

India's biogeochemical potential enables it to lead the world in alleviating global hunger and stabilizing climate

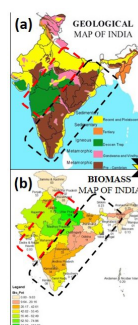
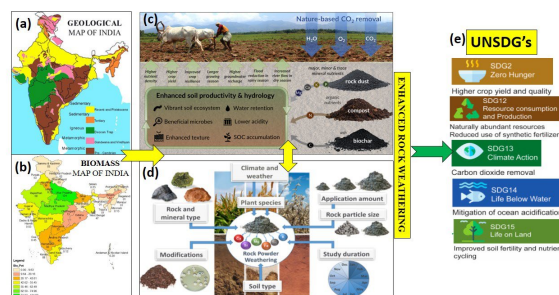
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To keep anthropogenic global warming below 2°C, significant CO₂ removal (CDR) and immediate emission reductions are required. Food insecurity and climate change in India, the world's most populous country, highlight the need for research into CDR technologies such as enhanced weathering. A blend of rock dust, compost, and biochar improves soil health, plant nutrition, and air quality while producing a long-lasting, slow-release fertilizer. Biochar provides reactive surface area that captures nutrients from enhanced rock weathering and stores them in soil for efficient recycling to plant root mycorrhizae, reducing erosion, storing carbon, and retaining water for a longer growing season. Basalt powders contain magnesium, calcium, phosphorus, silicon, iron, manganese, copper, and zinc, and have the greatest potential for soil regeneration. India's Deccan Traps basalt deposit covers 500,000 square kilometers and is easily accessible from many of the country's agricultural districts. Pyrolysis, the process of burning biomass in a reducing atmosphere, will produce biochar and agricultural and home waste can be turned into compost, preventing CH₄ from entering the atmosphere. Improving soil nutrient profiles promotes plant growth, enhances disease resistance, and improves soil structure. Improved soil nutrient profiles and higher agricultural productivity increase food crop nutrients, benefiting human health and farmers' economies. The weathering of magnesium and calcium-rich minerals in rock dust increases soil pH by converting CO₂ to a geologically stable form of carbon. During rock dust weathering, CO₂ is transformed to bicarbonate, which not only raises soil pH but also absorbs carbon in a stable form that can remain outside the atmosphere for millions of years. In this methodology, rock weathering is an effective and natural CO₂ removal mechanism. Furthermore, as rock weathering produces bicarbonate, it helps to mitigate ocean acidification by spreading to oceans via local streams. The method has the potential to greatly improve Indian Ocean ecosystems. To accomplish UN Sustainable Development Goals in India, a national research and development strategy must be formed to determine the best use of India's rock powder and biomass resources for each critical rock/soil/crop/climate system. India's climatic, geological, and agronomic assets could make it a world leader in large-scale CO₂ removal.



- Both maps demonstrate a significant relationship, as illustrated by the dotted boxes.
- Red box showing area with high biomass in great plains of north India which receive fertile sediments from Himalayan mountains and in central-western India falling under Deccan Trap basalts.
- Black box showing area with low biomass in south-central and eastern India falling under granite, laterite and metamorphosed terrain.