Climate Change: The Problem

The recent trend in global temperature increase indicates a rise of up to 6°C in the next 100 years. That's a large increase, and it will bring devastating climate change. By ***Suzanne Hall***

The earth's climate is changing, and there can be no doubt about that now. In this article, we take a look at the evidence for that claim and at projections for the future; then we examine the implications of climate change for the earth and mankind; and, finally, we point out what's behind the sudden climate change. For an overview of the science behind these investigations, please see the companion article, Climate Change: The Science .

The Earth's Temperature Is Rising

In 2001, a working group of the Intergovernmental Panel on Climate Change (IPCC), an international scientific body set up to provide policymakers with authoritative information about climate change, published its Third Assessment Report . The report found that the planet has shown clear signs of warming over the past century. Global temperature rose by about 0.6°C during the 20th century, with about 0.4°C of this rise occurring since 1970. The 1990s was the hottest decade and 1998 the hottest year since 1860, when temperature measurements first started to be recorded. Nine of the 10 hottest years since 1860 have occurred after 1990. Temperatures are now rising at three times the rate of the early 20th century.

According to the IPCC, if the present trend continues, then the earth's average temperature will rise by 1.4°C to 5.8°C. That's the *average* increase in surface temperature (which includes the cooler sea surface) for the *entire planet*. In some areas, such as central Asia, the average increase is projected as high as 10°C. These numbers might seem small—till you discover that even a 1°C increase in average temperature is larger than any change that has occurred in a single century for the past 10,000 years, which was when the last Ice Age receded. In fact, global temperature has risen only 5°C to 6°C since the last Ice Age. So, to put it bluntly, the rise in temperature in the next 100 years will be equal to the rise in temperature over the last 10,000 years.

The Effects of Global Warming

First, the volume of land glaciers and sea ice has been shrinking. Since 1960, ice cover has decreased by about 10%. Sea ice in the Northern Hemisphere has decreased by an area of 250,000 sq km per decade since 1972. In August 2000, there was no ice at the North Pole; it was an area of open water.

Second, when ice cover shrinks, sea levels rise and the height of waves hitting coasts will be higher. The IPCC estimates that the rise in sea level will be between 9 and 88cm over the next century. Areas such as the deltas and mudflats of the Sundarbans, where the Ganges and Brahmaputra reach the sea, will be vulnerable to inundation and could affect 70 million people. Similar numbers could be affected in each of the delta regions of China and Egypt.

Third, as oceans become warmer, hurricanes and tropical storms will move farther afield from the tropics (where they are now confined), and will cause damage to urban areas that have not been built to cope with them. Northern landmasses will warm more than coastal regions, leading to further unpredictable and extreme weather changes. Because of the increased volume of water in the system, precipitation will increase overall but with sharp variations over time and space. Droughts and floods will become more frequent. The Asian summer monsoon will become less reliable, bringing more economic hardship to this region. And, possibly, major ocean currents, such as the Gulf Stream, will change direction or become less warm, leading to cold weather in the landmasses they now keep warm *(see sidebar, 'Warming or Cooling').*

Fourth, there will be a considerable effect on flora, fauna, and biodiversity. Plants and animals will move farther from the equator or

to higher altitudes. In some cases, where that option is not available—such as those of the alpine flora and fauna of Australia—they will die out. Coastal ecosystems will change, and coral reefs may be destroyed by warmer water.

Fifth, tropical diseases will spread farther afield.

Sixth, food production will rise in temperate regions as these become warmer and enjoy longer periods of warmer weather, but will decrease in tropical regions as these get drier and become subject to unstable weather patterns.

The list above attempts to give a sense of the major negative effects anticipated. There are several other effects that are not anticipated or that go unremarked because their scale has not been properly estimated. It is also important to realize that once a certain tipping point is reached, a chain of currently unknowable and potentially disastrous effects can be set in train.

Why Global Temperature Is Rising

Global temperature is rising because of the 'greenhouse effect', whereby greenhouse gases in the earth's atmosphere trap heat that the earth radiates. There are six main greenhouse gases in the atmosphere: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. For a more detailed discussion, see the companion articles: Carbon Dioxide Sources and Atmospheric CO2

Globally, carbon dioxide makes up for more than two-thirds of greenhouse gas emissions, which are produced almost exclusively by the burning of carbon-based fossil-fuel energy (coal, oil, and gas). Methane emissions are the next highest source of greenhouse gases, and come primarily from agriculture, waste, and coal mining. The other greenhouse gases are emitted from a small number of industrial processes, and are easier to control through technology. Controlling carbon dioxide (and methane) emission, however, is not easy, and is the challenge facing the world if climate change is to be seriously tackled.

24 July 2004. References: 'How We Can Save the Planet' by Mayer Hillman, Penguin, 2004; 'One World' by Peter Singer, Yale University Press, 2004; 'Third Assessment Report' of the IPCC, 2001.

SIDEBARS

Global Warming and Climate Change

Global warming refers to the phenomenon of rising global surface temperature. Climate change, according to the consensus of scientific opinion, is the result of global warming. Climate change is therefore the broader term. It is useful to keep in mind that, although the two phenomena are related, they are separate, and that the evidence for each should be considered separately.

Positive Feedback

The IPCC predictions *(see article)* do not take into account unexpected shocks or 'positive feedback', which could accelerate climate change. Geological records show that fast changes in climate have occurred in the past. Examples of possible positive feedback would be: (i) changes in ocean currents, and (ii) the release of large amounts of methane locked in sediments below the Arctic seabed.

Warming or Cooling?

If the Gulf Stream, which carries warm water past Western Europe and makes winters there milder, were to change direction or become less warm, Western Europe could cool by 5°C within a few decades—a return to the Ice Age. So global warming could actually lead to cold weather.

SIDEBARS

Human Vulnerability

Humans may not become extinct, but many will die. The process has already started. The WHO estimates that 150,000 people in developing countries are dying of causes brought about by global warming, ranging from malaria and malnutrition to extreme heat and cold, and floods. By 2020, that number is expected to double.

The Ultimate Concern

We don't know the limits of nature—how much rain could fall for how long a period, how much more powerful and frequent hurricanes could become, for how long droughts could endure. The ultimate concern is that if runaway global warming occurred, temperatures could spiral out of control and make our planet uninhabitable.

*– **Michael Meacher,** former UK Environment Minister, in 2003.*