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Global Warming vs. the Next Ice Age

Will the greenhouse effect prevent the return of glaciers?

by **Franklin Hadley Cocks '63, SM '64, ScD '65** Dec 21, 2009

Global warming is an inescapable issue for our age. But 150 years ago, most scientists believed that Earth had been steadily cooling since it was formed. When Louis Agassiz presented the concept of a Great Ice Age to the Swiss Society of Natural Sciences in 1837, his suggestion that the planet had turned colder and then warmed up again was met with skepticism and even hostility, triggering years of fierce scientific debate before the idea was accepted.

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Exactly why our planet occasionally cools down has taken more than a century to work out. Now we know that cyclic gravitational tugs from Jupiter and Saturn periodically elongate Earth's orbit, and this effect combines from time to time with slow changes in the direction and degree of Earth's tilt that are caused by the gravity of our large moon. Consequently, summer sunlight around the poles is reduced, and high-latitude regions such as Alaska, northern Canada, and Siberia turn cold enough to preserve snow year-round. This constant snow cover reflects a great deal of sunlight, cooling things down even more, and a new ice age begins. Naturally, this process does not occur with anything like the speed portrayed in the movie *The Day After Tomorrow*, but geological and other evidence shows that it happens at least four times.

COLD, HARD FACTS Franklin Hadley Cocks '63 visits the grave of Louis Agassiz, the great proponent of the ice age concept.

With so much attention focused on global warming, this chilly prospect has been all but forgotten. Given how catastrophic another ice age could be, one might be tempted to ask whether a human-caused increase in atmospheric and ocean temperatures will actually be a boon.

There's little question that global warming is happening. Climate data show that Earth's average temperature has risen at least 0.7 °C (1.3 °F) over the 20th century. Temperature increases over the 21st century will probably be two and a half to five times as large,because greenhouse gases like carbon dioxide allow sunlight to penetrate the atmosphere but make it harder for outgoing infrared radiation to escape. What's more, just as carbonated soda fizzes when it warms up, warmer temperatures cause the ocean to release carbon dioxide taken up during colder periods. Analyses of ice trapped in glacial ice over the last 800,000 years show that atmospheric carbon dioxide generally ranged between 200 and 300 parts per million by volume (ppmv); increases in these levels were slightly preceded by increases in temperature caused by natural orbital shifts. During this period, global temperature varied by about 12 °C. Now, carbon levels are approaching 400 ppmv as the burning of fossil fuels pumps more and more carbon dioxide into the atmosphere. Even if the rate of growth could be moderated enough to stabilize levels at about 550 ppmv, average temperatures might well rise by about 5 °C: with devastating effects for us earthlings, such as rising sea levels and dramatic changes in weather patterns.

But even that warming will not stave off the eventual return of huge glaciers, because ice ages last for millennia and fossil fuels will not.In about 300 years, all available fossil fuels may well have been consumed.Over the following centuries, excess carbon dioxide will naturally dissolve into the oceans or get trapped by the formation of carbonate minerals. Such processes won't be offset by the industrial emissions we see today, and atmospheric carbon dioxide will slowly decline toward preindustrial levels. In about 2,000 years, when the types of planetary motions that can induce polar cooling start to coincide again, the current warming trend will be a distant memory.

This means that humanity will be hit by a one-two punch the likes of which we have never seen. Nature is as unforgiving to men as it was to dinosaurs; advanced civilization will not survive unless we develop energy sources that curb the carbon emissions heating the planet today and help us fend off the cold when the ice age comes. Solar, nuclear, and other non-fossil-fuel energy sources need to be developed now, before carbon emissions get out of hand. MIT alumni could play a prominent part in discovering the technology needed to keep us all going. And there are fortunes to be made from the effort. It's worth thinking about.

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