

# Global warming is changing organic matter in soil

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(PhysOrg.com) -- New research shows that we should be looking to the ground, not the sky, to see where climate change could have its most perilous impact on life on Earth.

Scientists at the University of Toronto Scarborough have published research findings in the prestigious journal, *Nature Geoscience*, that show global warming actually changes the molecular structure of organic matter in soil.

"Soil contains more than twice the amount of carbon than does the atmosphere, yet, until now, scientists haven't examined this significant carbon pool closely," says Myrna J. Simpson, principal investigator and Associate Professor of Environmental Chemistry at UTSC. "Through our research, we've sought to determine what soils are made up of at the molecular level and whether this composition will change in a warmer world."

Soil organic matter is what makes dirt fertile and able to support plant life – both of which are especially important for agriculture. Organic matter retains water in the soil and prevents erosion. Natural processes of decomposition of soil organic matter provide plants and microbes with the energy source and water they need to grow, and carbon is released into the atmosphere as a by-product of this process. Warming temperatures are expected to speed up this process which will increase the amount of CO<sub>2</sub> that is transferred to the atmosphere.

"From the perspective of agriculture, we can't afford to lose carbon from the soil because it will change soil fertility and enhance erosion" says Simpson. "Alternatively, consider all the carbon locked up in permafrost in the Arctic. We also need to understand what will happen to the stored carbon when microbes become more active under warmer temperatures."

Until Simpson's research, scientists didn't know

much about soil's molecular composition. Part of the reason is that, from a chemical perspective, soil is difficult to analyze due to its many components, including bacteria, fungi and an array of fresh, partially degraded, or old plant material. Simpson's team, which includes research collaborators Professors Dudley Williams and Andre Simpson, is uniquely positioned to address this new frontier. The team uses a NMR (Nuclear Magnetic Resonance) facility - the only NMR facility in Canada specifically dedicated to environmental research – to gain a detailed view of soil's molecular structure and reactivity.

In their current study, Simpson's team used an outdoor field experiment in the valley behind the UTSC campus to ensure natural ecosystem processes were preserved. Electrodes warmed the test soil between three and six degrees through winter and summer seasons, over a 14-month period. Throughout the test period, the team analyzed the molecular composition of soil samples.

Provided by University of Toronto

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