The Washington Post

Climate Solutions

The audacious effort to reforest the planet

By Ben Guarino
Photographs by Hannah Reyes Morales
Jan. 22, 2020

At age 9, Felix Finkbeiner planted his first tree.

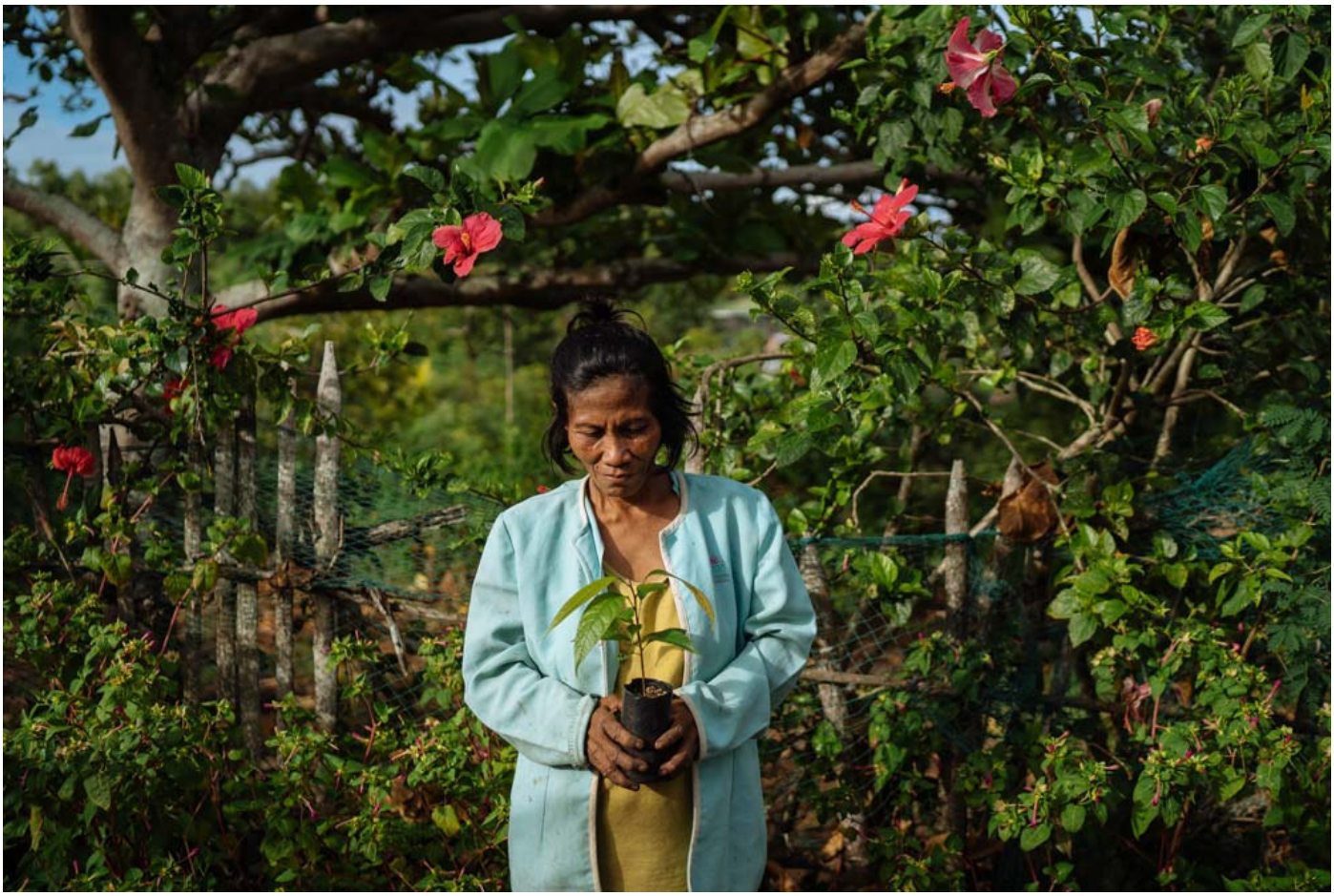
He had just learned about Wangari Maathai, a Kenyan woman who won the Nobel Peace Prize for leading an effort to plant 30 million trees in Africa. The boy was struck by her message — that trees are powerful allies in the fight to curb global warming.

Some of the more sophisticated details went over his head, Finkbeiner recalled. But, he said, he "understood the tree-planting part." So, in 2007, he dug a hole in front of his school near Munich and inserted a crab-apple sapling. "I thought that we kids should be planting some trees, as well," he said.

Finkbeiner's fourth-grade awakening blossomed into a personal crusade and eventually birthed a tree-planting foundation, Plant for the Planet. The organization, which is responsible for planting millions of new trees around the world, is part of a growing constellation of campaigns that seek to reforest every continent except Antarctica.

Driven by the recognition that trees suck Earth-warming carbon out of the atmosphere far more efficiently than any machine, the effort has attracted millions of dollars in support — and inspired hope that trees could become an even more potent weapon in the battle against climate change.

"We've been astonished to find that it is up there with all the best climate change solutions," said ETH Zurich ecologist Thomas Crowther, thesis adviser to Finkbeiner, now a 22-year-old PhD student in environmental science. Plant for the Planet inherited a massive tree-planting program, renamed the Trillion Tree Campaign, from the United Nations in 2011; Crowther is its chief scientific adviser.



FROM TOP: Children sit under the shade of a tree in Biliran in the Philippines, one of the most deforested countries on the planet. Around them are seedlings planted in an effort to fight climate change. Trees absorb carbon through their leaves as part of photosynthesis. A woman poses with a seedling.

On Tuesday in Davos, Switzerland, President Trump said the United States would join 1t.org, a new project launched by the World Economic Forum to connect the Trillion Tree Campaign and other reforestation programs around the world.

“In doing so we will continue to show strong leadership in restoring, growing and better managing our trees and our forests,” said Trump, who last year suggested devastating wildfires in California could have been avoided by raking the forest floors.

Greta Thunberg, the 17-year-old climate activist who was in the audience when Trump spoke, said planting trees is good but no solution to global warming. Thunberg and others say countries and industries must stop emitting carbon now and switch to solar, wind and other clean energy.

Most environmentalists, including those involved in reforestation, would agree with that sentiment. Still, tree planting offers a simple, accessible, low-tech idea with wide appeal.

In October, YouTube broadcaster Jimmy Donaldson, who goes by MrBeast, launched a campaign to raise $20 million to plant 20 million trees.

Billionaire Elon Musk donated $1 million and temporarily changed his Twitter handle to "Treelon." In July, Ethiopia broke a world record for the most trees planted in a day, when officials said 23 million peopleplanted 350 million trees.

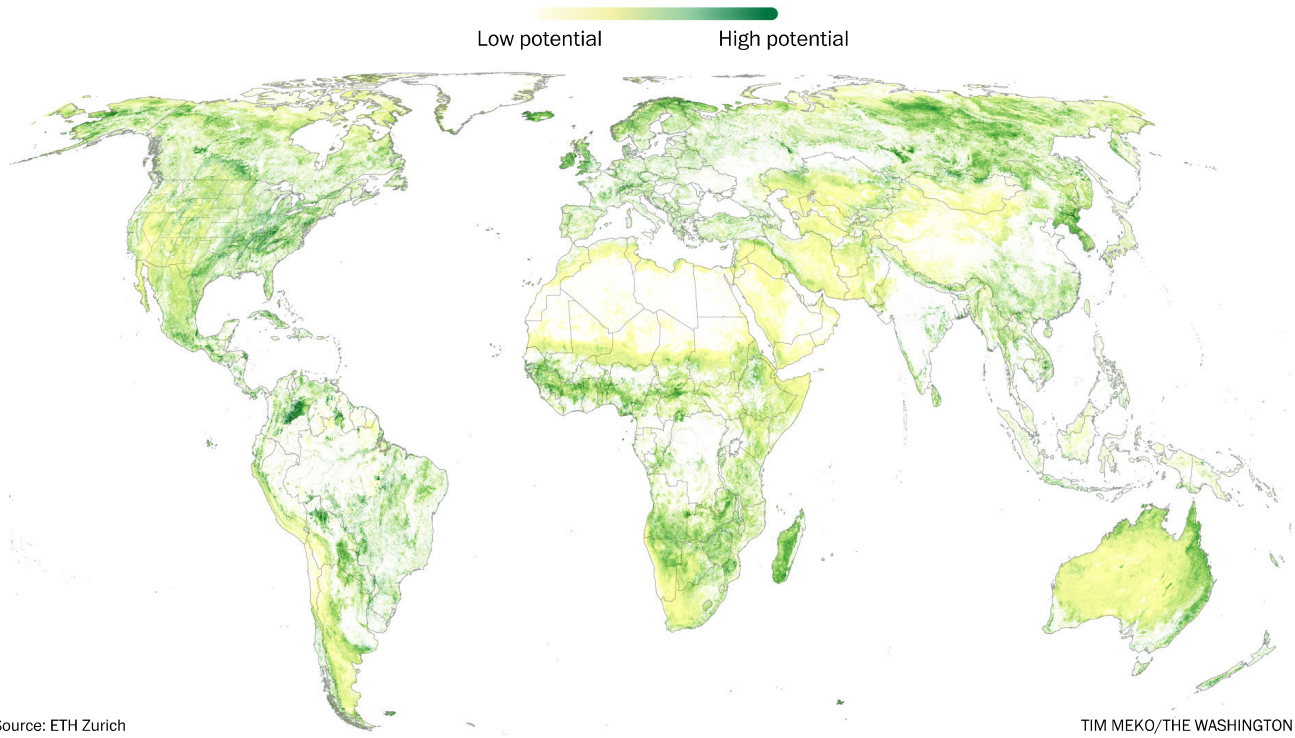
Trees are the most efficient carbon-capture machines on the planet. Through photosynthesis, they absorb carbon dioxide, the greenhouse gas that traps heat in the environment, and turn it into energy. That energy creates new leaves, longer stems and more mass — locking away carbon.

That makes healthy forests carbon sinks. American vegetation, according to the U.S. Environmental Protection Agency, absorbed enough carbon dioxide to offset 11 percent of the nation's greenhouse gas emissions in 2017.

When it comes to climate change, however, not all trees are created equal. The right species must be planted. They must live to maturity. Location also matters: Trees planted in Germany do not have the same carbon-fighting capacity as trees planted in the tropics, where they grow more rapidly and therefore capture more carbon. While new forests in high latitudes can cause the Earth's surface to grow darker and absorb more heat, forests in the tropics are frequently covered by clouds that reflect sunlight and cool the planet.

Reforestation potential

Researchers have identified the areas that have the most potential to be reforested, excluding urban areas and land used for agricultural purposes.



Source: ETH Zurich

TIM MEKO/THE WASHINGTON POST

But planting trees in the tropics can be hard. There, in developing regions, trees are often more valuable if they are cut down to be used as fuel or

lumber — or to make way for farming. In 2017, 40 football fields of tropical forests were lost every minute, according to Global Forest Watch, a nonprofit organization that monitors the world's forests.

The reforestation landscape is dotted with small groups, many of which use corporate money given as carbon offsets that are becoming increasingly popular. "This can work but it can also be misused," said ecologist Robin Chazdon. She said some corporations pay tree-planting groups as a way to "wipe their hands clean" and compensate for their carbon pollution.

Even the Trillion Tree Campaign is not without flaws. Critics have raised questions about the campaign's reliance on self-reports, causing Plant for the Planet to dial back its numbers by more than a billion trees.

In the past year, nearly 1,000 reforestation organizations sought funding from Ecosia, a Berlin-based search engine that uses its profits to sponsor tree planting.

"It is actually very worrying that so many campaigns are set up by organizations that say they want to plant a billion or trillion trees without obviously having any idea about what it takes," said Pieter van Midwoud, head of Ecosia's tree-planting operations.

Plant for the Planet focuses heavily on tropical regions. Latin America, Africa and parts of Southeast Asia, Finkbeiner said, "are the top priorities."

The group is restoring 20,000 hectares — about 50,000 soccer fields — of degraded rainforest in Mexico's Yucatán Peninsula, where it has planted 5 million trees since 2015 on land owned and protected by Plant for the Planet. The organization has hired local farmers to tend trees and keep bees.

"We've got 100 people there planting, on average, one tree every 15 seconds," Finkbeiner said. By clearing grass and other fast-growing plants that would choke the young trees, Finkbeiner said, the foundation keeps most of them alive for at least a year, at which point "they're almost certain to survive." Each tree is estimated to capture 200 kilograms of carbon dioxide in its lifetime, equal to the amount released when driving a car 500

miles.

Because it takes decades for new forests to mature, the most efficient way to use trees to capture carbon is to protect them from being cut down in the first place, environmentalists say.

In a 2014 agreement forged by the United Nations, more than 200 countries and corporations such as McDonald's pledged to cut deforestation in half by 2020 and to stop it altogether by 2030.

The pace of deforestation has steadily risen since 2000. Logging, agriculture and other human behaviors have driven some plants to extinction and annihilated forests, hobbling nature's carbon-capture machine. Each year between 2014 and 2018, the world lost more than 26 million hectares of trees — tree cover the size of the United Kingdom, according to the United Nations.

Planting trees to save communities and the climate

▶ 7:28

The tension between environmental and economic goals is vividly illustrated in Kawayanon, a village on a small Pacific island that is part of the Philippines.

The potential for replanting in the Philippines is great, because it is one of the most deforested countries on the planet. In 1900, tropical rainforests covered more than 70 percent of the archipelago. By 1990, that tree cover had plummeted to 19 percent.

In 2011, a presidential order created the Philippines National Greening Program with a goal of reforesting 3.7 million acres, an area about the size

of Connecticut. In 2015, the plan was expanded to 5.6 million acres.

On paper, the strategy is simple: Pay poor farmers small sums to plant trees. The new forests would in turn reduce poverty, conserve biodiversity, and provide food and lumber that is sustainably harvested.

A small number of studies indicated that the idea should work. In one experiment, half of 120 Ugandan villages were paid about $28 per year for every hectare of forest they protected. After two years, 4 percent of the forest had been lost to clear cutting in the villages that were paid. In the villages that were not paid, more than twice as much forest was lost.

Considering the cost of carbon emissions, the benefits of the Uganda program far outweighed the expense, said Northwestern University economist Seema Jayachandran, the study's author. "If you can get people to do it, it is a net win for carbon sequestration," she said.

The best plans provide long-term motivations to keep forests alive. Otherwise, after payments stop, locals may abandon the young trees before they mature. Or poor residents turn to the trees for cooking fuel. Some forests have even been destroyed so planters can be paid again to plant.

Over two decades, Kawayanon tried and failed four times to regrow its forest. Finally, forestry officials decided to try something new.

"There is a saying in forestry: It is not about trees, it is about people," said Nestor Gregorio, a research fellow at Australia's University of the Sunshine Coast who studies low-cost forestry techniques. "If people will find trees important, then they will look after the trees."

Gregorio worked with a colleague, forestry expert John Herbohn, and several others to help the villagers see the trees as a source of future livelihood rather than an immediate resource. Fruit trees provide an ongoing supply of food. Some groves will be harvested for lumber and replanted, in keeping with sustainable practice. Stands of native trees left to grow replenish the watershed and prevent erosion, Gregorio's research has shown.

FROM TOP: Children clean up their school grounds in Cebu, an island in the Philippines where reforestation is underway. Children from an elementary school dance in the show, in which kids used plants and leaves as costumes. Two girls pose after rehearsing for a local production about the natural world.

The scientists taught the farmers to identify the full and tall specimens that produce the hardiest seedlings, nicknamed “mother trees,” and showed them how to transfer seedlings to recovery chambers, which rejuvenate them after the trauma of collection. During planting season, they taught the farmers to dig large holes in the soil, a foot on each side, to better trap moisture. Gregorio and Herbohn are spreading these lessons to other villages in the Philippines and in Papua New Guinea.

Two dozen members of the Kawayanon Farmers Association now run a tree nursery. Benefits from the trees supplement the $600 a year they earn from farming — below the living wage in the Philippines. Each day they tend little seedlings; during planting season, they carry them up the side of a volcanic mountain. The farmers, many in their 50s and 60s, barely break a sweat in the 80-degree weather.

At first glance, the greenery looks like any healthy forest. Ferns curl at the base of the trees. Only upon closer inspection is it apparent that the trees are spaced in neat, unnatural rows.

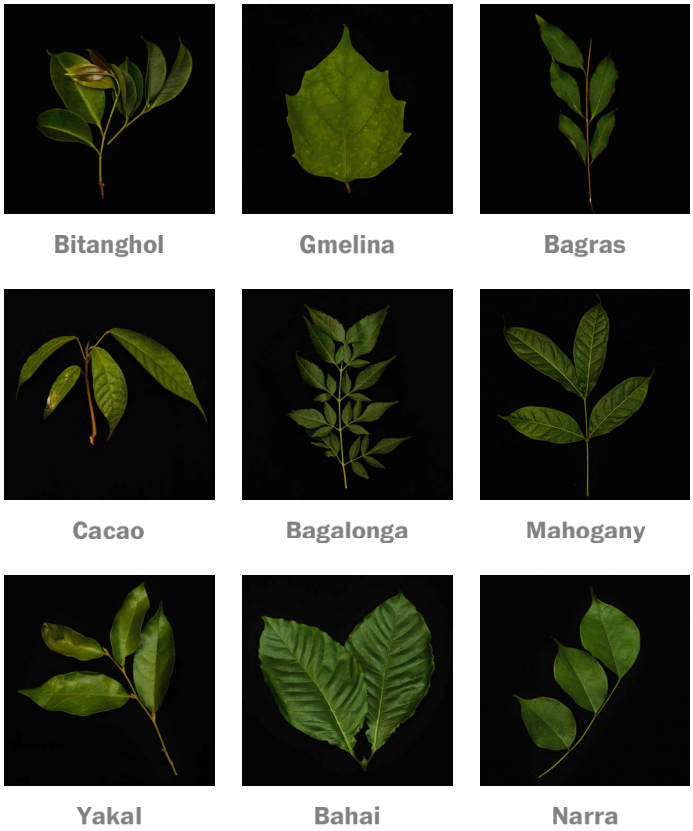
“Before there were illegal cuttings the trees were large and big and beautiful,” said Annabelle T. Hayahay, a leader in the Kawayanon group.

The new trees, she said, will return yellow grassland “back to forest.”

Now five years old, Kawayanon’s 45-acre forest is a model for the National Greening Program. Nationwide, the program planted more than a billion seedlings between 2011 and 2018. The tree cover in the Philippines has begun to return — increasing to about 23 percent, according to a U.N. Food and Agriculture Organization report in 2015.

Green leaves, rare trees

Kawayanon’s farmers raise several different species in their tree nursery. Many are native to the Philippines. Some species — like yakal and other trees of the genus Shorea, valued for hard lumber and used in traditional medicine — are endangered.



Still, the Philippine forests and the greening program are threatened by politics and illegal logging.

Danilo S. Lendio, who oversees the Department of Environment and Natural Resources station in Cebu province, said his office has broken up the same tree harvesting ring three times. The first time, the man in charge of the ring was a lieutenant in the army, Lendio said. The second time, he had been promoted to captain. By the third round, the ringleader was a general, and the DENR was warned it would be too risky to continue to bust him.

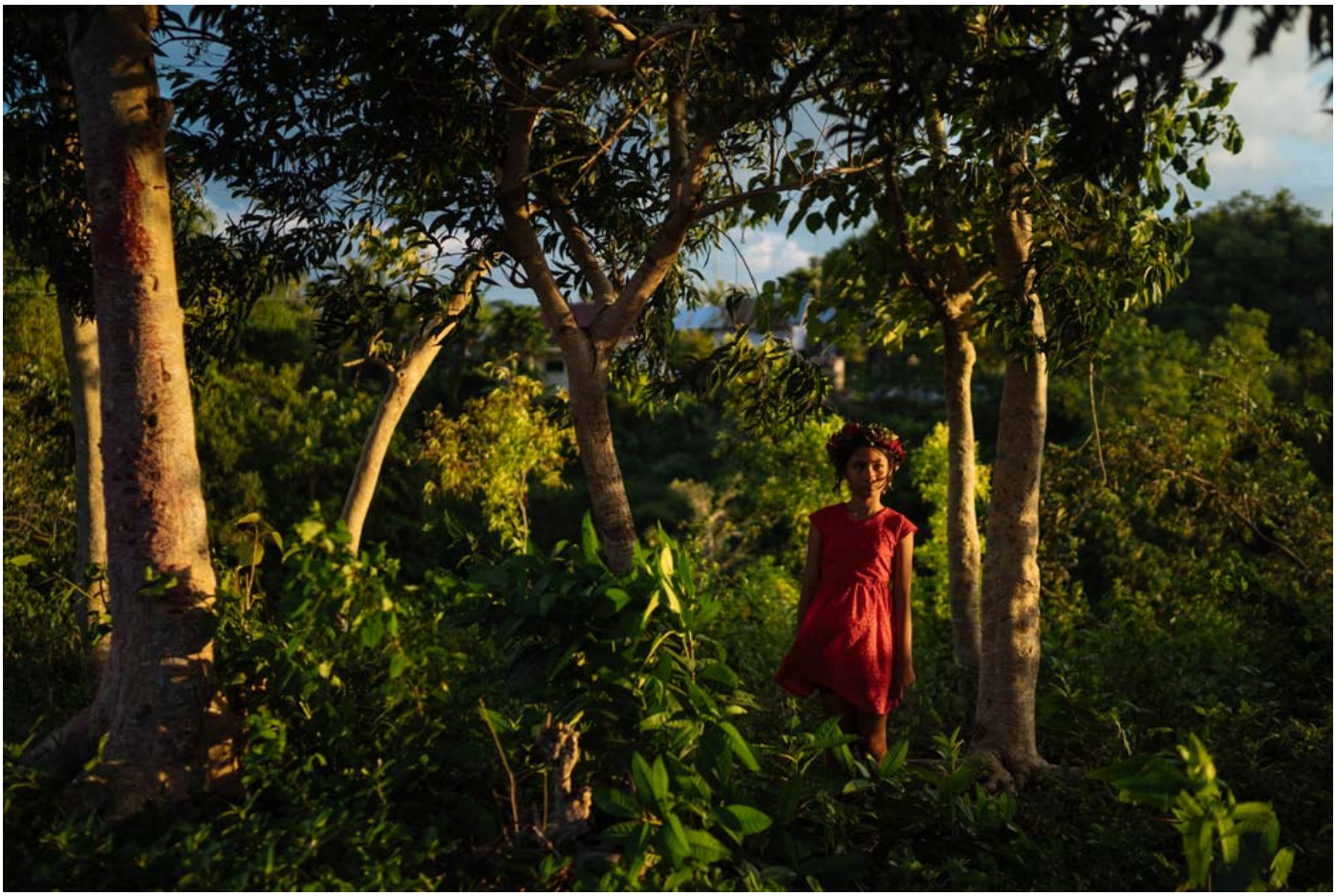
Lendio said he will persist. “As long as he’s doing what he is, we will continue,” he said.

Meanwhile, president Rodrigo Duterte’s administration cut the greening program’s budget in half last year, citing poor performance. Administration officials declined to comment on the decision.

Though the Philippines produces less than 1 percent of the world’s greenhouse gas emissions, it is a nation on the edge of climate change, which underscores its need to restore its rainforests.

Global warming has probably strengthened the storms that pummel its shores. In November 2013, Typhoon Haiyan battered the country’s low-lying eastern islands with a wall of water. The hurricane’s winds, which reached up to 180 miles per hour, were some of the fastest ever recorded. More than 6,300 people died.

Had the mangrove forests been healthier, they may have absorbed some of Haiyan’s winds and surges. A lush mangrove forest was credited with saving the seaside town named General MacArthur.



FROM TOP: A child in a grove of trees in Cebu, where the government is paying farmers to plant trees as a way to fight climate change. A man picks fruit from a tree in Biliran on the way home from another Filipino reforestation site. Butterflies are seen in an area being reforested by locals in Cebu.

If such problems could be overcome, how much carbon could trees capture? Jean-Francois Bastin, an ecologist and geographer at the Swiss Federal Institute of Technology, has spent the past decade trying to answer that question.

Several years ago, Finkbeiner wanted to know how many trees currently exist, a question that inspired Bastin, Crowther and others to map global tree density. In a study published in Science in 2015, they estimated that there are about 3 trillion trees on the planet. A follow-up in 2019 found room, theoretically, for about a trillion more.

Using Google Earth satellite images, Bastin, Crowther and their colleagues examined 80,000 half-hectare plots in protected areas worldwide, noting where trees should be abundant, such as rainforests, and where they don't grow, such as grasslands. Using this knowledge, they calculated the total theoretical canopy cover in today's climate if the planet were scrubbed of human existence.

When the needs of people were added back into the equation, the researchers calculated that an additional 0.9 billion hectares could be covered with trees, an area the size of the continental United States. When fully grown — which would take hundreds of years of effort — this forest would suck more than 200 gigatons of carbon out of the atmosphere, or 25 percent of the carbon in the atmosphere, the scientists calculated.

The study found that six countries hold more than half the potential to restore trees — the United States, Russia, Brazil, Canada, Australia and China — because they have the most land available to plant.

Jeomar Etulle, a Filipino farmer, walks through a thicket of trees in Cebu planted by an organization he helps manage. In the Philippines, where one-third of the forest cover has been decimated in recent decades, an international team of scientists is working with local farmers to restore trees — nature's carbon-capture machines.

Few scientists dispute trees are useful. But "there are some concerns about some of the messages in the Bastin-Crowther paper," Chazdon said, meaning the researchers didn't fully address the real-life barriers to reforestation.

Other critics say the math was off. The journal Science has published six critiques: Some argued the model overestimates the ability of forests to capture carbon because it ignores carbon trapped in soil. Another group of researchers noted that, in northern regions, transforming reflective snow into green leaves would be counterproductive.

The lab stands by its calculations, but Crowther has acknowledged that trees should not be planted everywhere the model suggests they can grow. Nor are trees a panacea for fighting climate change, he said: "Cuts to emissions" by ending humanity's dependence on fossil fuels "are the central part" of the battle.

Still, Crowther said, planting trees is "one of thousands of solutions that are absolutely critical."

Ben Guarino
Ben Guarino is a reporter for The Washington Post's Science section. He joined The Post in 2016.

About this story

Story editing by Lyndsey Layton, Laura Helmuth and Lori Montgomery. Video by Gretchen Maladad, Ray Whitehouse and Jayne Orenstein. Photo editing by Karly Domb Sadof. Copy editing by Mina Haq. Development and design by Andrew Braford.