



## B A C K G R O U N D E R

### **The Greenhouse Effect And California**

Simply put, the greenhouse effect compares the earth and the atmosphere surrounding it to a greenhouse with glass panes. Plants in a greenhouse thrive because the glass panes keep the air inside at a fairly even temperature day and night, and throughout the four seasons of the year.

Just as the glass lets heat from sunlight in and reduces the heat escaping, greenhouse gases and some particles in the atmosphere keep the Earth at a relatively even temperature. Greenhouse gases like carbon dioxide, methane, and nitrous oxide in our atmosphere keep the Earth's average surface temperature close to a hospitable 60 degrees Fahrenheit. Without the greenhouse effect, the Earth would be a frozen globe, with an average temperature of about 5 degrees Fahrenheit. Most life as we know it would cease.

Thus, the naturally occurring greenhouse effect is beneficial, creating a pleasant, livable environment on the Earth. Natural levels of greenhouse gases have changed in the past. However since the start of the industrial revolution, the rate of increase has accelerated markedly because of the use of machines powered by fossil fuels like coal and oil.

There appears to be a close relationship between the concentration of greenhouse gases in the atmosphere and global temperatures. The burning of fossil fuels produces large amounts of carbon dioxide as well as other pollutants. Many of these pollutants absorb infrared energy that would otherwise escape from the Earth. As the infrared energy is absorbed, the air surrounding the earth is heated. An overall warming trend has been recorded since the late 19th century, with the most rapid warming occurring over the past two decades. The 10 warmest years of the last century all occurred within the last 15 years. It appears that the decade of the 1990s was the warmest in human history, and preliminary information is pointing to 2002 possibly being the warmest year on record. Global warming is changing the Earth's climate.

While the evidence for climate change is overwhelming, it is impossible to predict exactly how it will affect California's ecosystems and economy in the future. There are, many areas of concern.

As the average temperature of the Earth increases, weather is affected. Rainfall patterns change. Droughts and flashfloods are likely to become more frequent and intense. Mountain snowcaps will continue to shrink. Climate change and the resulting rise in sea level are likely to increase the threat to buildings, roads, powerlines, etc. Agricultural patterns will change as crops and productivity shift along with the climate change. Physical changes such as these impact California's public health, economy and ecology.

We can expect to see worsening air quality, an increase in the number of weather-related deaths, and a possible increase in infectious diseases. Higher temperatures contribute to increased smog, which is damaging to plants and humans. Climate change also affects forests in ways that increase fire hazards and make forests more susceptible to pests and diseases.

One area of considerable concern is the effect of climate change on California's water supply. During the winter, high in the Sierra Nevada, snow accumulates in a deep pack, preserving much of California's water supply in "cold storage" for the hot, dry summer. If winter temperatures are warmer however, more precipitation will fall as rain, decreasing the size of the snowpack. Heavier rainfall in the winter could bring increased flooding. Less spring runoff from a smaller snowpack will reduce the amount of water available for hydroelectric power production and agricultural irrigation. Evidence of this problem already exists. Throughout the 20th century, annual April to July spring runoff in the Sierra Nevada has been decreasing, with water runoff declining by about ten percent over the last 100 years.

Another predicted outcome of climate change, a rise in sea level, is already being seen in California, with a 3 - 8 inch rise in the last century. This can lead to serious consequences for the large populations living along California's coast. Sea level rise and storm surges can lead to flooding of low-lying property, loss of coastal wetlands, erosion of cliffs and beaches, saltwater contamination of drinking water, and damage to roads and bridges.

Higher temperatures also cause an increase in harmful air emissions -- more fuel evaporates, engines work harder, and demands for electric power increase along with an increase in power plant air pollution. Air pollution is also made worse by increases in natural hydrocarbon emissions from vegetation during hot weather. High temperatures, strong sunlight, and a stable air mass are ideal for formation of ground-level ozone, the most health-damaging constituent of smog. As the temperature rises and air quality diminishes, heat related health problems also increase.

While carbon dioxide is the greenhouse gas emitted in the largest quantity, other greenhouse gases such as methane, nitrous oxide, and hydrofluorocarbons also contribute to climate change. Many greenhouse gases have lifetimes of decades or even centuries in the atmosphere, so the problem cannot be eliminated quickly. Thus, the problems we are experiencing today do not accurately represent the full effects we may see years from now based on current levels of greenhouse gases.

The United States has the highest emissions of greenhouse gases of any nation on Earth. In California, more than half of the fossil fuel emissions of carbon dioxide are related in some way to transportation. Fossil fuel combustion accounts for 98 percent of carbon dioxide emissions.

To lessen the State's contribution to climate change, California needs to start now - to develop integrated strategies that will reduce traffic congestion, criteria air pollutants, and emissions of greenhouse gases from mobile sources. To learn more about greenhouse gases and climate change, access the ARB's Internet site on these subjects at [www.arb.ca.gov](http://www.arb.ca.gov).

**For More Information:**

Call our Public Information Office at (916) 322-2990 or visit our website at [www.arb.ca.gov](http://www.arb.ca.gov)