

# Sudden Collapse in Ancient Biodiversity: Was Global Warming the Culprit?

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Ancient fossil leaves tell a story of sudden loss of biodiversity that may have future parallels.

Scientists have unearthed striking evidence for a sudden ancient collapse in plant biodiversity. A trove of 200 million-year-old fossil leaves collected in East Greenland tells the story, carrying its message across time to us today.

Results of the research appear in this week's issue of the journal *Science*.

The researchers were surprised to find that a likely candidate responsible for the loss of plant life was a small rise in the greenhouse gas carbon dioxide, which caused Earth's temperature to rise.

Global warming has long been considered as the culprit for

extinctions--the surprise is that much less carbon dioxide gas in the atmosphere may be needed to drive an ecosystem beyond its tipping point than previously thought.

"Earth's deep time climate history reveals startling discoveries that shake the foundations of our knowledge and understanding of [climate change](#) in modern times," says H. Richard Lane, program director in the National Science Foundation (NSF)'s Division of Earth Sciences, which partially funded the research.

Jennifer McElwain of University College Dublin, the paper's lead author, cautions that sulfur dioxide from extensive volcanic emissions may also have played a role in driving the plant extinctions.

"We have no current way of detecting changes in sulfur dioxide in the past, so it's difficult to evaluate whether [sulfur dioxide](#), in addition to a rise in carbon dioxide, influenced this pattern of extinction," says McElwain.

The time interval under study, at the boundary of the Triassic and Jurassic periods, has long been known for its plant and animal extinctions.

Until this research, the pace of the extinctions was thought to have been gradual, taking place over millions of years.

It has been notoriously difficult to tease out details about the pace of extinction using fossils, scientists say, because fossils can provide only snap-shots or glimpses of organisms that once lived.

Using a technique developed by scientist Peter Wagner of the Smithsonian Institution National Museum of Natural History in Washington, D.C., the researchers were able to detect, for the first time,

very early signs that these ancient ecosystems were already deteriorating--before plants started going extinct.

The method reveals early warning signs that an ecosystem is in trouble in terms of extinction risk.

"The differences in species abundances for the first 20 meters of the cliffs [in East Greenland] from which the fossils were collected," says Wagner, "are of the sort you expect. "But the final 10 meters show dramatic losses of diversity that far exceed what we can attribute to sampling error: the ecosystems were supporting fewer and fewer species."

By the year 2100, it's expected that the level of carbon dioxide in the modern atmosphere may reach as high as two and a half times today's level.

"This is of course a 'worst case scenario,'" says McElwain. "But it's at exactly this level [900 parts per million] at which we detected the ancient biodiversity crash.

"We must take heed of the early warning signs of deterioration in modern ecosystems. We've learned from the past that high levels of species extinctions--as high as 80 percent--can occur very suddenly, but they are preceded by long interval of ecological change."

The majority of modern ecosystems have not yet reached their tipping point in response to climate change, the scientists say, but many have already entered a period of prolonged ecological change.

"The [early warning](#) signs of deterioration are blindingly obvious," says McElwain. "The biggest threats to maintaining current levels of biodiversity are land use change such as deforestation. "But even

relatively small changes in [carbon dioxide](#) and global temperature can have unexpectedly severe consequences for the health of ecosystems."

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