Global Warming Theory

The highest form of science is measuring data to the highest accuracy possible. The lowest form of science is hypothesizing a model to explain the data. In between is “theory”. (“Laws” are subsets of theories.) A theory is a hypothesis that has been shown to agree with the measured data to a high degree of accuracy. No theory is perfect, in that it may only agree with most of the relevant data, but not all relevant data. Often there are two competing theories over some period of time to explain a data set; later data then can show that one theory is better than the other. Then the lesser one loses its status as the theory for that particular set of data, but it still can be an adequate theory for a reduced set of data. For example, Newton’s theory of motion works very well for human-scale motion, but has been supplanted by Einstein’s theory of relativity for high speeds which has been supplanted by relativistic quantum theory for very small objects such as atoms.

One often sees the phrase “It is just a theory.”, which is meant to denigrate a theory. Contrary to the intention, that is high praise! If one wants to denigrate what is claimed to be a theory, one should state “It is just a hypothesis.”.

The hypothesis of anthropogenic global warming began in 1896. (For a history of the discovery of global warming see http://aip.org/history/climate/index.htm .) As with any scientific theory, one cannot give a specific date when anthropogenic global warming became a theory; it was many years ago.

It is a well-established law of the theory of global warming that carbon dioxide is a major cause of global warming. It is true that other gases contribute to anthropogenic global warming, but carbon dioxide is the main cause. Some other gases cause more short-term global warming than does carbon dioxide, but the longevity of carbon dioxide in the atmosphere gives it the prize. For example, water vapor is a huge cause of global warming, but rapid precipitation removes it from the atmosphere. And it gets there in the first place because of the global warming caused by carbon dioxide. Methane is a powerful cause of global warming, but its concentration is much smaller than carbon dioxide and it reacts to become carbon dioxide and water vapor with a half-life of about a decade. (So, not putting methane into the atmosphere would help reduce global warming, both because of it being there and because it becomes short-lived water vapor and long-lived carbon dioxide.)

The concentration of carbon dioxide in the atmosphere is small, but it is very powerful. For example, the Earth would be frozen if there were no carbon dioxide in the atmosphere. So, the current nearly 400 parts per million of carbon dioxide in the atmosphere does an astonishing job of keeping us warm.

Given that the current amount of carbon dioxide in the atmosphere keeps the Earth from freezing, it is easy to realize that increasing its concentration makes the Earth warmer; it is increasing at about two parts per million per year mostly due to humans burning fossil fuels and cutting down trees; hence, anthropogenic global warming.

The theory of global warming is quite complex. To determine how global warming affects humans requires complicated models incorporating the physics, chemistry and biology of the Earth. There are many such competing models seeking to become theories. Over the last decade the many models have converged into wide agreement on many phenomena of interest to human civilization. For example, much sea-level rise in the future is already certain even if no more carbon dioxide were put into the atmosphere. Also, severe storms will become the norm and increase if the amount of carbon dioxide in the atmosphere keeps rising. Higher temperatures will put more water into the atmosphere, causing floods in areas prone to precipitation and droughts in areas not prone to precipitation. Rapid release of carbon dioxide and methane into the atmosphere will occur if certain triggers happen in the arctic region, such as melting the permafrost.

All of the competing models predict that civilization is headed into a dire global-warming emergency mainly due to burning fossil fuels and deforesting the land. The best way to mitigate the coming emergency is to quit burning fossil fuels. Since the amount of fossil-fuels burning is directly related to the Earth's population, birth control becomes a moral action that humans could take.

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