The Greenhouse Effect and Global Warming

Greenhouse gases have many sources, some related to human activities and some not. The source of greenhouse gases that concern scientists the most is fossil fuel burning. Oil, coal, and natural gas contain carbon that was once in the atmosphere, but has been stored in the lithosphere for millions of years (hence the term "fossil"). When we burn these fuels, we re-introduce the carbon into the atmosphere, some of it in the form of carbon dioxide, a greenhouse gas. (Cement production and other industrial activities are also key sources of carbon dioxide and ozone; rice agriculture and cattle raising produce large amounts of methane, a greenhouse gas that is more rare than CO₂, but far more effective at absorbing and emitting longwave radiation.)

All other things being equal, more greenhouse gas molecules in the atmosphere should mean an increase in the greenhouse effect and a resulting increase in temperatures. The eventual result? Many scientists think that this process of global warming will lead to costly environmental problems.

The greenhouse effect is a very complicated process and is only one of the processes that influences temperatures on earth. In addition, temperatures fluctuate so much from day to day and year to year that it is very difficult to determine for sure whether or not the average global temperatures are actually increasing. Therefore, no one has been able to prove conclusively global warming is actually happening, and scientists disagree as to how much increases in greenhouse gases will affect the earth's climate, if at all.

One source of uncertainty is that scientists only have a limited understanding of all the sources of greenhouse gases and how they are naturally removed from the atmosphere. For example, plants remove carbon dioxide from the atmosphere as part of photosynthesis, but scientists are not certain how much carbon dioxide Earth's plant life absorbs each a year or if this rate would increase if the amount of carbon dioxide in the atmosphere were to increase.
Similarly, animals—including microorganisms that break down dead plant matter—produce carbon dioxide and methane, so we might expect increased rates of plant biomass production to result in increased levels of animal biomass that would not only cycle the carbon stored in plants back into the atmosphere in the form of CO2, but might add more methane, which is a more potent greenhouse gas than either water vapor or CO2, to the atmosphere.

Another important source of uncertainty is the role of clouds. Warmer temperatures may increase the amount of water vapor in the atmosphere, but the effect of this water vapor on temperatures is unclear. On the one hand, water vapor is a greenhouse gas, so increasing it might lead to higher temperatures. On the other hand, if the water vapor condenses and forms clouds, Earth's albedo should increase, blocking sunlight from reaching the surface and thus lowering temperatures.