

---

# Global Warming Phenomenon, An Impending Catastrophe?

---

By

**JOHN O. OKARA**

*Biology Education Department  
Federal College of Education (Tech.),  
Asaba, Delta State.*

**VICTORIA B. OJIH**

*Physics Education Department  
Federal College of Education (Tech.),  
Asaba, Delta State.*

And

**CHINYERE P. OBIDIEGWU**

*Biology Education Department  
Federal College of Education (Tech.),  
Asaba, Delta State.*

## Abstract

*Global warming is the observed increase in the average temperatures of the Earth's surface and oceans due to the greenhouse effect of certain gaseous pollutants in the atmosphere. Studies have shown that average global temperatures have risen by 0.5°C (about 1°F) in the past century, with a tendency to further increase as a result of human and industrial activities. An alarming aspect of global climate change is that a few degrees increase in temperature will have profound effect on the natural environment/human life. Based on computer-model analysis of climate change, scientists anticipate a warming of 1.1°C to 6.4°C between 1990–2100. This future epidemic led to the Kyoto Protocol – the world's primary international agreement on combating global warming. Countries that ratify this agreement commit to reduce their emissions of CO<sub>2</sub>, and five other greenhouse gases. This paper highlights major causes, consequences as well as possible ways of combating this menace. It is hoped that the world largest emitters of CO<sub>2</sub>, particularly the United States, would have the political and economic will to commit to the Kyoto Protocol, and save mankind this impending catastrophe.*

## ***The Coconut***

Global warming is the observed increase in the average temperatures of the earth's near surface air and oceans in recent decades and its projected continuation. Research has shown that the average global temperature has risen by 0.5°C (about 1°F) in the last century (Parker, 2005).

Scientific opinion on climate change is that most of the observed increase in global average temperatures since the mid-twentieth century is traceable to the increase in anthropogenic *greenhouse* gas concentration in the lower atmosphere as a result of agricultural and industrial activities. These gases are transparent to short-wave radiation from the sun but tend to block the long wave heat energy from being radiated back towards space from the earth (Pearson, 2000). Thus an increase in the concentration of these *greenhouse* gases causes more heat to be trapped in the lower atmosphere raising earth's average temperatures.

Researchers have studied global warming with computer models of the climate and predicted that the net effect of adding *greenhouse* gases will be a warmer climate in the future. Models referenced by the intergovernmental panel on climate change (IPCC) predict that global temperatures are likely to increase by 1.1-6.4°C (2.0-11.5°F) between 1990 and 2100! (IPCC, 2001).

Scientists are concerned about the harmful effect of the *greenhouse* gases since a few degrees rise in temperature may be devastating if not checked. Efforts are being made by industrialized nations on how to combat the future epidemic (Elkins, 2003). In this regard, this paper discusses the causes and possible effects of global warming as well as efforts of industrialized nations in combating this impending catastrophe.

### **History of Global Warming**

Studies indicate that several centuries before 1850, the Earth's temperature was believed to have been relatively stable, with possibly regional fluctuations such as the medieval warm period or the little Ice Age. Relative to the period 1860-1900, global temperatures on both land and oceans have increased by 0.75°C (1.4°F) according to the instrumental temperature record. Scientists envisaged that global average temperatures have a tendency to increase as a result of industrial and agricultural activities (Peterson, 2003).

Since 1979, land temperatures have increased about twice as fast as ocean (0.25°C/decade against 0.13°C/decade). Temperatures in the lower troposphere have equally increased between 0.12°C and 0.22 °C (0.22 °F and 0.4°F) per decade since 1979 according to satellite temperature measurements (Pearson, 2003). Record of hot temperatures across much of North America and Europe during the summer of 1993

caused many people to believe that global warming was already a reality and the effects will not be noticeable until the middle of the 21<sup>st</sup> century (USEPA, 2005).

Based on estimates by NASA's Goddard Institute for Space Studies, 2005 was the warmest year since reliable widespread instrumental measurement became available in the late 1800s, exceeding the previous record set in 1998 by a few hundredths of a degree. Estimates prepared by the world metrological organization and the UK Climatic Research Unit concluded that 2005 was the second warmest year behind 1998 (GFDL, 2007).

According to United Nations Framework Convention on Climate Change (2006), adding carbon dioxide (CO<sub>2</sub>) or methane (CH<sub>4</sub>) to earth's atmosphere with no other changes will make the planet surface warmer. Climate commitment studies indicate that even if *greenhouse* gases were stabilized at present day levels, a further warming of about 0.5 °C (0.9°F) would still occur.

### **Causes of Global Warming**

Torn and Harte (2006) outlined some of the causes of global warming as follows:

1. **Carbon Dioxide:** Most scientists concerned about global warming agree that carbon dioxide is the most significant *greenhouse* gas. Carbon dioxide occurs naturally, constituting about 0.04% of the atmosphere and is used by plants during photosynthesis to produce oxygen. Enormous amount of carbon dioxide is produced from natural sources such as decomposition of dead plant, forest fire and gas exchange between the surface of oceans and the atmosphere. Under normal circumstances, the gas is kept to balance by 'sink' that drains it from the atmosphere. The oceans, for instance absorb slightly more carbon dioxide than they give out. During photosynthesis plants take in carbon dioxide, removing a total of about 102billion tons of carbon from the atmosphere every year. This careful balance is disrupted by human activities. In 1993, the burning of oil, coal and natural gas added about 5.7billion tons of carbon dioxide to the atmosphere, while deforestation added an estimated 2billion tons. Scientists studying air samples collected from bubbles sealed in glaciers have concluded that carbon dioxide in the atmosphere has increased approximately 25% since the beginning of the industrial age in 1750.
2. **Methane:** Methane occurs naturally in the atmosphere in trace amounts. It escapes from the earth's interior through volcanoes and other openings in the crust, and is produced by biological processes as well. Methane is given off also when dead plants in the mud and stagnant water of swamps and marshes decompose. Methane is also produced as intestinal gas in ruminant animals. Studies indicate that concentrations of methane in the atmosphere have more

## *The Coconut*

than doubled since the beginning of the industrial age. As a *greenhouse* gas, it has 21 times more warming effect on a molecule-for-molecule basis than carbon dioxide.

3. **Nitrous Oxide:** Nitrous oxide is a combination of nitrogen and oxygen, the two most important abundant gases in the atmosphere. Like methane, small amounts of nitrous oxide can be significant. A molecule of methane has 200-300 times more warming effect than a molecule of carbon dioxide. It also remains in the atmosphere about 150 years much longer than other *greenhouse* gases. The natural balance of nitrous oxide in the atmosphere is maintained primarily by microorganisms in the soil, some of which take nitrogen out of the air and convert it into forms that can be used by plants. Others take fixed nitrogen from the soil in a process called denitrification and release it into the air as nitrous oxide. The amount of nitrous oxide in the atmosphere has increased as a result of human activities such as burning fossil fuels and wood as well as the use of nitrogen-based fertilizers.
4. **Halocarbons:** Halocarbons are compounds formed by combination of carbon and the family of elements called halogens. Halocarbons are responsible for ozone depletion in the atmosphere. Though the scarcest of the *greenhouse* gases, they are a cause for concern. Studies show that a molecule of hydrocarbon in the atmosphere has 3,000-13,000 times more effect on *greenhouse* warming than does a molecule of carbon dioxide. They are also the oldest of the *greenhouse* gases having lasted up to about 400 years.
5. **Solar Variation:** The IPCC Fourth Assessment Report (AR4) gives a best estimate for radiative forcing from changes in solar activities of +0.12 watts per square meter, which is less than half of the estimate given in the Third Assessment Report. For comparison, the combined efforts of all human activity were estimated to be an order of magnitude greater at +1.6 watts per square meter.

## **Consequences of Global Warming**

Intergovernmental Panel on Climate Change (2007) enumerated some effects on both the natural environment and human life already being attributed to global warming, at least in part, are:

- \* Glacier retreat
- \* Ice shelf disruption such as the Larson Ice Shelf
- \* Rise in sea level
- \* Changes in rainfall patterns
- \* Increased intensity and frequency of hurricanes and extreme weather events. While changes are expected for overall patterns, intensity, and frequencies, it

is difficult or impossible to attribute specific events (such as Hurricane Katrina) to global warming.

#### **Some Anticipated Effects Include:**

- \* Sea level rise of 110-770mm (0.36-2.5 feet) by the year 2100.
- \* Flooding of coastal cities.
- \* Repercussion to agriculture.
- \* Possible slowing of the thermohaline circulation.
- \* Increased intensity and frequency of hurricanes and extreme weather events.
- \* Ocean acidification.
- \* Outbreak of diseases such as malaria, yellow fever and dengue.
- \* Mass extinction events.

#### **Climate Models**

Scientists have studied global warming with computer models of the climate. These models predict that the net effects of adding *greenhouse* gases will be a warmer climate in the future. However, even when the assumptions of fossil fuel consumption and CO<sub>2</sub> emission are used, the amount of predicted warming varies among models and still remains a considerable range of climate sensitivity (Houghton *et al.*, 1992).

In line with the climate model and future *greenhouse* gas uncertainty, the IPCC anticipates a warming of 1.1°C -6.4°C (2°F-11.5°F) between 1990 and 2100. They also used these models to investigate the causes of recent climate change by comparing the observed changes to those that the models predict from various natural and human derived forcing factors. Climate models can produce a good match to observations of global temperature changes over the last century. These models do not ambiguously attribute the warming that occurred around 1910-1945 to either natural variation or human effects; however, they suggested that the warming since 1975 is dominated by man-made *greenhouse* gas emissions (Houghton, 1990).

#### **Combating Global Warming**

The Intergovernmental Panel on Climate Change (2007) has predicted an average global rise in temperature of 1.4°C-5.8°C between the year 1990 and 2100. Efforts are being made to combat global warming looking at the future epidemics. These efforts include mitigation and the Kyoto Protocol.

#### **Mitigation**

The broad agreement among climate scientists that global temperatures will continue to increase has led nations, states, corporations and individuals to implement

### *The Coconut*

actions to try to curtail global warming. Some of the strategies proposed for mitigation of global warming include development of new technologies, carbon offsets; renewable energy such as wind power and solar power, nuclear power; electric or plug-in hybrid electric vehicles, non-fossil fuel cells, energy conservation, carbon taxes, improving natural carbon dioxide sinks, deliberate production of sulfate aerosols which produce a cooling effect on the Earth, population control, carbon capture and storage, and nanotechnology. Many environmental groups encourage individual action against global warming, often aimed at the consumer, and there has been business action on climate change.

### **Kyoto Protocol**

The Kyoto Protocol is the world's primary agreement on combating global warming. It is an amendment to the United Nations Framework Convention on Climate Change (UNFCCC). The objective is the stabilization of *greenhouse* gas concentrations in the atmosphere at levels that would prevent dangerous anthropogenic interference with climate system.

### **Results to Date**

Below is the list of the change in *greenhouse* gas (GHG) emissions from 1990 to 2004 for some countries that are part of the Climate Change Convention as reported by the United Nations.

Table 1: Reported change in *greenhouse* gas emission from 1990-2004.

Country	Change in GHG Emissions	EU Assigned Objective for 2012	Treaty Obligation 2008-2012
Germany	-17%	-21%	-8%
Canada	+27%	N/A	N/A
Spain	+49%	+15%	-8%
United States	+16%	N/A	N/A
France	-0.8%	.0%	-8%
Greece	+27%	+25%	-8%
Ireland	+23%	+13%	-8%
Japan	+6.5%	N/A	-6%
United Kingdom	-14%	-12.5%	-8%
Portugal	+41%	+27%	-8%
EU-15	-0.8%	N/A	-8%

Goddard Institute for Space Studies (2005)

### **Conclusion**

The global warming phenomenon is, indeed, one of the greatest challenges confronting humanity. The major cause of this climate change has been traced to the continuous emission of *greenhouse* gases. Further emission will, of course, result in more warming with grave consequences on the environment and human life in general. The predictions of Intergovernmental Panel on Climate Change that global temperatures are likely to increase by 1.1- 6.4 °C between 1990 and 2100 makes this climate malady an impending global catastrophe. Thus, drastic measures aimed at combating climate change remains the only way out of this quagmire.

### **Recommendations**

1. All the countries that have so far ratified the Kyoto Protocol should, as a matter of priority, commit to the implementation to the agreement.
2. Developing countries such as India and China, which are high emitters of *greenhouse* gases, ought not to be exempted from implementation of Kyoto Protocol.
3. There is need to stop *Gas Flaring*, as currently practiced in the Niger Delta region of Nigeria. Gas flaring is known to contribute significantly to climate change and environmental pollution.
4. It is necessary for various governments to strengthen the enforcement of legislations which preserve and protect our forests. Deforestation eliminates the vegetation that, otherwise, removes carbon dioxide from the atmosphere during photosynthesis.
5. Finally, there is need to focus attention on the development and application of *Biomass Energy* to reduce on dependence on fossil fuels.

### **References**

- Cohen, A. S., L. L. Coe, S. M. Harding & L. Schwart (2004). Osmium isotope evidence for the regulation of atmospheric CO<sub>2</sub> by continental weathering. *Geology*,32(2):157-160.
- Elkins J.W. (1993). Decrease in the small rates of atmospheric chlorofluoro- carbons 11 and 12. *Nature*, 364:780-783,
- Goddard institute for space studies (2005). GISS surface temperature analysis. NASA Goddard institute for space studies.
- Gregory, J.M., R.J. Stouffer, S.C.B. Raper (2002). An observationally based estimate of the climate sensitivity. *Journal of climate* 15 (22): 3117-3121.

*The Coconut*

- Houghton J.T., B.A. Callender. & S.K. Varney (1992). The supplemental report to the intergovernmental panel on climate change (IPCC) scientific assessment.
- Intergovernmental Panel on Climate Change (2007). Climate change 2007: The physical science basis-Summary for policymakers. <http://www.ipcc.ch/SPM2feb07.pdf>.
- Mashin, M.& E. Thomas (2003). The clathrate gun is firing blanks: evidence from balancing the deglacial global carbon budget. Geophysical research abstracts [http://www.gsa.confex.com/gsa/inqu/finalprogram/abstract\\_55405.htm](http://www.gsa.confex.com/gsa/inqu/finalprogram/abstract_55405.htm).
- Pearson, P.N. (2000). Atmospheric carbon dioxide concentrations over the past 60 million years. *Nature*, 406: 6797.
- Peterson, T. (2003). Assessment of urban versus rural in situ surface temperatures in the contiguous United States. *Journal of Climate*, 16 (18): 2941-2959
- Smith, T.M. & R.W. Reynolds (2005). A global merged land-air-sea surface temperature reconstruction based on historical observations 1880- 1997. *Journal of climate*, 18 (12): 2021-2036
- Stott, M. (2003). Do models underestimate the solar contribution to recent climate change? *Journal of Climate*, 16:2110-2115.
- Torn, M., & J. Harte (2006). Missing feedbacks, asymmetric uncertainties, and the underestimation of future warming. *Geophysical research letters* 33(10): L10703.
- US Environmental Protection Agency (2005). Climate change: Basic information. <http://www.epa.gov/climatechange/basicinfo.html>