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BETRAYAL *of* SCIENCE *and* REASON

How Anti-Environmental Rhetoric Threatens Our Future

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To the memory of Senator John Heinz
and to Teresa Heinz, who carries on his work

rent scientific data than the eminent scientist, Professor Edward O. Wilson of Harvard, a wide range of other well-known scientists cited in the book, or, for that matter, myself."[29] Curious indeed.

Brownlash writers also cheerfully exploit any dissent that occurs among scientists. If scientists don't agree on rates of species extinction, or on strategies for ecosystem management, or on details of model projections of global warming, brownlash advocates are quick to point out—and exaggerate—those differences. Thus Gregg Easterbrook, Ronald Bailey, and other brownlash writers make much of the news that climatologists don't agree on the details of global warming, although it isn't the warming itself but the probable *rate* of warming and changes in precipitation patterns that are under dispute. In doing this, they help perpetuate the myth that a basic consensus on warming doesn't exist within the scientific community, justifying their view that any action undertaken to reduce greenhouse gas emissions should be delayed until "all the data are in."

The congeniality of brownlash views with short-term economic gain is indicated by their repeated coverage in the American business press—especially in *Forbes* magazine and in the editorial section of the *Wall Street Journal,*which are favored outlets. Indeed, the *Wall Street Journal* frequently lavishes praise on brownlash writers, thus further elevating their work in the eyes of its readers (mostly non-scientists). The difference between the preponderance of views in the editorial pages of the *Wall Street Journal* and those of the scientific community speaks volumes about the *Journal*'s positions on matters of environmental science.

For instance, an editorial in that newspaper referred to Gregg Easterbrook's book *A Moment on the Earth*[30] as "an update on the state of Mother Earth today."[31] Yet the book contains so many serious errors that it has spawned a virtual cottage industry among scientists trying to correct them.[32] Typical were the comments of entomologist Jack Schultz of Pennsylvania State University: *Moment* "contains some of the most egregious cases of misunderstood, misstated, misinterpreted, and plainly incorrect 'science' writing I've ever encountered."[33] Ecologist Thomas Lovejoy, Undersecretary for External Affairs at the Smithsonian Institution, wrote: "I was stunningly disappointed by the book's rambling prose and profusion of inconsistency and error."[34] Physicist-ecologist John Harte of the Energy and Resources Group at the University of California, Berkeley, stated, "On far too many pages of this vexing book, I found examples of . . . misquoted and misinterpreted segments of scientists' writings, and of illogical thinking."[35] But Easterbrook, a journalist and contributing editor to *Newsweek* and the *Atlantic Monthly,* is only one of the more prominent brownlash writers and is far from the most extreme in his views.

In an effort to appear credible, brownlash writers frequently cite one another, often leaning on statements by the Ph.D. contrarians, which imbues their work with an aura of validity. Much of the nonsense promulgated by Rush Limbaugh in his bid to convince the public to ignore the threat of stratospheric ozone depletion[36] can be traced to *21st Century Science and Technology.* Among other things, that magazine has carried out a very effective campaign of misinformation on the issue of ozone depletion—one detailed in *Science,* the premier North American scientific journal.[37] We'll deal later with the science that shows Limbaugh's position to be nonsensical; here we primarily trace the brownlash linkages. Limbaugh credits his views to marine biologist Dixy Lee Ray's *Trashing the Planet.*[38] Ray in turn cited S. Fred Singer and Rogelio Maduro.[39] Maduro is an associate editor of *21st Century Science and Technology* and coauthor (with R. Schauerhammer) of *The Holes in the Ozone Scare: The Scientific Evidence That the Sky Isn't Falling,* published by 21st Century.[40]

Maduro and Schauerhammer argue vehemently that natural sources of ozone-destroying chlorine in the atmosphere are much more important than the synthetic chlorofluorocarbons (CFCs) that the scientific community has identified as the leading culprits.[41] Leaning on the Maduro and Schauerhammer book, Limbaugh and his collaborator John Fund (who writes editorials for the *Wall Street Journal*)[42] state that "Mt. Pinatubo in the Philippines spewed forth more than a thousand times the amount of ozone-depleting chemicals in *one* eruption than all the fluorocarbons manufactured by wicked, diabolical corporations in history. . . . Conclusion: mankind can't possibly equal the output of even one eruption from Pinatubo, much less a billion years' worth, so how can we destroy ozone?"[43]

This is classic anti-science. It sounds authoritative, but it is well known among scientists as a totally incorrect conclusion. The chlorine-containing compounds released by volcanoes do not contribute much to ozone breakdown in the stratosphere because they don't end up

there. Nonetheless, Ray continued to publish erroneous information on the impact of volcanoes on ozone in her 1993 book *Environmental Overkill.*[44]

Interestingly, contrarian Fred Singer told *Science* in 1993 that atmospheric scientists had done "a very careful job of tracing the amount of chlorine and fluorine in the stratosphere. . . . I'm now reasonably convinced that CFCs make the major contribution to stratospheric chlorine, and what has convinced me is the published data."[45] *Science* added, "And that leaves the critics with little basis for claiming that the ozone layer has long withstood high levels of chlorine without harm."[46] We wonder how vigorously Rush Limbaugh has retracted his error.

The ozone backlash provides an excellent example of how non-scientific publications can influence public perceptions of scientific issues. Maduro's views "percolated from Ray to Limbaugh" and also served as the basis for an article in the June 1993 issue of *Omni,* which reaches more than 1 million readers, "claiming to expose ozone research as a politically motivated scam."[47] Maduro's book sounds so authoritative that atmospheric researchers have said "they can see how readers who are not experts in the field might find the arguments compelling."[48] Harvard atmospheric chemist James G. Anderson commented, "Part of the strategy in this backlash is to try to entrain apparently responsible scientists who clearly don't understand the problem and have not gone over the data before they've commented."[49]

We can sympathize with the plight of the ordinary reader (or even the ordinary talk-show host) when faced with such a campaign. It does not augur well for the future of an increasingly scientifically illiterate population when even scientists can be taken in. The bottom line is that the battle with the brownlash is not some kind of scholarly discourse. It is actually more like a street fight,[50] and within the bounds of scientific accuracy it must be fought as such.

A major part of the problem, of course, is that all of us have difficulty perceiving large-scale or slowly developing environmental problems.[51] Human beings evolved, both culturally and genetically, in situations in which there was no advantage to perceiving changes occurring slowly, decade by decade. People have been programmed to react quickly and appropriately to a sudden environmental change, as when a leopard appeared in the path ahead. But there was no advantage to registering a change in climate—if it occurred, it was not human caused, and there

was precious little a band of hunter-gatherers could do about it except seek greener pastures. Indeed, there is reason to believe that our nervous systems evolved to keep the general environmental backdrop of our lives seemingly constant in order to allow us to concentrate on short-term changes happening against that backdrop.[52]

Now many critical changes are taking place in our backdrop because of human activities, but most of them are happening too slowly for people to notice. Many changes might be detected more easily by organisms with sensory capabilities different from those of human beings. Like birds, people are sight-oriented animals and have relatively poorly developed chemosensory abilities. Toxification of the planet might be much more obvious to dogs, which live in a world shaped to a great extent by their sense of smell. One can barely imagine how we would perceive changes in our environment if, like some fishes, we oriented to it primarily by detecting distortions in electrical fields, or if we responded primarily to sonar returns as bats do.

But people can't detect the buildup of greenhouse gases by sight, hearing, or smell. We know the concentration of CO_2 is increasing because of a climbing zigzag line on a graph attached to a machine that measures the concentration of CO_2 in the air over Hawaii. Even some trained scientists have trouble emotionally grasping the potential for disaster suggested by that zigzag line. Dirty air and dirty water are easy to spot and react to; declining biodiversity, soil erosion, and overpumped aquifers are harder to perceive.

Indeed, people seem incapable of directly perceiving even threats as dramatic as the linkage between cigarettes and poor health. Compared with risks from exposure to most other environmental hazards, the direct risk to health from smoking is astronomical—one out of every three smokers dies prematurely because of the habit. Yet people persisted in smoking for hundreds of years without fully realizing the danger, and it took a large scientific effort over decades to persuade the medical community and most of the general public of the hazards of tobacco. In fact, many people remain unconvinced, often citing the common (but irrelevant) experience of knowing healthy octogenarians who have smoked for sixty years.

It is not surprising that if a one-in-three risk of early death is not directly detectable by many people, the majority cannot detect risks on the order of one in a hundred. Nevertheless, with regard to pollutants,

ever, established a network of filter instruments across the entire Soviet Union, and they had to replace them because they did not work well at any latitude. So the basis of the fable represented by the quoted excerpt is poor instrumentation.[88] (For further details on the science of this point, see the notes at the end of the book.)

- **Chlorofluorocarbons (CFCs) can't rise into the stratosphere and deplete ozone.** "CFCs are heavy, complex molecules. . . . It is especially difficult to see how they can rise as high as 30 km, where the greatest concentration of ozone is located." (Rogelio Maduro, 1989)[89] "How does CFC rise when its molecules are four to eight times heavier than air?" (Dixy Lee Ray and Lou Guzzo, 1993)[90] "If CFCs are responsible for the destruction of the ozone layer, why has their presence never been detected in the stratosphere?" (R. Bennett, 1993)[91]

This array of statements reveals outrageous misconceptions about the dynamics of the atmosphere. Gases of the atmosphere are not layered like a lasagne. If they were, the lowest few feet of atmosphere would consist of krypton, ozone, nitrous oxide, carbon dioxide, and argon. Above that would be a thick layer of pure oxygen, and above that an even thicker layer of pure nitrogen followed by water vapor, methane, neon, helium, and hydrogen. The lack of a hydrological cycle alone would preclude the existence of any life on land. Earth can sustain life because to an altitude far above the ozone layer, the atmosphere undergoes dynamic mixing, dominated by motions of large air masses, which thoroughly mixes light and heavy gas molecules.[92]

Because of this mixing, CFCs have been detected in, as Rowland put it, "literally thousands of stratospheric air samples by dozens of research groups all over the world."[93] Thus the brownlash notion that CFC molecules are simply too heavy to rise into the stratosphere has no basis in reality. In fact, the only significant mechanism for cleansing the atmosphere of CFCs is decomposition by ultraviolet light in the stratosphere—with associated ozone depletion.

- **Chlorofluorocarbons are not likely to be the source of the chlorine that is depleting the ozone layer because volcanoes are a much more prolific source of chlorine.** "Mount Erebus [in Antarctica] . . . pumps out 50 times more chlorine annually than an entire year's production of CFCs." (Dixy Lee Ray and Lou Guzzo, 1993)[94] "Conclusion: mankind can't possibly equal the output of even one eruption from Pinatubo, much less a billion years' worth, so how can we destroy ozone?" (Rush Limbaugh, 1992)[95]

Mount Erebus *does* pump out fifty times more chlorine per year than humanity adds in CFCs. Unfortunately, the statement is irrelevant to depletion of the ozone layer. Good scientists have long carefully considered volcanoes, which emit hydrogen chloride (HCl), as sources of stratospheric chlorine. In 1980, a paper in *Science* by David Johnston of the U.S. Geological Survey raised the issue to some prominence, suggesting that "volcanic sources of stratospheric chlorine may be significant in comparison with anthropogenic sources."[96] Following publication of his paper, a series of investigations ruled out volcanic eruptions as the chief source of stratospheric chlorine.[97] It is likely that much of the HCl released by volcanoes is dissolved in the abundant steam they also emit and thus is quickly rained out. This is not surprising; before Johnston's paper appeared, atmospheric scientists knew that HCl is water soluble and rains out. But CFCs are insoluble. As Rowland said in his AAAS presidential address: "The working atmospheric science community has . . . rejected volcanoes as an important source of chlorine (and fluorine) for the stratosphere, at least for the past 15 years during which significant ozone depletion has been observed."[98] Nonetheless, perennial contrarian Fred Singer wrote in the *National Review* in 1989, "[E]vidence is firming up that volcanoes . . . contribute substantially to stratospheric chlorine, and thus dilute the effects of CFCs."[99] It wasn't until four years later that he finally recanted this assertion in a statement to *Science* magazine.[100]

In 1990, Dixy Lee Ray and her assistant Lou Guzzo declared in *Trashing the Planet:* "[T]he eruption of Mount St. Augustine (Alaska) in 1976 injected 289 billion kilograms of hydrochloric acid directly into the stratosphere. That amount is 570 times the total world production of chlorine and fluorocarbon compounds in the year 1975. . . . So much is known."[101] Ray and Guzzo confused a *hypothesis* about the results of a gigantic eruption 700,000 years ago (which left the Long Valley crater in California) with measurement of a 1976 event. Rowland referred to Ray's gaffe in his AAAS presidential address: