NEWS RELEASE

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Tree Productivity May Affect the Rate of Climate Change, Researchers Say

FOR IMMEDIATE RELEASE

Free air carbon enrichment (FACE) experiment site in Rhinelander, Wis.

A team of researchers, including a professor from North Carolina State University, has discovered that increasing concentrations of carbon dioxide (CO_2) in the atmosphere may cause forests to increase their ability to remove the gas from the air. This finding could have important implications for the future rate of global climate change.

Dr. John King, assistant professor of tree physiology at NC State, is among a team of researchers who studied the effects of increased atmospheric CO_2 on forests. The team published their findings in the Dec. 5 online edition of the *Proceedings of the National Academy of Sciences.*

Trees utilize carbon dioxide in the process known as photosynthesis. The trees remove CO_2 molecules from the atmosphere through their leaves and turn them into carbohydrates that fuel growth. Scientists wanted to learn whether increasing amounts of atmospheric CO_2 would cause forests to grow more rapidly, enhancing forest net primary production (NPP), or the amount of wood, roots, and leaves that forests produce.

The team conducted free air carbon dioxide enrichment (FACE) studies in four different forest types located in the United States and Italy. Using a computer-controlled air monitoring and CO_2 delivery system, the scientists increased the amount of atmospheric CO_2 in those forests to the level that they believe will be in the atmosphere by the year 2050: 550 parts per million (ppm) compared to current CO_2 levels of approximately 370 ppm today.

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The researchers found that the trees exposed to the higher levels of CO_2 increased NPP by a median of 23 percent across a wide range of forest types, ages and productivity levels. These results suggest that the forest response to elevated atmospheric CO_2 is widely conserved – or stays about the same – across temperate forest ecosystems. This knowledge will help scientists to more accurately predict the future behavior of the global carbon cycle and climate system in response to rising atmospheric CO_2 using complex computer simulation models.

The researchers caution, however, that local variation in such factors as water and nutrient availability in soil, pathogens, or other forms of pollution may cause responses of some forests to differ from those observed in the FACE experiments.

"If global forest NPP is stimulated to the extent observed in our experiments, then forests will effectively scrub more carbon dioxide out of the atmosphere," King says. "Since carbon dioxide is a potent greenhouse gas, the hope is that this could decrease the rate of climate change worldwide by counteracting the greenhouse effect."

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Note to editors: An abstract of the paper follows.

"Forest response to elevated CO_2 is conserved across a broad range of productivity"

Authors: Richard J. Norby, Oak Ridge National Laboratory; William H. Schlesinger, Duke University; John King, North Carolina State University; et al
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Abstract: Climate change predictions derived from coupled carbon-climate models are highly dependent on assumptions about feedbacks between the biosphere and atmosphere. One critical feedback occurs if C uptake by the biosphere increases in response to the fossil-fuel driven increase in atmospheric [CO_2] ("CO_2 fertilization"), thereby slowing the rate of increase in atmospheric [CO_2]. Carbon exchanges between the terrestrial biosphere and atmosphere are often first represented in models as net primary productivity (NPP). However, the contribution of CO_2 fertilization to the future global C cycle has been uncertain, especially in forest ecosystems that dominate global NPP, and models that include a feedback between terrestrial biosphere metabolism and atmospheric [CO_2] are poorly constrained by experimental evidence. We analyzed the response of NPP to elevated CO_2 (550 ppm) in four free-air CO_2 enrichment experiments in forest stands. We show that the response of forest NPP to elevated [CO_2] is highly conserved across a broad range of productivity, with a stimulation at the median of 23 +/- 2%. At low leaf area indices, a large portion of the response was attributable to increased light absorption, but as leaf area indices increased, the response to elevated [CO_2] was wholly caused by increased light-use efficiency. The surprising consistency of response across diverse sites provides a benchmark to evaluate predictions of ecosystem and global models and allows us now to focus on unresolved questions about carbon partitioning and retention, and spatial variation in NPP response caused by availability of other growth limiting resources.