Researchers show depth-dependent responses of soil organic carbon under nitrogen deposition

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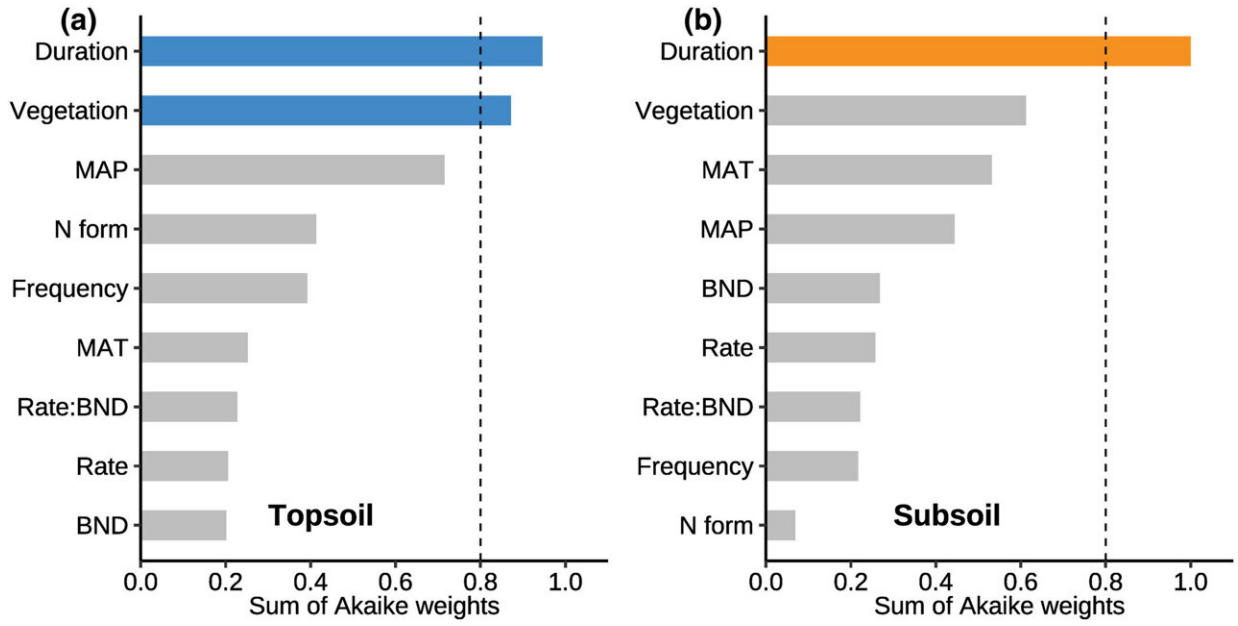

Experimental duration was the most important predictor in the responses of soil organic carbon (SOC) to nitrogen (N) addition in both topsoil and subsoil. Credit: *Global Change Biology* (2024). DOI: 10.1111/gcb.17247

In a study published in *Global Change Biology*, scientists from the

Institute of Earth Environment and the South China Botanical Garden of the Chinese Academy of Sciences have shed light on understanding the effects of nitrogen addition on soil organic carbon storage across soil profiles. Their findings may help address the recent controversial issues of managing soil as a carbon sink under elevated nitrogen deposition.

Increased atmospheric nitrogen (N) deposition has greatly altered soil organic carbon (SOC) storage, thereby affecting the carbon (C) cycle-climate feedback. Due to significant differences in external plant carbon inputs, microbial community structure, soil aeration, and soil texture between topsoil and subsoil, the effects of N deposition on SOC at different depths are likely to be different or even opposite. However, there is a lack of subsoil studies.

To investigate whether the effects of N addition on SOC storage vary with soil depth, the researchers conducted a comprehensive global data collection to examine the effects of N addition on SOC in both topsoil (0–30 cm) and subsoil (30–100 cm). They found that N addition significantly increased SOC in the topsoil, but had no significant effect on SOC in the subsoil.

To explore the underlying mechanisms associated with the depth-dependent responses of SOC to N addition, they incorporated many ancillary variables in the model selection analysis, including N addition methods, vegetation type, mean annual temperature and precipitation, background N deposition rate, and so on.

They showed that the topsoil SOC increased significantly with the duration of N addition, while SOC in the subsoil initially increased with N addition but decreased over time.

This study highlights the importance of considering soil depth together with N deposition duration in predicting SOC storage under N addition. The lack of depth-dependent SOC responses to N addition in experimental and modeling frameworks has likely resulted in the overestimation of soil C sink capacity under future N deposition.

More information: Yuanliu Hu et al, Depth-dependent responses of soil organic carbon under nitrogen deposition, *Global Change Biology* (2024). DOI: 10.1111/gcb.17247

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