

## Global Warming, Advocacy

Global warming refers to an unequivocal and continuing rise in the average temperature of Earth's climate system. Since the early 20th century, when accurate records began being kept, the global air and sea surface temperature has increased about 0.8 °C (1.4 °F). Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.

Scientific understanding of the cause of global warming has been increasing. In its fourth assessment of the relevant scientific literature, the Intergovernmental Panel on Climate Change (IPCC) reported that scientists were more than 90% certain that most of global warming was being caused by increasing concentrations of greenhouse gases produced by human activities.

The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases. Earth's natural greenhouse effect makes life as we know it possible, with it it would be too cold for life. However, human activities, primarily the burning of fossil fuels and clearing of forests, have intensified the natural greenhouse effect, causing global warming.

Currently, the United States, and most of the world, is locked into what could be called the fossil fuel, or carbon economy. Our automobiles, trains and planes are fueled almost exclusively by petroleum products like gasoline and diesel. A huge percentage of our power plants use oil, natural gas and coal for their fuel. This has huge negative consequences for the environment. About 19.64 pounds of carbon dioxide (CO<sub>2</sub>) are produced from burning a gallon of gasoline (it is slightly lower with the addition of *ethanol*); about 22.38 pounds of CO<sub>2</sub> are produced by burning a gallon of diesel fuel. Because these 20 something pounds of carbon comes out as a mostly invisible gas, carbon dioxide, most of us are oblivious to it. Of course we notice it when we are sitting with the windows down stuck in traffic and we get a face full of truck exhaust.

Since 1971, most of the warming on Earth has occurred in the oceans. Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90% of the energy accumulated between 1971 and 2010. It is certain that the upper ocean (0–700 m) warmed from 1971 to 2010, and it likely warmed between the 1870s and 1971. Also, the oceans are huge 'carbon sinks' that trap greenhouse gases, around half of all carbon dioxide produced by humans since the industrial revolution has dissolved into the world's oceans. Warming and increased CO<sub>2</sub> levels both have adverse effects for marine life, and for humans.

Perhaps the ocean organism most vulnerable to temperature change is coral. There is evidence that reefs will bleach (eject their symbiotic algae) at even a slight persistent temperature rise. Coral reefs are essential spawning, nursery, breeding, and feeding grounds for numerous organisms. Other organisms affected by temperature change include krill, an extremely important link at the base of the food chain. Krill reproduce in significantly smaller numbers when ocean temperatures rise. This can have a cascading effect by disrupting the life cycle of krill eaters, such as penguins and seals—which in turn causes food shortages for higher predators, including humans.

There are costs for humans besides food supply; when water heats up, it expands. Thus, the most readily apparent consequence of higher sea temperatures is a rapid rise in sea level. New research shows a major section of west Antarctica's ice sheet will completely melt in coming centuries and probably raise sea levels higher than previously predicted. Sea level rise causes inundation of coastal habitats for humans as well as plants and animals, shoreline erosion, and more powerful storm surges that can devastate low-lying areas. Warmer surface water dissipates more readily into vapor, making it easier for small ocean storms to escalate into larger, more powerful systems.

The effects of global warming are already costing money, even as the validity of the science is being debated in the media. As illustrated by Sandy's devastation - 44 dead, billions of dollars in damage, a flooded subway system and New York's largest-ever power outage -- the New York City area is highly exposed to the threat of damaging storm surge during hurricanes because of rising sea levels. The state of New York commissioned a study of how climate change will affect its infrastructure and how to adjust its operations to mitigate those effects. As a result in 2013 New York Mayor Michael Bloomberg announced a \$20 billion plan to prepare for rising sea levels and hotter summers expected as a result of climate change in the coming decades. Global warming has very real economic consequences, and the governments of many coastal regions around the world are realizing what is happening and taking steps to prepare.

The global warming controversy concerns the public debate over whether global warming is occurring, how much has occurred in modern times, what has caused it, what its effects will be, whether any action should be taken to curb it, and if so what that action should be. From the early 1990's in the United States, conservative think tanks mobilized to challenge the legitimacy of global warming as a social problem. They challenged the scientific evidence, argued that global warming will have benefits, and asserted that proposed solutions would do more harm than good. There is almost always huge economic interests backing global warming deniers, a lot of very powerful people stand to lose a lot of money if we start to transition away from a carbon economy, and so they use their power to prevent that.

There is virtually unanimous scientific agreement that human-caused global warming is real and poses a serious concern. The National Academy of Sciences

analyzed 1,372 climate researchers and their publication and citation data to show that 97–98% of the climate researchers most actively publishing in the field support the tenets of anthropogenic (man-made) climate change. There is hard empirical evidence that both the climate is getting warmer and that CO<sub>2</sub> and other greenhouse gas levels have never been this high.

An ice core is a core sample that is typically removed from an ice sheet or from high mountain glaciers elsewhere. As the ice forms from the incremental buildup of annual layers of snow, lower layers are older than upper, and an ice core contains ice formed over thousands of years. The properties of the ice can be scientifically analyzed to reconstruct a climatic record over the age range of the core. This enables the reconstruction of local temperature records and the history of atmospheric composition. Antarctic ice cores show us that the concentration of CO<sub>2</sub> was stable over the last millennium until the early 19th century. It then started to rise, and its concentration is now nearly 40% higher than it was before the industrial revolution.

Vulnerability of human societies to climate change mainly lies in the effects of extreme weather events rather than gradual climate change. During the 21<sup>st</sup> century these changes have led to the emergence of large-scale environmental hazards to human health, such as extreme weather, increased coastal flooding, ozone depletion, loss of biodiversity, reductions in water supplies, stresses to food-producing systems and the global spread of infectious diseases; and they are only expected to get worse.

In small islands and megadeltas, inundation as a result of sea level rise is expected to threaten vital infrastructure and human settlements. This could lead to issues of homelessness in countries with low lying areas such as Bangladesh, with a population of 150 million, as well as statelessness for populations in countries such as the Maldives and Tuvalu. These island countries could cease to exist. Rising sea levels also cause saltwater to enter into fresh underground water and freshwater streams. This reduces the amount of freshwater available for drinking and farming. Warmer water temperatures also affect water quality and accelerate water pollution.

The majority of the adverse effects of climate change are experienced by poor and low-income communities around the world, who have much higher levels of vulnerability to environmental determinants of health, wealth and other factors, and much lower levels of capacity available for coping with environmental change. A report on the global human impact of climate change published by the Global Humanitarian Forum in 2009, estimated more than 300,000 deaths and about \$125 billion in economic losses each year, and indicating that most climate change induced mortality is due to worsening floods and droughts in developing countries. This also raises questions of climate justice, since the 50 least developed countries of the world account for not more than 1% of worldwide emissions of greenhouse gases.

The only way to reduce global warming temperatures is to dramatically reign in our emission of greenhouse gases. The only way that can occur is if more people get educated on the science and begin to inform others. There are easy things you can do today to reduce your carbon footprint, or the amount of greenhouse gas emissions you generate. Changing the light bulbs in your house and other appliances to high efficiency models is one way to reduce emissions, and unplugging electronics and chargers when they are not in use is another. Filtering your own water, instead of buying plastic bottles is another important step you can take (the bottled water industry is very bad for the planet). Of course riding a bike or taking public transportation, or not using your car so much, is also very important.

Only when more people get educated and become aware of the effects of greenhouse gas emissions will we be able to deal with global warming. This will also require a major shift in the way our economy operates away from fossil fuels and toward clean renewable energy. In an age of political stalemate where nothing productive gets done, it will be up to the citizens to demand this change.

It is important to note though that even if we immediately dropped carbon dioxide emissions to zero, the gases we've already released would take decades or longer to dissipate.