

# Drought-exposed leaves adversely affect soil nutrients, study shows

April 5 2011, by Brian Wallheimer

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Jeff Dukes is studying the effects of a changing climate on plants and soils.  
Credit: Purdue Agricultural Communication photo/Tom Campbell

Chemical changes in tree leaves subjected to warmer, drier conditions that could result from climate change may reduce the availability of soil nutrients, according to a Purdue University study.

Jeff Dukes, an associate professor of forestry and natural resources, found that red maple leaves accumulate about twice as much tannin when exposed to hot, droughtlike conditions. Those tannins, which defend leaves from [herbivores](#) and pathogens, were shown to interfere

with the function of common enzymes in soil.

"When the leaves are particularly water-stressed by drought or drought with higher temperatures, we see more protective compounds, more tannins and a change in the chemistry of the tannins," said Dukes, whose findings were published in the early online version of the journal *New Phytologist*. "This suggests that when these leaves fall, they may slow down soil processes such as decomposition and [nutrient cycling](#). This could, in turn, affect plant growth and nutrient uptake."

The findings are the first for the Boston Area Climate Experiment, a National Science Foundation-funded project that Dukes directs. Plants on several field plots are exposed to various future [climate scenarios](#) using heaters and other means to control conditions.

"We've basically built a big time machine that moves different plots of land into different possible futures by changing temperatures and precipitation levels," Dukes said.

The increase in leaf tannins observed in this experiment could cause leaves to decompose more slowly and also interfere with critical soil enzymes, leaving fewer nutrients for plants. The tannins in the red maple leaves also were chemically different, making them interact more strongly with the soil enzymes.

Dukes said the tannin issue could effect a sort of tug-of-war in the [carbon cycle](#). With fewer nutrients, plants would take carbon dioxide out of the air more slowly. But if fallen leaves are decomposing slower, then the carbon would be released back to the atmosphere more slowly.

"This is an issue that could affect many natural processes," Dukes said. "We just don't know what the net result will be."

In this experiment, leaves were removed from the experiment plots and tested in laboratories. Dukes said he would next test other plants' leaves exposed to similar conditions to see how their tannins are affected. He also will test his findings in the field to see how an increase in tannins affects soil in a natural setting.

Provided by Purdue University

Citation: Drought-exposed leaves adversely affect soil nutrients, study shows (2011, April 5)  
retrieved 27 April 2024 from

<https://phys.org/news/2011-04-drought-exposed-adversely-affect-soil-nutrients.html>

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