

COMBATING A TWO-DECADE CAMPAIGN ATTACKING THE SCIENTIFIC CONSENSUS ON CLIMATE CHANGE

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New research published this year found that among peer-reviewed climate papers stating a position on anthropogenic global warming, over 97% endorsed the scientific consensus that humans were causing climate change. Meanwhile, the public think there is a 50:50 debate among climate scientists. How did this “consensus gap” arise and can it be closed?

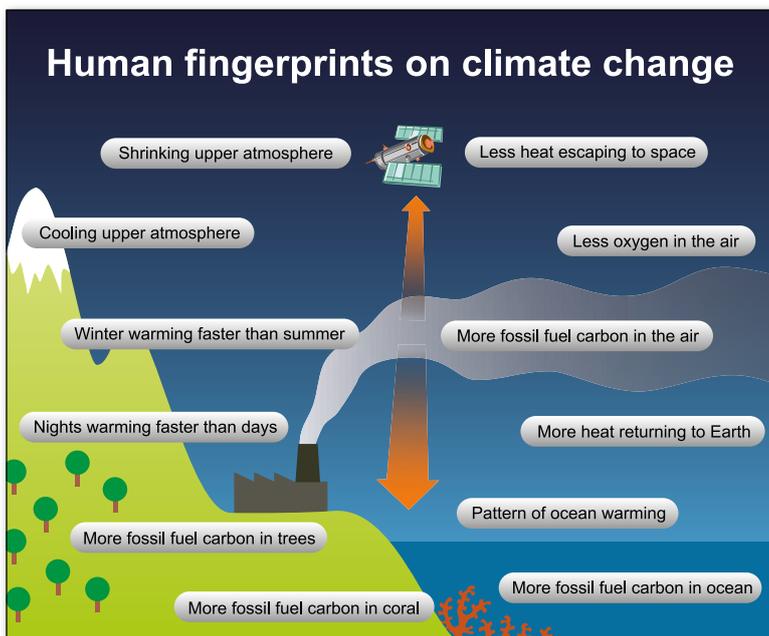
Climate science is a sprawling, multi-disciplinary field incorporating radiative physics, atmospheric chemistry, meteorology, geology and many other fields. As with any area of science, different aspects are understood to varying degrees. Cutting-edge areas of climate research include the role of aerosols in cloud formation, or the role of ocean mixing in exchanging heat between the atmosphere and the deep ocean.

One area of climate change well understood for decades is the fundamental fact that humans are causing global warming. The mechanism driving the greenhouse effect was first identified in the 1850s, when John Tyndall ran laboratory experiments measuring the absorption of infrared radiation by certain gases. These included carbon dioxide, water vapour and methane, now known as greenhouse gases for their ability to trap heat.

Tyndall also described distinctive patterns associated with greenhouse warming. If increased greenhouse gases were causing global warming, Tyndall expected that nights would warm faster than days and winters warm faster than summers. 160 years ago later, Tyndall's predictions have been fulfilled. The greenhouse signatures anticipated in the daily and annual cycle have been observed.

In fact, a number of "human fingerprints" associated with greenhouse warming have been observed (see Figure 1). As increased greenhouse gases absorb more infrared radiation, satellites have observed less heat escaping to space. This should cause more infrared radiation to return to the Earth's surface, which surface measurements of downward radiation have confirmed. Another tell-tale human fingerprint is a cooling stratosphere (upper atmosphere) while the troposphere (lower atmosphere) warms.

▼ FIG 1: Observed indicators of anthropogenic global warming. Feature image credit: John Garrett



The strengthening consensus on human-caused global warming

As empirical evidence for human-caused global warming accumulated, agreement among the scientific community strengthened. The seminal work measuring the scientific consensus on climate change was Naomi Oreskes' 2004 analysis of peer-reviewed papers, published from 1993 to 2003, on the topic of 'global climate change' [1]. Among 928 climate papers, the number rejecting human-caused global warming totalled zero.

A 2009 survey of Earth scientists found that the higher a scientist's expertise in climate science, the more likely they were to endorse the consensus [2]. Among actively publishing climate scientists, they found 97% agreement. Interestingly, the group of scientists showing highest scepticism about climate change were economic geologists. Nearly every reputable, relevant scientific organisation in the world, including the National Academies of Science from 33 different countries, has issued statements endorsing human-caused global warming. This isn't to say the consensus is unanimous. One dissenting organisation is the American Association of Petroleum Geologists.

The Intergovernmental Panel on Climate Change (IPCC) is widely regarded as the most authoritative source of information on climate change. The IPCC has issued a series of increasingly definitive statements on the human role in recent climate change. Their language has evolved from the tenuous "the balance of evidence suggests that there is a discernible human influence on global climate change" in 1996 to recent global warming being "...very likely due to the observed increase in anthropogenic greenhouse gas concentrations" in 2007. The latest IPCC report released in 2013 upgraded "very likely" (more than 90% probability) to "extremely likely" (more than 95% probability).

The two-decade attack on scientific consensus

As scientific consensus strengthened, efforts to confuse the public about the level of agreement in the scientific community intensified as documented in Figure 2). The misinformation campaign originated from opponents of climate action who rather than propose alternative policy solutions to climate change instead opted to attack the science.

A key strategy was (and still is) creating the illusion of ongoing debate by magnifying the voices of a few dissenting scientists. This strategy dates back to 1991, when Western Fuels Association spent over half a million dollars on a campaign designed to "reposition global warming as theory (not fact)." Their approach was to promote the views of a handful of scientific spokesmen, giving the impression of a 50:50 debate among the climate science community. Another common technique is the promotion of "fake experts", using spokespeople unqualified in climate research. The most prominent example of the fake expert strategy

is the Petition Project, launched by the Oregon Institute of Science and Medicine (OISM) in 1998. This petition features over 31,000 scientists signing a statement that humans aren't disrupting our climate. The Petition Project is widely cited by many, including public figures such as Congressman Dana Rohrabacher. What the petition neglects to highlight is that 99.9% of the signatories on the survey aren't climate scientists.

In 2002, a memo by Republican political strategist Frank Luntz was leaked, disclosing the conservative strategy to delay climate action. Luntz argued that "should the public come to believe that the scientific issues are settled, their views about global warming will change accordingly". Consequently, he advised Republicans to cast doubt on the scientific consensus.

Luntz was ahead of the curve. In 2011, social scientists measured an important link between public perception of consensus and support for climate policy [3]. When people perceive that scientists agree on climate change, they're more likely to support for climate policy. Based on this insight, Luntz' was strategizing over a decade before social scientists joined the dots.

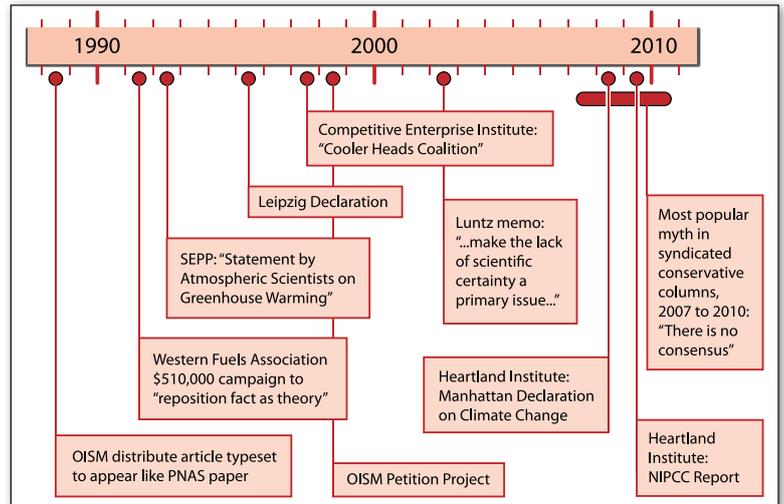
Opponents of climate action recognise a winning formula and persist with this approach to this day. A recent study tallied up the different climate myths presented in opinion pieces from 2007 to 2010 by syndicated conservative columnists [4]. The most common myth was "there is no consensus". Why is this rather transparent form of misinformation so effective? When presented with two opposing voices debating about climate science in the news media, people become more confused about global warming and less likely to support climate action [5]. Consequently, opponents of climate action have endeavoured to position their spokespeople in the media, arguing against climate science.

The result is a significant "consensus gap" between public perception and the actual 97% scientific consensus (see Figure 3). Public polls have found that nearly half of the American public think climate scientists are still in disagreement [6]. In my own research, when I asked Americans what percentage of climate scientists agree on human-caused global warming, the average answer was 55%.

Closing the "Consensus Gap"

I recently led a citizen science effort to conduct the most comprehensive analysis of climate research yet done [7]. We analysed 21 years of peer-reviewed papers from 1991 to 2011, identifying over 4000 abstracts that stated a position on whether humans were causing global warming. Among those papers, 97.1% endorsed the consensus. We also found that the consensus was already present in the peer-reviewed literature in the early 1990s, with agreement strengthening over two decades.

In 2007, Naomi Oreskes predicted that as a scientific consensus formed, you should expect to see less explicit



endorsements of the consensus position [8]. For example, you don't often see new physics papers reaffirming the validity of Einstein's theory of relativity. We found that over the 21 year period, the percentage of abstracts stating a position on human-caused global warming decreased. Fewer papers bothered to endorse the consensus position in their abstract. At the same time, among abstracts stating a position, the percentage endorsing the consensus increased. This pattern fulfilled Oreskes' prediction.

An important aspect of scientific research is replication. To independently check our abstract ratings, we emailed the scientists who authored the papers, asking them to rate the level of endorsement of their own research. Exactly 1,200 scientists responded, resulting in over 2,000 papers receiving a rating from the papers' authors. Among the papers that were self-rated as expressing a position on human-caused global warming, there was a 97.2% consensus. According to the actual scientists conducting the research, there is an overwhelming and strengthening consensus (see Figure 4).

Closing the consensus gap was never going to be easy. To further complicate matters, public perception of consensus is strongly associated with political ideology. The more conservative one's political views, the lower the perceived consensus. However, even liberals think the consensus is only around 70%, indicating that the consensus gap is a mix of information deficit, the injection of misinformation and influence of cultural values. On the plus side, presenting quantitative information about the consensus has been shown to significantly increase acceptance of anthropogenic global warming [9].

How does one address a public misconception that has persisted for two decades? The golden rule to refuting myths is to "fight sticky myths with stickier ideas" [10]. We decided to focus our public messaging on a single number, the 97% consensus. The message couldn't be simpler and considering public perception of consensus languishes at 55%, it was sure to take many by surprise (a trait of sticky ideas).

▲ FIG 2: Two decade campaign manufacturing doubt on scientific consensus. OISM is the Oregon Institute for Science & Medicine, SEPP is the Science & Environmental Policy Project (founded by Fred Singer) and NIPCC is the Nongovernmental International Panel on Climate Change. Image credit: John Garrett

Our paper was published in the peer-reviewed journal *Environmental Research Letters* in May this year. To raise awareness of the 97% consensus, we launched a website [11], explaining the paper's results using simple language and strong visuals. We also encouraged readers to rate the abstracts themselves via an online, interactive system [12]. The idea was for readers to engage with our content, replicate our methodology and compare their ratings with our own.

The group of scientists showing highest scepticism about climate change were economic geologists

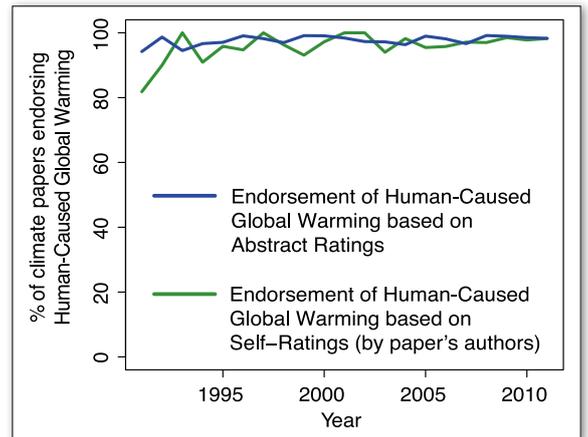
Our goal of raising awareness of the 97% consensus was given a significant boost when President Obama tweeted our research to over 31 million followers. Shortly afterwards, Obama delivered a landmark speech calling for climate action where he again invoked the 97% consensus. Representative Henry Waxman, former Vice-President Al Gore and the UK Minister for Energy and Climate Change also highlighted our research.

It remains to be seen whether public perception of consensus will shift due to these efforts. It also bears mentioning that raising awareness of scientific consensus is not a magic bullet that will singlehandedly solve the climate problem. Climate change is described as a “wicked problem”, with a range of strategies required to overcome the many barriers to climate action. Nevertheless, closing the “consensus gap”, the chasm between public perception and the 97% reality, will remove a roadblock that has delayed public support for climate action. ■

▼ FIG 3: The gap between the public perception of scientific agreement and the actual 97% consensus (public opinion data collected by John Cook) Image credit: SJI Associates

About the Author

John Cook is the Climate Communication Fellow for the Global Change Institute at the University of Queensland. He created *SkepticalScience.com*, a website that refutes climate misinformation with peer-reviewed science. In 2011, *Skeptical Science* won the Australian



▲ FIG 4: Percentage of climate papers endorsing human-caused warming. Blue line represents consensus based on abstract ratings. Green line represents consensus based on ratings provided by the papers' authors.

Museum Eureka Prize for the Advancement of Climate Change Knowledge. John co-authored the college textbook *Climate Change Science: A Modern Synthesis*, the book *Climate Change Denial: Heads in the Sand* and several papers on climate change and the psychology of misinformation.

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THE "CONSENSUS GAP"

THE PUBLIC THINK...

55%

OF CLIMATE SCIENTISTS AGREE ON GLOBAL WARMING

IN REALITY...

97%

OF CLIMATE SCIENTISTS AGREE ON GLOBAL WARMING

When people don't realize there's a scientific consensus, they're less likely to support climate action. This underscores the importance of closing the consensus gap.