

Statistics needed

The Deniers -- Part I

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In the global warming debate, there are essentially two broad camps. One believes that the science is settled, that global warming is serious and man-made, and that urgent action must be taken to mitigate or prevent a future calamity. The other believes that the science is far from settled, that precious little is known about global warming or its likely effects, and that prudence dictates more research and caution before intervening massively in the economy.

The "science is settled" camp, much the larger of the two, includes many eminent scientists with impressive credentials. But just who are the global warming skeptics who question the studies from the great majority of climate scientists and what are their motives?

Many in the "science is settled" camp claim that the skeptics are untrustworthy -- that they are either cranks or otherwise at the periphery of their profession, or that they are in the pockets of Exxon or other corporate interests. The skeptics are increasingly being called Deniers, a term used by analogy to the Holocaust, to convey the catastrophe that could befall mankind if action is not taken. Increasingly, too, the press is taking up the Denier theme, convincing the public that the global-warming debate is over.

In this, the first of a series, I examine *The Deniers*, starting with Edward Wegman. Dr. Wegman is a professor at the Center for Computational Statistics at George Mason University, chair of the National Academy of Sciences' Committee on Applied and Theoretical Statistics, and board member of the American Statistical Association. Few statisticians in the world have CVs to rival his (excerpts appear nearby).

Wegman became involved in the global-warming debate after the energy and commerce committee of the U.S. House of Representatives asked him to assess one of the hottest debates in the global-warming controversy: the statistical validity of work by Michael Mann. You may not have heard of Mann or read Mann's study but you have often heard its famous conclusion: that the temperature increases that we have been experiencing are "likely to have been the largest of any century during the past 1,000 years" and that the "1990s was the warmest decade and 1998 the warmest year" of the millennium. You may have also heard of Mann's hockey-stick shaped graph, which showed relatively stable temperatures over most of the last millennium (the hockey stick's long handle), followed by a sharp increase (the hockey stick's blade) this century.

Mann's findings were arguably the single most influential study in swaying the public debate, and in 2001 they became the official view of the International Panel for Climate Change, the UN body that is organizing the worldwide effort to combat global warming. But Mann's work also had its critics, particularly two Canadians, Steve McIntyre and Ross McKittrick, who published peer-reviewed critiques of their own.

Wegman accepted the energy and commerce committee's assignment, and agreed to assess the Mann

controversy pro bono. He conducted his third-party review by assembling an expert panel of statisticians, who also agreed to work pro bono. Wegman also consulted outside statisticians, including the Board of the American Statistical Association. At its conclusion, the Wegman review entirely vindicated the Canadian critics and repudiated Mann's work.

"Our committee believes that the assessments that the decade of the 1990s was the hottest decade in a millennium and that 1998 was the hottest year in a millennium cannot be supported," Wegman stated, adding that "The paucity of data in the more remote past makes the hottest-in-a-millennium claims essentially unverifiable." When Wegman corrected Mann's statistical mistakes, the hockey stick disappeared.

Wegman found that Mann made a basic error that "may be easily overlooked by someone not trained in statistical methodology. We note that there is no evidence that Dr. Mann or any of the other authors in paleoclimate studies have had significant interactions with mainstream statisticians." Instead, this small group of climate scientists were working on their own, largely in isolation, and without the academic scrutiny needed to ferret out false assumptions.

Worse, the problem also applied more generally, to the broader climate-change and meteorological community, which also relied on statistical techniques in their studies. "[I]f statistical methods are being used, then statisticians ought to be funded partners engaged in the research to insure as best we possibly can that the best quality science is being done," Wegman recommended, noting that "there are a host of fundamental statistical questions that beg answers in understanding climate dynamics."

In other words, Wegman believes that much of the climate science that has been done should be taken with a grain of salt -- although the studies may have been peer reviewed, the reviewers were often unqualified in statistics. Past studies, he believes, should be reassessed by competent statisticians and in future, the climate science world should do better at incorporating statistical know-how.

One place to start is with the American Meteorological Society, which has a committee on probability and statistics. "I believe it is amazing for a committee whose focus is on statistics and probability that of the nine members only two are also members of the American Statistical Association, the premier statistical association in the United States, and one of those is a recent PhD with an assistant-professor appointment in a medical school." As an example of the statistical barrenness of the climate-change world, Wegman cited the American Meteorological Association's 2006 Conference on Probability and Statistics in the Atmospheric Sciences, where only eight presenters out of 62 were members of the American Statistical Association.

While Wegman's advice -- to use trained statisticians in studies reliant on statistics -- may seem too obvious to need stating, the "science is settled" camp resists it. Mann's hockey-stick graph may be wrong, many experts now acknowledge, but they assert that he nevertheless came to the right conclusion.

To which Wegman, and doubtless others who want more rigorous science, shake their heads in disbelief. As Wegman summed it up to the energy and commerce committee in later testimony: "I am baffled by the claim that the incorrect method doesn't matter because the answer is correct anyway. Method Wrong + Answer Correct = Bad Science." With bad science, only true believers can assert that they nevertheless obtained the right answer.

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THE CV OF A DENIER

Edward Wegman received his Ph.D. degree in mathematical statistics from the University of Iowa. In 1978, he went to the Office of Naval Research, where he headed the Mathematical Sciences Division with responsibility Navy-wide for basic research programs. He coined the phrase computational statistics, and developed a high-profile research area around this concept, which focused on techniques and methodologies that could not be achieved without the capabilities of modern computing resources and led to a revolution in contemporary statistical graphics. Dr. Wegman was the original program director of the basic research program in Ultra High Speed Computing at the Strategic Defense Initiative's Innovative Science and Technology Office. He has served as editor or associate editor of numerous prestigious journals and has published more than 160 papers and eight books.

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