Decreasing acid deposition increases carbon dioxide removal in a silicate-treated forested watershed

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Enhanced Rock Weathering (ERW) is a land-based Carbon Dioxide Removal (CDR) strategy which aims to increase inorganic carbon and alkalinity export to the oceans for long-term sequestration. It operates by carbonic acid weathering of crushed, applied rocks or individual minerals, with silicate minerals preferred as they do not release carbon during weathering. Few studies have assessed ERW effectiveness at the catchment scale, but silicate treatments have occasionally been applied to soils, streams and lakes to counteract acidification due to anthropogenic deposition. In 1999, an 11.8-ha watershed in the Hubbard Brook Experimental Forest (HBEF), New Hampshire, was treated with 3.5 t ha^{-1} of the calcium silicate mineral wollastonite ($CaSiO_3$). This treatment substantially increased cumulative streamwater calcium and bicarbonate fluxes relative to an untreated reference watershed over a 15 year period. However, forward modelling based on long-term streamwater chemistry data suggests that bicarbonate and calcium fluxes were decoupled due to sulfuric, organic and nitric acid weathering. Decreasing acid deposition has improved conditions for carbonic acid weathering at HBEF, but our results highlight the need for a better understanding of ERW interactions with the nitrogen and organic carbon cycles.