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Enhanced Rock Weathering for Carbon Dioxide Removal and agronomic benefits – A systematic review of the literature

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Enhanced Weathering (EW) has been proposed as a carbon dioxide removal (CDR) method with large-scale deployment potential. Its real-world performance remains poorly constrained, however, with evidence fragmented across disciplines and between experimental and modeling studies. To make sense of the current body of literature, we conducted an international systematic review and constructed a harmonized database compiling reported CDR rates from both EW-focused research and agronomic studies of silicate rock flour as a fertilizer. This effort compiled >500 independent estimates of CDR rates, along with paired geochemical measurements and deployment parameters—including soil and porewater chemistry, changes in soil inorganic carbon stocks, cation exchange capacity and base saturation, and cation release from applied rock powders. We also compiled data on agronomic responses to silicate rock flour applications, including crop yield and soil pH, to examine how agronomic performance co-varies with geochemical weathering signals and inferred CDR. While individual studies in the database demonstrate trends consistent with kinetic and thermodynamic controls (e.g., correlations with feedstock mineralogy, grain size, temperature, etc.), patterns within the aggregated database are obscured, reflecting the multivariate dependencies of EW, and ultimately CDR rates. This synthesis clarifies the current empirical basis for EW performance estimates and highlights priorities for additional synthesis and statistical analysis. The underlying database will be released as an open-access resource to support transparent synthesis, scenario analysis, and measurement, reporting, and verification (MRV) development.