Climate Restoration: A Pre-Industrial Climate by 2050

Everyone wants to restore a safe climate — one that humans have actually survived over the long term.

Climate restoration means restoring a climate that humans have actually survived long term, with CO2 levels below 300 parts per million (ppm). Climate restoration will require reaching net-zero PLUS removing what we've already pumped into the air: a trillion tons of CO2.

We need to restore the climate by 2050, while Earth systems are still sufficiently intact to do so.

Our species has never lived with sustained CO2 levels above 300 ppm. Today, CO2 levels are 420 ppm— 40% higher. The widely accepted climate goal of net zero by 2050 would send CO2 above 450 ppm— 50% higher than humans have ever experienced long term.

Climate restoration is a moral imperative for climate justice now and for future generations. Since the poor are the first and most affected by climate chaos, climate justice requires climate restoration. And without climate restoration we're playing Russian roulette with our grandchildren— an immoral proposition.

Why *isn't* climate restoration the world's climate goal? The current goal dates from 1992, when the United Nations agreed to "stabilize GHG levels." At that point, scientists thought stability would be enough. Today, however, the old agreement limits critical climate action. Climate restoration will start in earnest when the nations of the world update our common goal to be "restore and stabilize" greenhouse-gas (GHG) levels.

While not yet widely recognized, we *can* restore the climate by 2050, and projects have already begun. The methods and even financing already exist. We can pay for climate restoration through philanthropy from concerned grandparents and organizations, without large government outlays.

To restore the climate by 2050 will require investing about $2 billion per year— less than 1% of the transition to clean energy. We can and must do both.

How can we restore the climate?

The most efficient and cost-effective climate restoration solutions copy Mother Nature. Nature pulls massive amounts of CO2 from the atmosphere by two main pathways:

1) Boosting photosynthesis in the ocean, and

2) Forming limestone on the seafloor (from the fallen shells of sea animals). Limestone is nearly half CO2 by weight and stores 99% of the carbon on the planet.

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The "Big Four" Climate Restoration Solutions

Climate restoration solutions must be permanent (keep CO2 sequestered for at least 100 years); scalable (to remove at least 10 billion tons of CO2 a year); and financeable through available means, without assuming government funding.

Out of hundreds of CO2-removal (CDR) methods proposed, so far only four meet all three climate-restoration criteria. Based on natural processes, these "big four" also turn out to be surprisingly low cost. In fact, three produce commodities with large existing markets—i.e., fish, seaweed, and building materials. Therefore they are expected to finance themselves.

Ocean Iron Fertilization (OIF). Before ice ages, nature pulls large amounts of CO2 from the atmosphere by boosting photosynthesis— in the ocean. It increases the mineral dust, particularly iron, blowing from land to sea, thus promoting healthy phytoplankton. The base of the marine food web, phytoplankton also restore fisheries. We know how to replicate this natural process. Island and coastal communities are exploring OIF for both climate restoration and economic development.

Synthetic limestone. This high-quality construction material—nearly half CO2 by weight— can store CO2 in the concrete of roads and buildings. It is successfully in use at the San Francisco International Airport. Synthetic limestone also means less quarrying for rock.

Seaweed. Fast-growing kelp and sargassum consume huge amounts of CO2 in their photosynthesis. On mariculture farms, half the seaweed can be processed and sold as food, chemicals and other products (including vegan leather). The rest can sink and store biocarbon in the deep.

Methane oxidation. Accelerating nature's way of removing atmospheric methane promises to turn back global warming to the level last seen in 2002. It can also protect humanity from a catastrophic methane "burst" from melting permafrost.

Are DAC and carbontech the same as climate restoration?

Direct Air Capture (DAC) and other carbontech methods of CO2-removal (CDR) receive a lot of attention and funding. DAC filters CO2 from the air and purifies it. After billions of dollars in government funding, however, DAC has actually removed scant CO2, and most of that has been used to push more oil out of oil fields. The carbontech-CDR business model relies on subsidies as well as selling "carbon offsets" to those who wish to counteract their continued use of fossil fuels. The catch is that every ton of CO2 captured is, by definition, negated by a ton of CO2 emitted—so CO2 levels remain the same. In contrast, climate restoration means dropping CO2 levels back below 300 ppm, from 420 where they are now.

Could DAC related CDR restore the climate? DAC today costs around $1,000 to capture one ton of CO2. Removing the trillion tons of legacy CO2 through DAC and other carbontech would cost more than a year of world GDP: $100 trillion dollars. Even if the cost drops by 90%, ($100/ton) it would cost more than the U.S. Federal budget to restore the climate via these methods. Therefore the short answer is, No.

Climate-restoration solutions are over 1,000 times more cost-efficient than DAC. They're natural processes. They work at a massive scale, which nature has shown to be safe. Ocean iron fertilization and synthesized limestone have the potential to remove 50-60 gigatons of atmospheric CO2 a year. Thus they could restore pre-industrial CO2 levels by 2050, while reviving fisheries and providing building materials that store CO2.