

# Scientists: Pace of Climate Change Exceeds Estimates

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Sunday, February 15, 2009; A03

CHICAGO, Feb. 14 -- The pace of global warming is likely to be much faster than recent predictions, because industrial greenhouse gas emissions have increased more quickly than expected and higher temperatures are triggering self-reinforcing feedback mechanisms in global ecosystems, scientists said Saturday.

"We are basically looking now at a future climate that's beyond anything we've considered seriously in climate model simulations," Christopher Field, founding director of the Carnegie Institution's Department of Global Ecology at Stanford University, said at the annual meeting of the American Association for the Advancement of Science.

Field, a member of the United Nations' Intergovernmental Panel on Climate Change, said emissions from burning fossil fuels since 2000 have largely outpaced the estimates used in the U.N. panel's 2007 reports. The higher emissions are largely the result of the increased burning of coal in developing countries, he said.

Unexpectedly large amounts of carbon dioxide are being released into the atmosphere as the result of "feedback loops" that are speeding up natural processes. Prominent among these, evidence indicates, is a cycle in which higher temperatures are beginning to melt the arctic permafrost, which could release hundreds of billions of tons of carbon dioxide and methane into the atmosphere, said several scientists on a panel at the meeting.

The permafrost holds 1 trillion tons of carbon, and as much as 10 percent of that could be released this century, Field said. Along with carbon dioxide melting permafrost releases methane, which is 25 times more potent a greenhouse gas than carbon dioxide.

"It's a vicious cycle of feedback where warming causes the release of carbon from permafrost, which causes more warming, which causes more release from permafrost," Field said.

Evidence is also accumulating that terrestrial and marine ecosystems cannot remove as much carbon from the atmosphere as earlier estimates suggested, Field said.

In the oceans, warmer weather is driving stronger winds that are exposing deeper layers of water, which are already saturated with carbon and not as able to absorb as much from the atmosphere. The carbon is making the oceans more acidic, which also reduces their ability to absorb carbon.

On land, rising carbon dioxide levels had been expected to boost plant growth and result in greater sequestration of carbon dioxide. As plants undergo photosynthesis to draw energy from the sun, carbon is drawn out of the atmosphere and trapped in the plant matter. But especially in northern latitudes, this effect may be offset significantly by the fact that vegetation-covered land absorbs much more of the sun's heat than snow-covered terrain, said scientists on the panel.

Earlier snowmelt, the shrinking arctic ice cover and the northward spread of vegetation are causing the Northern Hemisphere to absorb, rather than reflect, more of the sun's energy and reinforce the warming trend.

While it takes a relatively long time for plants to take carbon out of the atmosphere, that carbon can be released rapidly by wildfires, which contribute about a third as much carbon to the atmosphere as burning fossil fuels, according to a paper Field co-authored.

Fires such as the recent deadly blazes in southern Australia have increased in recent years, and that trend is expected to continue, Field said. Warmer weather, earlier snowmelt, drought and beetle infestations facilitated by warmer climates are all contributing to the rising number of fires linked to climate change. Across large swaths of the United States and Canada, bark beetles have killed many mature trees, making forests more flammable. And tropical rain forests that were not susceptible to forest fires in the past are likely to become drier as temperatures rise, growing more vulnerable.

Preventing deforestation in the tropics is more important than in northern latitudes, the panel agreed, since lush tropical forests sequester more carbon than sparser northern forests. And deforestation in northern areas has benefits, since larger areas end up covered in exposed, heat-reflecting snow.

Many scientists and policymakers are advocating increased incentives for preserving tropical forests, especially in the face of demand for clearing forest to grow biofuel crops such as soy. Promoting biofuels without also creating forest-preservation incentives would be "like weatherizing your house and deliberately keeping your windows open," said Peter Frumhoff, chief of the Union of Concerned Scientists' climate program. "It's just not a smart policy."

Field said the U.N. panel's next assessment of Earth's climate trends, scheduled for release in 2014, will for the first time incorporate policy proposals. It will also include complicated models of interconnected ecosystem feedbacks.

The panel's last report noted that preliminary knowledge of such feedbacks suggested that an additional 100 billion to 500 billion tons of greenhouse gas emissions would have to be prevented in the next century to avoid dangerous global warming. Currently, about 10 billion tons of carbon are emitted each year.