

Harvard Forest's response to CO₂ reveals past and future for the New England landscape

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New genetic analyses show that some common Amazon tree species are more than 8 million years old. The analysis also reveals that these surprisingly old species have endured past periods of significant climate warming. It therefore appears unlikely that human-caused temperature increases alone will cause mass extinctions of the trees in the coming century. Find out more in this news release. Credit: Christopher Dick

You might never know it, but the seemingly quiet Harvard Forest in Massachusetts is actually hard at work. Like other forests, it's busy doing some serious global housekeeping, which is being monitored by scientists at Harvard University.

"There's this enormous sucking sound, metaphorically speaking, that is happening across the New England landscape and the eastern U.S. It's the carbon being brought down out of the atmosphere, into our forests, which is reducing the amount that is up in the atmosphere," says David Foster, who is director of the Harvard [Forest](#), which stretches for 3,000 acres near Petersham, Mass., about 60 miles west of Boston.

With support from the National Science Foundation (NSF), Foster and other researchers here study [forest ecology](#). "We're trying to understand what shaped the land, where the landscape is going, and what's going to be the fate of the land in the Eastern United States," he explains. That research includes determining how the forest responds to carbon dioxide in the atmosphere.

"Research at the Harvard Forest integrates data collected at multiple time scales, from minutes to centuries, to understand how complex forests function," explains Saran Twombly, program director for [Long Term Ecological Research](#), within the NSF's Directorate for Biological Sciences. "These long-term studies have been necessary to show that slow-growing forests can respond to rapid environmental change. They emphasize the age-old adage that understanding the past is essential to predicting the future."



At Harvard Forest in 1990, a team of scientists recreated a major hurricane in a two-acre patch of mature oak forest. Eighty percent of the trees were flattened with a large winch and cable. Half the trees died within three years, and the scientists left the dead and damaged wood on the ground. In the 20 years since, the researchers have monitored everything from soil chemistry to the density of leaves on the trees. Find out more in this news release. Credit: Marcheterre Fluet

On the day we visited, [atmospheric scientist](#) Bill Munger was climbing up one of two 100-foot towers used to collect [air samples](#). It looks rather risky, as Munger harnesses himself to the tower just before his climb. He cautions that, "if you are really afraid of heights and don't trust your equipment, you can be kind of afraid."

Apparently, he's not. As Munger starts his climb up the tower to change some filters that keep dust from contaminating his instruments, he explains that the carbon dioxide (CO₂) measurements are made four times a second, and concentrations change, depending on whether the

wind gusts are moving up or down.



In U.S. Northeast and Mid-Atlantic regions the reds and golds of fall might someday fade. Autumn colors were different there a century, or even a half-century, ago, and they will likely continue to change, says ecologist David Foster at the Harvard Forest Long-Term Ecological Research (LTER) site in Massachusetts. Harvard Forest is one of 26 such NSF LTER sites around the world in ecosystems from forests to deserts, grasslands to coral reefs. Learn more in this Discovery. Credit: David Lee

"It goes past our sensors, our inlets, and we look at the difference in concentrations or temperature of the air going down and the air coming back up, and then we can add that up over a half an hour and get during that half hour how much CO₂ went into the forest or how much came out of the forest," explains Munger.

"So, we get the balance between the incoming and outgoing CO₂, and we measure that throughout the year and then we can add it up and say 'this forest took up two tons of carbon for every hectare,' or 'it didn't take up any,' or 'it gave some back.'"



Rivers and streams in the United States are releasing substantially more carbon dioxide into the atmosphere than previously thought. The findings could change the way scientists model the movement of carbon among land, water and the atmosphere. Find out more in this news release. Credit: William Sobzak, College of the Holy Cross

After analyzing decades of data, Munger says the [Harvard Forest](#) is drawing more and more carbon from the atmosphere every year. He says they've concluded that "every year the forest has been taking up 2 to

maybe 4 metric tons of carbon."

Globally, we emit more than 30 billion metric tons of CO₂ annually, and that number continues to rise. The forests are working overtime. Foster can confirm that because he says the forest is, "storing more carbon in the form of wood and in the form of material that gets stored, and built into the soils around this landscape."

Foster says forests can't solve the climate problem because globally we pump far more CO₂ into the atmosphere than they can take out, but he believes forests are more critical than ever for managing CO₂ levels.

More information:

www.nsf.gov/news/news_summ.jsp?cntn_id=126283

www.nsf.gov/news/news_summ.jsp?cntn_id=125744

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