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Climatic factors and reindeer grazing – the effects on soil carbon dynamics in subarctic boreal pine forest.

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Reindeer (*Rangifer tarandus* L.) are the most important large mammalian herbivores in the northern ecosystems, affecting plant diversity, soil nutrient cycling and soil organic matter decomposition. Changes caused by reindeer in vegetation have indirect effects on physical features of the soil e.g. soil microclimate, root biomass and also on soil carbon dynamics.

In a field experiment in Finnish Lapland, Värriö Strict Nature Reserve (67˚46' N, 29˚35' E) we investigated how the reindeer grazing in subarctic boreal forest combined with climate (air temperature and precipitation) affects soil temperature, soil water content, and ultimately the CO_2 efflux from forest soils. The study was carried out in the growing seasons of the years 2013 and 2014, where 2013 was an extremely dry year (specially the summer), and the year 2014 was a "normal" year in means of precipitations. Our study areas are located in the northern boreal subarctic coniferous forest at the zone of the last intact forest landscapes in Fennoscandia, where large areas of relatively undisturbed subarctic Scots pine (*Pinus sylvestris* L.) forests can still be found. We established the experiment as a split plot experiment with 2 blocks and 5 sub-plots per treatment that were divided into grazed and non-grazed parts, separated with a fence. The sample plots are located along the borderline between Finland and Russia, where the ungrazed area was excluded from reindeer already in 1918, to prevent the Finnish reindeer from going to the Russian side and there are not many reindeer on Russian side of the area.

Our study showed that in subarctic mature pine forests, soil temperatures were higher, and soil water content was fluctuating more on grazed areas compared to non-grazed areas in both years. In both years, the soil water content on the grazed area was highest in June. The situation changed somewhere in the second half of July when the moisture content in the non-grazed area was higher. We found significant negative correlation between soil water content and soil temperature. The soil CO_2 effluxes were mostly affected by the year of measurement, time of measurement (different months through growing season), soil temperature and also area (grazed or non-grazed). In both years we measured higher CO_2 emissions on the grazed areas compared to non-grazed areas but the difference was not significant. The average soil CO_2 efflux values were significantly higher in year 2014 compared to 2013 mainly due to differences in soil temperature at the beginning of the season. Soil moisture content was not affecting the soil CO_2 efflux.