Drought impedes carbon sequestration by earthworms

May 31 2022

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Soil-borne organisms, especially earthworms, break down leaves and other dead material, releasing nutrients and making the soil fertile while sequestering carbon in the soil and thus helping counteract climate

change. During dry spells, however, earthworms and other soil fauna either retreat deep into the soil or aestivate.

A research team led by WSL has studied how a lack of water in forests affects these processes—at least indirectly. The team recorded the number of soil organisms, the level of decomposition of organic matter and the volumes of carbon sequestered in plots established in the Finges forest (canton of Valais). The WSL has been conducting a long-term WSL experiment there since 2003, artificially irrigating some of the plots in summer and leaving others exposed to the valley's natural dry conditions.

Lack of water inhibits soil fauna

Many more earthworms were found on irrigated plots than on non-irrigated ones. This was also the case for smaller organisms such as springtails and woodlice, which also play a key role in litter decomposition. As such, much more organic matter was decomposed in the soil. The researchers demonstrated this by burying leaves in small nets with different mesh sizes, allowing fauna to pass through depending on their size.

This finding is significant with regard to climate change, because through their industrious feeding soil organisms ultimately bind the carbon in CO_2 from the atmosphere to the soil humus, where it is stored over long periods of time. "If forest soils become too dry, this inhibits the activity and quantity of soil-borne organisms and forests may absorb less carbon in the long term," says study leader Frank Hagedorn, Head of Biogeochemistry at WSL.

Both in Switzerland and across Europe, dry soils contain significantly less carbon than moist ones. "Our study has shown that soil fauna are a key reason why this is the case." The team concluded that earthworms,

woodlice and other soil organisms are responsible for dry soils containing less humus and therefore being less fertile. Such organisms react most sensitively to drought, even more so than fungi or microorganisms.

Hagedorn says he was surprised at how quickly the differences became apparent. "Soil humus forms over hundreds to thousands of years. We didn't expect to be able to see differences in the levels of carbon stored after just ten years." According to Hagedorn, their study published in *Global Change Biology* demonstrates the vital role of soil-borne fauna in the carbon cycle in forests. He also stressed that future long-term forest monitoring programs and climate change studies need to focus more on such organisms.

More information: Claudia Guidi et al, Soil fauna drives vertical redistribution of soil organic carbon in a long-term irrigated dry pine forest, *Global Change Biology* (2022). DOI: 10.1111/gcb.16122

Provided by Swiss Federal Institute for Forest, Snow and Landscape Research WSL