

College of Natural Resources
University of California, Berkeley
Breakthroughs, Volume 2, Number 2
Fall 1996

New Findings on Global Warming

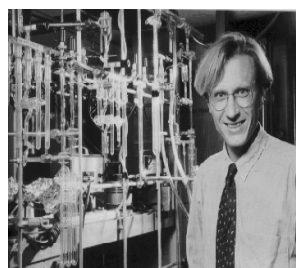
Scientists Discover Carbon Stored in Soils Will Effect Global Warming

As global warming heats the Earth's surface, soils worldwide will release carbon dioxide into the air and intensify environmental problems, report researchers at UC Berkeley, UC Irvine, and UC Santa Barbara in the April 19 issue of Science.

If the Earth's temperature rises even half a degree, forest soils alone will release as much carbon dioxide as 25 percent of that emitted annually from burning fossil fuels in cars, factories, and the like, according to the paper.

Carbon dioxide is a colorless gas that helps trap heat in the atmosphere.

"The amount of carbon that would be shed into the atmosphere from soils would be very significant," says RONALD AMUNDSON, Associate Professor of Ecosystem Sciences at CNR and one of three researchers on the project. His collaborators were SUSANN E. TRUMBORE of UC Irvine and OLIVER A. CHADWICK of UC Santa Barbara.



Ronald Amundson

Jane Scherr photo

"Soils contain more carbon than all the Earth's plants plus everything in the atmosphere," says Amundson. "Soils add carbon to the air as microbes decompose the humus they contain. This humus in soil doesn't necessarily look very exciting, but it's a very dynamic part of the global carbon cycle."

How carbon from soils cycles into the atmosphere and back is important because of the so-called greenhouse effect, in which rays of light from the SUN bounce off the Earth as infrared radiation and are trapped by molecules of carbon dioxide and water vapor in the atmosphere.

Like the glass panes of a greenhouse, this interaction warms the planet. Without it, the Earth would be colder than 50 degrees below zero.

However, scientists worry too much of a good thing could be a problem. Because carbon dioxide molecules are spewed into the air as pollutants and blanket the Earth, the result could be global climate change with temperatures climbing as much as 5 degrees Celsius by the middle of the next century.

Previously there were not enough data to factor soils into global warming predictions, though they were considered a potentially important aspect of the problem, says Amundson.

"There's a constant cycle of carbon dioxide from photosynthesis into plants that ultimately die and then decompose into the soil," says Amundson. "The carbon is finally released from the soil back into the atmosphere as carbon dioxide by microbes."

Heating of soil through global warming will stimulate the microbes and force the soil to give up more carbon into the air, he and his collaborators found.

Also, "the warmer the site is, the faster biological processes go on and the faster the carbon cycles," Amundson says.

Oddly, the work of the three UC researchers depended on an unanticipated result of nuclear bomb testing.

"There was a greatly increased carbon-14 content in atmospheric carbon dioxide in the late '50s and early 60s when the Soviet Union and the United States began to do above-ground nuclear testing," said Amundson. "The carbon-14 in the atmosphere shot up dramatically to nearly double of what it was and it's been slowly dropping back down, so now it's approaching pre-nuclear testing levels."

This effect pulsed soils worldwide with a radioactive tracer for carbon.

"Carbon-14 has no known global health effects but it has provided an interesting chemical signature to see how fast carbon is cycled in soils," said Amundson.

However, to make the comparison in carbon-14 contents between soils collected before this radioactive pulse and after; the three scientists needed to locate old soil samples "systematically collected a long time ago with the location carefully recorded and then stored to prevent contamination," said Amundson.

UC Berkeley held the unlikely treasure trove: about 15,000 jars of dirt sitting around in a warehouse for 40 years. Originally, the samples were collected to map soil types in California.

They're in quart-sized glass jars, row after row of these things, many in typical canning jars. Every once in a while the department had to make a decision whether it should throw them out," Amundson said.

Keeping them paid off. It's now the best collection of pre-nuclear age California soils in existence, and only one of two such extensive and well-documented soil collections in the US. UC Berkeley's collection made it possible for the three UC campuses to complete the project.