

Enhanced Rock Weathering field trials at an upland grassland, Wales, UK: an assessment of carbon dioxide removal and ecological co-benefits.

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To meet net zero targets, there is an increasing need to develop and implement novel carbon removal technologies, one of which is enhanced rock weathering (ERW). ERW has the potential to provide a maximum technical gross carbon capture potential of 18.7 Mt CO₂ yr⁻¹ in the UK by 2050¹. There is also evidence of significant co-benefits associated with ERW, such as enhanced crop productivity and improved soil ecology².

However, the deployment of ERW is currently limited by a low ‘technology readiness level’ (TRL), with data lacking from large-scale, long-term field trials. This is particularly true in UK grassland systems, which make up around two-thirds of UK agricultural land area³ and where ERW presents significant potential for improvement, considering the productivity of these environments is often limited by soil acidification and nutrient depletion.

Therefore, we are trialling the addition of basalt to a typical, sheep-grazed, acidic, unimproved, upland grassland in mid-Wales at the long-term Plynlimon Research Catchments. We are quantifying greenhouse gas removal (GGR) via ERW, measuring greenhouse gas fluxes, and assessing a range of co-benefits in paired, hydrologically isolated catchments (~5 ha each). Hosting these trials at Plynlimon allows us to contextualise observed changes within several decades of baseline biogeochemical monitoring.

After two years of basalt additions, we are beginning to see biogeochemical impacts potentially linked to ERW, with short-lived increases in stream pH and alkalinity and no adverse impacts to soil health, biodiversity indicators or toxic trace element accumulation. We also provide potential carbon dioxide removal (CDR) estimates from the catchment, however, we recognise the complexity of large, heterogenous field sites for quantifying GGR at catchment scale, highlighting the need for further discussions when considering upscaling data from field trials.

¹Richard, S., et al. (2021). Greenhouse gas removal methods and their potential UK deployment.

²Beerling, D. J., et al. (2024). Enhanced weathering in the US Corn Belt delivers carbon removal with agronomic benefits. *PNAS*, 121(9), e2319436121.

³Qi, A., et al. (2018). Grassland futures in Great Britain—Productivity assessment and scenarios for land use change opportunities. *Science of the Total Environment*, 634, 1108-1118.