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1997 VITAL SIGNS

# VITAL SIGNS 1997

THE ENVIRONMENTAL TRENDS THAT ARE SHAPING OUR FUTURE

Lester R. Brown
Michael Renner
Christopher Flavin

WORLDWATCH INSTITUTE

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# Global Temperature Down Slightly

Seth Dunn

The temperature of the atmosphere at the Earth's surface averaged 15.32 degrees Celsius in 1996, according to preliminary figures, placing it among the five warmest years since data collection began in 1866.[1] (See Figure 1.) Though this is a slight drop from the 1995 high of 15.40 degrees Celsius, global temperatures have increased nearly half a degree since 1950.[2]

The 1990s are already the warmest decade on record—averaging 0.1 degrees Celsius above the 1980s—according to the Goddard Institute for Space Studies at NASA, which collects the land and ocean surface-temperature measurements.[3]

The warmth of the current decade is particularly remarkable because it has occurred in conjunction with several short-term natural and humanmade cooling effects. These include the century's largest volcanic event, the 1991 eruption of Mount Pinatubo; the solar energy cycle, which has been at a minimum during the 1990s; and atmospheric depletion of ozone, now at record levels.[4]

More recent cooling influences also affected 1996 temperatures. The presence of La Niña, an upwelling of unusually cool waters in the equatorial Pacific Ocean, had a role in the temperature drop. Also partly responsible was the reversal of the North Atlantic Oscillation, a 30-year trend of cooling in Greenland and warming in North America and Europe, leading to record precipitation and extreme cold events in the two latter regions during 1996.[5]

According to data from the Hadley Centre and the University of East Anglia, 1996 continued an underlying upward trend begun in the mid-1970s, with some regions warming quickly.[6] Summer temperatures in northern Siberia are warmer than they have been in a millennium, forcing boreal forests northward.[7] Antarctica has warmed at more than twice the average global rate during the last 50 years, causing five of the continent's ice shelves to disintegrate.[8]

Rising atmospheric temperatures interact dynamically with ocean processes. Geological records and computer models reveal that the ocean's heat-carrying conveyor belt shifts suddenly in response to temperature changes—leading to abrupt climate changes such as dramatic cooling in northern Europe—which may reduce the ocean's ability to absorb carbon.[9] Warming also causes oceans to lose nitrate, slowing the growth of carbon-assimilating phytoplankton.[10]

Many aquatic, marine, and terrestrial ecosystems are highly sensitive to small temperature increases: freshwater fish, coral reefs, and boreal forests are particularly at risk.[11] Warming, moreover, behaves synergistically with ozone depletion and acidification to compound ecological stresses.[12] And it can feed on itself in certain instances: the loss of boreal forest and warming of tundra could release large amounts of carbon dioxide as well as methane, another potent greenhouse gas.[13]

Feedbacks from the ocean and biosphere as the atmosphere warms are examples of climate's tendency to behave unexpectedly when rapidly forced to change.[14] Such "surprises," which have occurred in the past but are difficult to predict, could increase the rate of warming—which is already expected to be the fastest seen in 10,000 years.[15] This climate instability poses serious and widespread risks to human health, according to a 1996 report prepared for the World Health Organization, the United Nations Environment Programme, and the World Meteorological Organization.[16]

Evidence of the human "fingerprint" in climate change continues to strengthen with improved understanding of sulfates and other influences on the atmosphere's temperature.[17] (See Figure 2.) A team led by Goddard's James Hansen has clarified the relationship between these influences and observed global temperature changes, and suggests there could be a return to the warming trend as the La Niña effect fades.[18] Hansen believes there is a "high likelihood" that another temperature record will be set before the end of the century.[19]





GLOBAL AVERAGE TEMPERATURE, 1950–96

| YEAR | TEMPERATURE (degrees Celsius) |
|---|---|
| 1950 | 14.86 |
| 1955 | 14.92 |
| 1960 | 14.98 |
| 1965 | 14.88 |
| 1966 | 14.95 |
| 1967 | 14.99 |
| 1968 | 14.93 |
| 1969 | 15.05 |
| 1970 | 15.02 |
| 1971 | 14.93 |
| 1972 | 15.00 |
| 1973 | 15.11 |
| 1974 | 14.92 |
| 1975 | 14.92 |
| 1976 | 14.82 |
| 1977 | 15.11 |
| 1978 | 15.05 |
| 1979 | 15.09 |
| 1980 | 15.18 |
| 1981 | 15.29 |
| 1982 | 15.08 |
| 1983 | 15.24 |
| 1984 | 15.11 |
| 1985 | 15.09 |
| 1986 | 15.16 |
| 1987 | 15.27 |
| 1988 | 15.28 |
| 1989 | 15.22 |
| 1990 | 15.39 |
| 1991 | 15.36 |
| 1992 | 15.11 |
| 1993 | 15.14 |
| 1994 | 15.23 |
| 1995 | 15.40 |
| 1996 (prel) | 15.32 |

SOURCE: Goddard Institute for Space Studies, New York, 14 January 1997.

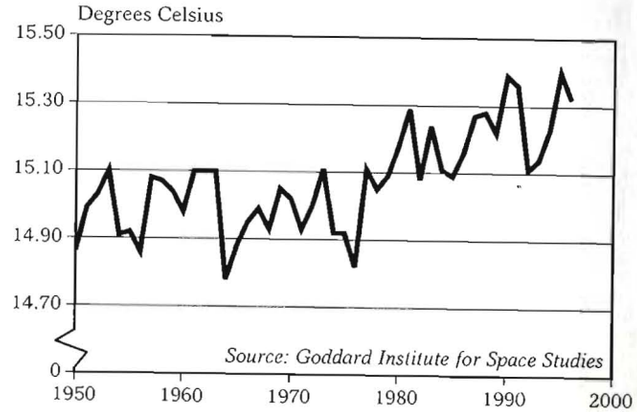


**Figure 1: Average Temperature at the Earth's Surface, 1950–96**

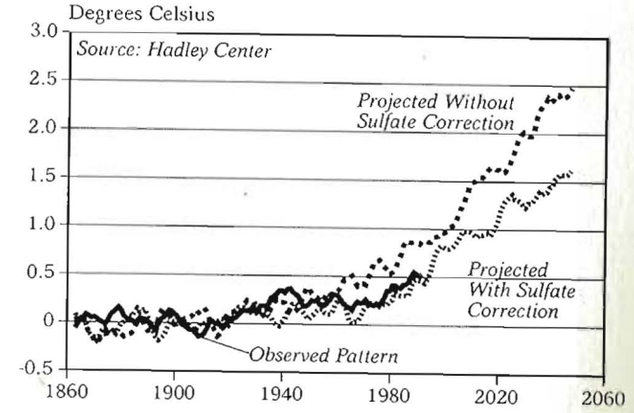


**Figure 2: Models of Global Warming Compared With Observations, 1863–2047**

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