

Pressemitteilung

Christian-Albrechts-Universität zu Kiel

Eva Sittig

18.05.2022

<http://idw-online.de/de/news794036>

Forschungsergebnisse
Meer / Klima, Tier / Land / Forst, Umwelt / Ökologie
überregional



Overgrazing disrupts entire ecosystem

Research team led by Kiel University identifies microbiological threshold.

The Tibetan highlands have a special significance both as a grazing ecosystem and global carbon store. Furthermore, it plays a key role in the formation of the monsoon and supplying of potable water for a fifth of the earth's population. An international research team from Kiel University (CAU), together with the universities of Göttingen and Hanover and the Chinese Academy of Sciences has for the first time identified, on a microbiological basis, the critical threshold of grazing in the Central Asian landscape above which pasture degradation becomes irreversible. The researchers found that smaller areas are already irretrievably lost. But: The majority of the grazed area could still be saved upon condition that the keeping of livestock is reduced. The scientific journal Nature Communications has published the findings in its latest edition.

The Cobresia grass widespread on the Tibetan plateau has for centuries been adapted to moderate grazing by herds of roaming nomads. The grass's roots, both dead and living, protect the underlying permafrost soils from degradation – the gradual loss of their ecosystem functions to the point of erosion. But in recent decades grazing has increased, especially near settlements. Climate change, which is thawing the permafrost soils, is putting additional pressure on the Cobresia grasslands.

Researching at 4,200 metres above sea level

The researchers examined the soils at several locations on the Tibetan Plateau which exhibited varying degrees of pasture degradation. To do this, they determined the carbon and nitrogen stocks in the soil, the composition of the microbial soil community of bacteria and fungi, and the activity of soil enzymes directly in the field. One finding was that the combination of overgrazing and climate change leads to a 42 percent decline in carbon stocks and a 33 percent decline in nitrogen stocks within the most affected areas. "Two thirds of the carbon losses are due to erosion of the fertile topsoil, with one third attributable to reduced input of plant biomass and increased mineralisation," says study lead Professor Sandra Spielvogel from the Institute of Plant Nutrition and Soil Science at CAU. "As degradation increases, there are significant changes to the composition of microorganisms in the soil. Initially, the microorganisms in the soil primarily break down the easily degradable components of the dead roots, producing hydrolytic enzymes to do this. It is only once there is no longer enough easily degradable material that the stabilising lignified root residues are also degraded. The point of transition is indicated by oxidative enzymes becoming abruptly dominant in the system. Once the protective root cover is missing, erosion also increases significantly, causing the remaining topsoil to be completely removed," the soil scientist explains.

Trends can still be halted

Exceeding the grazing limit we identified changes to the entire ecosystem. As the Earth's "third pole" after the north and south poles, a release of the carbon stored in the Tibetan highlands would have the potential to affect the global store of CO₂. "Erosion of the fertile topsoil exposes the subsoil. With no vegetation, this earthen layer reflects the sun's rays

more strongly. This is aggravated by changes to evaporation which impacts the entire water balance of the affected area. This in turn has been shown to influence cloud formation and other atmospheric properties over the Tibetan Plateau," summarises Spielvogel. "Once the soil is this severely damaged, you reach a point of no return. With growing seasons extremely short (at three to four months), it would take centuries at that altitude to regenerate soil that has been damaged that much." The only way to avoid these self-reinforcing effects is to reduce the amount of livestock on the pastures in question; that is, to keep fewer animals per hectare and to change location more frequently.

The research was conducted as part of DFG Priority Programme 1372: Tibetan Plateau: Formation - Climate - Ecosystems (TiP).

Original publication:

Andreas Breidenbach et al, Microbial functional changes mark irreversible course of Tibetan grassland degradation, Nature Communications, <https://doi.org/10.1038/s41467-022-30047-7>

Photos available for download:

www.uni-kiel.de/de/pressemitteilungen/2022/071-yark-with-mountains.JPG

Yak with mountains: The pastures in Tibet are mainly used for yaks.

© Lena Becker, Leibniz University Hannover

www.uni-kiel.de/de/pressemitteilungen/2022/071-nicht-ueberweidetes-grasland.JPG

Non-overgrazed grasslands: Pastures used moderately by herds of roaming nomads.

© Lena Becker, Leibniz University Hannover

www.uni-kiel.de/de/pressemitteilungen/2022/071-ueberweidetes-grasland.JPG

Overgrazed grasslands: Intensive grazing, especially near settlements, leads to erosion of the fertile topsoil.

© Lena Becker, Leibniz University Hannover

www.uni-kiel.de/de/pressemitteilungen/2022/071-spielvogel.jpg

Sandra Spielvogel portrait.

© personal photo

Contact:

Prof. Dr Sandra Spielvogel

Kiel University

Institute for Plant Nutrition and Soil Science

Telephone: 0431/880-7411

Email: s.spielvogel@soils.uni-kiel.de

<https://www.soils.uni-kiel.de>

Press contact:

Dr Doreen Saggau

Public Relations & Academic Communications

Faculty of Agriculture and Nutritional Sciences

Telephone: +49 431 880-7126

Email: dsaggau@agrar.uni-kiel.de

Christian-Albrecht University of Kiel

Press, Communications and Marketing: Eva Sittig, text/editorial: Prof. Sandra Spielvogel/Christin Beeck

Postal address: D-24098 Kiel, tel.: (0431) 880-2104, fax: (0431) 880-1355

Email: presse@uv.uni-kiel.de Internet: www.uni-kiel.de/en Twitter: [www.twitter.com/kieluni](https://twitter.com/kieluni)

Facebook: www.facebook.com/kieluni Instagram: www.instagram.com/kieluni

wissenschaftliche Ansprechpartner:

Prof. Dr Sandra Spielvogel
Kiel University
Institute for Plant Nutrition and Soil Science
Telephone: 0431/880-7411
Email: s.spielvogel@soils.uni-kiel.de
<https://www.soils.uni-kiel.de>

Originalpublikation:

Andreas Breidenbach et al, Microbial functional changes mark irreversible course of Tibetan grassland degradation, Nature Communications, <https://doi.org/10.1038/s41467-022-30047-7>

URL zur Pressemitteilung: <https://www.uni-kiel.de/en/details/news/071-tibet-grassland>