

Global Warming: The History of an International Scientific Consensus

1896: Arrhenius, a Swedish chemist, advances the theory that carbon dioxide emissions from combustion of coal would enhance Earth's greenhouse effect and lead to global warming.

1924: Based on 1920 coal use, Lotka, a U.S. physicist, speculates that industrial activities will double atmospheric carbon dioxide (CO₂) in 500 years.

1957: Revelle and Seuss of the Scripps Institute of Oceanography, report for the first time that the oceans do not absorb much of the CO₂ emitted to the atmosphere, leaving significant amounts, which could eventually warm the Earth.

1958: Keeling of the Scripps Institute, begins the first reliable and continuous measurements of atmospheric carbon dioxide, finding CO₂ concentrations to be 315 parts per million and rising.

1967: The first reliable computer simulation calculates that global average temperature may increase by more than 4°F when the atmospheric CO₂ level doubles that of pre-industrial times.

1976: Scientists at several research institutions identify chlorofluorocarbons (CFCs), methane, and nitrous oxide as greenhouse gases.

1979: A National Academy of Sciences (NAS) panel on climate change advises that "A wait-and-see policy may mean waiting until it is too late" to avoid significant climate changes.

1983: A NAS report confirms that a doubling of CO₂ levels eventually would warm the Earth by 3–8°F. The same year a U.S. Environmental Protection Agency (EPA) study states that as a result of warming, "agricultural conditions will be significantly altered,

environmental and economic systems potentially disrupted, and political institutions stressed."

1985: A conference sponsored by the United Nations Environment Program (UNEP), the World Meteorological Organization (WMO), and the International Council of Scientific Unions forges a consensus of the international scientific community on the issue of climate change. The conference report warns that some future warming appears inevitable due to past emissions regardless of future actions and recommends consideration of a global treaty to address climatic change.

1987: An Antarctic ice core reveals an extremely close correlation between CO₂ concentrations and temperature going back more than 100,000 years.

1988: The Intergovernmental Panel on Climate Change (IPCC), made up of leading climate scientists from around the world, is established by UNEP and WMO to assess the scientific and economic basis of climate change policy in preparation for the 1992 Rio Earth Summit.

1990: An appeal signed by 49 Nobel prize winners and 700 members of the National Academy of Sciences states, "There is broad agreement within the scientific community that amplification of the Earth's natural greenhouse effect by the buildup of various gases introduced by human activity has the potential to produce dramatic changes in climate . . . Only by taking action now can we insure that future generations will not be put at risk." The same year the IPCC, drawing on 170 scientists from 25 countries, publishes a report stating that human activity "will enhance the greenhouse effect, resulting on average in an additional warming of the

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Earth's surface." It calculates that an immediate 60% reduction in CO₂ emissions would stop the buildup of carbon dioxide.

1992: The NAS publishes a study reporting that despite uncertainties, greenhouse warming poses a potential threat, "sufficient to merit prompt responses ... Investment in mitigation measures act as insurance protection against the great uncertainties and the possibility of dramatic surprises. In addition, the panel believes that substantial mitigation can be accomplished at modest cost. In other words, insurance is cheap." Also in 1992, the U.N. Framework Convention on Climate Change is signed by 155 nations at the Rio Earth Summit. The convention calls for "stabilization of atmospheric concentrations of greenhouse gases at a level that would prevent dangerous anthropogenic interference with the climate system."

1993: The U.N. Framework Convention on Climate Change is ratified by more than 50 nations, putting it into effect.

1994: March through December 1994 is the warmest such period on record, according to the National Weather Service's Climate Analysis Center.

1995: The IPCC concludes that "... the balance of evidence suggests that there is a discernible human influence on global climate." 1995 matches 1990 as the hottest year on record.

1997: More than 160 nations adopt the Kyoto Protocol, with legally binding obligations to limit emissions of industrialized nations for the years 2008–2012. The Protocol's emissions targets are hailed as important first steps toward the objective of avoiding dangerous climate change.

1998: The year is the warmest of the last century based on thermometer data and the warmest of the last millennium based on proxy temperature data.

2001: Despite the strengthening scientific consensus on global warming, President George W. Bush withdraws from the Kyoto Protocol, largely isolating the U.S. from the world community on taking responsible action to address the problem. That same year a new IPCC assessment states that "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." And that even a warming of between 1°C–2°C (1.8°F–3.8°F) is likely to pose high risks to unique and threatened ecosystems, and lead to increases in the risk of extreme climate events. Also in 2001, the NAS, at the request of President George W. Bush, issued a report finding that "temperatures are in fact rising, and are most likely due to human activities." In addition, the United States Global Change Research Program released a study finding that temperatures in the U.S. will rise by 3–5°C (5–9°F) over the next century, and predicted increases in both flooding *and* drought conditions, with many ecosystems, including populated coastal areas, vulnerable to climate change.

2002: The European Union, Canada and Japan ratify the Kyoto Protocol, bringing the agreement's total membership to over 100. While other nations take action, President Bush calls for 10 more years of research on climate change and proposes only voluntary measures to mitigate climate change until 2012. That same year heavy rains cause disastrous floods in Central Europe leading to over 100 deaths and more than \$30 billion in damage. In addition, extreme drought in many parts of the world results in thousands of deaths and significant crop damage.

2003: Senators John McCain and Joe Lieberman's bipartisan bill to reduce emissions of greenhouse gas pollution nationwide secures 43 votes in the Senate.



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For more information, please contact Environmental Defense, 257 Park Avenue South, New York, NY 10010, 212-505-2100
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