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Using stable isotopes to separate lime-borne CO_2 from biotic CO_2 in managed peat soils

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Liming is a common management practice in agricultural soils. Adding carbonates to the soil, however, may cause CO_2 release when the lime-carbonates dissolve in water. Currently, CO_2 emissions from lime are calculated using the mass-balance approach proposed by the IPCC Tier 1 method, which assumes that all carbon in lime ends up as CO_2 in the atmosphere. But to minimize risks associated with these estimations, direct measurement based data are needed. We conducted a split-plot experiment within a cut-away peatland cultivated with a bioenergy crop (reed canary grass) with lime and fertilizer treatments to determine effects of lime and mediated pH increase on CO_2 emissions and microbial activity and to better understand mechanisms underlying liming effects. Respiration rates were measured over two growing seasons, and complementary laboratory studies were conducted. To separate CO_2 derived from lime and CO_2 derived from biotic respiration the δ13C of CO_2 respired was determined and the two-pool mixing model was applied. The results show that lime contributes significantly to CO_2 release from acidic, managed peat soils. Thus there is a great risk to overestimate heterotrophic microbial activity in limed soils by measuring the CO_2 release without separating abiotic and biotic CO_2 production. In the presentation, the IPCC approach will be compared with the gained experimental data on lime-derived CO_2 emissions from the managed peatlands.