

In earlier times, canaries were often used in mines since their sensitivity provided an early warning to miners of harmful gases and/or lack of oxygen.

Like canaries in mines, flora and fauna the world over are providing an early warning of potential consequences of global warming. Are we, and the institutions that represent us, paying attention to these harbingers of change? Are we

and our institutions prepared to accept the evidence that human activities, primarily the burning of fossil fuels and deforestation, are a principal cause of global warming? Are we willing to act responsibly on that knowledge?

Ecosystems are responding to climate warming. For example, in the Antarctic Peninsula, where my own studies of the Antarctic marine ecosystem are carried out, we have seen a significant warming trend in winter temperatures (6°C during the past 55 years) and a shortening of the sea ice season by a few weeks. Adlie penguins can only survive in the winter pack ice surrounding Antarctica. Chinstrap penguins are closely related but are almost exclusively associated with ice-free Antarctic waters. Over the past several decades, as the western Antarctic Peninsula has experienced significant warming and reduced sea ice, the more ice-intolerant Chinstraps have increased their population, whereas the ice-dependent Adlie penguins have decreased. Our penguins, analogous to canaries in the mine, are warning us of global warming.

There is widespread evidence of global warming, and accumulated evidence shows that human activities have set in motion an unplanned global experiment on planet Earth. Like the sorcerer's apprentice, humankind may not be able to turn off, or reverse, this unplanned experiment in climate change should we discover that we do not like the eventual consequences. In *Climate Change 2001*, the Intergovernmental Panel

Global Warming: A Global Warning

By Raymond C. Smith

on Climate Change (IPCC 2001, available in full on the Web at <http://www.ipcc.ch> or <http://www.ipcc.ch/pub/tar/wgl>), reports that “the Earth’s climate system has demonstrably changed on both global and regional scales since the pre-industrial era.” The IPCC 2001 report adds that “there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.” In stark contrast to this authoritative IPCC report, there is much strong rhetoric and significant disinformation surrounding the issue of global warming, and

the issue has been sadly politicized by those with a vested interest in the consumption of fossil fuels (coal, oil, and natural gas) and in maintaining the status quo.

In addition to indirect evidence cited in the IPCC report, there are direct temperature records from the period when instruments have been used to record data from around the world. The IPCC 2001 working group assembled this data and concluded that “the global average surface temperature has increased over the 20th century by about 0.6°C.” Furthermore, the data provide proxy evidence that “the increase in temperature in the 20th century is likely to have been the largest of any century during the past 1,000 years.” These proxy data are

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based on temperature estimates from tree rings, corals, ice cores, and historical records that have been calibrated against more recent data from modern instruments. The IPCC 2001 report provides a volume of examples and evidence with respect not only to temperature changes but also to changes in humidity, precipitation, storms and their frequency, and other phenomena related to climate.

Attributing the cause of the observed warming has been more difficult, but newer studies cited in the IPCC 2001 report consistently show evidence for human influence in the climate record of the last 35-50 years. Also, the recently released “U.S. Climate Action Report—2002,” prepared by the U.S. Environmental Protection Agency (as well as the White House Council on Environmental Quality, the State Department, and others) for the United Nations, also recognizes that “greenhouse gases are accumulating in Earth’s atmosphere as a result of