Magical rockdust activity sheet

39 Ways to Save the Planet

Royal Geographical Society with IBG

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Soil

Soil is a huge carbon store; it has an enormous ability to sequester carbon dioxide (CO_2). Listen to the BBC Radio 4 episode Magical Rockdust and continue reading to learn more.

Dolerite and basalt rocks are the by-product of quarrying and are described as basic silica rocks because they contain 50% silicate. The next most common minerals found within these rocks are calcium and magnesium. The last of these two minerals capture and stabilise carbon.

What is it?

Magic rockdust is essentially basaltic rockdust, which consists of silicate rocks that have been pulverised into a fine powder. Basaltic rocks are rich in magnesium oxide, iron, calcium oxide, silicon dioxide, sodium oxide and potassium oxide. Recent research has revealed that when this rockdust is spread on agricultural fields it absorbs CO_2. Agriculture accounts for nearly ¼ of the world's CO_2 emissions, making it an important industry to focus on for the accomplishment of reaching net zero by 2050 and limiting global warming to 1.5°C.

The magic rockdust initiative is a simple idea based on the natural process of weathering. In the natural world carbon dioxide dissolves with rainwater. As it hits the land, it reacts with rocks in the soil and the CO_2 converts into hydrogen-carbonate ions. Some stay in the soil and others leech out into rivers and the sea. Magic rockdust mimics this natural removal of CO_2.

Once spread on soil, the main finding is a noticeable difference in the microbes. In treated areas there is an improved micro-biome, with more microbes mobilising nitrogen, potassium, and phosphorus.

Figure 1 adding pulverised silicate rocks helps sequester CO_2 and improves productivity © Lynn Peiffer

This technique not only tackles climate change by sequestering carbon, but it is also beneficial for farming as the added elements increase soil nutrition (typical macro nutrients in loam soils are nitrogen, phosphorous, potassium, calcium, magnesium, and sulphur) and crop yields.

Impact

The biggest changes have been recorded in southeast Asian palm oil plantations, in Borneo, where the land lacks rocks that would naturally weather to capture CO_2. The soils are highly weathered. By adding freshly ground-up silicate minerals to these soils the rates of weathering can be enhanced.

When trialled in Norfolk, pea crops saw 80% higher rates of CO_2 drawdown and weathering (of rocks and soil) in crops that were amended with grounded basalt.

In the US Midwest rockdust was applied to soya beans, miscanthus (a biofuel), and maize. Soya beans recorded higher rates of rock and soil weathering with a co-benefit of maise crops increasing productivity. The maise also recorded reduced fluxes of nitrous dioxide (N_2O), a very potent greenhouse gas.

1. Taking the 12 most promising countries and using waste dust, what does Dr Tamsin Edwards say could be saved from greenhouse gas emissions?

The New Scientist goes further reporting that spreading rockdust could save around one-tenth of our carbon budget (which is the amount of carbon dioxide we can emit without catastrophic levels of global warming). The three biggest CO_2 emitters with the largest amounts of agricultural land are the United States, China, and India.

2. Use the table below to create either a bubble chart (you will need a 3 variables to do this) or a horizontal bar graph for the data below on who has the most potential for removing CO_2 by spreading rockdust on croplands.

Maximum annual carbon removals from enhanced rock weathering, gigatonnes of CO_2	
Country	**Gigatonnes of CO_2**
Brazil	0.17
Canada	0.06
China	0.53
France	0.07
Germany	0.05
India	0.49
Indonesia	0.07
Italy	0.03
Mexico	0.05
Poland	0.03
Spain	0.04
US	0.42

Table 1

Rockdust is an attractive option for addressing climate change because it does not require land use change unlike, for example, biofuel needing the conversion of agricultural to energy crops or rewilding necessitating afforestation projects.

Further reading

- Rockdust can help get carbon into the ground www.e360.yale.edu/features/how-adding-rock-dust-to-soil-can-help-get-carbon-into-the-ground

- A sprinkle of rockdust could help avoid catastrophic climate change www.newscientist.com/article/2248222-a-sprinkle-of-rock-dust-could-help-avoid-catastrophic-climate-change/

- Spreading rockdust could remove vast amounts of CO_2 from the air www.theguardian.com/environment/2020/jul/08/spreading-rock-dust-on-fields-could-remove-vast-amounts-of-co2-from-air

- Could rockdust be farming next climate change solution? www.smithsonianmag.com/smart-news/rock-dust-climate-180975363/

- University of Sheffield: Farming crops with rocks to reduce CO_2 and improve food security www.sheffield.ac.uk/news/nr/farming-crops-with-rocks-global-food-security-1.764697

- An effective climate change solution may lie in rocks beneath our feet www.theconversation.com/an-effective-climate-change-solution-may-lie-in-rocks-beneath-our-feet-142462

Suggested questions for Magic Rockdust

a. Soil is 'a good friend' in the fight against climate change. What does Tom Heap compare the carbon store of soil to?

b. In the American Midwest what was the increase in maise productivity from the addition of magic rockdust?

Answers

1. Up to about 3.6% of current global greenhouse gas emissions could be saved by using magic rockdust. If all the croplands are used (in these 12 countries) it would be more like 7%.

2. An example horizontal bar graph can be found in the Further reading list above.

An RGS-IBG expert

Go to What our experts say to hear further analysis from Professor Heather Viles from the University of Oxford (pictured below), Professor Larissa Naylor and Dr Adrian Bass from the University of Glasgow and Dr Phil Renforth from Herriot-Watt University.