# UNH Research Finds Trees Adapt to Changes Caused by Climate Change

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DURHAM, N.H.— Research from the University of New Hampshire finds that the increase in carbon dioxide (CO2) emitted into the atmosphere by human activity and fossil fuels is altering the way forests grow and use water. Scientists found that trees in the United States respond to this rise in CO2 by using it to grow faster or by conserving water, depending on whether water is abundant or scarce. Their results differ from existing literature about how forests are helping to mitigate climate change.

**TREES IN ONE OF THE SITES WHERE UNH RESEARCHERS EXTRACTED WOOD CORES FROM TREES STEMS TO ANALYZE CARBON AND OXYGEN ISOTOPES ON THE LAST 30 YEARS TO HELP DETERMINE HOW THEY RESPONDED TO THE RISE IN ATMOSPHERIC CO2 AND CLIMATE VARIABILITY. *PHOTO CREDIT: UNH***

“Plants are smart,” said Scott Ollinger, director of the UNH Earth Systems Research Center. “If you give them more CO2 and they don’t need to conserve water, they’ll photosynthesize faster and continue to lose water at the same rate. But at sites where water is scarce, they shift toward conserving water at the expense of faster growth.”

The study (https://www.pnas.org/content/early/2019/07/30/1905912116), recently published in the Proceedings of the National Academy of Sciences, focused on the water-use efficiency of forests, which is the tradeoff between CO2 uptake during photosynthesis and water loss during transpiration, or the evaporation of water through plant leaves. Trees take in water and CO2 to grow and they emit water vapor through pores in their leaves as a result; they can adjust the amount they take up or emit based on changing environmental conditions. Scientists previously suspected the increase in atmospheric CO2 levels would cause trees to lose less water, but this new research provides a more complicated story.

“Water-use efficiency indicates how much a plant grows based on how much water they use,” said Ollinger. “It’s like a car’s miles per gallon, but instead it’s tons of carbon per gallon of water.”

Water-use efficiency has been increasing in trees across the globe, but it was unclear how and why that’s been happening. The research team examined eight sites representing a range of water availability across the country. They extracted wood cores from the stems of the two most dominant tree species on each site, and the most recent 30 years were identified, with each ring analyzed for carbon and oxygen isotopes — a technique that ultimately helped scientists discern what is happening with the trees.

"This isotope approach is the only method that allows us to figure out how trees have responded to the rise in atmospheric CO2 and climate variability over the past decades or even the past century," said Rossella Guerrieri, a UNH post-doctoral researcher, now at the Centre for Ecological Research and Forestry Applications in Barcelona, Spain, and first author on the study.

The researchers also found that different tree species have different capabilities and make different carbon/water tradeoffs. Because climate variability is increasing, the implication is that maintaining a diversity of tree species will help forests continue providing the climate mitigation benefits we rely on. Researchers hope the results will encourage scientists who model climate change to incorporate plants into their equations.

Funding for this research was provided by the National Science Foundation (NSF), NASA and USDA through the New Hampshire Agricultural Experiment Station.

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Caption: Trees in one of the sites where UNH researchers extracted wood cores from trees stems to analyze carbon and oxygen isotopes on the last 30 years to help determine how they responded to the rise in atmospheric CO2 and climate variability.*Photo credit: UNH*

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Caption: Extracted wood core from trees stems taken by UNH researchers to analyze carbon and oxygen isotopes on the last 30 years to help determine how they responded to the rise in atmospheric CO2 and climate variability. *Photo credit: UNH*

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