

Utilising Mine Residues for Enhanced Weathering: Results from a Field Trial with Nickel Slag in Brazil

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Demand for critical metals is rapidly increasing due to the green energy transition, leading to higher volumes of mine residue materials, including slags and tailings, which present both environmental challenges and opportunities for carbon sequestration via enhanced weathering. Although residues from the mining industry have long been discussed as a potential feedstock for terrestrial enhanced weathering, there are as of yet no reports of large-scale field trials applying mine residues to crops for the purpose of carbon dioxide removal (CDR).

Here we present results from a field trial in Goiás state, central Brazil, in which between 1 and 50 t ha⁻¹ of nickel slag was applied to tropical soils at a eucalypt plantation. Established in 2022, our 8-hectare pilot project aimed to quantify CDR using both water and soil-based methods. Soil water samples were taken with permanent lysimeters throughout the rainy seasons, and soil samples were collected annually. We also measured metal uptake into the plants and assessed the extent to which cations were upheld on soil exchange sites in these relatively acidic (pH ~4) soils. Microbial community responses were also evaluated in order to assess broader environmental impacts. Initial results indicate elevated alkalinity in soil waters following slag application, consistent with CDR via bicarbonate export. Slag dissolution rates measured in the field were also compared to those measured under laboratory conditions, providing a clearer understanding of mineral weathering processes.