Logging destabilizes forest soil carbon over time, study finds

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Chelsea Petrenko, a doctoral candidate at Dartmouth College, is lead author of a study showing that logging triggers the gradual release of the carbon stored in a forest's mineral soils. Credit: Dartmouth College

Logging doesn't immediately jettison carbon stored in a forest's mineral soils into the atmosphere but triggers a gradual release that may contribute to climate change over decades, a Dartmouth College study finds.

The results are the first evidence of a regional trend of lower carbon pools in soils of harvested hardwood forests compared to mature or

pristine hardwood forests. The findings appear in the journal *Global Change Biology Bioenergy*.

Despite scientists' growing appreciation for soil's role in the global carbon cycle, mineral soil carbon pools are largely understudied and previous studies have produced differing results about logging's impact. For example, the U.S. Forest Service assumes that all soil carbon pools do not change after timber harvesting.

The Dartmouth researchers looked at how timber harvesting affects mineral soil carbon over 100 years following harvest in the northeastern United States, where soils account for at least 50 percent of total ecosystem carbon storage. Mineral soils, which underlie the carbon-rich organic layer of the soil, make up the majority of that storage, but are sometimes not included in carbon studies due to the difficulty in collecting samples from the rocky, difficult terrain. The researchers hypothesized that the mineral soil carbon would be lower in forests that had been harvested in the last century than in forests that were more than 100 years old. They collected mineral soil cores from 20 forests in seven areas across the northeastern United States and compared the relative amounts of carbon in the soil from forests that were logged five years ago, 25 years ago, 50 years ago, 75 years ago and 100 years ago.

The results showed no significant differences between mineral soil carbon in the older versus harvested forests. But there was a significant relationship between the time since forest harvest and the size of the carbon pools, which suggested a gradual decline in carbon across the region that may last for decades after harvesting and result in increased atmospheric carbon dioxide.

"Our study suggests that forest harvest does cause biogeochemical changes in mineral soil, but that a small change in a carbon pool may be difficult to detect when comparing large, variable carbon pools," says

lead author Chelsea Petrenko) (formerly Vario), a doctoral candidate in the Graduate Program in Ecology and Evolutionary Biology and a trainee in Dartmouth's IGERT program for Polar Environmental Change. "Our results are consistent with previous studies that found that soil carbon pools have a gradual and slow response to disturbance, which may last for several decades following harvest."

A previous Dartmouth study found that clear-cutting releases detectible amounts of carbon stored in deep forest soils, challenging the notion that burning woody biomass for energy is more carbon-neutral than fossil fuels. "Mineral soil, which is the most significant ecosystem carbon pool in temperate forests, should be studied more closely before the carbon neutrality of bioenergy from local wood in temperate forests is asserted," says Petrenko, whose research focuses on the biogeochemistry of warming ecosystems and the impact on climate change.

Provided by Dartmouth College

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