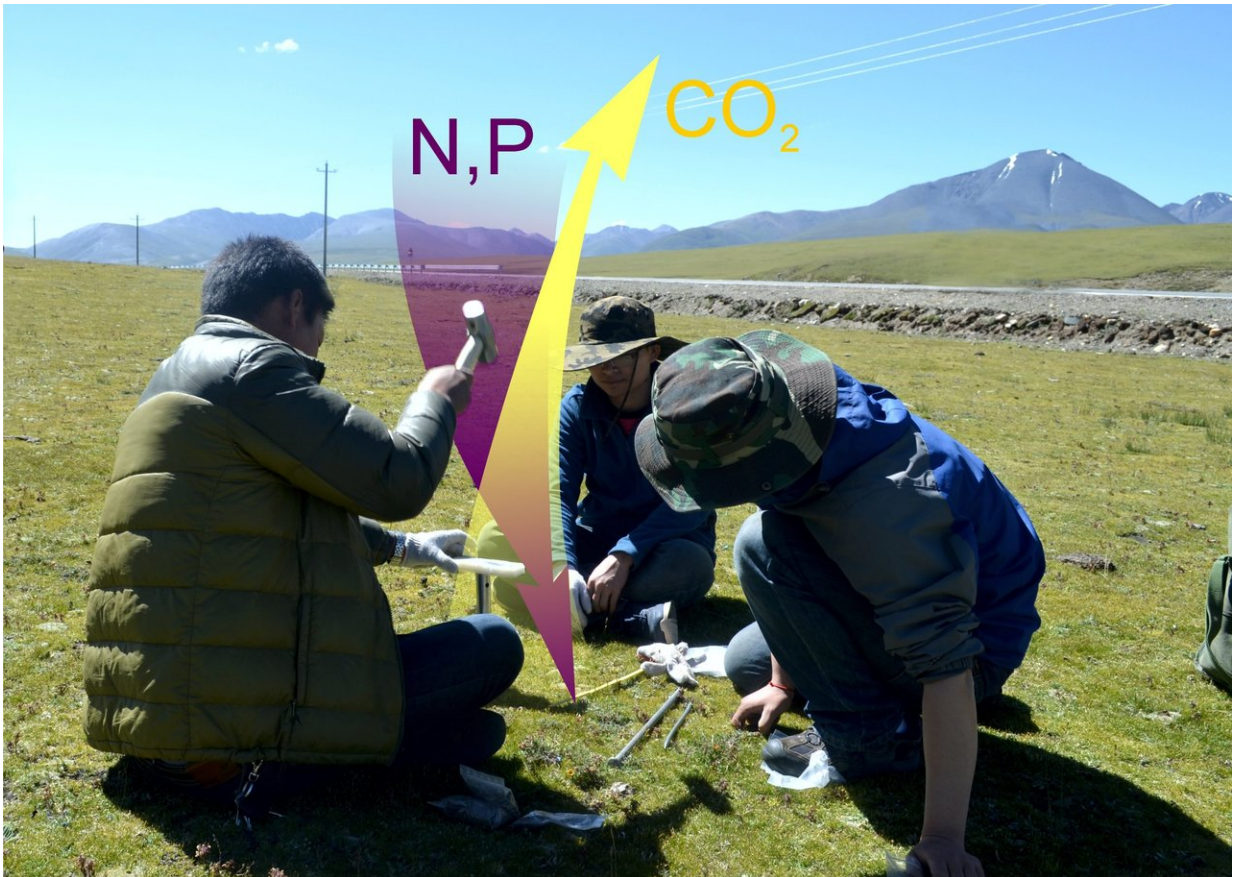


Tibetan soil enrichment with nitrogen and phosphorus leads to carbon loss

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A RUDN soil scientist studied the soils of the Qinghai-Tibet Plateau and found out that simultaneous increase of nitrogen and phosphorus levels reduces the volume of organic carbon in the soil. Credit: Yakov Kuzyakov/Natalia Deryugina

A RUDN soil scientist studied the soils of the Qinghai-Tibet Plateau and found that a simultaneous increase of nitrogen and phosphorus levels reduces the volume of organic carbon in the soil. The work will help reconsider the use of fertilizers in agriculture. The article was published in *Science of the Total Environment*.

Organic [carbon](#) moves in an endless natural cycle: it is stored in the bodies of plants and animals, returns to the [soil](#) after death in the form of organic compounds. Then microorganisms decompose them to CO₂, which reaches the atmosphere and is eventually incorporated into living organisms again. If the level of carbon in the soil drops, it leads to the accumulation of CO₂ in the atmosphere resulting in a greenhouse effect and a number of negative consequences for plants, animals and people. Therefore, it is important to monitor carbon levels in agricultural soils.

A RUDN soil scientist, together with his colleagues from China, Australia, New Zealand and Germany has been studying the combined influence of [nitrogen](#)- and [phosphorus](#)-containing fertilizers and their mixtures on the levels of organic carbon in soils for four years. Nitrogen and phosphorus are elements of proteins and energy-carrying molecules in living organisms. Thus, life without them would simply be impossible.

The study was carried out on the Qinghai-Tibet Plateau—an alpine grassland area with limited resources of nitrogen and phosphorus. It turned out that the addition of nitrogen-containing substances increases the levels of organic carbon in the soil, stabilizing the meadow ecosystem and leading to the growth of herbs, but reducing their variety. When nitrogen is added with phosphorus, the levels of organic carbon are reduced due to the stimulation of [microorganisms](#) and microbial decomposition of the soil organic matter.

The authors determined how the excess of nutrients affected the levels of carbon. When the fertilizers were added to the soil together, it

accelerated the growth of bacteria that turn organic matter to carbon dioxide. According to the team, this happened under the influence of several ferments: β -glucosidase, cellulase, and polyphenol oxidase. They decompose the complex organic substances to simple structures like glucose and alcohol.

"The results of our study show that the alpine soils of the Qinghai-Tibet Plateau can be turned into a source of CO₂. To avoid that the management of alpine grasslands should be modified with fertilizers. This may not only increase the ground biomass but also improve the functioning of local ecosystems and increase the volumes of carbon that returns back to the soil," says Yakov Kuzyakov, RUDN, a co-author of the work and a Ph.D. in biology.

More information: Ruyi Luo et al, Nitrogen and phosphorus enrichment accelerates soil organic carbon loss in alpine grassland on the Qinghai-Tibetan Plateau, *Science of The Total Environment* (2018). [DOI: 10.1016/j.scitotenv.2018.09.038](https://doi.org/10.1016/j.scitotenv.2018.09.038)

Provided by RUDN University

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