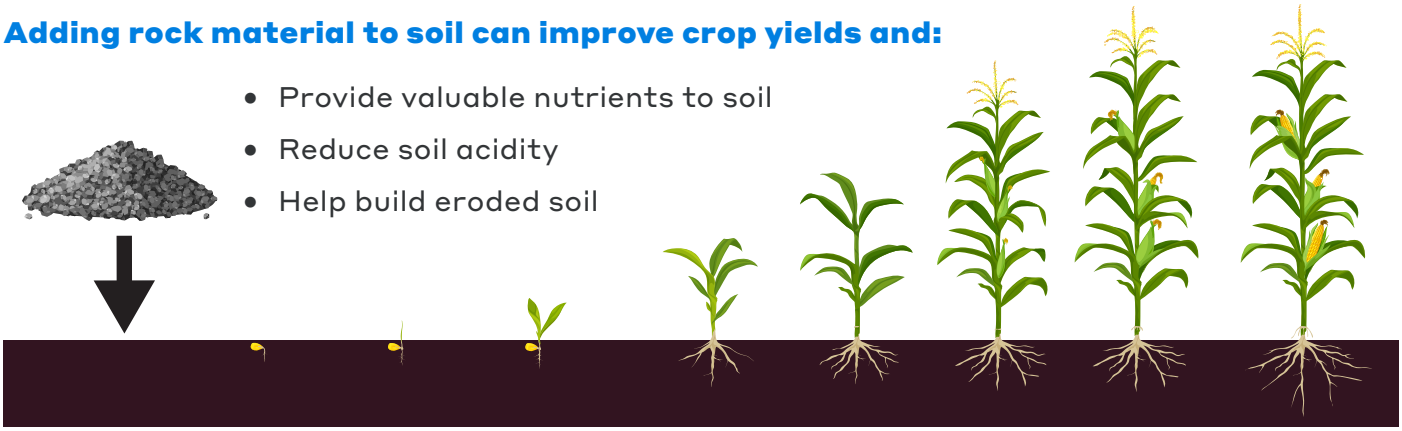
Bipartisan Policy Center

Enhanced Rock Weathering 101

Enhanced rock weathering (ERW) is an innovative land management and carbon removal practice that can reduce costs for farmers, bolster soil health, and provide environmental and carbon storage benefits.

Adding rock material to soil can improve crop yields and:

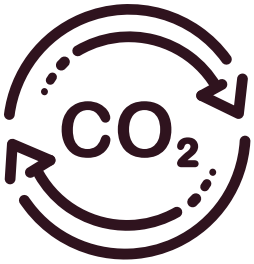
- Provide valuable nutrients to soil
- Reduce soil acidity
- Help build eroded soil



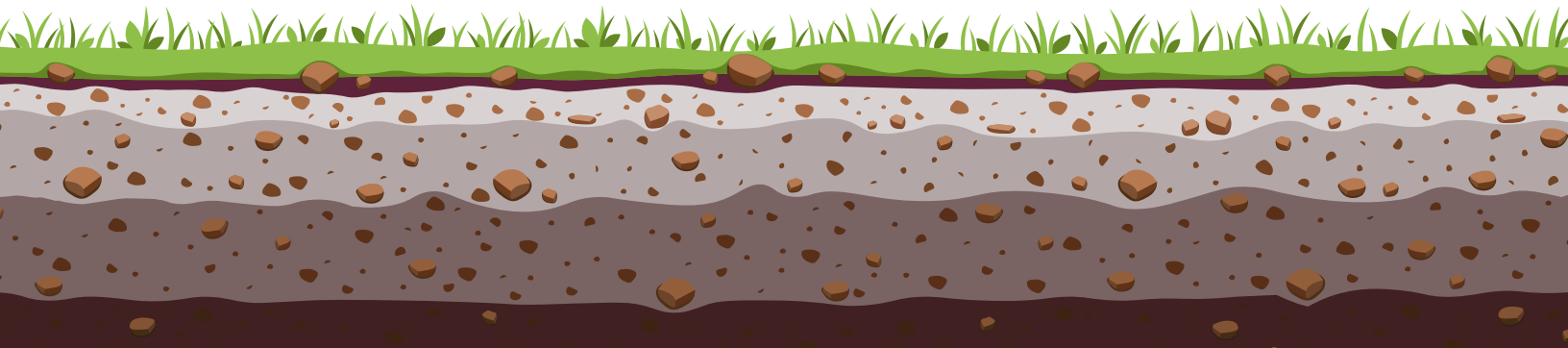
What is Enhanced Rock Weathering, and how does it improve soil health?

ERW involves spreading finely crushed volcanic rocks, like basalt or olivine, onto fields. The crushed rock improves soil pH and releases minerals essential for plant growth, including phosphorus, potassium, calcium, magnesium, and iron. This can also improve the capacity of soil to hold water for plant use and rebuild depleted soils. Farmers have added rock material to their soils for generations. ERW seeks to build on this longstanding practice and optimize benefits to crop yield, soil health, and carbon storage.

What are the carbon storage benefits of ERW?



ERW speeds up the natural geologic process that breaks down or "weathers" volcanic rocks when exposed to rain, wind, or seawater. The worn-down rocks absorb carbon dioxide (CO_2) from the atmosphere and, through a series of chemical reactions, are eventually turned into carbonate minerals that are permanently stored in the ocean or in new rocks on land. This process normally takes hundreds of years, but with ERW, the normal geologic process of removing carbon can be achieved in just a few years.



What are the economic opportunities of ERW?

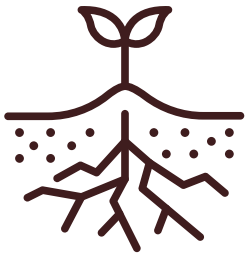
ERW implemented in addition to or instead of agricultural lime, a common additive used to improve soil pH, can enable more precise soil pH management and deliver comparable soil health benefits as liming. ERW can reduce producers' input costs for lime, synthetic fertilizers, pesticides, and fungicides, and may also increase crop yields. Recent research on midwestern farms found corn and soybean yields increased by 12% to 16% with ERW.[1]

Further, using rock material from nearby quarries for ERW can support the regional economy and preserve local jobs. **There is significant potential for utilizing basalt rock from existing quarries in Wisconsin, Michigan, Minnesota, Virginia, North Carolina, and Pennsylvania.** The same farm machinery used to apply agricultural lime can be used to spread rock material and, in many places, existing railroads can be used to transport rock from mines to farmland.

Depending on the type of rock and its source, ERW material ranges in price from $50 to $480 per ton of resulting CO_2 removed.[2] These costs are likely to go down over time as ERW moves beyond the research and pilot phases to wider-scale commercialization. Additionally, increased crop yields can lower the net cost of using ERW, along with savings from reduced need for agricultural inputs and fertilizers (typical costs per ton for lime: $20 to 80; urea phosphate: $890; diammonium phosphate: $938; potash: $862).

Private sector interest is growing in carbon credits generated from verified carbon removal projects, especially those like ERW that offer long-term, durable carbon storage benefits. Although it is an evolving market and long-term pricing remains uncertain, recent private sector contracts have priced carbon removal credits for ERW at close to $370 per ton of CO_2.[3]

What needs to be done to bolster ERW?



Field trials are underway, funded by the Department of Agriculture and the private sector, but additional research, pilots, and coordinated support from the federal government are needed to bring the practice to scale. Researchers are also investigating ERW in various production systems and quantifying outcomes for crop yields, carbon storage, and other environmental parameters. For example, early findings suggest that ERW may also reduce agricultural emissions of nitrous oxide (N_2O). **ERW researchers and companies are currently working with farmers in Alabama, Arkansas, Connecticut, Delaware, Illinois, Iowa, Louisiana, Maryland, Michigan, Minnesota, Mississippi, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Washington, West Virginia, and Wisconsin.**

[1] Beerling, D. et al. (2024). Enhanced weathering in the US corn belt delivers carbon removal with agronomic benefits. *Proceedings of the National Academy of Sciences*, 121(9). https://doi.org/10.1073/pnas.2319436121.

[2] Beerling, D. et al. (2018). Farming with crops and rocks to address global climate, food and soil security. *Nature Plants*, Vol 4, 138. https://www.nature.com/articles/s41477-018-0108-y.

[3] Our Portfolio, Enhanced Weathering, Frontier (2024). Available online: https://frontierclimate.com/portfolio?pathway=enhanced_weathering /10