

## Reply to Aarstad: Risk management versus “truth”

In his letter about our study (1), Aarstad (2) claims that the dominant perspective of climate scientists captured in our recent study (1) may not necessarily reflect objective truth judged by history. We present three responses to Aarstad’s comments. First, risk management presents a more relevant and explicit framework for assessing scientific confidence around anthropogenic climate change (ACC) than does waiting for history’s judgment of truth. Second, such claims of group-think or conspiracy-driven patterns in climate science fundamentally lack data and, therefore, credibility. Third, such unsubstantiated points contribute no substance to the discourse regarding climate science. We stand by the analysis presented in our study.

In our study, we state explicitly that, “Ultimately, of course, scientific confidence is earned by the winnowing process of peer review and replication of studies over time. In the meanwhile, given the immediacy attendant to the state of debate over perception of climate science, we must seek estimates while confidence builds” (1). Our study is predicated on a risk management framework that uses expert perspectives to synthesize the risk (probability and consequence) of ACC to inform societal decision making. Risk management provides a relevant framework regarding ACC given the urgency of making decisions, even with some remaining scientific uncertainty, and allows explicit treatment of Type I vs. Type II error aversion (3–5).

Aarstad (2) implies that climate researchers have to “decide which paradigm to pursue” and would not receive the same number of grants, publications, or citations by embracing the minority viewpoint. However, his claim omits one key piece of information—data. Aarstad (2) provides no evidence, only unsupported speculation, that grants, publications, or citations differ between ACC viewpoints when expertise is held constant. On the contrary, we suggest that primary data likely play a more formative role in scientific opinion than peer pressure. The

scientific method is fundamentally driven by data, and scientists are trained to form their perspectives based on data. In many cases, the incentives to challenge the dominant paradigm may be exactly the opposite of what Aarstad (2) suggests. Any young scientist with a wealth of robust data from well-executed research would become famous by overturning a part of a consensus paradigm. Every young scientist dreams of being the next Darwin or Galileo.

Aarstad (2) then makes the self-evident and unproductive argument that “predominating paradigms can be proven wrong” (2) and, therefore, the current understanding of ACC could be wrong. His selected anecdotes bear little relevance to the science of ACC, with its quantitative complexity, preponderance of independent lines of evidence, and urgency of societal decision making. More importantly, anecdotes do not constitute evidence.

Ultimately, history and scientific replication will increase confidence in many facets of ACC. However, the time-dependent consequences of action or inaction on ACC necessitate societal decision making long before history has reached its judgment. By analogy, when faced with a potentially life-threatening cancer, would one want to trust the diagnosis of 97% of the most world-renowned oncologists or wait for history to decide the correct diagnosis?

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