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## Warming called a global 'experiment'

**Schrag says climate change will probably affect poorer countries disproportionately**

**By Alvin Powell**  
 Harvard News Office

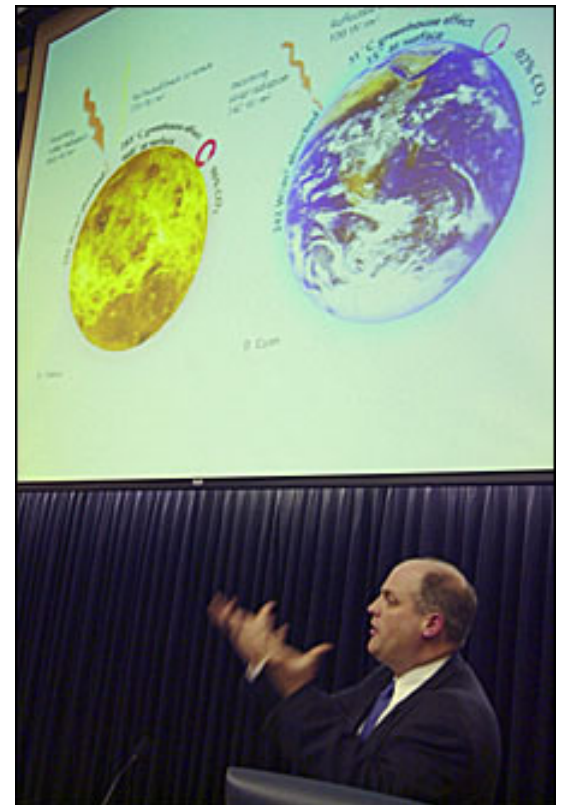
It will likely take an extreme storm, a devastating flood, or a killer heat wave to spur Americans into action against global warming, a Harvard climate scientist said Monday (Dec. 6), and the longer action is delayed, the worse the warming will be.

Professor of Earth and Planetary Sciences Daniel Schrag, director of the Harvard University Center for the Environment, outlined the scientific evidence for global warming before an audience of about 100 at the Harvard School of Public Health's Snyder Auditorium.

Schrag, introduced by Harvard School of Public Health Dean Barry Bloom, delivered the Dean's Distinguished Lecture and concluded that human-caused climate change is inevitable, though scientists don't know exactly how severe or even exactly what its effects will be.

Schrag said the public health effects related to climate change would probably be most severe in poorer nations. Though climate effects will be experienced in richer nations, those countries have the resources to adapt and protect the health of their citizens.

Schrag pointed to Hurricane Mitch, which devastated Honduras in 1998, compared with this year's series of hurricanes that slammed into Florida, with relatively low loss of life. Though some researchers expect that a warmer environment will mean a spread of infectious tropical diseases,



Daniel Schrag: 'We are performing an experiment on a planetary scale that hasn't been done for millions of years. Nobody knows what's going to happen and there will be surprises.' (Staff photo Jon Chase/Harvard News Office)

## Calendar

Two-week  
listing of  
upcoming events

like malaria, into cooler latitudes, Schrag said he thought developed nations' public health systems are up to the challenge.

Though poorer nations may be hardest hit by climate change, Schrag said it would be a mistake to divert attention from global warming to pour resources into developing those nations. Though there is much uncertainty about global warming, Schrag said, it appears clear that the effects will be dramatic and widespread.

"We are performing an experiment on a planetary scale that hasn't been done for millions of years," Schrag said. "Nobody knows what's going to happen and there will be surprises."

Researchers have looked to the past for clues about the future. The Eocene Period, 55 million years ago, appears to be the last time carbon dioxide in the Earth's atmosphere reached 500 parts per million, which is where optimistic estimates project carbon dioxide levels to reach by 2100, Schrag said.

At that time, it appears temperatures warmed into the higher latitudes, with palm trees growing as far north as Wyoming, pine forests growing in Antarctica, and crocodiles living in Greenland. Temperatures in the deep ocean, 35 degrees Fahrenheit today, were 20 degrees warmer, and global sea level was 300 feet higher than today.

"This is where we're heading. The question is how long will it take to get there. A thousand years? Ten thousand years? Or 500 years?" Schrag said.

One thing that worries scientists is that current computer models of the Earth's climate can't recreate a scenario with a warm climate that far north, even with higher carbon dioxide levels. That means that scientists are missing a critical factor in their understanding of how global climate works, Schrag said.

Even so, Schrag said, he believes the Eocene warming resulted from a doubling or tripling of carbon dioxide levels in the atmosphere, similar to what's expected over the next century. In the 1950s, carbon dioxide levels were about 330 parts per million. Already today, they've risen to about 380 parts per million - the highest level in 430,000 years - with projections for the next century ranging from 500 parts per million to 1,000 parts per million.

Climate history also belies the widespread belief that global climate will change slowly and gradually. Though climactic cycles such as ice ages and interglacial warming periods do indeed occur on cycles of tens of thousands of years, Schrag said other evidence shows that dramatic warming - at least locally - can happen over the course of decades. Evidence from around the world already shows that alpine glaciers are melting and scientists are concerned about sudden melting of ice sheets in west Antarctica and Greenland, each of which could raise global sea levels by six meters. Even without the melting of major ice sheets, scientists expect a 30 centimeter rise in sea level merely from expansion due to rising water temperatures.

Another concern, Schrag said, is the slow response time of global systems. Atmospheric carbon dioxide levels are quick to rise but slow to decline, even with cuts in emissions.

Schrag said the technical challenge facing the world is formidable, particularly with increasing development in large nations like China and India, much of which will likely be fueled by coal. He said a coordinated effort is important, though he termed the recent Kyoto Protocol "a drop in the bucket."

"Anyone who says climate scientists aren't really sure what will happen, they're right," Schrag said. "We haven't seen anything like this."

[alvin\\_powell@harvard.edu](mailto:alvin_powell@harvard.edu)

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