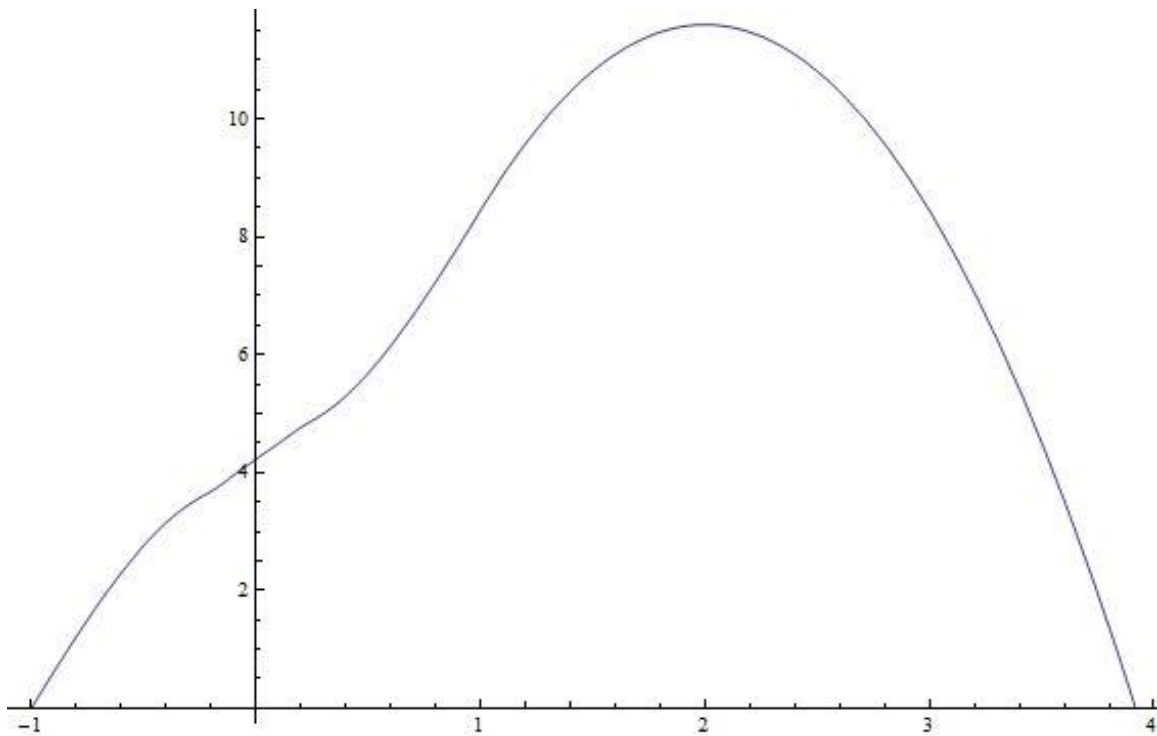


## Global Warming

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Figure 1: **Temp diagram holder**

1. Is the world getting warmer?
2. If so, do human carbon dioxide emissions make much difference to the temperature?
3. If temperatures do rise, is that bad, good, or neutral?
4. If it is bad, what should be done?
5. If something should be done, how can we overcome the free rider problem?

#### The Science

We do not really know what causes Ice Ages or climate change, but we know it does happen, with big effects.

If the earth has high carbon dioxide levels, that keeps heat from leaving a greenhouse effect. (Greenhouses keep heat from leaving the enclosed space.)

Carbon dioxide is generated when people burn coal, oil, or wood, or make cement from calcium carbonate.

Carbon dioxide is absorbed when plants grow.

Warming would help the U.S, Canada, and Russia, but hurt most Third World countries.

#### What Has Happened to Temperature?

World weather station data, picking points on a map (unadjusted for urbanization, etc.).

NASA data on global temperatures monthly 1880- present,

Annual temperatures, total and by hemisphere, <http://www.surfacestations.org/>  
and by state at [http://gallery.surfacestations.org/main.php?g2\\_itemId=20](http://gallery.surfacestations.org/main.php?g2_itemId=20)

Year Glob NHem SHem 1921 -13 -6 -21 1922 -24 -22 -27 1923 -21 -16 -26 1924 -22  
-13 -30 1925 -16 -9 -24 1926 -2 8 -11 1927 -14 -6 -22 1928 -12 -1 -23 1929 -25 -23 -27  
1930 -7 7 -21 1931 -1 11 -14 1932 -6 5 -17 1933 -18 -18 -17

Year Glob NHem SHem 1941 10 15 6 1942 3 12 -6 1943 10 19 1 1944 20 30 10  
1945 7 9 4 1946 -4 7 -15 1947 1 13 -12 1948 -4 8 -15 1949 -7 4 -17 1950 -15 -13 -18  
1951 -4 7 -15 1952 3 10 -4

Year Glob NHem SHem 1981 26 34 19 1982 5 1 8 1983 26 21 31 1984 8 -1 17 1985  
5 -4 14 1986 12 9 15 1987 26 21 31 1988 30 31 30 1989 18 23 14 1990 37 49 25 1991  
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Year Glob NHem SHem 1961 7 7 8 1962 4 14 -6 1963 8 15 2 1964 -20 -20 -20 1965  
-11 -14 -7 1966 -3 -1 -5 1967 0 4 -4 1968 -4 -4 -4 1969 8 0 15 1970 3 -3 10 1971 -10  
-16 -4 1972 1 -20 21 1973 14 8 20 1992 12 8 17 1993 13 16 11

Year Glob NHem SHem 2001 47 60 35 2002 56 67 45 2003 54 69 40 2004 48 64 33  
2005 62 82 42

Global Temperature Data from the NASA Site

1934 -6 6 -17 1935 -11 -3 -19 1936 -4 3 -11 1937 8 20 -5 1938 11 25 -3 1939 2 14  
-9 1940 5 11 -2 1953 10 27 -6 1954 -10 0 -21 1955 -10 -5 -15 1956 -17 -23 -12 1957 7  
6 9 1958 8 16 -1 1959 6 12 -1 1960 -1 10 -12 1974 -7 -20 5 1975 -5 -7 -3 1976 -16 -24  
-8 1977 12 8 16 1978 1 -3 5 1979 8 4 12 1980 18 11 24 1994 23 34 13 1995 38 54 21  
1996 29 25 33 1997 39 49 29 1998 56 69 42 1999 32 47 16 2000 33 49 17 2006 54 75  
33 2007 56 77 35 2008 44 60 28

Annual mean Land-Ocean Temperature Index in .01 C selected zonal means  
sources: GHCN 1880-12/2006 + SST: 1880- 11/1981 HadISST1 12/1981- 12/2006  
Reynolds v2 using elimination of outliers and homogeneity adjustment Note: - base  
period: 1951-1980 <http://data.giss.nasa.gov/gistemp/taledata/ZonAnn.Ts+dSST.txt>

Year Glob NHem SHem 1921 -13 -6 -21 1922 -24 -22 -27 1923 -21 -16 -26 1924 -22  
-13 -30 1925 -16 -9 -24 1926 -2 8 -11 1927 -14 -6 -22 1928 -12 -1 -23 1929 -25 -23 -27  
1930 -7 7 -21 1931 -1 11 -14 1932 -6 5 -17 1933 -18 -18 -17

Year Glob NHem

SHem 1941 10 15 6 1942 3 12 -6 1943 10 19 1 1944 20 30 10 1945 7 9 4 1946 -4 7  
-15 1947 1 13 -12 1948 -4 8 -15 1949 -7 4 -17 1950 -15 -13 -18 1951 -4 7 -15 1952 3 10  
-4

Year Glob NHem SHem 1981 26 34 19 1982 5 1 8 1983 26 21 31 1984 8 -1 17 1985  
5 -4 14 1986 12 9 15 1987 26 21 31 1988 30 31 30 1989 18 23 14 1990 37 49 25 1991

35 39 31

Year Glob NHem SHem 1961 7 7 8 1962 4 14 -6 1963 8 15 2 1964 -20 -20 -20 1965  
-11 -14 -7 1966 -3 -1 -5 1967 0 4 -4 1968 -4 -4 -4 1969 8 0 15 1970 3 -3 10 1971 -10  
-16 -4 1972 1 -20 21 1973 14 8 20 1992 12 8 17 1993 13 16 11

Year Glob NHem SHem 2001 47 60 35 2002 56 67 45 2003 54 69 40 2004 48 64 33  
2005 62 82 42

Global Temperature Data from the NASA Site

1934 -6 6 -17 1935 -11 -3 -19 1936 -4 3 -11 1937 8 20 -5 1938 11 25 -3 1939 2 14  
-9 1940 5 11 -2 1953 10 27 -6 1954 -10 0 -21 1955 -10 -5 -15 1956 -17 -23 -12 1957 7  
6 9 1958 8 16 -1 1959 6 12 -1 1960 -1 10 -12 1974 -7 -20 5 1975 -5 -7 -3 1976 -16 -24  
-8 1977 12 8 16 1978 1 -3 5 1979 8 4 12 1980 18 11 24 1994 23 34 13 1995 38 54 21  
1996 29 25 33 1997 39 49 29 1998 56 69 42 1999 32 47 16 2000 33 49 17 2006 54 75  
33 2007 56 77 35 2008 44 60 28

Annual mean Land-Ocean Temperature Index in .01 C selected zonal means  
sources: GHCN 1880-12/2006 + SST: 1880- 11/1981 HadISST1 12/1981- 12/2006  
Reynolds v2 using elimination of outliers and homogeneity adjustment Note: - base  
period: 1951-1980 <http://data.giss.nasa.gov/gistemp/tabledata/ZonAnn.Ts+dSST.txt>

Artful Scientific Writing 7 To note: 1. The blue heading says are consistent  
with, not show that. It could have said, Changes are consistent with an unchanged  
climate too. 2. The circled black writing undermines the blue headings conclusions.  
(<http://www.ipcc.ch/pub/un/syren/spm.pdf> IPCC, p. 6)

ClimateGate

The Climate Research Unit at the U. of East Anglia in England is the most  
complete source for world temperature data. Someone just leaked a large amount  
of emails and computer code theyd been keeping secret. They are shown to have  
tried to suppress other scientists research, illegally kept info secret, done incompetent  
programming, deliberately misled people about their results, and had as secret allies  
supposedly objective websites and newspapers.

New Zealand Fakery Watts Up with That

The caption to the photo on the NiWA site reads:

From NIWAs web site Figure 7: Mean annual temperature over New Zealand,  
from 1853 to 2008 inclusive, based on between 2 (from 1853) and 7 (from 1908) long-  
term station records. The blue and red bars show annual differences from the 1971  
2000 average, the solid black line is a smoothed time series, and the dotted [straight]  
line is the linear trend over 1909 to 2008 (.92C/100 years).

The trend is statistically insignificant at .06C per century since 185.

The Government Response: Combining Temperature Data from Multiple Sites in

Wellington

Satellite Data Much Better

THE WORLD IS WARMING UNEVENLY

Cato study, [http://www.cato.org/pubs/handbook/hb109/hb\\_109-48.pdf](http://www.cato.org/pubs/handbook/hb109/hb_109-48.pdf) from National Oceanic and Atmospheric Administration (Tinker, 1999),  
US Code 42.

## 1 7

521. Emission standards for new motor vehicles or new motor vehicle engines

(a) Authority of Administrator to prescribe by regulation Except as otherwise provided in subsection (b) of this section

(1) The Administrator shall by regulation prescribe (and from time to time revise) in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.

TITLE 42 *ç* CHAPTER 85 *ç* SUBCHAPTER III *ç*

## 2 7

602 Definitions

When used in this chapter

(g) The term air pollutant means any air pollution agent or combination of such agents, including any physical chemical biological radioactive physical, chemical, biological, (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air.

In 1999, 19 private organizations filed a rulemaking petition asking EPA to regulate greenhouse gas emissions from new motor vehicles under section 202 of the Clean Air Act. Fifteen months later, EPA requested public comment.

EPA received more than 50,000 comments over the next five months.

September 8, 2003, EPA entered an order denying the rulemaking petition, saying:

(1) that contrary to the opinions of its former general counsels, the Clean Air Act does not authorize EPA to issue mandatory regulations to address global climate change; and 16 (2) that even if the agency had the authority to set greenhouse gas emission standards, it would be unwise to do so at this time.

The EPA's denial was challenged in court. The Supreme Court said the EPA had to issue a rule. 2009: Commenting begins on the remanded EPA determination.

EPA, "Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act," <http://epa.gov/climatechange/endangerment.html> (April 22, 2009). Dec. 7, 2009: New endangerment finding. Regulations are coming in April 2010. Schelling (1992) Schelling won the Nobel Prize in economics for his work on game theory in the 1960s. Read: *The Strategy of Conflict*. Credible threats is the main

idea. Focal points too.

1. Agriculture is a small part of any advanced economy. Why does climate matter?

How Should Money Be Spent to Help the Third World?

What Are the Goals of Preventing Warming?

Solutions

1. Reduce carbon emissions (but how? taxes or tradable permits are impractical)

2. Plant trees

3. Fertilize the ocean with phosphate

4. Put light-blocking substances into the atmosphere (nuclear winter)

5. Lock carbon up under the ground somehow

6. Ameliorate effects by air conditioning, shifting to mild winter crops, higher sea walls, etc.

Rent-Seeking

The big electric utilities used to oppose any action. Now they are more supportive.

Utilities with nuclear plants will benefit.

Utilities that will reduce emissions anyway to comply with new sulfur dioxide rules will benefit from tradable carbon dioxide permits.

Cinergy and AEP rely heavily on old coal plants that are big polluters and CO<sub>2</sub> emitters. But many of those plants are nearing the end of their shelf lives, and will soon need replacing with cleaner alternatives. Since a climate program rewards companies that make the biggest CO<sub>2</sub> reductions, Cinergy and AEP would stand to rake in cash from a cap-and-trade regime simply by enacting their business plans.

"Kyoto's 'Capitalists'," *The Wall Street Journal*, 13 December 2004, p. A16. 7/26/2010

The Precautionary Principle

Suppose we are limited to spending at most one trillion dollars dealing with climate change. Suppose, too, we think that

(a) there is a 99% chance 3 trillion dollars in harm to the global economy,

(b) there is a 0

(c) there is a 190

The standard global warming line is that we should spend the trillion dollars on substituting other inputs for energy, to reduce CO<sub>2</sub> output and prevent the loss of the 3 trillion dollars.

The precautionary principle says that we shouldn't waste the trillion dollars on that— we should spend it on geoengineering research and technology to deal with the

1

**Questions You Should Be Able to Answer**

**Terms to Know**

**Homework Questions**

HERE PUT EXAMPLES WITH DIFFERENT NUMBERS THAN IN THE TEXT