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Soil organic carbon along a geothermal gradient in North-West Canada

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Global warming will increase soil microbial activity and thus catalyse the mineralisation of soil organic carbon (SOC). Predicting the dynamics of soil organic carbon in response to warming is crucial but associated with large uncertainties, owing to experimental limitations. Most studies use in-vitro incubation experiments or relatively short-term in-situ soil warming experiments. Long-term observations on the consequences of soil warming on whole-profile SOC are still rare. Here, we used a long-term geothermal gradient in North-West Canada to study effects of warming on quantity and quality of SOC in an aspen forest ecosystem.

The Takhini hot springs are located within the region of discontinuous permafrost in the southern Yukon Territory, Canada. The springs warm the surrounding soil constantly and lead to a horizontal temperature gradient of approximately 10°C within a radius of 100 meters. As these natural springs heat the ground for centuries and the forest ecosystem surrounding the springs is relatively homogenous, the site provides ideal conditions for observing long-term effects of soil warming on ecosystem properties. Soils were sampled at four different warming intensities to a depth of 80 cm and analysed for their SOC content and further soil properties in different depths.

For the bulk soil, we found a significant negative relationship between soil temperature and SOC stocks. This confirms that climate change will most likely induce SOC loss and thus a positive climate- carbon cycle feedback loop. The response of five different SOC fractions to warming will also be presented.