

Written evidence submitted by  
Dr Tamsin Edwards, Lecturer in Environmental Sciences,  
The Open University (COM0129)

**Key points**

- Uncertainty is a key driving force of science, yet the misunderstanding and misrepresentation of uncertainty in highly politicised areas such as climate science can be extremely damaging.
- The research community has struggled to secure public acceptance for scientific uncertainty as both inevitable and positive because it inspires us to understand the unknown. Too often uncertainty is equated to unreliability.
- Under pressure to make their research more accessible and influential, scientists can sometimes oversimplify the way they communicate their work to the public or policymakers, glossing over complexity. But being open and upfront about uncertainty is essential to winning public trust.
- Scientists would benefit from more training to engage effectively with the public online, instilling them with confidence to acknowledge uncertainty and nuance, welcome questions, and participate in conversations, rather than to deliver lessons.
- Scientists could give more consideration to how the way they present statistics to the media affects their interpretation, while journalists and policymakers could benefit from basic training in statistics and interpreting uncertainty.
- The media has a leading role to play in communicating uncertainty. Providing more opportunities for scientists to set a research news story in context (e.g. via accompanying opinion pieces or blog posts) could increase the quality of science reporting and strengthen public confidence in it.

**About the author**

1. Dr Tamsin Edwards is a Lecturer in Environmental Sciences at the Open University. Her research centres on quantifying uncertainty around climate change predictions, particularly contributions to sea level rise from the Greenland and Antarctic ice sheets, and how scientists can communicate this kind of uncertainty effectively.
2. She blogs for PLOS (Public Library of Science) at *All Models Are Wrong* and was a main scientific consultant for the award-winning BBC programme *Climate Change by Numbers*. She is regularly interviewed about climate science for national and international news media, and has won or been nominated for several awards for science communication.

**Scope of this submission**

3. The issue of how best to communicate scientific uncertainty – and the risks attached – was touched upon in this inquiry's earlier oral evidence sessions.
4. This submission aims to: highlight the importance of getting the communication of uncertainty in science right, particularly in highly politicised and emotionally charged subjects like climate change, and identify how the communication of uncertainty might be improved.

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**Embracing uncertainty in science**

5. Uncertainty can be regarded as the engine of science, in that it drives our search to understand the universe. However the misunderstanding and misrepresentation of uncertainty is damaging the relationship between scientists, policymakers, the media and the wider public.
6. Some argue that dwelling on uncertainty in science invites inaction or charges of unreliability, pointing to cases in the field of climate science where sceptics have tried to exploit uncertainty to support pre-existing views. Scientists are also under increasing pressure to ensure their research is accessible and has a positive impact on society. Uncertainty complicates things. Media seek sound bites and policymakers demand straightforward, practical recommendations that they can put into practice. In some cases this can lead to scientists oversimplifying the way they communicate their research, glossing over issues of uncertainty and complexity.
7. But a failure to be upfront about uncertainty is likely to backfire and may only serve to undermine public trust in science. Many in the research community will acknowledge that collectively we have failed to demonstrate to the public that uncertainty in science is inevitable and a fundamental part of the pursuit of knowledge. Scientists should consider how to communicate uncertainty in more positive terms. Uncertainty inspires us to understand the unknown. It provides us with an excellent opportunity to dig into the details of science and to engage the public in active scientific debate that might otherwise be invisible beyond academia. Open and frank discussions about uncertainty are essential to winning public confidence.
8. Society relies on algorithms and social media to filter the vast amounts of information and news media, but this allows individuals to select sources that confirm their pre-existing views and exclude others. This typically entrenches views and exacerbates polarisation on scientific issues and political responses, particularly when scientific uncertainties are large and the range of political responses diverse, so the opportunities for 'cherry-picking' information increase. The propensity to seek - and create - an artificial sense of certainty will only worsen as the amount of information increases. One way to counter this 'filter bubble' effect is for individuals to actively search for different viewpoints and information sources, particularly outside their own cultural groups.

**Communicating uncertainty: the scientist's role**

9. In 2014 Nature published a series of commentaries on a slowdown in global surface warming. Since the late 1990s the global average surface temperature had increased more slowly than in the previous two decades. The evidence pointed to a pause or hiatus rather than a complete stop, but it resulted in several media articles reporting that global warming had stopped. The pause in the warming of the atmosphere surprised the media and public, but scientists had expected it could happen in the short term - climate model projections had shown periods of cooling of a similar length in the past. The conclusion was that

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the research community's communication of this expectation had been poor and oversimplified.

10. One of the lessons we took from the way the story was reported was the need for more climate scientists to engage in online debate. As a result I now curate a Twitter list of climate scientists. Very active discussions on climate change across social media often cite complex technical issues from the most recent scientific literature, but the amount of content from climate scientists has tended to be significantly outweighed by that from commentators. If more climate scientists were to join in the online conversation then expertise from different research areas could be shared, and climate science – and the nuance of uncertainty – would be represented more directly and visibly.
11. As well as online, there is a need for scientists to engage through the media, whether broadcast, print or online, and public talks to ensure their research is communicated accurately and to provide a public face of science to improve trust. In climate science the public predominately hear scientific information through third parties, which amplifies the perception of politicisation or hidden agendas. A more diverse group of scientists in the public eye may also increase trust, if the public see science as being more trustworthy and relevant when the scientist is from a similar background, gender, ethnicity, etc. Scientists who do not wish to appear in broadcast media or give talks can support those who do by contributing to print and online media instead, and by aiding colleagues with expert briefings and a supportive working environment that acknowledges the importance of public engagement.
12. The media should be held accountable for inaccuracies and misrepresentation of science and uncertainty. In areas of science that assess risk, such as climate change, both minimisation and exaggeration of risks should be challenged. A recent exemplar is USA-based [climatefeedback.org](http://climatefeedback.org), which provides a framework for professional climate scientists to annotate and rate news reports. It has previously addressed both sceptical and overly catastrophic articles.
13. But, while personally and professionally rewarding, engaging the public in science is difficult: it is time consuming, unpredictable and can involve conflict, particularly online. Scientists would greatly benefit from dedicated training and ongoing professional support. From experience, conversations are more effective than lectures: effective listening is critical, as is respect for the other party. Defensiveness and overconfidence can be deeply damaging to relationships between scientists and public, while humour and humility are powerful tools in winning trust and maintaining civil dialogue. Finally, genuine scientific uncertainty should not be ignored or over-simplified.
14. Scientists would also benefit from dedicated training to present statistics to the media in a way that does not invite misinterpretation while still appealing to a wide audience.

**Communicating uncertainty: the policymaker's role**

15. Some policymakers have a high level of expertise in specific policy areas, including climate science. But the majority are not specialists. Consideration

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could be given to the provision of introductory-level training for policymakers in statistics or the quantification of uncertainty, perhaps delivered by scientists and statisticians through a structured programme. This could help policymakers themselves communicate uncertainty more effectively to the media and public.

16. Key areas of school education are critical thinking about information and online sources, to counter the 'filter bubble' and evaluate whether information is reliable, and computing and statistics, to analyse and interpret scientific uncertainty and media reporting.

**Communicating uncertainty: the media's role**

17. Knowledge of statistics and interpreting scientific uncertainty is understandably quite low among the majority of journalist and editors. Again some form of training, delivered by the scientific community, could deliver real benefit.
18. It is hoped that media organisations can offer more opportunities for scientists themselves to author opinion pieces. In November 2015 a paper I co-authored in the journal *Nature* was picked up by the media. The headline finding: we predicted Antarctic ice sheet instability will most likely contribute 10cm sea level rise by the end of the century but is extremely unlikely to contribute more than 30cm. I was grateful to *The Guardian* for publishing my follow-up comment piece, providing me with a high-profile online platform on which to tell the story from my own perspective and allowing me to capture a level of nuance and complexity that might otherwise have been lost in mainstream news coverage.
19. Providing academics with similar opportunities to set research news stories in the wider context could increase the quality of science reporting and strengthen public confidence in it.

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