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Study finds greenhouse gas carbon dioxide ramps up aspen growth

Summary: Chris Cole, professor of biology, and Jon Anderson, professor of mathematics, and Wisconsin colleagues find a surprising response to carbon dioxide.

(December 18, 2009)-The rising level of atmospheric carbon dioxide may be fueling more than climate change. It could also be making some trees grow like crazy.

That is the finding of a new study of natural stands of quaking aspen, one of North America's most important and widespread deciduous trees. The study, by scientists from the University of Wisconsin, Madison and the University of Minnesota, Morris and recently published in the *Global Change Biology* journal, shows that elevated levels of atmospheric carbon dioxide over the past 50 years have boosted aspen growth rates by an astonishing 50 percent.

Christopher Cole, Morris professor of biology, and Jon Anderson, Morris professor of mathematics, conducted the new study with University of Wisconsin, Madison colleagues Rick Lindroth, professor of ecology, and Don Waller, professor of botany and environmental studies.

"Trees are already responding to a relatively nominal increase in atmospheric carbon dioxide over the past 50 years," says Lindroth, an expert on plant responses to climate change.

The study's findings are important as the world's forests, which cover about 30 percent of the Earth's land surface, play an important role in regulating climate and sequestering greenhouse gases. The forests of the Northern Hemisphere, in particular, act as sinks for carbon dioxide, helping to offset the increase in levels of the greenhouse gas, widely viewed as a threat to global climate stability.

What's more, according to the study's authors, the accelerated growth rates of aspen could have widespread unknown ecological consequences. Aspen is a dominant tree in mountainous and northern forested regions of North America, including 42 million acres of Canadian forest and up to 6.5 million acres in Minnesota and Wisconsin. Aspen and their poplar cousins are considered "foundation species," meaning they exert a strong influence on the plant and animal communities and dynamics of the forest ecosystems where they reside.

"We can't forecast ecological change. It's a complicated business," explains Waller. "For all we know, this could have very serious effects on slower growing plants and their ability to persist."

Carbon dioxide, scientists know, is food for plants, which extract it from the air and through the process of photosynthesis convert it to sugar, plant food.

Previously, scientists have shown that plants and trees in growth chambers respond to levels of carbon dioxide well above levels in the atmosphere. The new study is the first to show that aspen in their native forest environments are already growing at accelerated rates due to rising ambient levels of carbon dioxide in the atmosphere.

“It’s a change hiding right in front of us,” says Cole. “Aspens respond to all sorts of things we had to account for—water, genetics, and other factors—but the strong response to carbon dioxide surprised all of us.”

The study measured the growth rates of 919 trees from Wisconsin forests dominated by aspen and birch. Trees ranging in age from 5 to 76 years old were sampled and subjected to tree ring analysis. Comparing the tree ring data, a measure of annual tree growth, with records of atmospheric carbon dioxide, the researchers were able to correlate increased rates of growth with changes in the chemistry of the air.

The surprising increase in growth rates for the trees sampled in the study is coupled, the authors note, with moist conditions. By contrast, aspen in the western United States do not seem to grow as fast as those in the American Midwest, most likely due to recent extended periods of drought. Also, while the researchers found that aspen grow much faster in response to elevated carbon dioxide, similar effects have not been observed in other trees species, notably oak and pine.

Findings from the new study, the authors note, could augur revisions of the estimates of how much carbon northern temperate northern forests can sequester.

“Forests will continue to be important to soak up anthropogenic carbon dioxide,” says Waller. “But we can’t conclude that aspen forests are going to soak up excess carbon dioxide. This is going to plateau.”

“Aspens are already doing their best to mitigate our inputs,” agrees Cole. “The existing trees are going to max out in a couple of decades.”

The National Science Foundation and the University of Minnesota, Morris funded the study.

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