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Quantifying CO_2 removal via enhanced rock weathering in constrasting croplands

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Enhanced rock weathering (ERW) is a method of atmospheric CO_2 removal whereby crushed reactive silicate minerals are applied at the Earths' surface and CO_2 is converted to alkalinity or pedogenic carbonate [e.g. 1]. Croplands are a prime candidate for application of this technique [2] as they have the available infastructure needed for rock powder application, and nutrients released during rock weathering may provide additional co-benefits [3].

Here we present results from some of the world's first field trials of ERW in agricultural environments, conducted by the Leverhulme Centre for Climate Change Mitigation. Two contrasting field trials are investigated: oil palm grown on a plantation in Sabah Malaysia, and corn and miscanthus crops grown in the US Corn Belt. Crushed basalt was applied at the same rate (50 tonnes per hectare per year) in each trial, and resuts are presented for 2 years from the Mayalsian trial and 3 years from Illinois.

Geochemical (including DIC, cation and anion concentrations, $^{87}Sr/^{86}Sr$ and $\delta^{13}C$) and water discharge data are used to quantify the extent of CO_2 removal at each site via alkalinity generation and pedogenic carbonate formation. Differences between the two field trials, as well as between subplots within each site, are discussed, including an assessment of the influence of climatic zone (tropical versus temperate) on the rate of chemical weathering. The multi-year assessment presented in this study provides vital contextual information for assessing the long-term effectiveness of ERW as an atmospheric CO_2 removal strategy.

[1] Taylor et al. (2016), Nature Climate Change, 6, 402-406
[2] Beerling et al. (2020), Nature, 583, 242-248
[3] Andrews and Taylor, (2019), Elements, 15, 253-258