this book focuses on data and is heavily footnoted, permitting interested readers to trace his efforts and look into his original sources.

As a scientist, I appreciate this level of detail. I didn't intend to read the whole book, wanting to focus on those sections most relevant to my own work: water, climate change, energy, and conflicts over resources. But I found myself sucked into the nitty-gritty of Lomborg's effort and ended up reading almost the entire thing—more than 350 pages of small print and many of the 2900 footnotes. It became a game similar to "Where's Waldo?" Readers with small children will know immediately what I'm talking about. Waldo is a popular cartoon character with a funny hat, glasses, and a distinctive red and white shirt. Tiny images of Waldo are carefully hidden in large pieces of colorful artwork with hundreds or thousands of small cartoon figures in complex cartoon landscapes. The goal is to find Waldo. Kids spend hours poring over these pages looking for the hidden image.

In *The Skeptical Environmentalist*, "Waldo" became a series of conceptual errors, misunderstandings, and data problems. As I turned each page, the surprise was which Waldo (or Waldos) I would find

next. There was no shortage. Some were trivial; others were dramatic in their scope and implication. Let me describe some of the most important "Waldos," focusing particularly on flaws in the sections on water resources.

Waldo 1: Conceptual confusions

Lomborg's understanding of basic environmental science concepts and the nature of risk assessment are highly flawed. There are many examples, but perhaps the most egregious is his intentional and explicit disregard of ecology and the connections among environmental problems. As he admits at the beginning, his book is "human-centered" and he considers the ecology of the planet to be of value only when it provides economic advantages and opportunities for humans: "One cannot generally argue that these species [at risk of extinction] constitute an actual economic resource" (Lomborg 2001, p. 115). In the rest of his book, all of the work done in recent years exploring and highlighting the intricate connections between human health and ecosystem health is ignored, and all of the research on our failing natural ecosystems is deemed unimportant.

This flaw makes it possible for Lomborg to point to improvements in some environmental indicators over time—not a new observation—and yet fail to see the declining ecological support systems underlying these indicators. Thus the book has sections on minerals, food production, water resources, acid rain, and so on, but nothing on wetland extent and health, coral reefs, ecological webs, and comparable issues that scientists now understand to be better indicators of overall environmental (and human) well-being (Daily 1997). He regularly comments on the quantity of resources without addressing the issue of quality—for example, he argues that global forest extent is relatively unchanged over the past 50 years (a contentious issue—see Waldo 3 below), but fails to adequately address the more complex implications of replacing mature old-growth forests with young, plantation forests.

Waldo 2: Selective choice of problems

Lomborg selectively chooses to address issues and problems that support his optimistic views. And indeed, some things are getting better, as environmental scientists have noted for years. But the subset of environmental issues he has chosen excludes those problems that are either of greatest importance or those that are most clearly worsening. As a result, the subtitle of the book—"Measuring the Real State of the World"—is a misnomer. Rather, Lomborg offers a partial measurement of a few of the world's environmental problems.

Examples? In his chapter on food and hunger, Lomborg notes the tremendous improvement in agricultural production in China in the past few decades, but fails to note that this improvement has come at the expense of China's soils and aquatic ecosystems and has led to unsustainable groundwater overdraft in many parts of the

country (Smil 1993). He notes that urban air pollution in the UK has improved along with local health, but ignores the health implications of exporting emissions outside of political borders (Lomborg 2001, p. 11). The most plausible risks of climate change, such as impacts on water resources, flooding, and ecosystems, he ignores completely, while challenging a series of far less likely consequences, such as whether the ice sheets of Antarctic and Greenland will melt catastrophically.

For water, he focuses on the issue of water scarcity—a subject of considerable debate even in the water community—but fails to address trends in water-related diseases such as cholera, malaria, or dengue fever. The 1990s, for example, saw the greatest outbreaks of cholera and dengue fever in this century.[1] He ignores evidence about deteriorating fisheries and wetland habitat. He glosses over unsustainable groundwater use.

Waldo 3: Selective use of data, misuse of data, misinterpretations, inappropriate precision, errors of fact

Lomborg makes many data mistakes—unexpected and disturbing in a statistician. Indeed, one of the greatest flaws in the book is his failure to discuss data problems in general, including how to read and understand environmental data, the failure of governments to collect and disseminate adequate environmental data, how to tell good data from bad data, how to use data, and so on. The environmental field suffers from having both too much and too little data. Vast quantities of information are available, of varying qualities, on many aspects of our environmental condition. Other measures are lacking completely. Lomborg rails against the misuse of data by environmentalists and the media but fails to note that data misuses are not limited to those who believe that environmental problems are real. Indeed, Lomborg promptly falls into all of the same traps he complains about, supporting the old adage that statisticians know best how to misuse statistics.

Selective use of data

By selectively using data, it is possible to support almost any conclusion—an approach Lomborg rightly criticizes others for. Yet he carefully selects just those data that support his position, while ignoring those that do not. For example, he regularly relies on data showing improvements in rich countries, while ignoring evidence (or the lack of evidence) about conditions in developing countries. He states, "The number of hours we work has been halved during the last 120 years, and because we live ever longer than we used to, we have more than twice as much leisure time to enjoy" (Ibid., p. 87). The "we" to whom he refers are the minority of the world's people

[1] For cholera data see Gleick 1998. For dengue data see the World Health Organization data at *www.who.int/emc/slideshows/dengue/sld001.htm.*

who live in the developed world. And even this subset hides populations who have not benefited from these advances.

He selectively chooses optimistic data in his assessment of water problems. To justify his belief that desalination will be the solution to water availability problems, he quotes prices of $0.5 to 0.8 per cubic meter to desalinate seawater (Ibid., p. 153). He fails to note that these are the estimated prices for a single plant that has yet to be built and that has several atypical characteristics (Gleick 2000, pp. 108–109). In fact, prices for desalination remain between $1 and $2 per cubic meter, and even if they were to drop by a factor of two, they would remain well out of reach of most water users. Lomborg states that we will no longer destroy aquatic ecosystems because "we have learnt the lesson" of the Aral Sea (Lomborg 2001, p. 157). Yet the destruction of the Aral Sea continues to this day, and inappropriate water management and use threaten other bodies of water.

Lomborg insists early in the book that global data are the most appropriate indicators of overall well being, since they integrate different regional trends. Sometimes this is appropriate, but sometimes it is incorrect, and Lomborg fails to differentiate. He cites data showing no trend in "global" storminess as an indication that changes in climate variability have been overstated (Ibid., p. 293). Yet global averages can, and in this case do, mask significant regional changes. Ironically, Lomborg himself is inconsistent and ignores global data when they show adverse impacts, choosing more positive regional changes to argue his points. In the section of food production, for example, he dismisses the drop in per capita global grain production and points instead to grain production in developing countries as a more important indicator (Ibid., p. 94). And even this measure shows a drop in the last few years. In his discussion of the pollution burden, he selectively limits his analysis to pollutants that have been regulated since the 1960s, showing declines in DDT in breast milk for example. Yet data are presented only for the richer nations, and only for regulated contaminants (Ibid., p. 211). In other parts of the world, the trends are often in the opposite direction.

Misuse of data

Data may be misused in a variety of ways and Lomborg draws on many of them. For example, looking at absolute changes in a statistic may produce a different result than looking at a relative, or percent change. It is possible to have a decrease in the fraction of a population suffering from a problem, yet still have an increase in the absolute number of people who are worse off. Lomborg notes this in a sidebar, yet switches back and forth between proportional and absolute changes himself, depending on the trend he wishes to highlight (Ibid., pp. 7 and 154, for example).

Another classic problem is comparing apples and oranges: different types of data may not be comparable. In Part I, Lomborg combines data sets on access to drinking water and sanitation that he

acknowledges were collected using different definitions, different time periods, and different combinations of countries, then tries to draw a "logistic best fit" to the data (Ibid., Figure 4, p. 20 and Figure 5, p. 22). No trend can be drawn using these incompatible data.

Inappropriate choice and misinterpretation of data

Lomborg makes simple mistakes in interpretation or chooses data sets that are not appropriate. He criticizes Lester Brown for documenting declines in the growth of total world grain production as an indicator of potential food problems, saying that it is more appropriate to "look at production per capita." Yet Brown does precisely this analysis as well.[2] Ironically, Lomborg implies that the per capita indicator would show an improvement. In fact, if total grain production has been declining, then per capita production has been declining even faster, exactly what the data show.

Lomborg computes the total amount of freshwater that is theoretically available, per person, on a global average basis and concludes that there is plenty of water around (Ibid., p. 150). Yet such a statistic is meaningless—the global average water availability per capita is irrelevant to the severe and complex problems of local and regional access to water. He confuses water withdrawals, water consumption, water availability, access to water, and water use (Ibid., p. 150)—very different concepts. This leads to conceptual confusions in his analysis of whether or not water supply and demand imbalances are real or can be corrected. For example, his confusion between "availability of water" and "use of water" leads him to reject the idea of a water problem: "Summing up, more than 96 percent of all nations have at present sufficient water resources" (Ibid., p. 154), despite the fact that more than one billion people are acknowledged to lack access to clean drinking water and 2.4 billion lack access to improved sanitation services.[3]

Inappropriate precision

Many environmental data are uncertain and imprecise—a point well understood by environmental scientists. Yet Lomborg fails to discuss the issue of uncertainty, and uses uncertain and imprecise data to make his points. For example, after arguing that the data on global forest cover do not support a decline over time, he offers data that he says shows an increase in global forest cover, from 30.04 percent to 30.89 percent of global land area between 1950 and 1994 (Ibid., p. 111). Unfortunately, our ability to measure "forest cover" falls well below the precision of these data—thus no significant conclusion can be drawn from the numbers Lomborg gives here. However, his footnotes provide plausible evidence of long-term

[2] Brown, Renner, and Halwell 1999, p. 31, shows total global grain production leveling off and a *decline* in per capita production.

[3] Official UN data can be found at *www.who.int/water_sanitation_health/Globassessment/Global2.1.htm.*

forest decline. Interestingly, when a comparable data set shows evidence of a larger decline, he complains, "these figures are vitiated by considerable uncertainty" (Ibid., p. 111). Of course, as noted earlier, global average figures hide far more important regional trends.

Errors of fact

Lomborg makes many errors, both important and trivial. He should have taken more care in checking basic information. For example, his assessment of the temperature record over the past century is just wrong (Ibid., p. 263)—there is strong agreement among atmospheric scientists that warming is now occurring due to anthropogenic influences.[4] He also suggests that total changes in water availability from climate change are small "(1–5 percent)," although both global and regional studies show that possible changes in water availability range from 10 to even 100 percent—potentially massive changes with enormous implications for water planning and management.[5]

Waldo 4: Misreadings and misrepresentations

Lomborg misunderstands, or misrepresents, the work of environmental scientists. A particularly egregious example concerns my own work, though no doubt other examples can be found. In writings going back more than a decade, I have pointed to the lack of access to clean water and sanitation services as a particularly disturbing problem, affecting billions of people. In my 1993 book, *Water in Crisis*, I note the connection between population growth and lack of water services, showing that between 1990 and 2000, nearly 900 million more people would be born in the regions where this lack is the greatest. In presenting these data, I describe them as the "total additional population requiring service by 2000" (Gleick 1993, Table C.4, p. 189). Lomborg misinterprets and misrepresents my work as a *prediction* that every one of these 900 million people would fail to get access to water and sanitation (Lomborg 2001, p. 21)—a ridiculous interpretation. Had he looked at the actual data I provided and read the explicit description of those data, he would have seen that they were properly labeled. Lomborg's misrepresentation indicates either shoddy analysis or intentional misrepresentation. He also misreads official UN statistics on this issue. Indeed, today, the best UN estimate is that the number of

[4] See the IPCC reports from Working Groups I and II at *www.ipcc.ch/.*

[5] See the water chapter of the IPCC reports and the National Assessment water sector report summarizing research on U.S water resources at *www.pacinst.org/naw.html.* Table 6 in this latter study shows that climate model estimates of changes in precipitation could range from +67 percent to –17 percent for different regions of the country. Tables 7, 8, and 9 in the same study shows that runoff could decrease by as much as 80 percent or increase by more than 100 percent for different regions and different plausible scenarios.

people without access to improved sanitation is over 2.4 billion—an absolute increase in recent years.[6]

Waldo 5: Simplification or gross generalization

Lomborg consistently simplifies or generalizes complex arguments in inappropriate ways, a classic error of environmental optimists. In several places, he argues that the "truth" is being distorted: "the public environment debate has unfortunately been characterized by an unpleasant tendency toward rather rash treatment of the truth" and "it is also crucial that we cite figures and trends which are true" (Ibid., p. 12). But "truth" is an elusive concept in environmental and ecological science. Environmental scientists know that uncertainty is a fundamental part of many of these issues—uncertainty due to inadequate data collection, or the complexity of ecological relationships, or the inability to know the future. As a result, much of what we know is estimation or expert judgment and should be described as such. Anyone claiming to know the "truth" is grossly overconfident and underinformed.

In Part II of his book, Lomborg describes improvements in a select number of indicators of human welfare, but then states "by and large all measurable indicators of human welfare show improvement" (Ibid., p. 91). This statement has many flaws, most notably his subtle qualifications of "by and large" and "measurable" contrasting with his blanket generalization of "all." Another gross generalization: "We have experienced fantastic progress in all important areas of human activity" (Ibid., p. 87).

While acknowledging, "there may be regional or logistic problems with water" (Ibid., p. 149), Lomborg discounts water problems because "basically we have sufficient water" at the global scale—a dangerous and meaningless simplification. He spends a lot of time proving that we will never "run out" of oil—something no environmental scientist would dispute—because of economic markets and the potential to substitute different forms of energy. (Ibid., pp. 124–125). Yet he goes on to conclude that there is no "energy problem," ignoring the complex connections between energy and the environment. He states that "the Green Revolution has been victorious" (Ibid., p. 67) without discussing the unsustainability of overpumping groundwater to meet agricultural needs in China, India, the U.S., and elsewhere. His discussion of conflicts over shared water resources relies on the work of a single analyst and an artificial argument: that wars will be fought over water (Ibid., pp. 156–157). This simplification ignores local and regional water-related disputes and conflicts, and the use of water as a political target or tool, which other analysts describe as far more

[6] Official UN data show that the percentage of people without access to improved sanitation has dropped, while the absolute number has increased. *www.who.int/water_sanitation_health/Globassessment/Global2.1.htm.*

likely.[7] He concludes that there is plenty of water because infinite quantities of desalinated water are available at prices that are not out of reach, ignoring the fact that the prices are typically an order of magnitude above what agricultural users currently pay (Ibid., p. 153).

Waldo 6: Confusion of observed trends and future projections

When past trends show environmental problems, Lomborg argues that we will do things differently in the future; but when past trends show improvement, he argues that they will continue. He also confuses "predictions" with literature describing possible futures (Ibid., p. 30). Many more pessimistic analysts are fully aware of the options available for doing things better—but they see a value in educating policymakers and the public about the risks of failing to pursue these options.

Lomborg notes that current 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 projection by stating, "But it is unlikely that we will not become better at utilizing and distributing water" (Ibid., p. 154). He acknowledges inappropriate exploitation of forests, but discounts its importance because he believes the proper application of economics will solve it (Ibid., p. 117). In his discussion of the rich-poor gap, he shows evidence of a clear increase in the discrepancies between rich and poor, but says this won't continue. To support this, he mixes historical data with a set of scenarios suggesting that the growing rich-poor gap was only an aberration (of the past 175 years) (Ibid., Figure 35, p. 75). In minimizing the risk of oil price disruption, he notes "…the US Energy Information Agency expects an almost steady oil price over the next 20 years at about $22 a barrel" (Ibid., p. 14). Maybe, but other credible forecasts differ.[8]

Waldo 7: Hidden value judgments

A wide variety of value judgments are hidden throughout *The Skeptical Environmentalist*. Lomborg rails against letting values distort analysis—a valid concern. Yet his values (*identified in italics below)* regularly taint his conclusions about the severity of particular problems. For example, he states "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" (Ibid., p. 150). Even if these numbers were correct, which they aren't, his phrase implies that 17 percent (or 22 percent) is not a problem—a value judgment. He also states, "The US has *only* lost approximately 30 percent of its original forest area" (Ibid., p. 112) as though that is an insignificant amount—again, a

[7] See, for example, Gleick 1998, pp. 105–135, and the water conflict chronology at *www.worldwater.org.*

[8] See IPCC Working Group III report at *www.ipcc.ch/.*

value judgment. A comparable statement is "the total forest loss in the Amazon since the arrival of man has *only* amounted to 14 percent" (Ibid., p. 10). If this were true, would this be good? He implies it would. Even when things are clearly getting worse, Lomborg justifies ignoring them as the price we pay for progress: "developing countries are really *just* making the same tradeoffs [for air pollution] as the developed countries made 100–200 years ago" (Ibid., p. 210). "Nutrient overload is the price we let the marine organisms pay for our success in feeding humanity, while maintaining large forest habitats" (Ibid., p. 210).

Waldo 8: Biased optimism

In the end, much of the book simply reflects Lomborg's optimistic view of the world, contrasted with a careful selection of more pessimistic views of a number of environmental analysts, scientists, and activists. Throughout the book, we are told that because we know how to do things right, we "will." (I've italicized Lomborg's optimistic language in several examples here.) "Additional dams alone *will* produce another 1,200 km^3 in accessible runoff" (Ibid., p. 157), so water scarcity will not be a problem. "Food *will* in all likelihood continue to get cheaper and more available, while we *will* be able to feed still more and more people"(Ibid., p. 159). "Global warming *will not* decrease food production…it *will not* increase the impact of malaria or indeed cause more deaths" (Ibid., p. 317)—unresolved questions still being carefully debated by scientists. "Our food production *will* continue to give more people more and cheaper food" (Ibid., p. 329). "It is reasonable to expect that the most water-scarce nations *will* shift their production away from agriculture" (Ibid., p. 158). "Sub-Saharan Africa has great *potential* for increasing the amount of food it produces… it is possible in practice to increase agricultural production substantially in sub-Saharan Africa" (Ibid., p. 66).

He acknowledges the research that suggests that global warming will be tougher on the poorer developing countries, but says that they will all be considerably richer by 2050 and hence able to solve this problem through trade and markets (Ibid., p. 289). Perhaps, but there is no reason to assume that Lomborg's crystal ball is any clearer than anyone else's.

Lomborg's vision of the future—one where children born today will live longer and be healthier, get more food, clean water, a better education, and a higher standard of living without destroying the environment—is one we all share. As an environmental scientist, however, I think we are more likely to get there by studying and acknowledging our problems and by taking action, than by putting on rosy glasses and crossing our fingers.

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