Research reveals 'negative feedback' loop between warming and net exchange of carbon caused by erosion

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In the study of human impact on the environment, there are few negative or stabilizing feedbacks on climate change.

A team of international scientists, including Professor Tim Quine from the University of Exeter, has studied the effect that temperature has on the amount of carbon gained by and released from soils due to soil erosion. This pioneering new research has revealed a negative feedback loop between warming and the net exchange of carbon within the atmosphere caused by erosion.

As they store more carbon than the atmosphere and vegetation combined, soils offer unique and pivotal potential to mitigate global climate change through sequestration—the removal and storage of carbon. However, change in soils can also pose a threat to global warming as the carbon in these stores can be released back into the atmosphere.

Soil organic carbon (SOC) storage is controlled by the balance of the amount of carbon gained through plants, and lost through natural decomposition. It is known that both of these are affected by erosion and climate, however, the effect on the interaction between climate and erosion on SOC storage has remained unclear.

In the new study, the researchers used existing data from sites across the world, experiencing different climates, to show rising temperatures promote increased efficiency in replacing eroded carbon but also increasing decomposition of buried carbon. The combined effect of these two opposing trends with increase in temperature is found to be an increase in the erosion-induced carbon sink.

The team estimate a 7% increase in the global carbon sink caused by erosion on croplands, due to warming by 2100. These results reveal a negative feedback loop between climate change and erosion-induced disturbance to SOC cycling.

The study "Temperature effect on erosion-induced disturbances to soil

organic carbon cycling" is published in *Nature Climate Change*.

Professor Quine said, "Through international multidisciplinary collaboration, our team have made progress in better understanding of the role of erosion in perturbing soil carbon dynamics and the interaction with warming. Despite the negative feedback, it is imperative that we continue to focus efforts on controlling soil erosion and rehabilitating soils for their many benefits for ecosystem service delivery."

More information: Zhengang Wang et al, Temperature effect on erosion-induced disturbances to soil organic carbon cycling, *Nature Climate Change* (2023). DOI: 10.1038/s41558-022-01562-8

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