# Global warming-major causes and consequences

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**Abstract**

Global warming is an important environmental issue which is rapidly becoming a part of popular culture. This paper provides an account of the science associated with this
Important issue. The difference between weather and climate is highlighted. Temperature records to prove global warming are discussed. Global warming, the enhancement of the natural greenhouse effect caused by emissions associated with human activities of greenhouse gases such as carbon dioxide, methane, nitrous oxide, and halogenated compounds is described. The graphs showing emission of these gases during past years are shown. The major sources of green house gases and consequences of global warming are emphasized. A few suggestions to control the increase in temperature due to global warming are also presented.

## 1. Introduction

Weather and climate have a profound impact on living organisms on the planet. Ecological systems have evolved over geological time scales to suit the prevailing climate. The past 10 to 20 years have brought disturbing evidence that human activities may cause significant changes in future global climate. "Global Warming" is now an issue known to hundreds of millions of people across the world. Here is an overview of the current state of knowledge concerning greenhouse gases and global warming. The purpose here is to address the following questions: How weather is different from climate?, Is global warming real?, To what degree are human activities responsible for climate change? How does global warming effect the living beings?, and What steps we can take to save earth?. At this point it is relevant to note the difference between weather and climate. Climate is what we “expect” and weather is what we “get”. Weather is the state of the atmosphere (temperature, humidity, precipitation, wind, cloud cover, etc.) in a particular location at a particular time; it fluctuates greatly and is notoriously difficult to predict. Climate is the time-averaged weather in a given geographical region. Climate is a temporal and spatial average and is consequentially much more predictable than weather. Thus, the average temperature during a given month in a particular area (climate) can be predicted with some confidence, however, the temperature at a given time and location (weather) is much more difficult to predict. Climate varies from month to month, season to season, and year to year. Statistically significant changes in climate occurring over a time scale of decades or longer constitute "climate change".

Some people believe that global warming is a myth, they don’t believe the environment is in danger. Global warming is not just a theory, it is real, and it is happening now. The temperature of the Earth is rising, the ozone layer is decreasing, we are trapping increased heat in the atmosphere and sooner or later a number of animal species will become extinct and human health will be at risk. Across the globe there have been increases in droughts, hurricanes, floods and unusual weather occurrences that hurt crops, destroyed homes, and have taken lives. The temperatures in 2014 have been the warmest since records started to be kept in 1880.

The last century has seen the temperature of the Earth rise because of the excessive use of fossil fuels that have made a hole in the ozone layer. A hole in the ozone layer increases the amount of UVB rays reaching the Earth, which increases the risk of health effects. Plants can also be affected by the amount of UVB radiation. Although we can't look at thermometers going back thousands of years, we do have some records that help us figure out what temperatures and concentrations were like in the distant past. For example, trees store information about the climate in the place where they live. Each year, trees grow thicker and form new rings. In warmer and wetter years, the rings are thicker. Old trees and wood can tell us about conditions hundreds or even several thousands of years ago. Keys to the past are also buried under lakes and oceans. Pollen, creatures, and particles fall to the bottom of oceans and

lakes each year, forming sediments. Sediments preserve all these bits and pieces, which contain a wealth of information about what was in the air and water when they fell. Scientists reveal this record by inserting hollow tubes into the mud to collect sediment layers going back millions of years.

There are a group of scientists who met in London to discuss the Earth and what is in store for the future of the planet. The Planet Under Pressure Conference (PUP) has concluded that the Earth is coming to the point where a recovery from global warming will not be possible. They believe that by 2100 the temperature will rise by 6 degrees Celsius (42.8 degrees F) if gases continue to rise without control. This would result in the loss of ice sheets and rainforests. The tropical rainforests produce 40% of the world's oxygen. Losing the rainforests would take a major toll on environment and human health. Another effect is the threat to coral reef development. The Great Barrier Reef is home to over 350 species of coral, 1,800 species of fish, and also home to hundreds of sharks, sponges, and even dolphins and whales. Some species would probably go extinct because of the Earth changing and their habitat and source of food disappearing. Global warming would not only affect the animals on Earth but also the humans. Greenland's ice caps would also increase in the speed in which they are melting, raising the sea level by 23 feet and swallowing some of the land on the coasts of several continents. Grass has been seen growing on Antarctica and also Himalayas where the ice has melted away. The world will see a dramatic change over the next 100 years unless we try to make changes and do our part to conserve the planet.

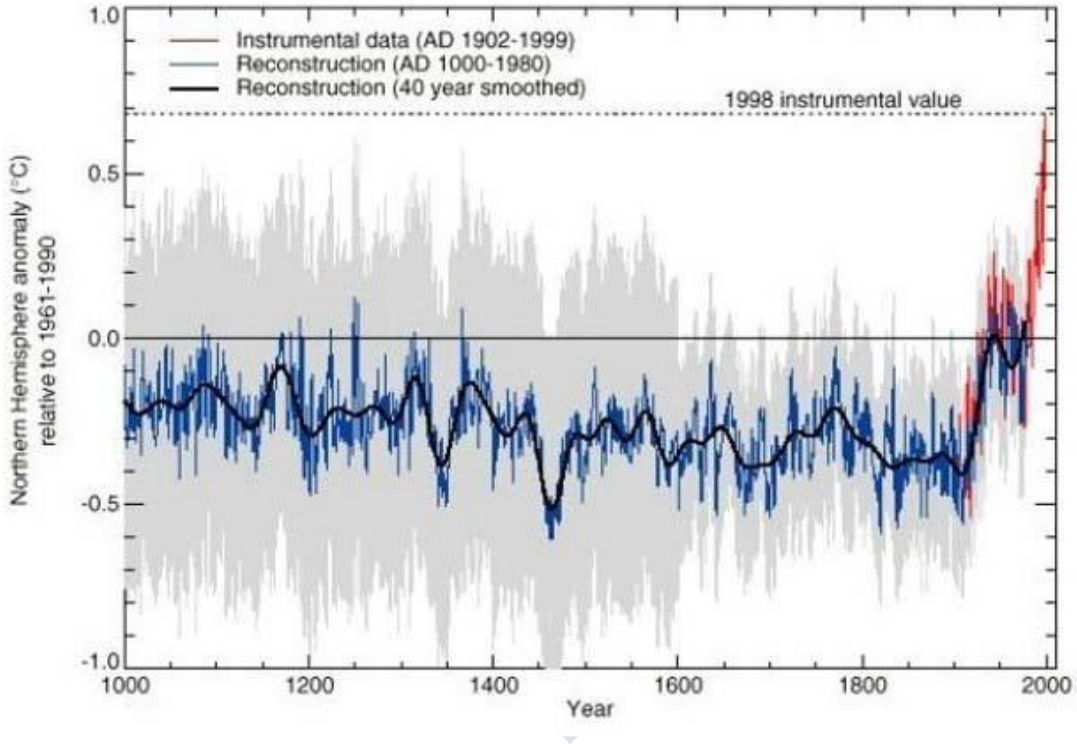


Figure1: Average Northern Hemisphere temperature over the past 1000 years. Red = instrumental record, blue = reconstructed using proxy indicators, black = 40 year average, grey = estimated uncertainty range. (Reproduced with permission from IPCC)

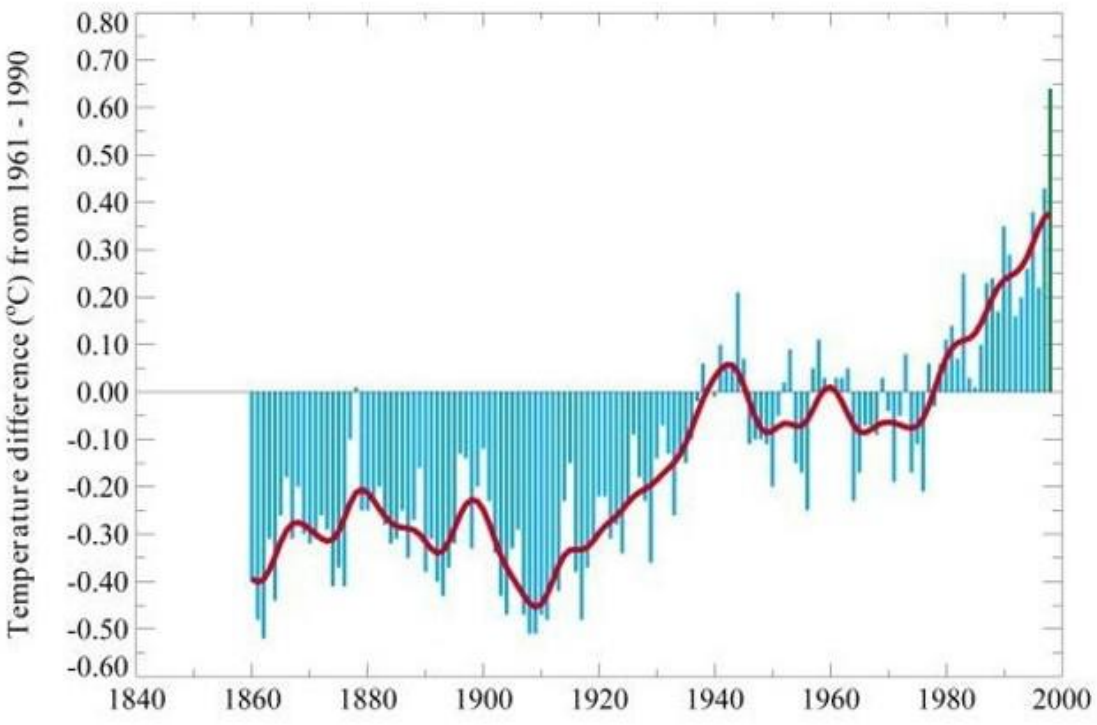


Figure 2. Global average temperature since 1860 (reproduced with permission from IPCC)

Figures 1 and 2 show the average annual Northern Hemisphere surface temperature over he past 1000 years and the average global temperature over the past 140 years. The red line in Figure 1 is the instrumental record which stretches back approximately 140 years, the blue line is the "reconstructed" temperature deduced from tree rings, ice cores, corals, and historical records. The black curve is the 40 year smoothed average. The temperature record for the Southern Hemisphere is less complete, but is consistent with, that of the Northern Hemisphere. Several interesting points arise from inspection of Figure 1. First, the average Northern hemispheric temperature is far from constant over the past 1000 years. Many fluctuations are observed. Second, there is a small but 1000–1900 with a magnitude consistent with that expected from astronomical forcing. Third, and most significant for the present discussion, there is a pronounced and abrupt (in geological terms) warming over the past century. Figure 2 provides a more detailed picture over the past 140 years which shows that the warming occurred during two periods (1910–1940 and 1980–present). The vertical bars in Figures 1 and 2 represent the difference between the average annual temperature for each year and the average for 1961-1990. 1998 was the warmest year, the 1990s was the warmest decade, and the 1900s was the warmest century in the past millennium. The data in Figures 1 and 2 indicate that global climate is changing. The temperature record is not the only indication of a changing climate. There are many other indicators such as the substantial retreat of mountain glaciers in many locations around the world, decreased snow cover in the Northern hemisphere, decreased tropical precipitation, increased mid-to-high latitude precipitation, sea level rise, decreased extent of Arctic ice, and thinning of Arctic ice. The combined data prove beyond a reasonable doubt that global climate is changing.

Having concluded that global warming is indeed occurring, the next question is "Should we be concerned?" The warming observed thus far ($0.6 \pm 0.2^{o}$C since the late nineteenth century) is modest and, in itself is unlikely to lead to a substantial global impact. It seems likely that most of the warming observed to date is associated with human activities releasing greenhouse gases such as carbon dioxide. In light of the long atmospheric lifetime of carbon dioxide, substantial increases in its emission during the past century, and expected increases in future emissions, the atmospheric concentration of carbon dioxide in the year 2100 will almost certainly be substantially greater than that today and the climate will continue to warm. The IPCC has considered numerous emission scenarios and concluded that global temperature may rise between 1.4 and 5.8 $^{o}$C by 2100 (depending on emission scenario).

## 2. Causes of global warming

Greenhouse gases are released into the atmosphere in many ways, including through the burning of fossil fuels (such as coal and petroleum) and by deforestation. As some environments warm they also release carbon that may have been stored for thousands of years.

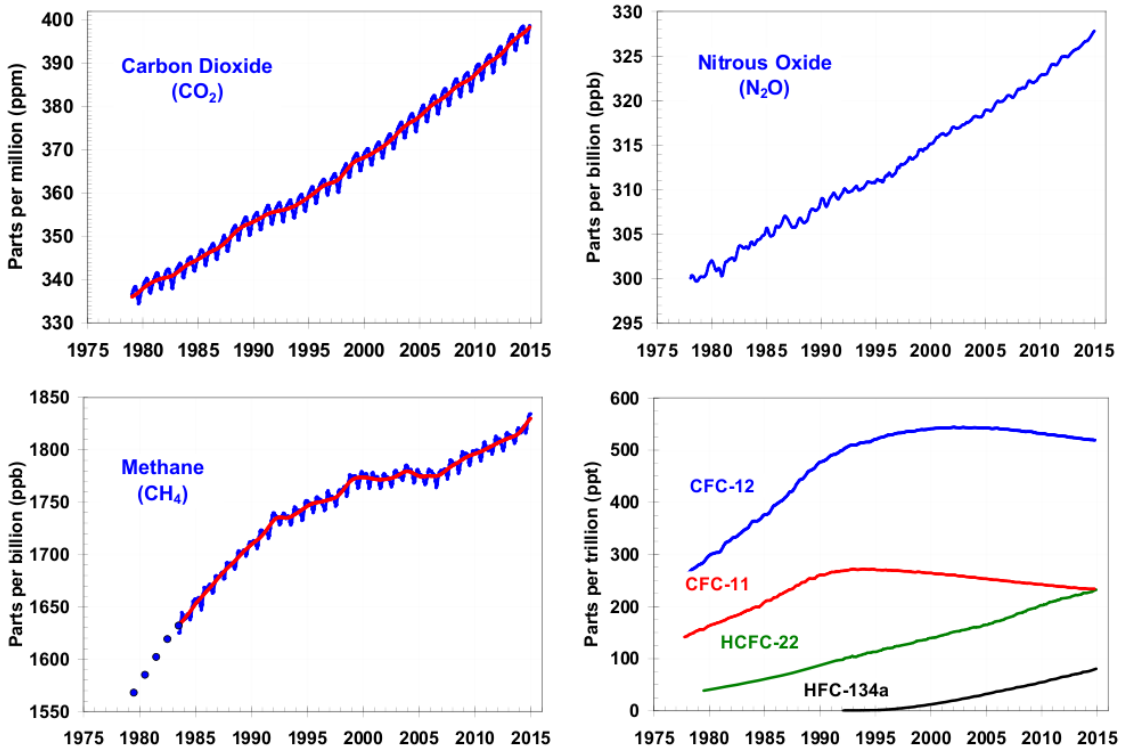


Fig.3. The concentration of major green house gases like $CO_2$, $N_2O$, $CH_4$ and CFC in atmosphere from 1975 to 2015

This shows the concentrations of carbon dioxide, methane, and nitrous oxide in the atmosphere over the past 1000 years as measured in air trapped in bubbles in ice core samples from sites in Antarctica and Greenland and, for the more recent data, measured directly in ambient air. The units for carbon dioxide concentration are parts per million (ppm) while those for methane and nitrous oxide are parts per billion (ppb), 1 ppm = 1000 ppb. As seen from Figure, the overall trend of carbon dioxide, methane, and nitrous oxide concentrations is the same. For the time period 1000–1800 there is little, or no, discernable change, while over the period 1800–2000 there is a substantial increase in the atmospheric levels of all three gases. It is well established that the increases in the atmospheric concentration of carbon dioxide, methane, and nitrous oxide during 1800–2000 reflect the impact of human activities in general and the industrial revolution in particular. The major sources of these gases are

### 2.1 Burning fossil fuels

Most of Australia's greenhouse gas emissions come from the burning of fossil fuels for energy (e.g. for electricity and transport). When oil, gas or coal burns, carbon contained within it combines with oxygen in the air to create carbon dioxide. India's electricity-related emissions are high because we rely primarily (77%) on coal for electricity generation and coal is the most greenhouse-intensive fuel.

### 2.2 Deforestation: burning and removing vegetation

All plants take in carbon dioxide from the air and release oxygen, which is why they are sometimes referred to as carbon "sinks". This process is called photosynthesis. When land is cleared and trees or vegetation removed or burnt, the stored carbon is converted back into carbon dioxide.

### 2.3 Farming

Animals, particularly sheep and cattle, produce large amounts of methane. Some fertilisers also release nitrous oxide, which is another greenhouse gas.

**2.4 Waste breakdown**

Carbon dioxide and methane are released during the decay of food, vegetation and paper dumped in landfills. The same thing occurs when sewage wastes break down.

**2.5 Industry**

Many industrial processes, such as cement production, liquid natural gas production and coal mining, produce or emit a variety of greenhouse gases.

**3. Consequences of global warming**

Global warming is expected to have far-reaching, long-lasting and, in many cases, devastating consequences for planet Earth. For some years, global warming, the gradual heating of Earth's surface, oceans and atmosphere, was a topic of heated debate in the scientific community. A major report released Sept. 27, 2013, by the Intergovernmental Panel on Climate Change (IPCC) stated that scientists are more certain than ever of the link between human activities and global warming. One of the most immediate and obvious effects of global warming is the increase in temperatures around the world. The average global temperature has increased by about 1.4 degrees Fahrenheit (0.8 degrees Celsius) over the past 100 years, according to the National Oceanic and Atmospheric Administration (NOAA). Since recordkeeping began in 1895, the hottest year on record for the 48 contiguous U.S. states was 2012. Worldwide, 2012 was also the 10th-warmest year on record, according to NOAA. And nine of the warmest years on record have occurred since 2000. According to NOAA, 2013 tied with 2003 as the fourth warmest year globally since 1880. In 2014, some cities in the United States had the warmest summers on record, according to Scientific American. A report by the World Meteorological Organization released July 3, 2014, said that deaths from heat increased by more than 2,000 percent over the previous decade.

Extreme weather is an effect of global warming. While experiencing some of the hottest summers on record, much of the United States also has been experiencing colder than normal winters. Global warming may also lead to extreme weather other than cold or heat extremes. For example, hurricane formations will change. Though this is still a subject of active scientific research, current computer models of the atmosphere indicate that hurricanes are more likely to become less frequent on a global basis, though the hurricanes that do form may be more intense. Lightening is another weather feature that is being affected by global warming. According to a 2014 study, a 50 percent increase in the number of lightning strikes within the United States is expected by 2100 if global temperatures continue to rise. The researchers of the study found a 12 percent increase in lightning activity for every 1.8 degree F (1 degree C) of warming in the atmosphere. The number of extreme weather events that are among the most unusual in the historical record, according to the CEI, has been rising over the last four decade Scientists project that extreme weather events, such as heat waves, droughts, blizzards and rainstorms will continue to occur more often and with greater intensity due to global warming, according to Climate Central. Climate models forecast that global warming will cause climate patterns worldwide to experience significant changes. These changes will likely include major shifts in wind patterns, annual precipitation and seasonal temperatures variations. In addition, because high levels of greenhouse gases in the atmosphere are likely to remain high for many years, these changes are expected to last for several decades or longer, according to the Environmental Protection Agency (EPA). In the northeastern United States, for example, climate change is likely to bring increased annual rainfall, while in the Pacific Northwest, summer rainfall is expected to decreases.

**Suggestions:**

We can help to reduce the demand for fossil fuels, which in turn reduces global warming, by using energy more wisely. The best way to reduce global warming is planting a tree because deforestation is the main cause of global warming. Because during photosynthesis, trees and other plants absorb carbon dioxide and give off oxygen. They are an integral part of the natural atmospheric exchange cycle here on Earth, but there are too few of them to fully counter the increases in carbon dioxide caused by automobile traffic, manufacturing and other human activities. A single tree will absorb approximately one ton of carbon dioxide during its lifetime. Do your part to reduce waste

by choosing reusable products instead of disposables. Buying products with minimal packaging (including the economy size when that makes sense for you) will help to reduce waste. And whenever you can, recycle paper, plastic, newspaper, glass and aluminum cans. Adding insulation to your walls and attic, and installing weather stripping or caulking around doors and windows can lower your heating costs more than 25 percent, by reducing the amount of energy you need to heat and cool your home. Turn down the heat while you're sleeping at night or away during the day, and keep temperatures moderate at all times. Setting your thermostat just 2 degrees lower in winter and higher in summer could save about 2,000 pounds of carbon dioxide each year. Wherever practical, replace regular light bulbs with compact fluorescent light (CFL) bulbs. Replacing just one 60-watt incandescent light bulb with a CFL will save you $30 over the life of the bulb. CFLs also last 10 times longer than incandescent bulbs, use two-thirds less energy, and give off 70 percent less heat. Less driving means fewer emissions. Besides saving gasoline, walking and biking are great forms of exercise. Explore your community mass transit system, and check out options for carpooling to work or school. When you do drive, make sure your car is running efficiently. For example, keeping your tires properly inflated can improve your gas mileage by more than 3 percent. When it's time to buy a new car, choose one that offers good gas mileage. Home appliances now come in a range of energy-efficient models, and compact florescent bulbs are designed to provide more natural-looking light while using far less energy than standard light bulbs. Avoid products that come with excess packaging, especially molded plastic and other packaging that can't be recycled. Set your water heater at 120 degrees to save energy, and wrap it in an insulating blanket if it is more than 5 years old. Buy low-flow showerheads to save hot water and about 350 pounds of carbon dioxide yearly. Wash your clothes in warm or cold water to reduce your use of hot water and the energy required to produce it. That change alone can save at least 500 pounds of carbon dioxide annually in most households. Use the energy-saving settings on your dishwasher and let the dishes air-dry. Save electricity and reduce global warming by turning off lights when you leave a room, and using only as much light as you need. And remember to turn off your television, video player, stereo and computer when you're not using them. It's also a good idea to turn off the water when you're not using it. While brushing your teeth, shampooing the dog or washing your car, turn off the water until you actually need it for rinsing. You'll reduce your water bill and help to conserve a vital resource. Share this information about recycling and energy conservation with your friends, neighbors and co-workers, and take opportunities to encourage public officials to establish programs and policies that are good for the environment.

**Conclusions**

At the beginning of this paper the following questions were posed: "Is global climate changing?", "To what degree are human activities responsible for climate change?", what are the consequences of global warming? And what we can do to control the rising temperature? In the light of the discussion we are now in a position to provide answers to these questions. "Is global climate changing?" The answer to this question is "Yes". There is a large body of scientific data that shows beyond any reasonable doubt that the global climate has warmed significantly over the past 150 years. "To what degree are human activities responsible for climate change?" The answer to this somewhat controversial question is "It is very likely that human activities are responsible for a substantial fraction of the observed climate change". The natural greenhouse effect is a well known phenomenon. It is well established that human activities have led to large increases in the atmospheric concentrations of the three most important long lived greenhouse gases. Then we discussed about the serious consequences of global warming and also tried to suggest a few steps to control global warming which are quite practical.

**References**

1. Timothy J. Wallington,Jayaraman Srinivasan,Ole John Nielsen,Ellie J. Highwood, (2004), GREENHOUSE GASES AND GLOBAL WARMING, in Environmental and Ecological Chemistry, [Ed. Aleksandar Sabljic], in Encyclopedia of Life Support Systems (EOLSS), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford ,UK.

2. Arrhenius, S., (1896). On the influence of carbonic acid in the air on the temperature of the ground, *Phil. Mag., S.* 41, 237-277.
3. Fourier, J., (1827). Memoire sur les Temperatures du Globe Terrestre et des Escapes Planetaires, *Mem. Aca. Sci. Inst. Fr.*, 7, 569-604.
4. Houghton, J., (1997). Global Warming: The Complete Briefing, Cambridge University Press (1997).
5. http://www.epa.gov/globalwarming
6. http://www.giss.nasa.gov
7. www.google.com