

**United States Senate Testimony
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David R. Legates, Ph.D., C.C.M.

Follow-up Questions from Senator James M. Inhofe

In my speech on the Senate floor yesterday I noted your comments regarding Dr. Mann's work, as shown on this chart. Do you stand by these comments?

Your chart was not attached, but I do remember your speech. My comments regarding Dr. Mann's work have not changed since I made them; in fact, further research has made me even more skeptical about his extravagant and unsubstantiated claims regarding his 'hockey stick' graph.

I note that you are an expert in statistical techniques. In my speech on the Senate floor yesterday I noted that, even assuming all of the science used by the political left, come the end of 50 years hence, the Kyoto Protocol would have no measurable effect on temperatures. Do you agree?

I agree, and so does Dr. James Hansen of the Goddard Institute for Space Studies (GISS). Writing on his GISS website (<http://www.giss.nasa.gov/research/forcings/altscenario/>), he states:

"The 1997 Kyoto Protocol, which calls for industrialized nations to reduce their CO₂ emissions to 95% of 1990 levels by 2012, is itself considered a difficult target to achieve. Yet the climate simulations lead to the conclusion that the Kyoto reductions will have little effect in the 21st century, and 'thirty Kyotos' may be needed to reduce warming to an acceptable level."

Regardless of what we both believe about the ultimate effects of anthropogenic greenhouse gas increases, the Kyoto Protocol, if implemented, would have no measurable effect on the temperature of the earth for the foreseeable future.

If the Kyoto Protocol forces harsher mandates, does it follow that the weaker legislative proposals before us in the Senate would likewise have no measurable effect?

It stands to reason that because the Kyoto Protocol will have no measurable effect on the temperature of the earth, that anything weaker would also have none.

In my speech on the floor of the Senate yesterday, as these charts show, I noted the economic dislocations for the poor and the disproportionate minority impacts that would result from the harsh mandates of cap and trade schemes. So you believe these schemes are scientifically justifiable?

Your charts were not attached to your list of follow-up questions, but I believe I do remember them from your speech. However, while I have personal views regarding my opposition to cap and trade schemes, I believe that commentary on the utility of such efforts are outside the scope of my expertise.

We have a law entitled the Data Quality Act which states that the federal government cannot disseminate data or information, and thus cannot regulate on data or information, that does not meet certain quality standards. One important quality standard is the reproducibility of the data. Considering the differences that you have with Dr. Mann here, do you consider his information of sufficient quality to use for regulation, because it does not look like it to me?

That has been my concern – that the research of Dr. Mann is the outlier and does not fit with the preponderance of the evidence against the ‘hockey stick’. Research that has appeared since the hearing, by McIntyre and McKittrick (2003), Soon *et al.* (2004), Esper *et al.* (2004), and Chapman *et al.* (2004) have uncovered the problems associated with and lack of reproducibility inherent in Dr. Mann’s work. In particular, McIntyre and McKittrick (2003) cite problems with Dr. Mann’s research including poor data handling methods, the use of obsolete data, and incorrect calculation of statistical methods. Our own work (Soon *et al.*, 2004) uncovered the fact that we could not resolve the ‘blade’ of the ‘hockey stick’ using the smoothing method referenced by Dr. Mann in the IPCC report and that his research erroneously characterized the observational record – the IPCC concludes a 0.6°C warming has occurred since 1900 but Dr. Mann’s latest ‘hockey stick’, using the same data source, shows a 0.95°C warming. Esper *et al.* (2004:113) note the absence of the Medieval Warm Period and the Little Ice Age in the ‘hockey stick’ temperature reconstruction and argue that this is due to Dr. Mann’s use of unreliable tree ring de-trending methods that are unable to resolve variability on longer time scales. Most recently, Chapman *et al.* (2004) commented on a comparison of borehole temperature measurements with Dr. Mann’s proxy records and questioned Dr. Mann’s analysis techniques, concluding they are ‘just bad science’ and that Dr. Mann had undertaken a ‘selective and inappropriate presentation’ of results. Thus, I concur with you that his work certainly does not conform to the requirements of open access and reproducibility, required by the Data Quality Act, nor does it meet even minimal quality standards.

Chapman, D.S., M.G. Bartlett, and R.N. Harris, 2004: Comment on “Ground vs. surface air temperature trends: Implications for borehole surface temperature reconstructions” by M.E. Mann and G. Schmidt. *Geophysical Research Letters*, **31**, L07205, doi:10.1029/2003GL019054.

Esper, J., D.C. Frank, and R.J.S. Wilson, 2004: Climate reconstructions: Low-frequency ambition and high-frequency ratification. *EOS, Transactions of the American Geophysical Union*, **85**(12):113,120.

McIntyre, and McKittrick, 2003: Corrections to the Mann et al. (1998) proxy data base and Northern Hemispheric average temperature series. *Energy & Environment*, 14:751-771.

Soon, W.-H., D.R. Legates, and S.L. Baliunas, 2004: Estimation and representation of long-term (>40 year) trends of Northern-Hemisphere-gridded surface temperature: A note of caution. *Geophysical Research Letters*, **31**(3).

Why is using detailed environmental change at many sites worldwide (the method you and your co-authors used) better than using a coarse average of reconstructed temperature as an indicator of climate?

Both analyses are useful, but it is important that coarse averages represent the individual observations. In the case of Dr. Mann's 'hockey stick', we examined the individual records and found that the 'hockey stick' did not faithfully reproduce known climate signals (*i.e.*, the Medieval Warm Period and the Little Ice Age) evident in the original observations. Coarse averages have their place as a synthesis, but the individual observations are important because statistical methods used to produce the averages can obscure important information.

As a reviewer of papers for scientific journals, could you elaborate on the processes of peer review involved here?

Dr. Mann's insistence that his *EOS* paper is 'peer-reviewed' because the editor is an atmospheric scientist makes a mockery of the peer review process. The process works as follows. First, the author submits the manuscript to an editor who reviews it briefly. Based on the topic, the editor selects appropriate reviewers (usually two or three, sometimes more) who have expertise in the topic but do not have a vested interest in the outcome (publish or not) of the paper. In particular, reviewers must not currently be working with any of the authors, must not be at the same institution as any of the authors, and must not be in a current dispute with any of the authors. The editor must make sure that the reviews are returned in a timely manner and that the reviews are appropriate – I have received reviews that I had to disqualify (both in favor of and opposed to the manuscript) because they appeared to have been written with little thought and provided little constructive criticism. The editor then returns the manuscript to the authors with instructions as to how the manuscript must be modified (if possible) to warrant publication. The manuscript goes back and forth between the reviewers and the authors until the reviewers are satisfied, or until the editor deems that an impasse has been reached, in which case the editor makes the final decision.

Please describe "Academic Freedom."

Academic freedom is a concept that arises from the tenure system. The period before tenure is granted is a trial period where the professor demonstrates his/her ability to perform teaching, research, and service duties, usually lasting from five to seven years (most people are put forth for tenure in their sixth year of an assistant professor appointment). Once a person is awarded tenure, then it is recognized that they have demonstrated their worth, which allows them more freedom to pursue more controversial topics.

The American Association of University Professors defines 'academic freedom' in the following three points:

- Teachers are entitled to full freedom in research and in the publication of the results, subject to the adequate performance of their other academic duties; but research for pecuniary return should be based upon an understanding with the authorities of the institution.

- Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial matter which has no relation to their subject. Limitations of academic freedom because of religious or other aims of the institution should be clearly stated in writing at the time of the appointment.
- College and university teachers are citizens, members of a learned profession, and officers of an educational institution. When they speak or write as citizens, they should be free from institutional censorship or discipline, but their special position in the community imposes special obligations. As scholars and educational officers, they should remember that the public may judge their profession and their institution by their utterances. Hence they should at all times be accurate, should exercise appropriate restraint, should show respect for the opinions of others, and should make every effort to indicate that they are not speaking for the institution.

(from <http://www.aaup.org/statements/Redbook/1940stat.htm>)

Was the temperature warmer 4,000-7,000 years ago?

Yes. The general agreement is that the temperatures during the ‘climatic optimum’ were warmer than present by about 2°C over much of the earth’s surface – possibly warmer in some places.

Was the temperature warmer when the dinosaurs roamed the earth? Was the Co2 concentration higher then also?

Although there is considerable uncertainty in any estimate of conditions nearly 65 to 100 million years ago, it has been estimated that air temperatures were no more than 10°C warmer than present while the carbon dioxide concentrations were largely commensurate with what they are today.

Do you have more data than Mann?

In short, yes. Much of the ‘hockey stick’ relies on tree-ring proxies from only the western United States and exhibits a strong under-representation the tropical areas. Moreover, much of the data Dr. Mann used was taken from datasets compiled in the 1960s and 1970s – we included data from more recent proxy analyses.

Is your data newer and more comprehensive?

My answer to this question is included in the above response.

Can you and your institutions and universities be bought and influenced by research dollars?

I cannot speak for the University of Delaware as a whole, but I can speak for myself. All of my research funds for global climate change studies have come from Federal sources (the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the National Science Foundation, and the United States Department of the Interior). I have not accepted research funds from private sources, not because it would influence my view or the outcome of my research, but because many view it as having the *appearance* of impropriety.

Indeed, the inclusion of Dr. Soon's grant from the American Petroleum Institute on the acknowledgements section of our research has been the focus of newspaper reports that have argued the American Petroleum Institute has 'told us what to say'. Nothing could be farther from the truth.

My view of climate science is that it is the quest for a true understanding of the way our natural world works and how humans affect it. As such, producing research to fulfill an agenda without regard to the validity of the conclusions I draw would be anathema to me. As a Christian, my ethics and morality would preclude me from making a scientific statement without scientific proof.

On the other hand, I cannot say that everyone holds themselves to such standards. A colleague of mine went to a Regional Assessment Group meeting associated with the 'United States National Assessment of the Potential Consequences of Climate Variability and Change'. A climatologist providing the regional assessment indicated that the climate would be 'warmer and wetter'. At the meeting, my colleague confronted the group, arguing that it is just as likely to be 'colder and drier'. The response from the group: "We're getting funding from the EPA to say that it's warmer and wetter, so it'll be warmer and wetter."

I know that when I served on a National Science Foundation panel, panelists could not have their proposals reviewed by the panel nor could panelists sit in on discussions from proposals submitted from their host institution. Thus I am a bit puzzled to note that the Climate Change Data and Detection Section of the National Oceanic and Atmospheric Administration has awarded Dr. Mann three research grants in the last two years while he served on their panel (as Dr. Mann admitted in his opening statement – he has been a panelist since 2000). The National Science Foundation would not have allowed that as it gives the appearance of impropriety.

Please explain the difference between your research and that of Mann.

In a nutshell, I object to the three components of Dr. Mann's 'hockey stick' – the 'shaft', the 'blade', and the uncertainty characterization. Regarding the 'shaft', Dr. Mann has contended that globally- and hemispherically-averaged air temperature from 200 to 1900AD have been nearly constant (decreasing slightly). Research by Soon *et al.* (2003) has clearly demonstrated that climate signals such as the Medieval Warm Period and the Little Ice Age, while present in proxy records from around the globe, are absent from Dr. Mann's 'shaft'. More recently, research by Esper *et al.* (2004) indicates that other proxy reconstructions are faithfully able to resolve these signals and that the flaw lies with Dr. Mann's method of analysis and its inability to retain millennial-scale variability. Thus, the 'shaft' is a grossly incorrect characterization of the last two millennia. Moreover, research by McIntyre and McKittrick (2003) highlight the errors inherent in Mann's methodology and the flawed and rather careless way in which the research was conducted.

Soon *et al.* (2004) further investigated the 'blade' of Dr. Mann's 'hockey stick' and found it to be inconsistent with IPCC estimates of warming over the last century. Dr. Mann, in the latest incarnation of his 'hockey stick' (Mann and Jones, 2003), shows a warming over the last century of 0.95°C; a figure that is more than 50% larger than the 0.6°C argued by the IPCC. We also

found that we could not reproduce the ‘blade’ of Dr. Mann’s ‘hockey stick’ using the smoothing technique that Dr. Mann indicated he used (as given in the figure caption in the IPCC report). This further underscores the careless nature of his work.

Finally, Dr. Mann provides an assessment of the uncertainty associated with his reconstructions, but it is based solely on the fit statistics from his principal component analysis (which McIntyre and McKittrick have shown to be incorrectly calculated). It fails to account for other significant forms of error and I am currently working on a paper to show that the true estimate of uncertainty is at least twice that presented by Mann and Jones (2003).

Thus, I object to Dr. Mann’s ‘hockey stick’ characterization of temperature over the last two millennia on the basis that the ‘shaft’ does not appropriately represent the data, the ‘blade’ is exaggerated far above accepted values, and the uncertainty characterization is grossly understated. This leads me to reject Dr. Mann’s two main conclusions; namely, that anthropogenic factors provide the overwhelming influence on global and hemispheric temperatures in the last 1800 years (the ‘shaft’ is incorrect) and that the 1990s are the warmest decade, with 1998 being the warmest year, of the last 1800 years (the ‘blade’ is overstated and the uncertainty is under-represented).

Esper, J., D.C. Frank, and R.J.S. Wilson, 2004: Climate reconstructions: Low-frequency ambition and high-frequency ratification. *EOS, Transactions of the American Geophysical Union*, **85**(12):113,120.

Mann, M.E., and P.D. Jones, 2003: Global surface temperature over the past two millennia. *Geophysical Research Letters*, **30**(15), 1820, doi: 10.1029/2003GL017814.

McIntyre, and McKittrick, 2003: Corrections to the Mann et al. (1998) proxy data base and Northern Hemispheric average temperature series. *Energy & Environment*, 14:751-771.

Soon, W.-H., S.L. Baliunas, C. Idso, S. Idso, and D.R. Legates, 2003: Reconstructing Climatic and Environmental Changes of the Past 1000 Years: A Reappraisal. *Energy & Environment*, **14**:233–296.

Soon, W.-H., D.R. Legates, and S.L. Baliunas, 2004: Estimation and Representation of Long-Term (>40 year) trends of Northern-Hemisphere-gridded Surface Temperature: A Note of Caution. *Geophysical Research Letters*, **31**(3).

Is most of your data newer than the IPCC?

Yes. The IPCC report was published in 2001, which means the writing was begun more than a year prior. Since the IPCC used published results, which can take up to a year to appear in print, most of the data before about 1999 was unavailable to the IPCC authors.

Do you have anything else you would like to add?

I again would like to thank the committee for giving me the opportunity to help clarify an important misconception that has recently appeared in the global warming debate – that the 1990s are the warmest decade of the last millennium.

I would like to again address the question that Senator Thomas Carper asked me: “What would it take to convince you that this is a problem we need to deal with?” I think that is the ultimate question we need to address. My answer at the hearing was that we needed proof – proof that the changes to the climate are indeed human-induced and that they are harmful. This goes beyond our debate with Dr. Mann’s work but is at the heart of the issue. With respect to the hearing, I think Senator Hillary Clinton said it best:

“I would stipulate that the Earth's climate has changed through the millennia. There is no doubt about that. I have read enough to know that we have had ice ages and we have had floods and we have had volcanoes. We have had lots of naturally occurring events which have affected our climate...That is not debatable. The issue is whether the introduction and acceleration of anthropogenic activity primarily related to the burning of fossil fuels is putting into place conditions that will make it difficult, if not impossible for the Earth to regain its balance, that will support the conditions of life that we have inherited and are blessed with.”

The IPCC reports are purported to represent the current status of our understanding of climate, climate change, and climate variability. The Second Assessment Report contained the most often cited phrase, “The preponderance of the evidence suggests a discernable human influence on the climate.” Evidence to support that statement was supposed to come from several papers published by Dr. Benjamin Santer and his co-authors – and Dr. Santer was the author that inserted the phrase touting his own work. My research and those of several others pointed out the flaws in their statistical methodology, the biased choices of their data, and the lack of substantial corroboration from independent sources. In essence, their results have been rejected.

With the Third Assessment Report comes the new and important claim that the 1990s were the warmest decade of the last millennium. Evidence to support that statement was provided by research published by Dr. Mann and his co-authors – and as before, Dr. Mann was the author of the chapter that presented his own work. Again, subsequent research by a number of independent scientists have clearly demonstrated the flaws in Dr. Mann’s statistical methodology, the biased and inappropriate choice of his data, and the fact that the research of Dr. Mann is the outlier – the analysis that does not agree with the observations and does not agree with others who also have provided reconstructed air temperature analyses.

Thus, I still await the ‘proof’. What I have seen portrayed in scientific debates as ‘the proof’ has fallen far short under the light of scientific scrutiny. To me, it has not yet been demonstrated that the changes to the climate are human-induced and that they are harmful to life on earth. When that proof is forthcoming, I will change my opinion.