

# Effectiveness of Enhanced Rock Weathering for CO<sub>2</sub> removal through re-vegetation of mine tailings in Ghana.

MILLIE DOBSON, CHRISTINA S LARKIN AND  
RACHAEL H JAMES

School of Ocean and Earth Science, University of Southampton  
Presenting Author: [a.dobson@soton.ac.uk](mailto:a.dobson@soton.ac.uk)

Nearly all greenhouse gas emissions pathways that restrict global temperature increase to  $\leq 2^{\circ}\text{C}$  above pre-industrial necessitate Carbon Dioxide Removal (CDR) from the atmosphere<sup>[1]</sup>. One proposed CDR solution is Enhanced Rock Weathering (ERW), which aims to artificially speed up natural silicate weathering by applying crushed calcium and magnesium rich silicate rocks to agricultural soils<sup>[2]</sup>. Leftover material from mining activities, which produce an estimated 13Gt of tailings from silicate hosted deposits per year<sup>[3]</sup>, could be used as a potential feedstock for ERW.

Here we report results of a novel ERW field experiment being conducted in collaboration with an established gold mining company in Ghana. A decommissioned tailings storage facility was re-vegetated with oil palms that were planted directly onto the surface of the mine tailings after closure of the facility in 2017. We have been working to quantify the impact that re-vegetation has had on weathering rates, and consequently on removal of atmospheric CO<sub>2</sub>. Sampling has been conducted at two sites: one where oil palms were planted on tailings, and a “control” site where oil palms have been planted on local soil.

Initial results demonstrate that soil pore waters in the tailings site contain  $\sim 4\text{-}5\text{x}$  higher levels of both total alkalinity and cations (Mg<sup>2+</sup> and Ca<sup>2+</sup>) than soil pore waters from the control site, indicating rapid weathering of both silicate and carbonate minerals. Soil carbonate content, nutrient availability, and heavy metal mobilisation in the soils have been analysed using soil leaching procedures and combined with analyses of soil organic carbon to build up a full picture of weathering processes for full quantification of CDR. On-site monitoring also indicates that palms planted on tailings have higher yields of palm fruits. The approach thus holds promise as an inexpensive and efficient substitute for the practice of capping tailings ponds, that simultaneously offers the benefit of offsetting some of the CO<sub>2</sub> produced from mining activities.

[1] Smith, S.M. *et al. The State of Carbon Dioxide Removal*. (2023).

[2] Beerling, D.J. *et al. Nature Plants* **4**, 138–147 (2018).

[3] Bullock, L.A., James, R.H., Matter, J., Renforth, P. & Teagle, D.A.H. *Front. Clim.* **3**, 1–12 (2021).