A MOMENT OF TRUTH: CORRECTING THE SCIENTIFIC ERRORS IN GREGG EASTERBROOK'S *A MOMENT ON THE EARTH*

Part One

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The Environmental Defense Fund (EDF) is a leading, New York-based, not-for-profit research and advocacy organization with over 250,000 members nationwide. EDF's staff includes scientists, economists, engineers, and attorneys who seek practical solutions to a broad range of environmental and human-health problems.

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INTRODUCTION

In his book *A Moment on the Earth*, Gregg Easterbrook argues that environmentalists "are surely on the right side of history, but increasingly on the wrong side of the present, risking their credibility by proclaiming emergencies that do not exist." Yet his account of environmental issues is replete with errors and misinterpretations of the scientific evidence. This is especially notable in regard to the four chapters that deal with habitat loss, global warming, ozone depletion, and species extinction, probably the four most serious threats to the natural environment, according to a recent report by the Science Advisory Board of the U.S. Environmental Protection Agency. [1]

We believe that the record should be set straight on Easterbrook's critical scientific errors, for the faulty statements in these four chapters substantially undermine his thesis that many environmental problems have been overstated. [2]

Although some mistakes may be inevitable given a work of this size, Easterbrook's are so numerous and so one-sided in their minimization of the seriousness of environmental problems that they must be addressed. Moreover, he has included some assertions in his book after having been warned by technical experts that they were incorrect. [3]

This report by no means constitutes a complete account of the misstatements to be found in Easterbrook's work, but it provides a sample of some of the most egregious errors in just four of its chapters. With each correction of a disputed scientific statement, we provide sources in the peer-reviewed technical literature, unlike Easterbrook, who cites few sources to back up his claims.

Easterbrook writes on page 713, "When no source for a fact is indicated in the text or these notes, this is because the assertion is not generally in dispute among specialists." Despite this claim, throughout the text he makes numerous statements in regard to scientific matters without citation, which are not only open to dispute, but, as we shall show, are just plain wrong.

ENDNOTES

1. Science Advisory Board, U.S. Environmental Protection Agency, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection*, Washington, D.C., 1991.

2. Prior to the publication of this work, the Environmental Defense Fund also noted that Easterbrook incorrectly claimed that EDF accepted payment from the McDonalds Corporation and other companies. When this error was pointed out to Easterbrook, he agreed to write a erratum, to be placed in every published copy of the book.

3. For example, Easterbrook asked Michael Oppenheimer, senior scientist with the Environmental Defense Fund, to review his draft chapter dealing with ozone depletion but failed to fully correct several of the errors that Oppenheimer noted.

SECTION 1

"CLIMATE II: GLOBAL WARMTH" [CHAPTER 17]

In his chapter on global warming, Easterbrook makes many fundamental errors. He continually confuses global, regional, and local temperature trends, which may differ considerably; he mischaracterizes the results of a poll that was undertaken to determine scientists' views on global warming; and he mistakenly asserts that the sea level has not risen significantly, when it has.

Most flagrantly, however, he erroneously claims that the National Academy of Sciences (NAS) and the Intergovernmental Panel on Climate Change (IPCC), the two most respected scientific authorities on the subject, have substantially lowered their projections of future warming due to a doubling of carbon dioxide in the atmosphere, when they have not.

***A Moment on the Earth*, p. 277:**

> "Immediately it got cold. From 1940 through the 1970s global temperatures declined, hitting bottom during the frigid winter of 1977, coldest in a century in North America."

Correction:

Easterbrook is wrong on all three counts. First, global temperature did not decline significantly between 1940 and the 1970's; it wavered up and down by small amounts after having risen for several decades. Second, global temperature did not "hit bottom" during the winter of 1977, but averaged above normal. Finally, the average temperature for North America was also above normal that winter. It was in the eastern United States that it was indeed very cold. [1]

It is the *long-term global pattern* that is considered significant in the global warming context, not annual or seasonal changes in temperature in particular regions, which can be quite variable.

***A Moment. . . ,* p. 278:**

"In February 1992 the Gallup Organization polled members of the American Geophysical Union and American Meteorological Society, the two professional groups for climatologists. Only 17 percent said warming trends so far convinced them an artificial greenhouse effect was in progress."

Correction:

Though in many respects the poll was confusingly worded and its results difficult to interpret, there was one unambiguous finding: *Sixty-six percent of the scientists polled, a large majority, responded "yes" to the question: "In your opinion is human-induced greenhouse warming now occurring?"* This is far from the 17 percent cited by Easterbrook and others before him. Only 10 percent of the scientists disagreed with this proposition, and the remainder were undecided. Moreover, only 2 percent believed that there was *no* chance that substantial human-caused warming would occur over the next 50 to 100 years. [2]

***A Moment. . . ,* p. 278:**

"That same year Greenpeace surveyed climate researchers using a poll whose questions were worded so as to elicit alarm. Some 47 percent of respondents said a runaway greenhouse effect is either impossible or highly improbable."

Correction:

Easterbrook's reference to this finding, unaccompanied by any further discussion, and repeated later on the same page, on the jacket of the book, and in the preface, reveals that he either misunderstands the technical meaning of this term or is attempting to mislead the reader. A "runaway greenhouse effect" means not merely rapid warming, but an unstable feedback, leading to the complete evaporation of the oceans. There is little or no chance that a "runaway greenhouse effect" will occur, but there is a definite possibility that the warming will be rapid and substantial. [3]

***A Moment. . . ,* p. 279:**

"It turns out that the late 1800s was a cold period. Earth could experience 'record' warmth relative to the 1880s and remain cool compared to the bulk of its past."

Correction:

Although, as Easterbrook notes, accurate temperature data did not exist before 1860, the best available evidence suggests that the late 1800's were warmer than most of the previous 400 years, and close to average for the previous 10,000. Therefore, the observed warming since then has indeed been significant. [4]

***A Moment. . .*, p. 279:**

". . . conditions environmentalists would call a global- warming disaster [would entail] typical temperatures higher than today's by 10 to 22 degrees Fahrenheit. A temperature rise in this range would surely render the Earth inhospitable to genus *Homo* and thousands of other present species; but not even worst-case projections anticipate warming of such magnitude."

Correction:

Not true. The computer climate model developed by scientists at Princeton University projects that if CO2 concentrations were to quadruple, which may well occur after 2100 without concerted international actions to reduce emissions, temperature increases in this range would follow. [5]

***A Moment. . .*, p. 279:**

"Artificial greenhouse gases did not become significant until the postwar industrial boom of the late 1940s. According to greenhouse theory, sharp heat increases should have followed. Instead the warming rate slowed down."

Correction:

Climate models do not predict sharp temperature increases following immediately upon rises in accumulated greenhouse gases. Easterbrook ignores the lags in the system, caused by many factors, including the behavior of the ocean, non- linearities in the CO2 effect, reflection of sunlight by sulfate particles, and random fluctuations of climate, which combine to ensure that the release of greenhouse gases and temperature increases will not occur at exactly the same time. Indeed, computer models for climate warming that take account of these factors predict global temperatures in reasonable agreement with the observed temperature rise over the past 100 years. [6]

***A Moment* . . . , pp. 279-280:**

> "The studies that find a global warming trend during the 1980s rely on surface-temperature readings taken near cities. Researchers know that the urban "heat-island effect" distorts such readings, and they adjust data to compensate. The degree of adjustment required is controversial, however. The Goddard Institute, whose greenhouse studies are downbeat, subtracts about 0.1 degree Fahrenheit. Other researchers maintain that about 0.3 degrees must be subtracted to remove the heat-island effect. If the Goddard Institute adjusted by 0.3 degrees, this would cancel out the entire claimed global temperature increase of the 1980s."

Correction:

Not true. Easterbrook appears to confuse not only Fahrenheit and Celsius, but decades with centuries. The correction applied by Goddard for the urban "heat-island effect" is 0.1 degrees Celsius, not Fahrenheit, as Easterbrook states, and the correction is made over a century, not a decade. The correction would work out to about 0.01 degrees Celsius per decade, while the surface data show a warming of about 0.15 degrees Celsius over the 1980's. Thus, taking into account the urban "heat-island effect" does little to cancel out the observed warming, and this would be true even if one applied Easterbrook's hypothetical 0.3 degree figure for a century's correction. [7]

Finally, the warming is also apparent in sea-surface data and in surface data for the Southern Hemisphere, where there are few urban areas compared to the Northern Hemisphere. [8]

A Moment. . . , p. 280:

> "Studies of the total heat in atmospheric air volumes conflict with studies confined to ground temperatures. National Aeronautics and Space Administration data from atmospheric satellites show a small global temperature decline during the past decade."

Correction:

The supposed "conflict" has largely been resolved. There are several reasons why temperatures aloft and at the ground should behave differently over the short period of

fifteen years for which satellite data exist. These include different responses to volcanoes, to El Nino, and to the effects of ozone depletion. [9]

***A Moment. . . ,* p. 280:**

"In the United States, six of the ten years of the 1980s were indisputably warm in urban areas. This was taken in many quarters as proof that an inexorable global warming had begun."

Correction:

Once more, Easterbrook confuses regional and global temperature patterns. What was remarkable was that six of the ten years of the 1980's hit *record* warmth, and this was true not of urban areas in the United States, but *over the globe as a whole*. In the continental United States, on the other hand, the average temperature fell shy of record levels. [10]

***A Moment. . . ,* p. 280:**

"Then the trend dissipated, with 1991 and 1992 being slightly cool for American cities. Greenhouse true believers attributed this decline to the 1991 eruption of Mount Pinatubo, which ejected large amounts of sun-filtering aerosols into the stratosphere. Tests showed that by late 1992 most Pinatubo effects had washed out of the air, suggesting that if an emergency global warming were in progress it ought to resume in 1993. But global temperatures recorded by NASA satellites for 1993 remained slightly below the 1980s average."

Correction:

Again, late 1991 and the year 1992 were relatively cool over the entire *world*, due to the Pinatubo eruption, not merely in American cities, as Easterbrook puts it. And warming did *indeed* resume in 1993, but since not all of the Pinatubo effect had dissipated, the year was not quite as warm as the record years of the 1980's. Moreover, the amount of warming that occurred was almost exactly as predicted by the climate models. [11] Finally, Easterbrook neglects to mention that in 1994, global surface temperatures rebounded close to pre- Pinatubo levels, and it was the fourth or fifth warmest year ever recorded. [12]

***A Moment. . .*, pp. 281-282:**

"In 1988, [James] Hansen told a congressional committee he was '99 percent certain' that summer's heat wave stemmed in some manner from greenhouse emissions. . . . Though it surely was hot in North America in summer 1988, at the same time central Asia experienced a cold wave. The cold Asian area was roughly identical in size to the warm North American region."

Correction:

Again Easterbrook mixes up global and regional trends. Hansen's level of certainty, as clearly expressed before Congress, pertained to the existence of a global warming trend over the past century, and was based *not* on that summer's heat wave, but on a 100-year record of *global* temperatures. What happens during any one summer in North America or in central Asia bears little relation to long- term trends. [13]

All in all, Easterbrook's error-filled rendition of the warming trend, and his continual confusion of regional and global temperatures, is remarkable. What is most extraordinary is that he refers only indirectly (on p. 278) to the clearest and most immediately compelling fact in the global surface temperature record, which has been kept for more than a century: that the ten warmest years have all occurred since 1980.

***A Moment. . .*, p. 284:**

"Researchers who have set GCMs [general circulation models] to conditions of the nineteenth century find the models conclude that global temperatures should have risen about five degrees Fahrenheit by now."

Correction:

False. According to the models, this level of temperature change is not predicted to occur until much later, given the mediating effect of the oceans, among other factors. [14]

***A Moment. . .*, p. 286:**

"In 1979, the National Academy of Sciences convened a panel of climate modelers who projected an up to nine-degree Fahrenheit warming from doubled CO2. . . Since 1990 the National Academy of Sciences has backed away from the

high end of its 1979 forecast, though the number is still cited by doomsayers as an 'official' prediction."

Correction:

Completely untrue. The NAS has *not* reduced its "high-end" forecast, but in its latest report actually *raised* it, from 8.1 degrees Fahrenheit to 9 degrees Fahrenheit. To be exact, the range of likely warming corresponding to a doubling of atmospheric CO2 was widened by the Academy panel from 1.5-4.5 degrees Celsius (2.7-8.1 degrees Fahrenheit) in 1979 and 1983 to 1-5 degrees Celsius (1.8-9 degrees Fahrenheit) in its 1992 report. [15]

***A Moment. . .* , p. 286:**

"When in the late 1980s preliminary studies by the Intergovernmental Panel on Climate Change endorsed the nine- degree [Fahrenheit] number, the IPCC's became the doomsday prediction of choice. After the 1992 Rio conference broke up, the IPCC amended to its 'best guess' two to 4.5 degrees Fahrenheit from doubled carbon dioxide--a range that could hold nasty surprises for the ecology but is nothing like the emergency numbers that dominated Rio rhetoric. . . . the trend toward lower greenhouse-effect estimates . . . has received little media attention and caused no political stir, being nonalarming."

Correction:

It caused no stir because it never happened. The IPCC has *never* altered its range of possible warming due to doubled CO2 *or* its "best guess" estimate. In its first report, in 1990, the IPCC adopted the National Academy's range of 1.5 to 4.5 degrees Celsius (2.7-8.1 degrees Fahrenheit) for the doubling of CO2. [16] Since then, the IPCC has *continued* to endorse this range of possible warming.

Furthermore, in both reports, it endorsed the same "best estimate" of an increase of 2.5 degrees Celsius as the most likely scenario to result from CO2 doubling. As the IPCC clearly wrote in its 1992 report, "The range of values for climate sensitivity [to a doubling of carbon dioxide] reported in the 1990 Assessment and re-affirmed in this Supplement, was 1.5o to 4.5o C, with a best estimate, based on model results and taking into account the observed climate record, of 2.5o C." [17]

A Moment. . . , p. 287:

". . . in 1991 it was found that CFCs appear to have different greenhouse functions depending on altitude. At some altitudes they trap heat; at others they reflect sunlight back into space. Taken together the effects form a sort of zany equilibrium: CFCs may be bad for the ozone layer but now appear neutral to climate."

Correction:

CFC's do not reflect sunlight back into space, and on balance they are still believed to be net warmers of the atmosphere. But some of their warming effect is offset by their ozone-depleting action, since ozone itself is a greenhouse gas. [18]

A Moment. . . , p. 288:

"So if sulfur aerosols have been masking the greenhouse effect, global temperatures should have taken off in a spectacular way when sulfur pollution began its sharp decline in the 1970s. This did not occur."

Correction:

This is a gross exaggeration. The models again predict a lag, preventing any "spectacular" warming from occurring. [19] Moreover, sulfur pollution, though it did decline over the United States, actually increased in other places, such as China. Nevertheless, a significant warming has indeed occurred since the 1970's.

A Moment. . . , p. 288:

". . . since the atmosphere of the Southern Hemisphere has greenhouse gases but little sulfur, masking would be absent there. Thus Southern Hemisphere temperatures should be rising relative to the North. Records do not show this."

Correction:

The larger area of the ocean in the Southern Hemisphere also "masks" the warming, counteracting potential temperature differentials. [20]

A Moment. . . , p. 292:

"Scientific support for the notion of a drastic rise in sea level has waned rapidly.. . . The highest observed actual sea-level rise in this century is a mere one inch."

Correction:

This is another stunning misstatement of the scientific evidence on Easterbrook's part. The global average sea level has risen *four to eight* inches over the past century- -not a minor error, since, for example, this is large enough to have eroded over 40 feet of a typical barrier beach on the East Coast of the United States. [21]

***A Moment. . .*, p. 292:**

"Why isn't the sea rising if temperatures are rising? Because many glaciers are growing, not melting."

Correction:

The sea *is* rising (see above), and to a level consistent with the measured warming. And almost all mid-latitude glaciers are retreating, worldwide.

The evidence concerning the ice caps in Greenland and Antarctica is more ambiguous. In any event, according to climate models, Antarctic ice is projected to increase, not decrease, at least for several decades, because of additional precipitation in the region. [22]

***A Moment. . .*, p. 294:**

"*It's getting colder in Greenland?* Isn't the Earth supposed to be warming? . . . Temperature shifts are not uniform . . . But this would seem a strike against greenhouse theory, which holds that artificial warming should center in the high and low latitudes, as equatorial regions seem historically insulated against climate swings."

Correction:

To the contrary, recent cooling around Greenland does not contradict the conclusions of the climate models. Those models that take into account the dynamic role of the oceans show a suppressed warming in the North Atlantic region. Combined with the large natural variability of temperature at these latitudes, a cooling of Greenland for several decades would not be surprising, even as the world warms as a whole. [23]

***A Moment. . .*, p. 296:**

"Greenhouse believers often cite the equilibrium state of the natural carbon cycle to justify an assertion that even tiny human-caused additions of carbon dioxide

will cause big problems. Certainly this is possible. But in making the assertion doomsayers leave out a key modifier: The natural carbon cycle is in an *approximate* equilibrium state. Ice- core records are clear on the point that natural CO2 levels bounced up and down long before the first flint struck steel."

Correction:

The key modifier here is "long before." Natural variations in CO2 have contributed to large climate changes for millions of years. But for the last 10,000 years, the period over which civilization evolved, the earth has been in a fairly steady CO2 equilibrium and thus has enjoyed a fairly steady climate.

Over the last 200 years, however, human beings have added CO2 to the atmosphere at such a rapid rate that the levels are now more than 25 percent above what they had been for the last 10,000 years, hardly a "tiny" amount, as Easterbrook puts it. It is highly implausible if not impossible that the increasing accumulation of CO2, unlike previous ones of similar size, will have no significant effect, as he seems to imply. [24]

***A Moment. . .* , p. 301:**

"No one contends that the warming of the past century has done the slightest harm."

Correction:

As noted earlier, significant rises in sea level, due at least in part to global warming, have already accelerated coastal erosion in many areas. More recently, there has been a radical decline in the observed populations of zooplankton in the California current, which may explain recent declines in fish and seabird populations as well. This seems to be due to a local warming of the oceans, which is itself perhaps linked to an observed global rise in ocean temperatures. [25]

In addition, many coral reefs throughout the world are in decline, in part due to bleaching. One cause of bleaching is warmer ocean temperatures, which could also be related to the global trend. [26]

***A Moment. . .* , p. 315:**

"A little-reported part of Rio was a proposed agreement by which the First World would increase environmental aid to the developing world, for purposes such as

water sanitation. Western nations ended up rejecting this proposal, pleading, *We'd love to help, but we just committed ourselves to big investments in fighting the greenhouse menace*."

Correction:

Easterbrook sets up a false dichotomy. While arguments over funding priorities certainly occurred throughout the Earth Summit in Rio, the conference was specifically convened to address environmental problems from a global perspective. Agreements and funding mechanisms concerning global warming and biodiversity were the major new initiatives that resulted.

Although insufficient, international funds are *already* made available to build projects like sewage treatment systems, by Multilateral Development Banks and the U.S. Agency for International Development, and in amounts that far outstrip the much more limited funds devoted at Rio to dealing with global warming.[27]

***A Moment. . . ,* pp. 314-315:**

"Total 1993 preventable childhood deaths from gross water and air pollution in the Third World: 7.8 million.. . . On the runup to the Earth Summit at Rio, instant-doomsday hyperbole caused the world's attention to focus on the hypothetical threat of global warming to the exclusion of environmental menaces that are real, palpable, and awful right now."

Correction:

In essence, this seems to be Easterbrook's largest objection to the idea of global warming: Why shouldn't we focus on present-day problems of air and water pollution in the developing world, instead of future threats like climate change? Yet his argument, that there is little point in worrying about long-term global threats, when people in the developing world die from poor sanitation and air pollution every day, is as baseless as arguing that during the height of the Cold War, there was little point in trying to avert nuclear war, since every day, hundreds of people were already dying in regional wars and conflicts.

Indeed, Easterbrook's point is even more untenable, for those with the most to lose from global warming are indeed the very people for whom Easterbrook expresses the

most concern. The truth is that many public health problems in the developing world will only get worse in a warming regime. For example, substantial declines in agricultural productivity [28] are projected in those areas of the developing world, including parts of Africa, where many people are already malnourished and episodes of starvation occur. And the effects of air and water pollution in the developing world are projected to worsen significantly in an era of warmer temperatures. [29] Moreover, efforts to control global warming, such as increases in energy efficiency and investments in renewable energy (for example, solar power) will help reduce other forms of air pollution in the developing world as well.

***A Moment. . .*, p. 315:**

". . . there is growing suspicion that . . . developed countries suddenly care about this issue for selfish reasons. Global warming might affect property values on Cape Hatteras; raw sewage in drinking water in Bangladesh will not."

Correction:

Those who are most concerned about global warming view it as a critical threat because of its global implications. Indeed, the inhabitants of the developed world will be *best* able to insulate themselves from the deleterious consequences of global warming, with access to air- conditioning, advanced agricultural methods, modern medicine and drugs, and, most importantly, the resources to defend the coast. It will be the inhabitants of the developing world who will be hit hardest, with the least ability to adapt to the consequences of a warming world.

To use Easterbrook's own example, the water supply in Bangladesh will indeed become more contaminated as the sea level continues to rise. Salt-water intrusion, already a serious problem for the inhabitants of southern Bangladesh, is expected to become more severe as a result. Moreover, Easterbrook also neglects to mention that millions of Bangladeshis are projected to face an even more devastating fate as a consequence of climate change: the loss of their farmlands, their livelihoods, and possibly their very lives. An area of the country where 8 million Bangladeshis presently live may be underwater by the end of the next century, if current trends continue. [30]

ENDNOTES

1. IPCC, *Climate Change 1992: Supplementary Report*, World Meteorological Organization and United Nations Environment Programme, 1992, pp. 144, 147; H. Wilson and J. Hansen, New York. *Update of GISS Global Temperature Analysis Through 1993*, Goddard Institute for Space Studies, 1994; M. Sato, GISS, personal communication, April 1995. The Northern Hemisphere, not the globe, cooled slightly between the 1940's and early 1970's, but by considerably less than it had warmed between the late 1800's and the 1940's, and also less than it has warmed since the 1970's.

2. The Gallup Organization, *A Gallup Study of Scientists' Opinions and Understanding of Global Climate Change*, November 1991, pp. 5, 8. Available from the Center for Science, Technology and Media, 6900 Wisconsin Ave., Suite 700, Chevy Chase, MD 20815.

3. J. F. Kasting and T. P. Ackerman, "Climatic Consequences of Very High Carbon Dioxide Levels in Earth's Early Atmosphere," *Science* **234**: 1383-1385, 1986.

4. Intergovernmental Panel on Climate Change, *Climate Change: The IPCC Scientific Assessment*, New York, 1990, p. 202.

5. S. Manabe and R. J. Stouffer, "Century-scale Effects of Increased Atmospheric CO2 on the Ocean-atmosphere System, *Nature* **364**: 215-218, 1993.

6. The Hadley Centre, *Modelling Climate Change: 1860-2050*, British Meteorological Office, Department of Environment, February 1995. Easterbrook mentions the influence of sulfates and oceans on pages 287-288 and 290-292, respectively, but fails to correct the error that occurs on page 279. Furthermore, the later discussions are themselves marred by mistakes.

7. J. Hansen and S. Lebedeff, "Global Trends of Measured Surface Air Temperature," *Journal of Geophysical Research* **92**: 13345-13372, 1987; P. D. Jones, "Recent Warming in the Global Temperature Series," *Journal of Geophysical Research Letters* **21**: 1149-1152, 1994; J. E. Hansen, H. Wilson, M. Sato, R. Ruedy, K. P. Shah, and E. Hansen, "Satellite and Surface Temperature Data at Odds?", *Climatic Change*, in press, 1995.

8. IPCC, op. cit., 1992.

9. P. D. Jones, op. cit., 1994; J. E. Hansen, et al., op. cit., in press, 1995.

10. T. R. Karl, R. W. Knight, D. R. Easterling, and R. G. Quayle, "Trends in U.S. Climate during the Twentieth Century," in *Consequences: The Nature and Implications of Environmental Change*, vol. I, 1995, p. 7; H. Wilson and J. Hansen, op. cit., 1994.

11. J. Hansen, A. Lacis, R. Reudy, M. Sato, and H. Wilson, "How Sensitive Is the World's Climate?," *Research and Exploration* **9**: 142-158, 1993; P. D. Jones, op. cit. The recovery from the Pinatubo eruption is slowed by the thermal inertia of the ocean.

12. P. D. Jones, University of East Anglia, personal communication, January 1995. Satellite data for 1994 are not yet available.

13. *The New York Times*, June 24, 1988, p. A1; R. A. Kerr, "Hansen vs. the World on the Greenhouse Threat," *Science* **244**: 1041-1043, 1989; M. Oppenheimer and R. H. Boyle, *Dead Heat*, (Basic Books) 1990, pp. 51-74.

14. IPCC, op. cit., 1990, p. xi.; Hadley Centre, op. cit.; comment in endnote 6. Easterbrook's statement on page 284 concerning GCM's is more than a decade out of date.

15. National Academy of Sciences, *Policy Implications of Greenhouse Warming*, Washington, D.C., 1992, p. 21.

16. IPCC, op. cit., 1990, pp. 138-139.

17. IPCC, op. cit., 1992, p. 16. The *only* change in *any* of the "best estimate" CO2-doubling numbers occurred in 1990, when in its first report the IPCC substituted its own "best guess" figure of 2.5 degrees Celsius (4.5 degrees Fahrenheit) resulting from doubled carbon dioxide, for the earlier figure offered by the NAS of 3 degrees Celsius (5.4 degrees Fahrenheit), a very modest adjustment. Over time, the IPCC has not altered by one iota its "best estimate" of warming due to doubled carbon dioxide.

18. World Meteorological Organization, *Scientific Assessment of Ozone Depletion*: 1994, February 1995, p. 13.32.

19. T. M. Wigley, "Possible Climate Change due to SO2-derived Cloud Condensation Nuclei," *Nature* **339**: 365-367, 1989; R. J. Stouffer, S. Manabe, and K. Bryan, "Interhemispheric Asymmetry in Climate Response to a Gradual Increase of Atmospheric CO2," *Nature* **342**: 660-662, 1989.

20. Ibid.

21. IPCC, op. cit., 1990, p. 261; National Research Council, *Responding to Changes in Sea Level: Engineering Implications*, National Academy Press, 1987, p. 2.

22. IPCC, op. cit., 1990, p. 276. Aside from changes in the ice, the thermal expansion of water will account for about half of the amount of projected future sea-level rise.

23. R. J. Stouffer, S. Manabe, and K. Bryan, op. cit.

24. IPCC, *Climate Change 1994: Radiative Forcing of Climate Change and An Evaluation of the IPCC IS92 Emission Scenarios*, Cambridge University Press, U.K.. 1995, p. 17.

25. D. Roemmich and J. McGowan, "Climatic Warming and the Decline of Zooplankton in the California Current," *Science* **267**: 1324-1326, 1995; J. P. Barry, C. H. Baxter, R. D. Sagarin, and S. E. Gilman, "Climate-related Long-Term Faunal Changes in the California Rocky Intertidal Community," *Science* **267**: 672-675, 1995.

26. P. W. Glynn, "Coral Reef Bleaching in the 1980s and Possible Connections with Global Warming," *Trends in Ecology and Evolution* 6: 1975-1979, 1991.

27. S. Hajost, International Union for the Conservation of Nature, personal communication, March 1995; *Earth Summit: Rio Declaration and Forest Principles*, United Nations Conference on Environment and Development, Rio de Janiero, Brazil, June 3-14, 1992.

28. C. Rosenzweig and M. L. Parry, "Potential Impact of Climate Change on World's Food Supply," *Nature* **367**: 133-138, 1994.

29. P. R. Epstein, "Emerging Diseases and Ecosystem Instability: New Threats to Public Health," *American Journal of Public Health* **85**: 168-172, 1995; A. M. Thompson and M. Kavanaugh, "Tropospheric CH_4/CO/NO_X: The Next 50 Years," in *Effects of Changes in Stratospheric Ozone and Global Climate*, vol. 2, J. G. Titus, ed., U. S. Environmental Protection Agency, 1986, pp. 305-319; G. Z. Whitten and M. W. Gery, "The Interaction of Photochemical Processes in the Stratosphere and Troposphere," ibid., pp. 295-303.

30. See the discussion of salination and sea-level rise in J. M. Broadus, J. O. Milliman, S. F. Edwards, D. G. Aubrey, and F. Gable, "Rising Sea Level and Damming of Rivers: Possible Effects in Egypt and Bangladesh," in *Effects of Changes in Stratospheric Ozone and Global Climate*, vol. 4, J. G. Titus, ed., U. S. Environmental Protection Agency, 1986, pp. 165- 190.

SECTION 2

"RADIATION, NATURAL" [CHAPTER 19]

In this chapter and elsewhere, Easterbrook attempts to contrast what he calls the "doomsday" approach to environmental problems with his own so-called "eco-realism," ridiculing, for example, the "idea that relatively tiny amounts of CFCs could trigger an unstoppable progression that strips the entire ozone layer, leaving the biosphere defenseless" (*A Moment on the Earth*, p. 535). Yet this is what, in essence, could well have occurred, with very large depletions developing throughout the world, unleashing potentially disastrous consequences for the biosphere, if the decision to aggressively limit the use and production of CFC's had not been made.

Moreover, he places himself against the weight of scientific evidence in claiming that UV radiation may not have risen since the emergence of ozone depletion, and that where radiation increases occur, they may have little or no effect. Along the way, he makes elementary errors in relating the history of the discovery of ozone depletion and even suggests, against medical evidence to the contrary, that increases in UV radiation may not be harmful to human health.

***A Moment. . .* , pp. 529-530:**

> "First, though an ozone hole has been opening over Antarctica since the late 1970s, it is not yet known whether artificial chemicals are the sole cause. Nearly all atmospheric scientists believe CFCs play an important role in the South Pole hole. But part of the cause may be natural. Some new research suggests ozone breaches have been occurring on a cyclical basis since long before morning light first warmed our primate ancestors."

Correction:

> There is no "new research" that claims "cyclical" depletions of ozone in the Earth's past. Moreover, any assertions of ozone losses in prehistoric times are highly speculative. [1]

Easterbrook implies that the ozone hole observed over Antarctica might well have formed outside of the presence of man-made chlorofluorocarbons (CFC's) and related chemicals. To the contrary, atmospheric measurements have directly shown that the ozone hole would not have appeared without the introduction of CFC's. This is a subject on which the professional literature is now conclusive and it is a central finding of numerous peer-reviewed studies, including the *Scientific Assessment of Ozone Depletion: 1994*, published by the World Meteorological Organization (WMO).

This definitive document clearly states: "The Antarctic ozone hole is a new phenomenon.. . . The ozone hole has been shown to result from destruction of stratospheric ozone by gases containing chlorine and bromine, whose sources are mainly human-made halocarbon gases [e.g. CFCs and related compounds]." [2]

A Moment. . . , p. 530:

"Though research on this topic is in its early stages, some tests show surface levels of ultraviolet radiation have *declined* slightly during the last decade. Doomsayers never mention this."

Correction:

Here Easterbrook is referring to the findings of a limited UV monitoring network that operated at certain urban sites in the United States between the years 1974 and 1985. However, this network was not designed to measure long-term trends, and serious doubts have been raised about the callibration of the instruments. Moreover, as the WMO 1994 Ozone Assessment points out, a downward UV trend at these sites, if there were one, would have been due to local effects of particulate pollution.

As the WMO report clearly states, "Prior to the late 1980s, instruments with the necessary accuracy and stability for measurement of small long-term trends in ground-level UV-B were not employed.. . . When high-quality measurements have been made . . . far from major cities and their associated air pollution, decreases in ozone have regularly been accompanied by increases in UV-B." [3] Nevertheless, Easterbrook repeats this error on pages 540 and 541.

***A Moment. . . ,* p. 533:**

> "Data from Nimbus Seven [a NASA satellite] suggested the ozone layer was declining by a small amount . . . over populated areas of the Northern Hemisphere.. . . The controversy advanced to headline status in 1985 when a team of British researchers led by James [sic] Farman announced they had documented an ozone hole over the Antarctic: not a thinning but an outright breach."

Correction:

Easterbrook gets the rather elementary history of the ozone evidence backward. Analysis of Nimbus-7 data showing global declines in ozone was not published until 1988, three years *after* the British team first announced their discovery of the Antarctic ozone hole. [4]

***A Moment. . . ,* p. 533:**

> "Reactions to the news ranged from the sensible, such as a 1985 agreement for an international summit on CFC restriction; to the theatrical, for example James Anderson, an accomplished Harvard researcher and influential ozone pessimist, saying CFCs were 'attacking the Earth's immune system'."

Correction:

James Anderson designed the crucial experiment that proved conclusively that CFC's were the cause of the ozone hole. Portraying this esteemed scientist as an "ozone pessimist" is like calling a hurricane spotter a weather pessimist. And calling his reaction "theatrical" does a disservice to Anderson's justifiable concern. Here, as throughout the book, Easterbrook uses simplistic labeling as a substitute for substantive argumentation.

Without the scientifically grounded warnings of such "ozone pessimists" as Anderson, aggressive measures to eliminate the emissions of CFC's would never have occurred. Indeed, on the next page, Easterbrook speaks approvingly of John Frederick of the University of Chicago for pointing out that "had there been no prompt action after 1985, the situation might have deteriorated to a severe threat to the ecology" (*A Moment. . . ,* p. 534).

A Moment. . . , p. 534:

"Even severe ozone loss around the South Pole might mean little to the biosphere. This is so for the obvious reason, that there is only a moderate amount of life in Antarctica to imperil, and for the little-known reason that UV-B radiation falling on the poles is weak to begin with."

Correction:

What does "only a moderate amount of life" mean? In this statement, as well as in his incredulity that "relatively tiny amounts of CFCs" could cause serious ozone depletion, Easterbrook demonstrates a clear lack of scientific understanding.

Indeed, the phytoplankton that live in the waters around Antarctica make up the base of the food chain for an extremely rich and diverse ecosystem, including great whales, seals, sea lions, elephant seals, and penguins. And no matter how low the natural amount of radiation reaching the surface of the Earth in this part of the world, it remains an open question whether the the myriad life forms that exist there will be able to adjust to much higher levels of UV-B.

A Moment. . . , p. 534:

"But the deep-cold vortex winds of the South Pole have no counterpart over the North Pole or anywhere else in the world, suggesting that ozone breaches over populous areas, though not impossible, are less likely than the South Pole finding might imply."

Correction:

The northern polar vortex, though not as strong or as self- enclosed as the southern vortex, *is* cold enough to allow polar stratospheric clouds to form, resulting in significant ozone depletion from CFC's. [5] During the winter of 1995, for example, these processes caused a 30 percent ozone loss over large parts of the Arctic. [6]

More importantly, though mentioned by Easterbrook only in passing and without the use of actual figures, scientists have *already* observed substantially reduced levels of ozone over most of the globe, including North America, Europe, and elsewhere. By 1991, the depletion over North America, for example, averaged nearly 5 percent, and since then has further increased. [7]

A Moment. . . , p. 535:

"When nations began building high-energy accelerators to shatter protons and neutrons in search of quarks, some theorists suggested the collisions might manufacture a novel subatomic template to which all elemental particles would bind in some way, crushing the Earth, and perhaps the entire universe, out of existence. To this day, whenever a new accelerator such as the Superconducting Supercollider is contemplated, a committee of physicists is appointed to analyze whether the machine might generate a subatomic template."

Correction:

The "committee of physicists" Easterbrook cites is a fiction. No such committee worries about whether an accelerator will generate a so-called "subatomic template." [8]

A Moment. . . , p. 543:

"More generally, researchers increasingly question high estimates of skin cancers caused by ozone fluctuations..."

Correction:

Easterbrook is wrong on this. Skin cancer rates among fair- skinned people do rise substantially the nearer they reside to the Equator, where UV-B is higher, and epidemiologists have high confidence in the connection between UV-B exposure and the incidence of non-melanoma forms of skin cancer among humans. [9]

Scientists predict that the incidence of non-melanoma skin cancer will rise by hundreds of thousands of cases per year worldwide over the course of three or four decades due to ozone depletion. [10]

There has been one recent experiment, which Easterbrook notes, that suggests that melanoma skin cancer in fish may be induced more by UV-A, a form of radiation not affected by ozone loss, than by UV-B. However, the relevance of this result to humans is still unknown.

A Moment. . . , p. 543:

". . . increasing research . . . suggests living things have been exposed to such fluctuations many times in the past. For instance, some studies suggest that during

past eras of high volcanism, ongoing eruptions placed into the air, for centuries in succession, perhaps 100 times the human output of halons, gases extremely destructive of ozone. This almost certainly would have led to ozone depletion of a more severe character than the worst-case projections for present problems."

Correction:

Volcanoes do not emit halons--entirely synthetic chemicals- -but completely different substances, less intensely destructive to the ozone. [11] More importantly, though, Easterbrook neglects to mention that the period of high- sustained volcanism to which he refers occurred millions of years ago, long before modern man evolved, and so far back in time that we have little idea how it may have affected the ozone layer, if at all. [12] For example, ozone- depleting gases from eruptions may never have reached the stratosphere or may have in amounts too small to cause much harm. There may have been a substantially different density of ozone in the atmosphere millions of years ago, or a different chemistry in the stratosphere, leading to a different response to ozone-destroying chemicals. Thus, whether or not there were higher levels of UV radiation reaching the Earth is entirely unknown, and the effects of such hypothetical levels of radiation on the biosphere are impossible to ascertain.

A Moment . . . , p. 536:

". . . in the austral spring of 1990 . . . an Antarctic research facility recorded surface UV-B readings double those of 1988.. . . Yet . . . the doubled radiation worked out to only about the natural increase a person would experience by traveling south from Chicago to New Orleans."

Correction:

Few natural ecosystems routinely travel from Chicago to New Orleans, even for Mardi Gras. Clearly, a sustained doubling of the UV at the same location, and at the same point in the season, is by any calculation a radical change in the environment of an ecosystem.

Here Easterbrook uses the well-worn "traveler" fallacy, which he succumbs to again on page 541. In order to refute the importance of another study that showed a significant increase in UV radiation--this time at the tip of Argentina--he writes: "A team led by Frederick reported . . . [an increase that] was 50 percent over expected seasonal

intensity and lasted about a month. Does this sound like a calamitous rise? It works out to the natural UV-B increase a person would experience by moving north . . . from Cape Horn to Buenos Aires

As we noted before, non-melanoma skin cancer rates among fair-skinned humans *are* higher at latitudes nearer the Equator. Moreover, as already noted, whether ecosystems as a whole can adapt to sustained amounts of UV-B well above natural levels remains an open question. It is likely, however, that many species *will* suffer under increased UV-B.

ENDNOTES

1. J. Ellis and D. N. Schramm, "Could a Nearby Supernova Explosion Have Caused a Mass Extinction?" in *Proceedings of the National Academy of Sciences, U.S.A.*, 1995, pp. 235-238; These two scientists have speculated that supernovae exploding near the Earth a few times over hundreds of millions of years could have destroyed the ozone layer. But this suggestion supports neither Easterbrook's claim that the phenomenon was somehow "cyclical", nor his contention of the resilience of life. Indeed, according to the authors of this report, such events may have resulted in the "mass destruction" of living things, including, possibly, the dinosaurs. Easterbrook may be referring to ancient volcanic eruptions, per his discussion on page 543, which we also criticize in this report.

2. World Meteorological Organization, *Scientific Assessment of Ozone Depletion: 1994*, February 1995, p. xxxi.

3. WMO, op. cit., p. xxxiii. On page 540, Easterbrook refers to an article in *Nature* by S. A. Penkett; its conclusion that tropospheric ozone increases might overwhelm stratospheric ozone decreases was based on depletion calculated to have occurred up to 1982. But a far larger depletion has been measured since. Consequently, the Penkett article was already out of date by 1991 when the United Nations Environment Programme reported, "Thus we estimate that the combined trend [i.e., due to changes in stratospheric plus tropospheric ozone since the late 1970's] in the UV in the northern hemisphere is in the range of +3% to +11% per decade." (United Nations Environment Programme, *Environmental Effects of Ozone Depletion: 1991 Update*, November 1991, p. 6.) Since then, ozone depletion, and presumably UV, have further increased.

4. WMO, *Report of the International Ozone Trends Panel*, vol. I, 1988.

5. J. G. Anderson and O. B. Toon, "Airborne Arctic Stratospheric Expedition II: An Overview," *Journal of Geophysical Research Letters* **20**: 2499-2502, 1993.

6. P. Zurer, "Record Low Ozone Levels Observed over Arctic," *Chemical and Engineering News* 10: 8, 1995. Easterbrook refers to the possibility of significant Arctic depletion on page 540 but erroneously dismisses it.

7. WMO, *Scientific Assessment of Ozone Depletion: 1991*, p. 2.16; WMO, op. cit., 1995, p. iv.

8. P. Lyman, Fermi National Accelerator Laboratory, personal communication; B. Richter, director, Stanford Linear Accelerator, personal communication.

9. United Nations Environment Programme, *Environmental Effects of Ozone Depletion: 1991 Update*, November 1991, pp. 15-24; S. Madronich and F. R. de Grujijl, "Skin Cancer and UV Radiation," *Nature* **366**: 23, 1993.

10. UNEP, op. cit., 1991, p. 15.

11. WMO, op. cit., 1995, p. 2.11.

12. M. R. Rampino, "Volcanic Hazards," in *Understanding the Earth: A New Synthesis*, G. C. Brown, C. J. Hawkesworth and R. C. L. Wilson, eds., Cambridge, U.K., 1992, p. 521.

SECTION 3

"CASE STUDY: THE SPOTTED OWL" [CHAPTER 13]

The chapter on the northern spotted owl in *A Moment on the Earth* is so full of scientific errors and inaccurate assumptions that its conclusion--that the threat of extinction faced by the owl is overstated--is essentially worthless.

To his credit, Easterbrook is supportive of the Endangered Species Act and the efforts of environmental groups to save species in general. But in opposing the conclusions of independent biologists that the northern spotted owl faced extinction, Easterbrook neglects to cite the voluminous scientific evidence for this position, as contained in numerous peer-reviewed studies. Most importantly, he neglects to mention the definitive findings of the meeting in December 1993, in Colorado, in which biologists and statisticians from throughout the United States and Europe undertook the single largest population study of a bird of prey, and concluded that the northern spotted owl was indeed in rapid decline. [1]

***A Moment. . .* , p. 211:**

> "The [four northern spotted] owls were living wild in a habitat where it is presumed impossible for them to exist: a young woodland, not an old-growth forest. And they were living in a place, California, where environmental doctrine holds spotted owls are rare birds indeed."

Correction:

> Easterbrook's caricature of "environmental doctrine" is wrong on two counts. For many years, it has been well known to owl biologists that the thin coastal redwood belt of northwest California harbors many owls. But this area makes up only a small part of the owl's habitat, and, despite Easterbrook's suggestion, few northern spotted owls live in second-growth forests elsewhere in their range (except for a relatively small area in the eastern Washington Cascades). [2]

Indeed, the scientific panel headed by Jack Ward Thomas of the Forest Service, which reaffirmed in 1990 that the northern spotted owls were at risk of extinction, clearly observed the relative abundance of the birds in this area: "An interesting exception to the usual time needed for a forest to develop from bare ground into suitable owl habitat occurs in the coastal redwood forests of northwestern California, where owls occur in relatively high numbers in stands 50 to 80 years old. This exception is likely attributable to a unique set of conditions.. . . Because these unique conditions occur only in about 7 % of the owl's range, we strongly caution against assuming that they will occur elsewhere." [3]

***A Moment. . . ,* p. 213:**

"The owl-extinction alarm is premised on two notions: that spotted owls live only in ancient forests and that a last, fragile, dwindling population of the northern spotted exists mainly in Oregon and Washington."

Correction:

As he does throughout the book, Easterbrook sets up a straw- man argument so that he may demolish it. Biologists and environmentalists do not base their concern about the northern spotted owl--nor did the U.S. Fish and Wildlife Service decide to list the owl as an endangered species--on the notions the author cites. Instead, three main points proved decisive: One, the downward trend in the habitat of the owl was undeniable. Two, owl populations were declining rapidly, based on statistical analysis of the trends in the birth and death rates of sample owl pairs. Finally, existing regulations were deemed insufficient to reverse the habitat and population declines. [4]

***A Moment. . . ,* p. 214:**

"In 1993 Steve Self and Thomas Nelson, researchers employed by Sierra Pacific, a California timber company with a progressive reputation, projected spotted owl populations.. . . They estimated the state home to 6,000 to 8,000 pairs of spotted owls.. . . If Self and Nelson are even close to correct, the spotted owl population is not in the zone of an extinction emergency."

Correction:

Contrary to Easterbrook's implications, the total numbers of northern spotted owls, in California or in the rest of the Pacific Northwest, were never a primary issue in the

question of whether to list the owl as an endangered species (see above). Indeed, the definitive Thomas report, which supported the owl's listing, clearly stated that "current data do not permit a statistically reliable population estimate. The approximately 2,000 pairs located during the past five years or reconfirmed from pre-1985 surveys represent an unknown fraction of the total population." [5]

***A Moment. . . ,* p. 214:**

"[Timber company biologist Lowell] Diller is among the first to look for spotted owl in successional or nonancient California forests, not beginning his work until the bird was "listed" under the Endangered Species Act. Diller thinks that 'if research had started in California rather than in Oregon, the spotted owl would not now be considered endangered. It would be seen as a prolific, genetically secure bird.'"

Correction:

Northern spotted owl population research started at about the same time in California as it did in Oregon and Washington, well before the owl was listed. And Lowell Diller was not among the first to look for these owls in the second-growth forests of California. Gordon Gould of the California Department of Fish and Game began studies of these owls in the mid-1970's. R. J. Gutierrez and his students began work in 1980. In fact, some of the strongest research in the field relates to northern owl populations residing in California second-growth forests. [6]

***A Moment. . . ,* p. 217:**

". . . private timber firms harvest their lands at a profit, without subsidies, using selection logging or the related shelter-cutting, ecologically responsible practices that generate more jobs than clear-cutting."

Correction:

In fact, many private timberlands in the United States, including some of those in the Northwest forests that are home to the northern spotted owl, are harvested by clear-cutting. [7] Furthermore, shelter-cutting, an even-aged logging technique, is closer to clear-cutting than it is to selection logging, an uneven-aged method of harvest.

***A Moment. . . ,* pp. 217-218:**

". . . clear-cutting can be defended as a nature-mimicking practice in some circumstances.. . ."

Correction:

Logging does not mimic nature, since it removes most of the coarse woody debris. [8]

***A Moment. . . ,* p. 218:**

"Yet while [Eric] Forsman's paper is now celebrated as a founding text of owl doomsaying, he did not assert the spotted was falling extinct. Indeed Forsman found some of what Diller has found--the birds prospering in young timberlands . . ."

Correction:

Incorrect. Eric Forsman concluded that the northern spotted owl was doing poorly in young forests, as measured by their population density. [9]

***A Moment. . . ,* pp. 218-219:**

"Yet rapid forest rebounds in the midst of commercial activity have been the pattern throughout the United States and Western Europe. Serious deforestation commenced in the United States roughly two centuries ago in New England, as timber was cut or woods burned for cropland. About a century ago, destructive logging practices began to end in New England.. . . New Hampshire was 50 percent forest in about 1850 and is 86 percent forest today.. . . Figures throughout New England are the same."

Correction:

Forests *have* returned to New England, but without many of the species they once contained. New Englanders will look long and hard for passenger pigeons, woodland caribou, bison, and elk--all of which once lived in these forests but vanished as a result of hunting and deforestation.

***A Moment. . . ,* p. 219:**

"Formal warning of spotted owl extinction was not tendered until the 1986 Audubon report."

Correction:

Concern for the survival of the northern spotted owl was expressed much earlier, by the U.S. Department of the Interior in 1973, for example, and by D. B. Marshall and other scientists in 1975. [10]

***A Moment. . . ,* p. 219:**

"In the wake of that [Audubon] report conservation groups sued to have the northern spotted listed under the Endangered Species Act."

Correction:

Environmental groups did not sue until government officials arbitrarily and capriciously--in the words of Federal District Court Judge Thomas Zilley--changed the conclusions of the owl status review and decided not to list the owl as threatened. [11]

***A Moment. . . ,* p. 219:**

". . . a government science panel headed by the biologist Jack Ward Thomas concluded that 3,000 to 4,000 spotted owl pairs exist in the U.S. and to provide a margin of safety over the 1,500-pair extinction number, a minimum of 3,000 owl pairs must be protected."

Correction:

Untrue. The Thomas panel neither concluded that 3,000 to 4,000 owl pairs existed (it agreed that the total number was unknown) nor did it cite specific numbers necessary for protection of the species. [12]

***A Moment. . . ,* p. 219:**

"In 1991 William Dwyer, a federal judge in Seattle, banned most logging in Washington and Oregon to carry out measures the Thomas report called necessary to assure survival of 3,000 owl pairs. At this point the notion of an owl doomsday was locked in legally."

Correction:

Judge Dwyer merely issued an injunction until such time as the public agencies responsible for protecting the owl designed a credible conservation plan.

A Moment. . . , p. 220:

"As the California spotted owl is not considered endangered it has never been surveyed for in methodical fashion, leaving its population not well known."

Correction:

To the contrary, there have been *many* systematic surveys of the California spotted owl. [13]

A Moment. . . , p. 220:

"Some observers have long wondered whether there is really any meaningful difference between northern and California spotted owl. In 1990 George Barrowclough, an ornithologist at the American Museum of Natural History in New York, and Gutierrez of Humboldt State compared proteins from the northern and California spotted owls. 'No genetic difference was found' between the two, their report states. The researchers further found no statistically significant genetic differences between the northern and Mexican spotted owls . . ."

Correction:

According to Dr. R.J. Gutierrez, one of the authors of the cited report, Easterbrook has completely misinterpreted these results. The authors specifically stated that the limited genetic analysis they undertook prevented them from concluding that no meaningful differences existed between the northern and California spotted owls. As for the Mexican and northern spotted owls, Barrowclough and Gutierrez *did* find notable differences between them, and concluded that the two may be different species altogether. [14]

A Moment. . . , pp. 220-221:

"The Mexican spotted roosts in woodlands adjacent to the deserts of the Southwest and Mexico: habitat utterly different from the moist old-growth forests doomsayers describe as the sole imaginable habitat for northern spotted."

Correction:

The *vast* majority of Mexican spotted owls nest in the same types of habitats that northern and California spotted owls inhabit. [15]

***A Moment. . . ,* p. 221:**

"In 1994 Barrowclough began using genome sequencing, an advanced test, to determine whether there exist subtle DNA distinctions between northern and California spotted owls.. . . It's worth noting that Barrowclough calls both bird types 'Pacific Coast' spotted owls, reflecting a feeling the two soon may be seen as one and the same."

Correction:

The DNA analyses, now completed, demonstrate that there *are* substantial differences between the genes of the two kinds of owls, and that they are indeed *two entirely separate subspecies*. [16] Moreover, the term "Pacific Coast owls" is merely a shorthand way to refer to the two subspecies that inhabit the Pacific Coast states, and implies nothing about their genetic similarities or differences. [17]

***A Moment. . . ,* p. 221:**

"Does a figure such as 10,000 pairs of spotted owl still sound perilously small? . . . it is significantly greater than the population nadirs of similar raptors that avoided extinction. The bald eagle was down to 417 known nesting pairs in the lower 48 states in 1963 and now has recovered to about nine times that number.. . . The peregrine falcon was down to about 1,000 breeding pairs in North America two decades ago and now has bounced back to an estimated 5,000."

Correction:

The figure of 10,000 pairs derives from Easterbrook's erroneous conclusion that the California and northern spotted owls will be shown to be genetically identical. Furthermore, his argument is based upon a false comparison. The bald eagle and the peregrine falcon were threatened largely by pesticides. When DDT was banned, both species had considerable amounts of suitable habitat in which to live and reproduce. The threat to the spotted owl, in contrast, is almost exclusively due to the loss of habitat. Indeed, there are many examples of species that rapidly became extinct when their habitat disappeared, such as the cerulean paradise-flycatcher. [18]

***A Moment. . .*, p. 222:**

"Now many assert that owl numbers are less important than the demographic trend. That is, actual birds counted in 'the laboratory of nature' mean less than prospective birds projected by computer model."

Correction:

The demographic trend is established not by computer projections, but by an analysis of measured birth and death rates of sample owls, as observed in the field. The trend in owl numbers, scientists know, is more important than some poorly enumerated population size. [19]

***A Moment. . .*, p. 222:**

"Since the late 1970s, pessimistic owl studies have been projecting population trends averaging around minus-five percent annually, suggesting total spotted owl numbers should have fallen drastically by now. Yet actual field surveys continue to find more birds than previously counted."

Correction:

Easterbrook confuses survey efforts to find new owls with the survival and reproduction data of owls already located. Indeed, it is the latter evidence that has been considered crucial to demonstrate that the species is in danger of becoming extinct. That conclusion was *unanimously* shared by independent wildlife experts from government agencies, research institutes, and universities, who convened in Fort Collins, Colorado, for a December 1993 workshop on the northern spotted owl. Every Federal, state, private, and academic biologist who studied the owl was invited, as were statisticians and scientists from related fields to help in the analysis. Timber industry biologists were invited; only one attended, and he refused to share his data. [20]

More than 50 experts participated in this workshop, and various statistical analyses were made from their combined observations, drawn from 11 studies and spanning the entire range of the northern spotted owl, including California second-growth forests. The result was the single largest population analysis ever done for an endangered species. Among those who shared their data, the conclusions were clear and unanimous: The northern spotted owl was indeed in serious and rapid decline. Across its range, its

survival and reproduction rates were dropping, and these losses appeared to be accelerating. [21]

***A Moment. . . ,* p. 223:**

"By the theory that local variations in climate and diet convert creatures into different species, a black man who lives in Seattle, gets rained on, and eats salmon would be a different 'species' from a white man who lives in stifling humidity in Louisiana and dines on gumbo. By this theory the human race contains hundreds of entirely distinct species. The typical northern and California spotted owls appear more alike than the typical American and Asian. But according to orthodox doctrine, the different people are identical while the similar birds are drastically different."

Correction:

This statement reveals a serious ignorance of genetics and evolutionary biology. Speciation requires some sort of genetic barrier and time. Human beings can and do move long distances, mixing up their gene pool. When DNA is studied to ascertain the differences between members of various human races, humanity as a whole is found to be strikingly uniform, especially when compared to different animal subspecies.

As Steve Jones, professor of genetics at the University College, London, and editor of the *Cambridge Encyclopedia of Human Evolution*, has written: "Humans are a rather homogeneous species, perhaps because they evolved so recently.. . . Other creatures vary much more from place to place.. . . The genetic differences between snail populations of two adjacent Pyrenean valleys is much greater than that between Australian aboriginals and Europeans. That between the orangutan of Borneo and that of Sumatra, just a few miles apart, is ten times greater than the difference between any pair of human groups.. . ." [22]

***A Moment. . . ,* p. 225:**

"Yet with the exception of Pacific Coast salmon, whose 1990s runs were unequivocal disasters, only a handful of the supposed 1,400 additional dying Northwest old-growth species has shown worrisome population trends in studies.

Just one, a bird called the marbled murlet [sic], has been classified threatened under the Endangered Species Act.. . . About a half dozen plants in the region are 'missing in action'-- not observed recently, though known to prosper elsewhere.. . . So far in the postwar era there are *no* known extinctions of animals or vascular (loosely, green-stemmed) plants in the Pacific Coast forests.. . . Several mammals, among them the red vole and the fisher, are believed in decline. But so far zero known extinctions."

Correction:

First of all, Easterbrook neglects to mention the approximately 7,000 species of arthropods that scientists estimate are closely associated with old-growth forests. Most of these species have not been studied carefully enough to know their population trends. [23] More importantly, Easterbrook himself admits that a species of bird, several kinds of mammals, and a half dozen species of plants--in addition to the northern spotted owl--are declining or disappearing from Northwest forests. He also mentions the precipitous decline of the Pacific Coast salmon, which has led to the collapse of the area's once-thriving commercial and sport-fishing industries. How many signs do there have to be before an ecosystem is recognized to be in serious trouble?

***A Moment. . .* , p. 225:**

"Zero known postwar extinctions in the Pacific Coast forest belt. Combined with the prospect that there exist many more spotted owl than previously estimated, this raises the question of whether the owl instant doomsday, which has cost thousands of honest people their livelihoods and occupied the attention of presidents, is at heart a false alarm."

Correction:

To the contrary, it was the "instant doomsday" of economic collapse, as trumpeted by the timber companies, that has proven to be a false alarm. Three years into the imposed restrictions in logging, Oregon has posted its lowest unemployment rate in a generation, of just over 5 percent. Some rural counties show a rate of about 2 percent. Indeed, there are signs of impending labor shortages, and even the most timber-dependent counties in southern Oregon report rising property values and a net increase in jobs. [24]

Moreover, instead of making boards from 300-year-old trees growing on public lands, lumber mills are substituting smaller trees from private tree farms. As the mayor of Springfield, Oregon, said, "Owls versus jobs was just plain false." [25]

***A Moment. . .*, p. 227:**

"Consider that from 9,500 (the White House's own number) to 85,000 jobs will be abrogated by the Clinton owl plan. The lost jobs are skilled, high-wage employment of the sort that real-world Americans who aren't lawyers or consultants need to send their children to college."

Correction:

To the contrary, the average wage throughout Oregon has actually risen since the ban was placed on old-growth logging. And no net loss of jobs has occurred. Instead, many of the loggers who have lost their jobs are being retrained for high-skilled jobs in health care and high- tech industries. As Ed Whitelaw, professor of economics at the University of Oregon, has said, "These 100,000 job loss figures were just fallacious; they came out of a political agenda. Yet when I would say this, I was dismissed as an Earth-Firster or something." [26]

ENDNOTES

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SECTION 4

"SPECIES" [CHAPTER 30]

Easterbrook's arguments in his chapter on endangered species are equally problematic. While disputing the conclusions of natural scientists and wildlife biologists that human activities are causing the planet to experience a loss of species of major proportions throughout the globe, he relies on inaccurate assumptions and faulty reasoning. Easterbrook also makes repeated technical errors, such as confusing different species.

Moreover, as in the spotted owl chapter, he fails to grasp the difference between the better counting of existing numbers of species with observed trends that show that many of these species are in decline. This is evident when he wrongly dismisses as contradictory the increasing scientific estimates of the total number of species on Earth, and the consensus of biologists that extinction is proceeding at a rate unprecedented since the close of the age of the dinosaurs.

***A Moment. . .* , pp. 556-557:**

> "Roughly since the 1970s ecologists have claimed a rising degree of species loss caused by human activity. And in this same period researchers have supposed the natural world to contain far more species than once believed. These two trains of thought are barreling toward each other on the same track."

Correction:

> These statements are not contradictory. Virtually all biologists agree that the world is facing an alarming loss of biodiversity, caused by human actions. [1] Based on current trends of habitat destruction, it has been estimated that between 1 and 11 percent of the world's species will be committed to extinction by the year 2015. [2]
>
> Meanwhile, estimates of the total number of species now on the Earth are increasing, as biologists turn their attention to poorly studied groups of animals and plants in out-of-the-way places. [3]

***A Moment. . . ,* p. 558:**

". . . [the biologist Edward] Wilson . . . now projects a human-caused loss of 50,000 species per year, or 137 daily.. . . Under [this] loss estimate . . . about 1.1 million extinctions should have occurred globally since 1973. As America contains six percent of the world's land mass, a rough proration would assign six percent of that loss, or 66,000 extinctions, to the United States. Yet in the period only seven actual U.S. extinctions have been logged. There is a rather amazing gap between a projected 66,000 and a confirmed seven."

Correction:

Here, Easterbrooks's logic is based on scientifically inaccurate assumptions. First, he assumes that the distribution of species is roughly proportional to the land area. We *know* this isn't true. The rain forests, for example, occupy only 6 % of the Earth's land surface but contain more than 50 % of the world's species, in almost every well-studied taxon, including birds, fishes, and vascular plants. [4] Of the approximately 250,000 known vascular plant species, about two-thirds reside in the tropics and subtropics, and in just three countries, Colombia, Ecuador, and Peru, almost one-sixth of the world's plants can be found on just 2 % of the world's land surface. [5]

Easterbrook further assumes that rates of habitat destruction, the primary cause of extinctions, are roughly equivalent across the globe. This, too, is incorrect. Over the past decade, the tropical forests have been shrinking almost 1 % a year, on average, while the forests in the temperate areas of industrialized countries have increased slightly over the same period. [6]

***A Moment. . . ,* p. 559:**

"In 1993 two authorities on biodiversity, Michael Bean and David Wilcove of the Environmental Defense Fund, tallied 27 extinctions of North American fish species and subspecies since the year 1950. The Bean-Wilcove estimate is double the rate for the first half of the century, again a clear danger sign. But it's also a fish loss of about one per year, a figure impossibly low if pessimists . . . are right about their projections of annual losses by the many thousands."

Correction:

Easterbrook ignores that rates of extinction for particular types of species--in this case fish--may not be the same as rates for other types. Nor does he acknowledge that rates in one region may not be comparable to rates in other regions.

Moreover, Bean and Wilcove, the authors of the cited letter, *are* pessimistic about the overall rate of species loss in the United States. The number of species identified by the U.S. Fish and Wildlife Service as threatened or endangered continues to grow, as many natural areas in the United States that contain rare and localized species are developed.

***A Moment. . .* , p. 562:**

". . . as Ariel Lugo, a Forest Service official in Puerto Rico, pointed out in a 1991 issue of *Science*, when pristine forests are cut they do not vanish; rather, the next step is usually new second-growth forests. Many species from the pristine forest adapt to the second-growth habitat and continue living.. . . "

Correction:

First, forests don't always regenerate after being cut. Tropical rain forests, for example, are among the most fragile of ecosystems, containing thin soils, whose nutrients and minerals are washed away quickly by rain after deforestation. There are large areas throughout the American tropics where forests have been converted to cattle pastures, sugar cane fields, and other non-forested habitat. Many of these altered habitats will be very difficult if not impossible to restore to their previous, ecologically diverse conditions. [7]

Second, many species are unable to adapt to second- growth habitat. An example from the United States is the now-extinct ivory-billed woodpecker. [8]

***A Moment. . .* , p. 562:**

"Most troubling is a fundamental inconsistency in the work of Wilson.. . . It cannot be that a human-caused mass extinction occurred just 11,000 years ago, that ten million years must pass for nature to recover naturally from mass extinctions, and that today biological diversity is the highest ever."

Correction:

These three points are not related to each other as if in mathematical equilibrium. Measured over millions of years, global biodiversity has increased, as demonstrated by the fossil record. [9] Yet 11,000 years ago, roughly three- quarters of the large mammals in the Americas were hunted to extinction (victims included long-horned bison, sabertooth cats, dire wolves, and ground sloths). The mammalian biodiversity in the Americas has not recovered. [10] But because mammals are only a small proportion of the world's species--less than 0.3 percent, as currently described--the demise of some of them does not significantly change the numbers on species abundance. [11]

The fossil record also indicates that it commonly takes millions of years for affected groups to regain their diversity following major extinction events.

***A Moment. . . ,* pp. 562-568:**

On these pages, Easterbrook presents what he calls "An Endangered Species Scorecard." He refers to the Endangered Species Act and says, "Let's take a look at what is happening on the list." He then proceeds to examine superficially 24 species or species groups for the trend in their numbers.

Correction:

Of the 24, only 13 of his examples are unequivocally correct. In several cases he refers inaccurately to a group of animals as a single species--the kangaroo rat, for example (p. 563). There are many species of kangaroo rats, only some of which are on the endangered species list. Six times--or 25 % of his examples--he is simply wrong about whether a species or group of species is represented on the endangered species list: Mute swans, harp seals, tuna, sharks, wild turkeys, and mustangs have never made the list. He makes other errors within his inventory:

***A Moment. . . ,* p. 563:**

". . . political sentiment has run strongly against returning the wolf to Yellowstone, for fear that someday a child touring the park may be snatched and killed."

Correction:

Though some people may have expressed this fear, the opposition to the reintroduction of

wolves was and continues to be driven primarily by the fears of ranchers that it will lead to loss of livestock. [12]

***A Moment. . .*, p. 567:**

"Mountain lions, also called cougars, were extensively bounty-hunted in the nineteenth century, and by the 1960s were believed extinct in North America . . . Oddly enough, the Fish and Wildlife Service still classifies the eastern cougar as extinct, yet nevertheless also classifies it as an endangered species that cannot be hunted."

Correction:

Mountain lions were never believed to be extinct in North America. The species has always been seen in the West (as well as throughout Central and South America). The eastern cougar, a particular subspecies of the mountain lion, is widely believed to be extinct, but unconfirmed sightings are reported from time to time. [13]

***A Moment. . .*, p. 567:**

"...the steller [sic] sea lion . . . was listed as threatened in 1990 in response to a lawsuit by environmental groups, though about 65,000 steller sea lions are estimated to exist."

Correction:

The Steller sea lion was listed because of sudden and severe population declines throughout its range, with an overall decline of 78 % between the 1950's and 1990. The greatest loss occurred in the eastern Aleutians, where 10,802 sea lions were counted in 1985 but only 3,145 in 1989. [14] Declines of this magnitude and rate, by any calculation, justify protection.

***A Moment. . .*, pp. 567-568:**

"In the last decade environmental litigators have pressured the Fish and Wildlife Service to list creatures at any sign of population decline, regardless of whether the decline appears to engage a threat of extinction. This means a common invocation of doomsday cant--that 'more and more creatures are being listed as

endangered every day'--is deceptive, since the listings are based on increasingly lenient criteria and now may be registered even when a creature is numerous."

Correction:

The reality is really the reverse of what Easterbrook asserts. Most species are listed too late rather than too early to ensure their survival. According to a recent study, the median population size of an animal species at time of listing was just under 1,000--well below the level generally considered viable; for plant species the median population size was fewer than 120 individuals, and 39 of these species were listed with ten or fewer known members. [15]

***A Moment. . .* , p. 570:**

"In the Western world at least, if most imperiled species could make it through the period from the 1940s to the late 1970s--when gross pollution was everywhere, development was unrestricted, and the Endangered Species Act did not yet exist--then those species have already passed the worst test that will be administered by man."

Correction:

First of all, imperilment is a site-specific phenomenon, and over most of the globe, including major portions of the Western world, there are few laws to protect endangered species. Moreover, in much of the world, including many developed nations, habitat destruction continues unabated. Species whose habitats have been partly or entirely spared in the past, but are now finding themselves increasingly squeezed, will find little comfort in Easterbrook's unwarranted optimism.

Finally, in the future, human-caused climate change stands as one of the greatest threats to the survival of species, a prospect which, so far, the world has made little effort to forestall. [16]

***A Moment. . .* , p. 571:**

"In Monterey County, California, the bush lupine, a native plant, is protected under the Endangered Species Act. About 200 miles away at the Lanphere Christensen Dunes Preserve in Humbolt [sic] County, California, where the bush lupine is not native, the Nature Conservancy has been trying to eradicate the same

plant. It's hard to get your head around the notion that a plant can be so wonderful in one place that it deserves federal protection yet so horrible 200 miles away that it must be destroyed."

Correction:

Easterbrook confuses two strikingly different species of lupine--one highly endangered, the other not. The endangered species is *Lupinus tidestromii*, or Tidestrom's lupine, which is not a bush lupine but a creeping perennial found in only three dune systems in California. The other species, which the Nature Conservancy is trying to eradicate from the Christensen Preserve in Humboldt County, is the *Lupinus arboreus*, or yellow bush lupine, a much more common plant. [17]

***A Moment. . . ,* p. 572:**

". . . species arriving from someplace else do not possess mystical superpowers. They are just different, and the local ecology needs time to react to the difference."

Correction:

The fact remains that the introduction by humans of exotic species into ecosystems often leads to the imperilment and/or extinction of native species (as Easterbrook himself has pointed out, one paragraph earlier, with his example of the loss of several bird species on Guam after the accidental introduction of the brown tree snake). Indeed, of the known causes of animal extinctions since 1600, introduction of exotics ranks with habitat destruction as the most important. [18]

A recent study found that the introduction of new species was a major cause for the listing of 41 species as threatened or endangered in the United States, and a contributing factor in the listing of 160 more, since the establishment of the Endangered Species Act. [19] Another study found that over the past century, the introduction of new species has been a contributing factor in 68 % of the extinctions of North American fish. [20]

***A Moment. . . ,* p. 573:**

". . . many environmental groups, including the normally clearheaded Environmental Defense Fund, have succeeded in pressuring some states to outlaw

possession of ‘exotic’ species--animals endangered in other nations, but not in the U.S.--and have asked Congress for national legislation to that effect, depicting the notion of private U.S. stocks of endangered species from other shores as an odious hoarding. Yet . . . on a Texas ranch [there are] more representatives of the endangered scimitar-horned oryx than can be found in the species’ native Africa.. . . It’s hard to imagine how outlawing [this] collection will aid the survival prospects of the scimitar-horned oryx."

Correction:

First of all, EDF has never tried to pressure any state to outlaw possession of exotics. Secondly, he defines "exotic" erroneously. Exotic species are plants or animals that have been introduced, deliberately or accidentally, into countries or areas where they do not normally occur; whether they are endangered or not is irrelevant. Thirdly, his suggestion that the rationale for such restrictions, to prevent "odious hoarding" by private collectors, is wrong. The motivation of states that have imposed restrictions on exotic-game ranching has been to prevent the transmission of diseases and parasites to native wildlife. [21]

***A Moment. . .* , p. 575:**

"One looming absurdity is beetle protection [by the Endangered Species Act] . . . If beetles start receiving the instant-doomsday treatment, species protection will have veered into nonsense."

Correction:

Would Easterbrook have the Act specifically exclude beetles from its protection just because there are thousands of species of beetles? Or because beetles are small? What could be the logic behind this statement, especially if he believes that, as he writes on the very next page (p. 576), "every animal on Earth may be vital to the cosmic enterprise"? Indeed, obscure creatures often yield things of value; witness the derivation of penicillin from a bread mold or an anti-leukemia drug from the rosy periwinkle.

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CONCLUSION

In *A Moment on the Earth*, Gregg Easterbrook attempts to contrast his own supposedly "eco-realistic" views with the views of those he labels environmental "doomsayers." Yet what the book really does is to set Mr. Easterbrook's own opinions against the weight of scientific evidence, consisting of the findings of hundreds of independent climatologists, atmospheric scientists, and wildlife biologists, working in their respective fields throughout the world. While continually dismissing the assessments of these experts as overly pessimistic, he caricatures their positions, and incorrectly characterizes their work as part of a biased environmental "orthodoxy." In the process, he impugns the intelligence, judgment, and impartiality of some of the most esteemed scientists of our time, including Rachel Carson, James Anderson, and E. O. Wilson.

Moreover, he repeatedly criticizes scientists whose dire predictions have not come to pass, without fully acknowledging that their forecasts catalyzed changes in laws and policies that forestalled the predictions themselves.

Though the Environmental Defense Fund celebrates the successes of the past, including the banning of DDT and the restrictions on the use of CFC's, and believes that further achievements are within our grasp, we hold that this will be possible only with a realistic assessment of those environmental problems that still remain, based on the best scientific evidence.

Far from being "eco-realistic," Easterbrook's work betrays an extreme naivete concerning the workings of physical processes and natural ecosystems, resulting in an entirely unwarranted optimism that we will easily solve all of our environmental problems in the near future, if we have not done so already. Perhaps he himself should take to heart the advice he offers up so readily to environmentalists: "Learn science and speak logic. Many lesser creatures will thank you". (*A Moment on the Earth*, p. 647).

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