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Climate expert in the eye of an integrity storm

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STATE COLLEGE, Pa. - Michael Mann switched from physics to climate science back in graduate school because he thought climate offered a better chance to work "on a frontier."

He got his wish, and now, as the director of Pennsylvania State University's Earth System Science Center, he has experienced an aspect of frontier life more like the Wild West - a bounty on his head.

After dozens of Mann's personal e-mails were hacked in November, the tenured professor has been called a fraud, a clown, and worse by columnists and bloggers.

Irate citizens complained to a Pennsylvania state senator, who demanded that the university conduct a probe into Mann's scientific integrity. That inquiry is ongoing.

This is hardly Mann's first review. His work has been the subject of at least two major investigations by outside experts.

And last week, a message went around his department at the university, notifying everyone that a whistle-blower could make up to \$12 million by uncovering fraudulent use of federal grants. One blogger gloated that the offer would lead to Mann's having "a very unhappy new year."

Though he has been accused of dodging the press, Mann, 44, agreed readily to an interview on a bitterly cold day last week. The campus was deserted, as almost everyone was away for winter break. Mann was affable and calm as he answered the assertions of his critics.

The hardest part for him, he said, is having his integrity questioned. Scientists, he said, are "not trained to deal with these kinds of attacks."

"My suspicion is, this has been orchestrated at a high level," he said of the hacking.

Behind his desk were a picture of his 4-year-old daughter and a plaque commemorating his contribution to the 2007 Nobel Peace Prize, shared by the Intergovernmental Panel on Climate Change. Mann was the lead author on the group's 2001 assessment report.

He became well-known in the 1990s for his use of tree rings, ice cores, and

other clues to reconstruct Earth's climate in centuries past. That work led to a graph that came to be known as "the hockey stick" because it showed global temperatures taking a sharp upturn in the 20th century.

Mann points out that the hockey stick is not widely seen as a smoking gun implicating human activity in global warming. And it was not the giant graph used in Al Gore's *An Inconvenient Truth*. That was a graph of the carbon dioxide component of our atmosphere - which also is rising sharply.

As the son of a math professor, Mann said, he was more of a computer geek than a weather weenie while growing up in Amherst, Mass. At the University of California, Berkeley, he double-majored in applied math and physics, and then went to Yale University to study condensed matter physics - which involves the complicated behavior of atoms, molecules, and electrons in semiconductors and other materials.

His introduction to global warming came in 1990, he said, at a Yale colloquium. The lecturer, Allan Bromley, then science adviser to President George H.W. Bush, was skeptical that burning fossil fuels had started changing Earth's climate.

"Science at that point was undecided on whether we'd detected our influence on the climate yet," Mann said.

That lecture didn't propel him into climate science, he said. Instead, he realized one day that he didn't necessarily want to be a physicist.

So he got out a Yale course catalog and started reading, eventually deciding to switch to geophysics. He thought some of his skills working with complex systems in physics might carry over to studying climate.

His first project was to look for patterns in climate change over decades and centuries. Since no one recorded temperatures around the world until recently, he started looking at what clues could come from tree rings, corals, ice cores, and other natural objects whose growth or composition might reflect the temperature.

His first prominent paper, in 1995, showed some natural oscillations. That was seized upon by some conservative media as proof that nature, not man, was driving the climate. Mann said he believed both work as competing influences. "Trying to detangle them is a nontrivial task," he said.

The paper that contained the first hockey stick appeared in 1998, with a more complete reconstruction in 1999. Mann said he was surprised it got so much news coverage. After the first paper, he said, he was asked by the Clinton administration to advise the president on climate change for the 1999 State of the Union address.

That's when Mann said he realized the hockey stick had taken on a life of its own.

In 2006, U.S. Rep. Joe Barton (R., Texas), a global-warming skeptic, commissioned an investigation into the hockey stick papers, led by statistician Edward Wegman of George Mason University.

Wegman said Mann made a mistake in the way he centered the data in the graph. He suggested that Mann and his colleagues were brash young researchers who should have gotten more help on their math.

"These guys are going off with very little background," he said. "They're self-taught in the world of statistics." But Wegman said he saw no evidence that Mann committed any fraud or deception.

A different picture is painted by statistician Douglas Nychka, who examined Mann's work as part of a similar panel assembled by the National Academy of Sciences, also in 2006. "There are some things that he could have done better, but there's no fatal flaw," said Nychka. "There's nothing that would make you discount the whole analysis."

Nychka, who works for the National Center for Atmospheric Research in Boulder, Colo., said the paper became so controversial because it was misinterpreted as proof that humans cause global warming.

It's fascinating science in its own right, he said, but it is not the strongest evidence that the Earth has started to feel the impact of fossil-fuel burning and deforestation. What convinced him, he said, were climate models.

Using those, scientists find it difficult to reproduce the current warming trend without including the 40 percent increase in carbon dioxide that has occurred since the Industrial Revolution. Mann's work, he said, is good secondary support.

The hockey stick has been latched on to by people who are skeptical of human-generated climate change, Nychka said, adding, "They see it as evidence they need to discredit."

And that, he said, turned the hockey stick into a political football.

Nychka said he would like to see Wegman and Mann's other critics create their own graphs of past climates: "Why don't they come back with a positive contribution, put some alternative forward?"

The data are all easily available at several sites, said Nychka. Mann, for example, has posted his data leading to the "hockey stick" online through the National Climatic Data Center.

Since 1998, other people have made their own "paleoclimate" reconstructions. Putting those together, the National Academy report in 2006 created what has been called the spaghetti plot - a chart that superimposes different researchers' graphs of global temperatures over the last 1,000 years. The spaghetti strands curve up and down, but all rise dramatically in the 20th century. The overall pattern, notes Nychka, is the same.

Mann was back in the hot seat in November after unidentified hackers lifted more than 1,000 e-mails from the Climate Research Unit in England, many of which included messages from, to, or about Mann.

Mann recalls a Friday night when a colleague alerted him that the hackers had tried to expose the e-mails on RealClimate, the blog he founded with another climatologist.

Over the ensuing weeks, pundits have shifted their focus from one set of e-mail exchanges to another, dubbing the issue "climategate." First, the spotlight shone on an exchange between two other researchers referring to a "trick" Mann had used in plotting his data.

But not even Mann's critics can cite any evidence of deception in the now doubly investigated hockey stick papers. The term *trick*, said Mann, described a technique he used to display his data.

Other pundits criticized Mann and colleagues for agreeing to shun the journal Climate Research after it published work by climate-change skeptics. Mann said the

particular article was bad science and was "polluting" the journal.

Since the e-mails became public, Patrick Michaels, a climate researcher at the **Cato Institute**, has criticized Mann in the editorial pages of the Wall Street Journal. Michaels cited an exchange in which Mann asked Phil Jones of the University of East Anglia's Climate Research Unit to nominate him to become a fellow of the American Geophysical Union, the country's major group for earth scientists. Michaels called this unethical. Several AGU fellows who work outside the climate community said they saw nothing wrong with asking someone for a nomination.

Michaels also flagged an e-mail in which Mann discussed a reference he was writing for Jones. In that, Mann misstated a number called the "h index," which measures a scientist's productivity and influence.

Mann said it was just an error in a hastily typed private e-mail, in which he meant to say 52 but instead said 62. He produced a copy of the official letter, in which he got the number correct.

He said he was surprised that Michaels would castigate him over a typographical error. "They've sunk to a new low," Mann said of the e-mails. "This shows they've given up legitimate debate."

There is still much debate over how big a role human activity plays in the current warming trend, and how the future will be affected. Climate science - and earth science in general - is not expected to make the kinds of sharp predictions that chemists and physicists can make with repeated experiments. "It would be nice if we could do controlled experiments," Mann said. "But we have only one Earth."

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