

Reindeer grazing may counteract effects of climate warming on tundra carbon sink

March 21 2014



(Phys.org) —Experts in ecosystem carbon cycling and environmental modelling at The University of Nottingham have been involved in research which suggests reindeer could play an important part in protecting carbon sinks—the planet's natural carbon capture systems.

Local reindeer grazing history is an important determinant in the response of an ecosystem's [carbon sink](#) to climate warming, say researchers at the Arctic Centre of the University of Lapland. Their study has been published in the journal *Nature Climate Change*. The research project has been funded by the Academy of Finland. It is part of a doctoral thesis by Maria Väisänen at the University of Lapland. The thesis is co-supervised by Dr Sofie Sjögersten a lecturer in Environmental Sciences in the School of Biosciences at The University of Nottingham.

Dr Sofie Sjögersten said: "We have shown that the amount of reindeer grazing of the [tundra](#) determines if more greenhouse gases will be release as the climate warms". Neil Crout, Professor of Environmental Modelling in the School of Biosciences, said: "This works demonstrates the complexity of modelling ecosystem responses to climate warming. The interactions with other factors, grazing in our case, can be just as important as the direct effect of temperature rises and need to be considered in climate models."

The consequences of global climate warming on ecosystem [carbon](#) sink in tundra are of great interest, because carbon that is currently stored in tundra soils may be released to the atmosphere in a warmer climate. This could contribute to atmospheric carbon dioxide concentration, and thus create a positive feedback that intensifies global change.

A major portion of the Arctic is grazed by reindeer. In northernmost Europe, the reindeer was domesticated a few centuries ago. In a field experiment in northern Norway, the effects of experimental warming were compared between lightly and heavily grazed tundra. The grazing history between these areas had varied for the past 50 years. Carbon balances showed that under the current climate, lightly grazed, dwarf-shrub-dominated tundra were a stronger carbon sink than heavily grazed, graminoid-dominated tundra. However, warming decreased the carbon sink in lightly grazed tundra, but had no effect in heavily grazed tundra. Thus, tundra with a long history of intensive grazing showed a weak response to climate warming.

The main reason for this grazer-induced difference was that in heavily grazed tundra, graminoids with rapid growth rates were able to increase their photosynthesis and carbon fixation under increased temperatures. A similar phenomenon did not occur in tundra under light grazing, where nutrient availability limits plant production. Increased carbon fixation in heavily grazed tundra compensated the warming-induced increase in the

carbon dioxide release from the ecosystem.

Academy Research Fellow, Sari Stark from the Arctic Centre, said: "Grazing alters several ecosystem properties, such as plant species composition and soil nutrient availability, which in turn alter ecosystem responses to climate warming."

The significance of reindeer grazing history to tundra carbon balances has not been previously studied. The present results may modify [climate](#) models that predict the effects of [global warming](#) on global carbon cycles. The study shows that it is critical to know the grazing history before the responses of tundra carbon balances to [climate warming](#) can be understood. Different tundra systems possess highly varying [grazing](#) histories as a result of past and present reindeer management practices.

More information: Väisänen, M., Yläne, H., Kaarlejärvi, E., Sjögersten, S., Olofsson, J., Crout, N. & Stark, S.: "Consequences of warming on tundra carbon balance determined by reindeer grazing history." *Nature Climate Change*, [DOI: 10.1038/NCLIMATE2147](https://doi.org/10.1038/NCLIMATE2147)

Provided by University of Nottingham

Citation: Reindeer grazing may counteract effects of climate warming on tundra carbon sink (2014, March 21) retrieved 27 April 2024 from <https://phys.org/news/2014-03-reindeer-grazing-counteract-effects-climate.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.