Soil freeze-thaw stimulates nitrous oxide emissions from alpine meadows

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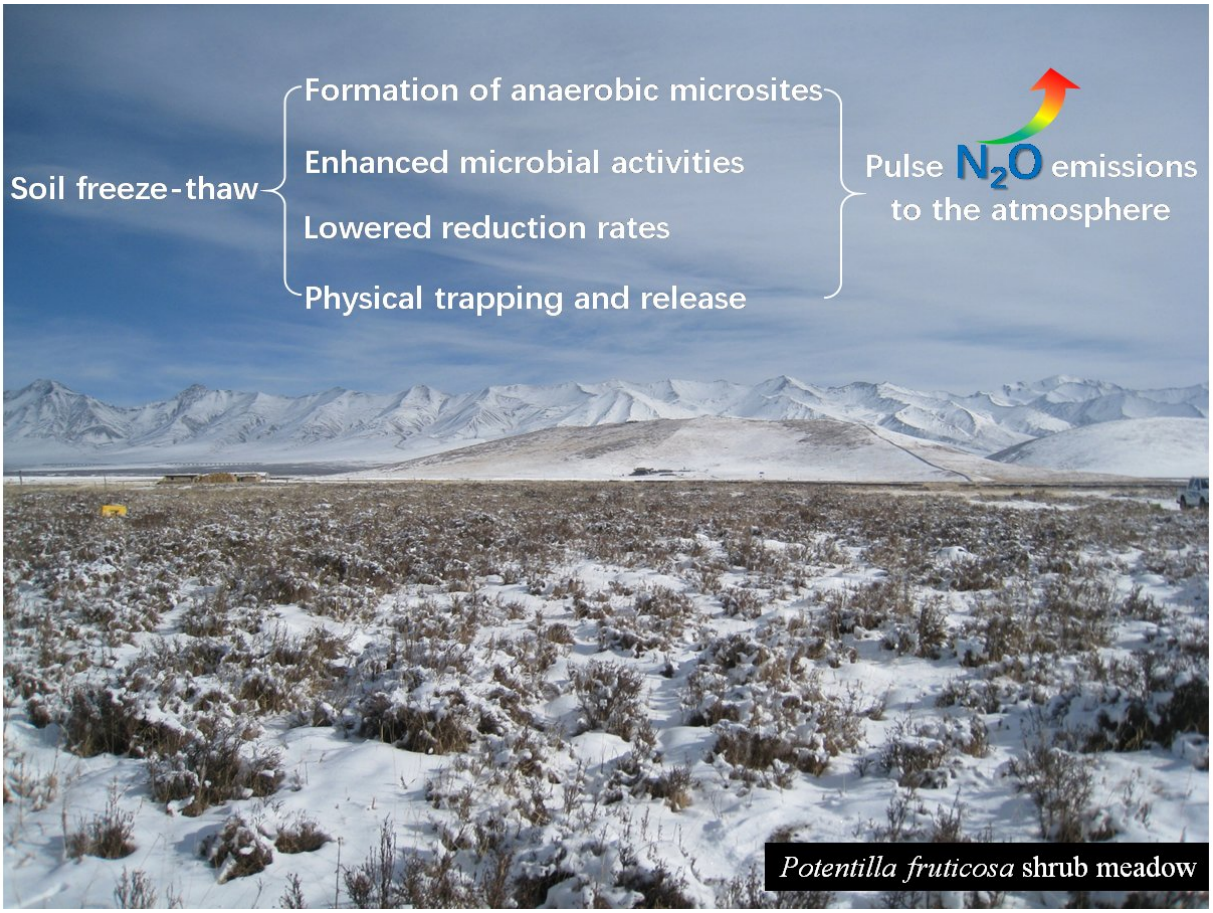

The stimulating mechanism of soil freeze-thaw on N2O emissions during the spring thaw period. Credit: Chunyan Liu

The rising concentrations of greenhouse gases in the atmosphere lead to

global warming, which is a major challenge for sustainable development. The Qinghai-Tibetan Plateau with widespread distribution of seasonal frozen soil is very sensitive to global warming. Soil freeze-thaw is a common natural phenomenon in the plateau, which can not only change the water and heat conditions, and the physical and chemical properties of soil, but also influence greatly the biosphere-atmosphere exchanges of greenhouse gases.

In a recently published study in *Agricultural Ecosystem & Environment*, scientists from Institute of Atmospheric Physics, Chinese Academy of Sciences, continuously investigated the methane (CH_4) and nitrous oxide (N_2O) fluxes between biosphere and atmosphere in an alpine *Potentilla fruticosa* shrub meadow in the Qinghai-Tibetan Plateau over three years. They found that the annual CH_4 uptake and temperature sensitivity coefficient (Q_10) were at the low end of the range for natural grasslands in China, which indicated that global warming at the same extent would result in less of an increase in the CH_4 sink in the Qinghai-Tibetan Plateau.

The N_2O emissions during the spring thaw period showed a tremendous inter-annual variation, which was closely linked to the variation in annual precipitation, especially the precipitation of the previous growing season. The high substrate concentrations and soil moisture during the spring thaw periods together provided the conditions for pulse N_2O emissions. Global warming prolongs the duration of soil freeze-thaw on the Qinghai-Tibetan Plateau and therefore, would stimulate the emissions of N_2O, a greenhouse gas with nearly 300 times the global warming potential of carbon dioxide that also depletes stratospheric ozone.

More information: Yongfeng Fu et al, Quantification of year-round methane and nitrous oxide fluxes in a typical alpine shrub meadow on the Qinghai-Tibetan Plateau, *Agriculture, Ecosystems & Environment* (2017). DOI: 10.1016/j.agee.2017.12.003

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