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Adaptation of terrestrial microbial communities to elevated CO2 concentrations

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From the IPCC report on global warming, it is clear that large-scale solutions are needed immediately to reduce emissions of greenhouse gases. CO2 capture and storage offers one option for reducing greenhouse gas emissions. Our study aims at investigating the environmental impact of CO2 leakage from deep reservoirs into near-surface terrestrial environments. Therefore, an ecosystem study has been conducted on a natural CO2 leak at the Laacher See, Germany. CO2 is produced below this extinct volcanic caldera. The CO2 releasing vent located on an agricultural field at the western shore of the lake is clearly visible due to a 5m wide core of exposed soil.
The determination of environmentally important microbial activities, eg. CO2 and methane production, sulfate reduction and methane oxidation, showed differences between the CO2-rich (>90 % of soil gas) medium (20%) and the control site with background CO2 concentrations. Especially in deeper soil layers, rates of methane production and sulfate reduction increased with increasing CO2 in the soil gas. Methane oxidation activity was highest at the control site. In accordance with the activities, also the microbial communities analysed by DGGE with general bacterial, archaeal and primers for funcitional genes of the C- and N-metabolism showed a shift in species composition between CO2-rich and control sites. However, all results indicate that effects of the gas vent are spatially limited. The ecosystem appears to have adapted to the different conditions through species substitution or adaptation, showing a shift towards anaerobic and acidophilic species under elevated CO2 concentrations.