Enhanced Rock Weathering

Source: TH

Enhanced Rock Weathering (ERW), a promising technique to **combat climate change**, involves **spreading crushed basalt on agricultural lands** to speed up **carbon dioxide capture** from the atmosphere.

- This method is **drawing attention** from tech giants and industries seeking to offset their emissions.

Enhanced Rock Weathering

- **About:** ERW **accelerates** the natural process of **weathering**, where rocks like **basalt break down and lock away carbon dioxide** in the form of **bicarbonate**, eventually turning into **limestone**. This process is turbocharged by grinding the rocks finely to increase their **surface area**.
- **Carbon Sequestration:** By using **finely ground rock** to increase surface area, **ERW enhances the rate of geological carbon sequestration**, making the process significantly **faster than it occurs naturally**.
- **Additional Benefits:** ERW **enhances soil alkalinity**, improving **crop yield** and **fertility**, while also **reducing downstream CO_2 emissions** by **neutralizing soil acids** before they reach **rivers and oceans.**
- **Debatable Effectiveness:** As a new technology, **ERW** shows **mixed results** in carbon removal.
    - While some studies report up to **10.5 tonnes of CO_2 per hectare over four years**, others show **lower rates**, underscoring the need for **accurate measurement** and **further research**.
- **Risk and Challenges:** While **ERW is generally safe**, some quick-weathering rocks may release **harmful heavy metals**.
    - The main concern is **overestimating carbon capture**, which could inflate **carbon credits** and lead to **higher emissions.**
- **Global Implementation:** ERW is being **trialled worldwide**, from **Darjeeling tea estates** to **US soy and maize farms**, with **Brazil issuing the first verified ERW carbon credits.**
- **Growing Investor Interest: Google signed the largest ERW deal for 200,000 tonnes of credits. Also, Mati Carbon (India startup) won the USD 50 million X Prize for carbon removal.**

GEO-ENGINEERING

Geoengineering means manipulating the earth's climate to lower its temperature to counter global warming

TYPES OF GEO-ENGINEERING

CARBON DIOXIDE REMOVAL

Technology/ Method Proposed	*Proposed Effects/actions*	*Potential Side Effects*	*Feasibility/Cost Effectiveness*
Land Use Management	Afforestation/ Reforestation	Minimum Side Effects	High feasibility, Low Cost
Bio-energy with carbon capture and storage (BECCS)	Biomass harvested and used as fuel	Potential land use conflict	Comparatively expensive
Direct CO_2 Capture	Industrial Process	Minimal	High technical feasibility
Fertilization of the ocean	Increased CO_2 absorption by promoting algae growth	High potential for adverse side effects	Feasible but not cost-effective
Accelerated Weathering	Pulverization of silicate rocks	Potential respiratory health impact	Could be combined with crop production, a feasible option at scale

SOLAR RADIATION MANAGEMENT

Stratospheric aerosol Injection	For reflecting sunlight back into space	Likely impact on the hydrological cycle	Feasible and potentially highly effective
Marine cloud brightening	Seeding of marine clouds with seawater aerosol	Likely impact on precipitation pattern	Low to medium cost and feasible at scale
Giant deflectors in outer space	Mirror placed in near earth orbit	Regional climate effects	Capital-intensive and long gestation
Surface albedo approaches	Painting the roof of the building bright white, Installing desert reflector	Major Impact on Desert Ecosystem	High labor and maintenance cost

REGULATION

- No specific international or Indian regulations on geoengineering.

INDIA'S EFFORTS

- **Department of Science and Technology:**
  - Geoengineering climate-modelling research programme (since 2013)
- **IISc:**
  - Initiative to understand the implications of solar geoengineering for developing countries
  - Scientists simulated injecting 20 million tonnes of sulphate aerosols into the Arctic stratosphere

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Read More: Carbon Sequestration