September 06, 2021

Earth & Space

How to fight climate change? Let forests grow

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This Break was edited by Max Caine, *Editor-in-chief* - TheScienceBreaker

ABSTRACT

While enthusiasm grows for reforestation as a tool for combatting climate change, we lacked information about how fast or slow new forests across the globe could capture carbon dioxide. So we created a first-of-its-kind map of potential carbon capture from natural forest regrowth for every square kilometer of the planet.

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The world is waking up to the potential for trees to help in the fight against climate change. Forests have always absorbed substantial carbon dioxide (CO2) from the atmosphere. Still, the human disturbance has relegated forests to approximately half their pre-historic extent, with more forests lost every day. Conservation and responsible management of standing forests are critical, but we need not stop there: regrowing natural forests represents an essential tool for drawing down the carbon dioxide levels in our atmosphere.

Until recently, we've lacked the science to take advantage of this natural tool. We had insufficient information about how fast or slow new forests could capture carbon dioxide and how this rate varied by location.

To solve this problem, we spent two years reading through thousands of papers to build the first-ever global dataset of the carbon capture potential of natural forest regrowth. While there are lots of ways to re-establish forests, we focused on natural forest regrowth. Natural forest regrowth involves simply allowing trees to grow back on previously cleared lands. When conditions are right, it is often less expensive and more beneficial to native wildlife than planting trees. We also focused on the early stages of forest regrowth, up to 30 years old forests, because we wanted to figure out how much carbon

forests could capture between now and 2050 when the world is striving to be carbon neutral. By poring through scientific papers and tracking down national forest inventories, we assembled 13,112 measurements of carbon in naturally regrowing forests scattered across the globe.

When we mapped these data points out, we were surprised by the tremendous variation in carbon capture potential across the globe, with drier savanna forests absorbing less than half a metric ton of CO2 per year and dense tropical forests absorbing more than 12 times that amount. In other words, location and context really matter. What are the most critical drivers of this tremendous variation? From site to site, we found that it matters whether the land was previously a pasture or a cropland or a harvested forest. Still, when you scaled out to the globe, climatic factors such as precipitation and temperature had the strongest and most consistent influence on forest growth.

This result was important because it allowed us to use available global-scale climate and environmental information to fill in the gaps between sites where we have data. For example, because our data showed that forests grow faster at rainier sites, we would expect other places with a lot of rain to regrow forests quickly.

The result is a cutting-edge forest growth map that predicts how quickly natural forest regrowth can capture carbon for every square kilometer of our planet. This map also demonstrated that existing estimates of carbon capture from regrowing forests (published in tables from the Intergovernmental Panel on Climate Change [IPCC]), undersold their potential as a climate solution. Our map increased the estimate of potential carbon capture from natural forest regrowth by 32% globally and by a full 50% for tropical forests. More importantly, our map shows an 8-fold range in carbon capture potential that IPCC tables fail to capture. Therefore, our map can help and drive action towards places where letting forests regrow can contribute the most to stabilizing our climate.

Our map also allows us to infuse solid numbers into big global estimates of how much climate mitigation new forests could provide. The mitigation potential of a forest depends on both how quickly new forests can capture carbon and where those new forests are. There is a range of estimates of the amount of land available for reforestation globally, but no matter which of these estimates you use, our map shows that letting forests regrow naturally is a huge potential climate solution. For example, when we plug in a map of 678 million hectares of "reforestable" land, our growth estimates pencil out to 8.9 billion metric tons of CO2 absorbed from growing forests each year through 2050. That's the equivalent of soaking up one-quarter of global fossil fuel emissions from the atmosphere every year.

We cannot avoid one thing: to win the fight against climate change, we must dramatically reduce our reliance on fossil fuels. However, Nature is also willing to lend a hand in this. Our work shows how deploying natural forest regrowth in the right places represents a powerful option for tackling climate change.