TIME

Trees Help Protect the Planet From Climate Change. But The World Isn't Doing Enough to Protect Forests

Aerial view of a burnt area of the Amazon rainforest near Porto Velho, Rondonia state, Brazil, on Sept. 15, 2021. The Amazon, the world's biggest rainforest, is known as the "lungs of the Earth." But it is now emitting more carbon than it absorbs. MAURO PIMENTEL/AFP—Getty Images

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People breathe out carbon dioxide, trees breathe in carbon dioxide. It's one of the first things children learn about the carbon cycle, the paths carbon takes as it moves among the living and nonliving things that make up the planet. That might be part of the reason trees and forests have long been a focal point of the carbon sequestration conversation. Dozens of companies

have committed to planting and protecting trees as part of their efforts to counteract greenhouse gas emissions, and by 2030 the Trillion Trees Campaign is aiming to increase the number of trees in the world by one third.

Tree planting sounds great and makes for striking photo-ops of CEOs and presidents turning soil with golden shovels—and there's compelling evidence that both new trees and existing forests can help bring down the concentration of carbon dioxide in the atmosphere. But trees' and forests' role in global warming is more complex than it may seem. Anyone hoping to harness the power of trees in the fight against global warming needs to appreciate that complexity.

Forest protection and tree planting projects predate the idea of net-zero: The Trillion Trees Campaign is a continuation of the Billion Trees Campaign of the early 2000s, which was inspired by the Green Belt Movement that started in Kenya in the 1970s. The current number comes from a much-cited 2015 paper that calculated that planting an additional 1.2 trillion trees would absorb the equivalent of 10 years of carbon emissions. A later 2019 paper calculated that 1 trillion trees could fit on about 2.2 million acres of available land, though its

definition of “available” has been contested.

Remembering Basic Science

How would trees pull off this feat? In a word, photosynthesis. Carbon dioxide (CO_2) and water (H_2O) are the ingredients for this recipe; light serves as the energy that helps the plant reassemble the hydrogen, oxygen, and carbon into carbohydrates (CH_2O) and oxygen (O_2).

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Plants use some of the carbohydrates they make through respiration. This is the same process people use when we convert the food we eat into energy; like people, plants breathe out some carbon dioxide when they respirate. On average, plants emit about half of the carbon dioxide they absorb and store the rest in their bodies as biomass while they’re alive. Trees can store more carbon in their bodies and hold onto it longer than most plants because they’re larger, denser, and live longer than the average blade of grass.

For nearly 100 million years after trees evolved in the Carboniferous period, nothing could break down the tough lignin that gives wood its rigidity, so dead trees piled up in swampy deposits that hardened under pressure and over time. Some of these deposits became the coal seams that are now mined and burned, re-releasing the carbon stored by ancient forests. The Carboniferous period is named after these carbon-rich coal seams, surrounded by layers of rock where geologists can find fossils of trees, ferns, marine animals, and other creatures from a bygone world.

Today, however, fungi have evolved to be able to break down lignin, and trees eventually decay after they die like the rest of us. Fungi and other decomposers also produce carbon dioxide through respiration, so the carbon that trees store can be re-released to the atmosphere as they decompose. Trees also release their carbon if they burn, either in wildfires (which have increased in frequency and intensity with global warming) or the slash-and-burn practices employed by farmers and ranchers that clear forest for agriculture. That’s a key detail to keep in mind when considering the role of forests in combating global

warming.

A Vital Carbon Sink at Risk

Despite these disturbances and the slower process of decay, earth's forests remain a net-sink for carbon dioxide. The planet is currently home to about 4 billion hectares of forest, which collectively emit 8.1 billion metric tons of carbon each year and absorb 16 billion metric tons. The net absorption of 7.6 billion metric tons is more than the United States emits in a year and about 30% of the amount the world emits in a year.

One might assume that the most significant carbon sinks would be tropical rainforests, the most biodiverse biomes on the terrestrial earth. But Southeast Asia's tropical rainforests, one of the world's three largest systems, are now a net source of carbon emissions due to fires, clearing for plantations, and peat soil drainage. The Amazon rainforest is on the brink of becoming a net source due to similar disturbances. The world's second largest tropical rainforest, located in the Congo River Basin, is the only rainforest in the top three that is still a significant carbon sink. These dire statistics are part of the reason why protecting forests, especially rainforests, has become a key talking point around decarbonizing the atmosphere and slowing global warming.

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"Whether it's in Amazonia or the Tongass Rainforest in Alaska ... those are all the lungs of our planet," says Dominick DellaSala, chief scientist at Wild Heritage, an environmental organization based in Berkeley, California. "The logging and development that takes place in those forests, that forever changes their ability to absorb and hang onto carbon." DellaSala says that businesses can avoid being part of the problem by avoiding wood and fiber sourced from old-growth forests.

Many other globally traded products are grown on land cleared from rainforests, including beef, cacao, and palm oil. The complex commodities market can make it difficult to account for which products are grown on former rainforest land, but companies such as Nestlé and IKEA have published "forest

positive" plans to reduce the amount of deforestation involved in their supply chains through efforts such as satellite monitoring and supply chain mapping.

The Carbon Offset Problem

Some businesses are investing directly in forest protection through the carbon offset market. Organizations sell the opportunity to protect the rainforest, sometimes for as little as $5 an acre, money which goes to Indigenous people, local governments, and other groups who might otherwise choose to cut down the rainforest for economic reasons. Companies can buy these credits to offset their own greenhouse gasses as part of the carbon accounting involved in reaching net-zero.

However, ProPublica reported in 2019 that several forest protection projects that had received money from carbon credit sales were not keeping their promises; some protected plots were cleared even though people had been paid to keep them forested. Even when the people involved stick to their commitments, forests set aside for carbon offsets can be burned by wildfires, releasing their carbon.

Additionally, there is just not enough land available for carbon projects (and without impacting food security). A 2021 report from Oxfam notes that "the total amount of land required for planned carbon removal could potentially be five times the size of India, or the equivalent of all the farmland on the planet."

Some carbon offset projects involve planting new trees, but these plantings do not absorb as much carbon as mature, natural forests. Still, each tree can absorb tens of pounds of carbon dioxide in a year, and carbon credit sellers, governments, and organizations are all getting involved in tree planting "to the point where we're also now concerned about the supply chain for tree planting to make sure that we're going to be able to have enough seeds to meet that demand," says Joe Fargione, lead scientist for North America at The Nature Conservancy.

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Fargione says that the most effective tree planting projects focus on restoring existing forests, rather than trying to create new ones. If planted in the wrong environment, trees can cause an increase in carbon emissions through side effects that may be difficult to anticipate ahead of time. For example, planting trees in grasslands can increase the risk of fire, releasing the carbon stored naturally in that environment's plants and soil. Draining peatlands to plant trees releases the carbon those wetland ecosystems can hold onto for centuries.

As much as they love trees and forests, scientists like Fargione and DellaSala agree that we can't rely on them to take care of the glut of carbon dioxide emissions humans have added to the atmosphere. To maintain trees' current role as a sink for a large slice of carbon dioxide emissions, the priority should be to restore and maintain the mature forests that still exist, finding better ways to protect them against ourselves.

—With reporting by Jennifer Junghans

This article is part of a series on key topics in the climate crisis for time.com and CO2.com, a division of TIME that helps companies reduce their impact on the planet. For more information, go to co2.com