Remineralize the Earth

The climate change solution right under our feet

Gone Tomorrow: Fertile Soils, Nutritional Value Disappearing



Loss of soil fertility is a global crisis. Since the adoption of chemical fertilizers, topsoil has lost significant organic matter. Soil erodes faster than it's replenished, and nature takes 1,000 years to create a mere 3 centimeters. Thus, 30% of arable land is now barren. We only have 60-100 harvests left.

Water contamination threatens the health of all life. Roughly 60% of soil ends up in rivers, streams and lakes, intensifying contamination from runoff fertilizers and pesticides.

Deforestation decimates wildlife populations. Mass tree loss destroys our soils, rangelands and freshwater. Entire ecosystems suffer.

Nutritionally-depleted food is the price we pay for the current industrial agriculture paradigm. Nutrient levels of calcium, iron, and vitamins A and C have been dropping drastically, causing a dramatic loss in the nutritional level of almost all minerals and nutrients.

Climate Change Matters: Earth, Oceans in Peril



Global warming has dramatically decreased snow and glacial coverage worldwide. In the last decade, Antarctica's rate of ice mass loss has tripled.

Sea levels rose about eight inches in the previous century. This rate has nearly doubled in the last two decades and is accelerating every year.

Oceans are warmer and more acidic due to increased carbon dioxide absorption. This kills off coral reefs, further endangers aquatic life and adds to extreme weather events.

Widespread fires have magnified concerns that we are locked in a worldwide pattern of conflagration that is both persistent and catastrophic.

Restore the Earth, Stabilize the Climate

Remineralization, widely regarded by a growing movement as a blueprint for restoring ecological balance, is crucial to roll back the effects of climate change.



Rock powders act as a natural slow release, long-lasting fertilizer greatly increasing soil fertility, biomass, biological productivity, and food supplies. At the same time, chemical reaction with rocks is the major mechanism that removes CO2 from the atmosphere on geological time scales. This is an important solution to reverse runaway global climate change. Remineralize the Earth is the major organization promoting and providing information on the use of rock powders in agriculture, pastures, forests, and for ecosystem regeneration.

Thomas J Goreau Geotherapy (CRC Press) Soil Carbon Alliance UN Commission on Sustainable Development

The brilliant, practical, natural, economic solution that is rock dust.

We are talking about **restoring soils and forests.** We are talking about **producing higher agricultural yields.** We are talking about **more nutritious food.** We are talking about **storing carbon in soils to stabilize the climate.**



Why Rock Dust?

It's Abundant

Millions of tons of finely ground rock dust are available as a byproduct of the aggregate industry.

It's Natural

Rock dust contains up to 70 or more minerals and trace elements needed by all life.

It's Economical

Rock dust costs less to apply versus conventional fertilizers and pesticides.

It's Brilliant!

Results with rock dust show as much as 2-4 times the yield for crops grown on degraded land and 4-8 times more biomass for forests.



... because rock dust creates better soils

Remineralize the Earth

Our Mission

Remineralization utilizes finely ground rock dust and sea-based minerals to restore soils and forests, produce higher yields and more nutritious food, and store carbon in soils to stabilize the climate.

Who We Are

Since 1996, Remineralize the Earth (RTE), a Northampton, MA based, 501(c)3 non-profit organization, has advocated for the life of this planet's soils, championing a cleaner, more natural alternative to both chemical fertilizers and pesticides. RTE brings together farmers and gardeners, scientists and policymakers, as well as the general public through education, outreach, projects, research and advocacy.

Healthy Soil, Healthy People

Through remineralization, we can bring soils back to life, increase yields, grow more nutritious food, and greatly reduce the cost of health care.



Nutrient Density

On average, you would need to eat 5 apples today to equal the same nutrition as 1 apple in 1965.

Now *imagine* increased yields while at the same time enhancing the nutrient quality of the food we eat.

Source: Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999 Donald R. Davis, PhD, FACN, Melvin D. Epp, PhD and Hugh D. Riordan, MD

The Science – Building the Case **Remineralize Forests in the Tropics**

Basalt Powder Restores Soil Fertility and Accelerates Tree Growth in **Impoverished Panamanian Tropical Soils**

BIOMASS PER TREE VS SOIL 50 **BIOMASS (Kg/Tree)** 45 40 35 30

H (basalt quarry rock dust), M (transition zone), L (local soil)

Thomas J. Goreau, Marina Goreau, Felix Lufkin, Carlos A. Arango, Gabriel Despaigne-Matchett, Gabriel Despaigne-Ceballos, Roque Solis, & Joanna Campe Chapter 17, Geotherapy Innovative Methods of Soil Restoration Carbon Sequestration, and Reversing CO2 Increase, 2015, Taylor and Francis Group, LLC

> Seedlings of Acacia Mangium were planted in September 1997

Results of 5 year study

- 8-fold increase in biomass
- 2.17 times increase in the height of the trees
- 4 times the survivability from the trees on basalt
- The trees on the local soil did not survive

RTE Board of Directors



Dr. Tom Goreau



The Science – Insurance Against Drought Increasing the Production of Cactus for Fodder in the Semi-arid Regions (2016-2018)

Doctoral student Fernanda de Paula Medeiros & Senior Collaborating Professor of the University of Brasilia (UnB), Suzi Huff Theodoro



dryGrow





In Bahia, Brazil, remineralization was used to enhance the production of two species of cactus for livestock and staple crops:

- "Giant" Opuntia ficesus-indica (L.) Mill.)
- "Sweet" (Nopalea cochenillifera (L.) Salm-Dick.)

Test Results for the First Year

- 3.888 times the growth for the rock dust + compost versus the control.
- The pH of the soil has been improved by the **four-fold increase of calcium** and the **two-fold increase of magnesium**.

Best results occurred in the blocks with the rock dust + organic compost mixture.



The Science

Remineralizing Forests Worldwide

Groundbreaking Results

Long term experiments released in 1986 in Europe showed that in a forest where pine seedlings were remineralized, after 24 years the wood volume was four times higher than in the untreated area. One application lasted for 60 years.

Source: Von u. Sauter and K. Foerst. The Bavarian Research and Experimental Institute for Forestry, Munich, Germany, 1986.



Remineralized forest in Brixlegg, Austria (1986)



Spruce branches without rock dust taken for mineral analysis (just outside the range of emissions)



Spruce branches with rock dust taken for mineral analysis

Source: The Effects of Basalt Rock. Dust Emissions on Spruce Trees at the Albert Basalt Quarry in Huhnerberg, Germany 1983, Fritz Leipold

Healthy Forests Deter Forest Fires and Sequester More Carbon

Research, Outreach, and Policy Making

Remineralizing forests will increases resistance to insects, disease, frost, and drought.

Mount a Campaign

Remineralize forests from the air- mobilize local, state, federal, National Guard, or other means.



Remineralized forest in Brixlegg, Austria (1986) Similar to the natural process of a volcanic eruption, the trees are coated with rock dust which washes into the soils with subsequent rainfall.

California Gov. Gavin Newsom declares state of emergency, promises funding due to increased wildfire risk

On January 8, 2019, California Gov. Gavin Newsom declared a statewide emergency Friday as result of "a vast tree die-off throughout the state" and deteriorating forest conditions that have increased the risk of wildfires. The state will spend \$1 billion on forest land management over the next five years and will propose to spend more than \$300 million to upgrade its planning and response to wildfires and other disasters.

Lake County, CA (LA Times)

The Science

Remineralize the Earth has the only online research database dedicated solely to remineralization

Table 1. Summary statistics of	the chemical	constituents	in soil	samples	from	sites	of un-
healthy trees in California.							

Variable	Mean	Median	Std Dev	Units	N
Al	24.3	5,3	41.7	(ppm)	70
В	0.6	0.4	0.4	(ppm)	119
Ca	1389.0	1201.5	758.7	(ppm)	136
CEC	14.4	12.4	6.6	(meq/100g)	120
Cu	1.6	1.2	1.7	(ppm)	123
Fe	75.4	68.5	78.6	(ppm)	123
K	207.1	180.6	125.0	(ppm)	124
Mg	451.9	363.6	321.9	(ppm)	124
Mn	14.8	11.5	12.9	(ppm)	123
Na	56.3	34.7	86.3	(ppm)	124
NO ₂ -N	11.0	5.7	21.2	(ppm)	120
Org. Matter	4.8	4.2	3.4	(%)	120
Р	28.4	13.5	34.0	(ppm)	132
pH	5.8	5.7	0.6		136
SO,-S	21.6	7.0	66.8	(ppm)	117
Sol. Salts	0.6	0.4	0.9	(mmhos/cm)	117
Zn	6.5	2.7	9.4	(ppm)	123



Figure 5. Calcium content of soils in this study as a log-log function of nearest distance to the coast in the sudden oak death-affected regions of California. Best-fit line of the data is a power law function (see equation). R is the regression coefficient; probability $(p) \leq .001$ (***).

Bryophytes and soil acidification effects on trees: the case of sudden oak death

Lee F. Klinger,

PhD homas J. Goreau • Ronal W. Larson • Joanna Camp Combined Proceedings International Plant Propagators' Society, Volume 55, 2005

Publishing our research

Innovative Methods of Soil Fertility Restoration.

Carbon Sequestration, and Reversing CO2 Increase

John Hamaker – Early Trials with Corn (1976-1977)



Glacial rock dust produced **65 bushels** of corn per acre, compared to **25 bushels** per acre from other local farms – with no irrigation.



From Scarcity to Abundance

Source: John D. Hamaker, co-author with Don Weaver, *The Survival of Civilization* Michigan, 1976-1977

Increasing Crop Yields in Mexico

Remineralization of 22,000 hectares with government subsidies (Zacatecas, 2008-2009)



A class project fertilizing tree seedlings with rock dust in a park in Zapopan, Jalisco. Many town parks were remineralized in the region.



Agro Insumos Nova Terra SA

After a huge decline in bean production in 2002-2007, Urea was replaced by rock dust and **production increased by 300%**.

Production also increased for corn, grape, peach, nopal and several varieties of chili pepper.

50,000 ha have since been remineralized.

Impacting Sustainability: Local to Global



Imagine an agroforestry model that can sustain the food, fuel and income of local communities – a model that can be scaled up to develop larger integrated systems for agriculture and biofuel.

Soil remineralization is simple, intuitively learned, and applicable at the community level. Materials required are inexpensive and among the planet's most abundant resources.

Our Vision: Current and Future Directions

Let's Remineralize! Science Ed K-12

Research Projects with Rock Dust and Biochar:

- Stone House Farm Hudson, NY
- Equinox Farm Berkshires, MA

Agroforestry Projects – Post-Hurricane Caribbean

Preventing Forest Fires through Remineralization



Our Projects

Help us give teachers the tools to educate a new generation of eco-warriors.



Paulo Freire Social Justice Charter School demonstration trial for aji peppers in Holyoke, Massachusetts. Another high school class on Barbuda testing the rock dust from the volcanic eruption from nearby Montserrat.

Let's Remineralize! Science Ed K-12 will

be an online tool for teachers to engage students with fun lesson plans and connect scientific concepts to relevant, real-world applications.

Junior scientists learn how returning minerals to soils benefits the climate and all plant life, from gardens to forests. They will share their results on our online GIS map and contribute to our research database.

Our world needs future leaders able

to tackle complex environmental challenges.

Our Projects

Stone House Farm – Hudson, NY

Ben Dobson, Farm Manager of Stone House Farm, Director, Hudson Carbon

Dr. Jim Tang, Researcher, Woods Hole Oceanographic Institute

Tom Vanacore, Rock Dust Local

Dr. Tom Goreau and Joanna Campe, Remineralize the Earth Stone House Farm is partnering with Remineralize the Earth and Rock Dust Local to integrate rock dust and biochar into their farming system. They will be measuring pivotal data like carbon sequestration to show that soils and agriculture will be playing a crucial role in stabilizing the climate.









Our Projects

Equinox Farm – Sheffield, MA

Studies with rock dust and biochar for cannabis (for CBD oil)

Ted Dobson, Farmer Equinox Farm

Dr. Jim Tang, Researcher Woods Hole Oceanographic Institute

Tom Vanacore Founder of Rock Dust Local

Dr. Tom Goreau and **Joanna Campe** Remineralize the Earth Cannabis offers an effective, economic means of capturing CO2. Equinox Farm will be doing trials with rock dust and biochar for cannabis for CBD oil.

Through the addition of rock dust and biochar, farmer Ted Dobson hopes to grow big, healthy plants with large, healthy root systems, with the potential for hemp to become an economic engine all over the planet.











Paradigm Shift: From Scarcity to Abundance

We can move from an economics based on scarcity to an economics of abundance through remineralization.

"One of the most important things humans can do as constructive passengers aboard Spaceship Earth is to help restore the health of our planet's soils and climate. Remineralize the Earth was one of the first organizations to identify and accept that challenge. Joanna Campe introduced me to the concept of remineralization over twenty years ago. The efforts and significant achievements at RTE are deserving of your support."

- Greg Watson, former Commissioner of Agriculture, Massachusetts

Our ongoing projects: Your donation dollars at work



RTE's domestic and international projects educate, advocate and engage in on-the-ground activism. Our multi-faceted approach incorporates, grassroots community initiatives as well as scientific research, entrepreneurial ventures and large-scale projects.

Local Projects – Paulo Freire Social Justice Charter School demonstration trial for aji peppers in Holyoke, Massachusetts and Grow Food Northampton.

International Projects – Bahia Research Projects and a high school class on Barbuda testing the rock dust from the volcanic eruption from nearby Montserrat.

Our Vision for the Future

For more than two decades, Remineralize the Earth has played a role in facilitating a worldwide network, leading to the development of numerous projects and entrepreneurial endeavors – from building the grassroots movement to establishing scientific credibility for remineralization.

Remineralize the Earth's Immediate Goals

- Develop an online educational project area for students and teachers
- Develop demonstration trials with industrial scale farmers with remineralization
- □ Initiate an agroforestry project in the post-hurricane Caribbean
- Continue our public education, media outreach and advocacy

Remineralize the Earth's Broader Vision

- **u** Further initiate agroforestry projects worldwide
- **u** Further develop comprehensive educational resources for schools
- Transition industrial-scale farming into regenerative agriculture and carbon-based farming
- Organize campaigns to remineralize forests to prevent forest fires

Your investment in Remineralize the Earth will help:













- 1. **Integrate** more sustainable models into industrial agriculture that go beyond organic to increase yields, food quality, and food security.
- 2. **Partner** with government agencies and NGOs to establish agroforestry projects in the Caribbean, Haiti and Puerto Rico, which will create resilient food systems that survive and thrive during future climate upheavals.
- 3. **Coordinate** an effort to mount a forest remineralization campaign, mobilizing local, state, federal, National Guard and volunteer organizations to prevent destructive and deadly forest fires. This will lead to forests and landscapes that are healthier and more resilient to drought, disease and weather extremes.
- 4. **Provide** online resources on biology, geology, soil science, climate science and other related topics, complementing schools' core curricula and giving K-12 educators the ability to connect scientific concepts to relevant, real-world applications through remineralization projects.

Remineralize the Earth's most valuable resource

At Remineralize the Earth, we collaborate with 20-30 students, graduate students, researchers, science writers, and professionals from all over the world who work together with us. Our volunteers contribute up to 20 hours a week per person, providing an incalculable value as far as what we are able to accomplish.

We are based in the Pioneer Valley, with the opportunity to take advantage of the Five College Consortium (UMass, Hampshire College, Amherst College, Smith College, Mount Holyoke). For more than 20 years we have worked with Hampshire students under federal work study, a tremendous program that has provided us with a 1 to 11 multiplier effect, covering \$11 of the students' \$12 wages.



























Remineralize the Earth

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Partnering with Remineralize the Earth

We invite your financial partnership to help us realize the global opportunity remineralization presents. Over many years, RTE has created a firm foundation on which to grow this opportunity. With your help, right now, we can put our vision and mission into action.

Your contribution will increase our capacity, output and influence in the crucial coming years, position us to grow in vitally important and strategic directions, and empower us towards global action and initiatives.

Help seed a new future

Pledges of \$5000-\$25,000 for the next three years will secure our current budget and put us on a path to expanding our capacity and making a greater impact.

Here's how you can participate in this watershed moment:

- Please make a multi-year pledge of \$5000-\$25,000
- Make a one-time "heroic" stretch gift (go for it!)
- Help engage new donors to participate
 - Become a new donor!

Join us on a new path

Help us transform the world with rock dust.