Field trials of Enhanced Weathering in two contrasting climate zones

M.G. ANDREWS[1]*, C.R. PEARCE[2], R.H. JAMES[1], M.D. MASTERS[3], I.B. KANTOLA[3], K.L. YEONG[4,5], M.J. HANAPI[5], S. BENEDICK[6], G. REYNOLDS[5], E.H. DELUCIA[3], D.J. BEERLING[4]

[1]University of Southampton, Southampton SO14 3ZH, UK (*correspondance: Grace.Andrews@southampton.ac.uk)
[2]National Oceanography Centre Southampton, Southampton SO14 3ZH, UK
[3]University of Illinois at Urbana-Champaign, Urbana, IL 61820, USA
[4]University of Sheffield, Sheffield S10 2TN, UK
[5]South East Asia Rainforest Research Partnership, 91112 Lahad Datu, Sabah, Malaysia
[6]Universiti Malaysia Sabah, 90509 Sandakan, Sabah, Malaysia

Enhanced Weathering (EW) of silicate rocks is a carbon dioxide (CO_2) removal strategy whereby powdered rock is applied to the land and/or ocean such that climate warming is mitigated through accelerated rates of chemical weathering. Agricultural sites are particularly suited for EW as they host the infastructure needed to apply rock powder to soils, and the nutrients released from rock during weathering facilitate a number of food security co-benefits such as increased crop yields [1].

We present results from EW field trials conducted in two agroecosystems under contrasting climatic conditions: (1) Three 1 ha plots of oil palm at the Sabahmas Oil Palm Plantation (Wilmar International Ltd.) in Sabah, Malaysia and (2) 4 ha plots of corn and miscanthus at the Energy Farm, University of Illinois Urbana-Champaign. The Malaysia field site has a tropical climate where warm wet conditions are predicted to drive very high weathering rates [2]. Conversely, the Illinois site has a continental climate, similar to the majority of arable land in North America and Europe. At each site basalt rock powder was applied at a rate of 50 tons ha^{-1} yr^{-1} and control plots where no rock powder was applied were monitored as well. We use major ion concentrations and radiogenic Sr isotope ratios ($^{87}Sr/^{86}Sr$) of discharge, soil water, soil exchangeable leachates and crop biomass to quantify basalt chemical weathering rates and ultimately CO_2 consumption rates for each plot. We report results from three years of EW trials in Illinois and one year of trial in Malaysia.

[1] Beerling et al. (2018), Nature Plants, **4**, 138-147. [2] Li et al. (2016), EPSL, **443**, 59-69.