Climate Change 101:
Understanding and Responding to Global Climate Change

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CLIMATE CHANGE 101
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January 2009 Update
A REAL PROBLEM WITH REAL SOLUTIONS

Scientists state unequivocally that the earth is warming. Climate change is happening, it is caused in large part by human activity, and it will have many serious and potentially damaging effects in the decades ahead. Greenhouse gas emissions from cars, power plants, and other human activities—rather than natural variations in climate—are the primary cause of contemporary global warming. Due largely to the combustion of fossil fuels, atmospheric concentrations of carbon dioxide (CO₂), the principal greenhouse gas, are at a level unequalled for at least 800,000 years. The greenhouse gases from human activities are trapping more of the sun’s heat in the earth’s atmosphere, resulting in warming. Over the last century, average global temperatures rose by more than 1°F and some regions warmed by as much as 4°F. The oceans have also warmed, especially in the upper layers (see Figure 1).

Carbon dioxide and other greenhouse gases always have been present in the atmosphere, keeping the earth hospitable to life by trapping heat. Yet, since the industrial revolution, emissions of these gases from human activity have accumulated steadily, trapping more heat and resulting in the enhanced greenhouse effect (see Figure 2). In 2005, atmospheric carbon dioxide concentrations had increased by 35 percent compared to pre-industrial levels, and concentrations of other greenhouse gases had grown...
**Figure 1**

**Global Warming Trend**

**Average Surface Warming and Ocean Heat Content**

Global average surface temperature change (left axis) and ocean heat content change in upper 2300 feet (right axis).

**SOURCES**


**Figure 2**

**The Greenhouse Effect**

Illustration of the greenhouse effect (adapted with permission from the Marian Koshland Science Museum of the National Academy of Sciences). Visible sunlight passes through the atmosphere without being absorbed. Some of the sunlight striking the earth is absorbed and converted to heat, which warms the surface. The surface emits heat to the atmosphere, where some of it is absorbed by greenhouse gases and re-emitted toward the surface; some of the heat is not trapped by greenhouse gases and escapes into space. Human activities that emit additional greenhouse gases to the atmosphere increase the amount of heat that gets absorbed before escaping to space, thus enhancing the greenhouse effect and amplifying the warming of the earth.

**NATURAL GREENHOUSE EFFECT**

The greenhouse effect is a natural warming process. Carbon dioxide (CO₂) and certain other gases are always present in the atmosphere. These gases create a warming effect that has some similarity to the warming inside a greenhouse, hence the name “greenhouse effect.”

**ENHANCED GREENHOUSE EFFECT**

Increasing the amount of greenhouse gases intensifies the greenhouse effect. This side of the globe simulates conditions today, roughly two centuries after the Industrial Revolution began.

As a result, global average temperatures have risen both on land and in the oceans, with observable impacts already occurring that presage increasingly severe changes in the future. Polar ice is melting at record rates. Glaciers around the globe are in retreat. Storms, including hurricanes, are increasing in intensity. Ecosystems around the world already are reacting as plant and animal species struggle to adapt to a shifting climate.

Scientists project that if the increase in man-made greenhouse gas emissions continues unabated, temperatures could rise by as much as 11°F by the end of this century, likely causing dramatic—and irreversible—changes to the climate, with profound consequences for humanity and the world as a whole. Water supplies in some critical areas will dwindle as snow and ice disappear. Sea levels will rise, threatening coastal populations. Droughts and floods will become more common. And hurricanes and other powerful storms will cause more and more damage. Agricultural production may increase with slight warming, but will decrease thereafter due to changes in precipitation, weather extremes, and the spread of crop pests and diseases. Changing weather patterns will also change the distribution and incidence of insect-borne and waterborne diseases, such as malaria and cholera. Human health will be jeopardized by all of these changes.