Planting new forests is part of but not the whole solution to climate change

22 June 2020

Credit: CC0 Public Domain

The large-scale planting of new forests in previously tree-free areas, a practice known as afforestation, is hailed as an efficient way to remove excess carbon dioxide from the atmosphere—a so-called natural climate solution.

But a new study led by a Colorado State University biology researcher finds that the carbon-capture potential of afforestation may be overestimated. The study, published online June 22 in *Nature Sustainability*, contends that ratios of soil organic carbon underneath afforested areas vary greatly across different ecosystems and climates, and these variations depend on factors like tree species, land-use history and soil type.

These results, based on over 11,000 soil samples taken across control and afforested plots in northern China, indicate that natural climate solutions alone are not enough to meet global climate mitigation goals.

"We hope that people can understand that afforestation practices are not one single thing," said Anping Chen, a research scientist in the CSU Department of Biology and a lead author on the study. "Afforestation involves many technical details and balances of different parts, and it cannot solve all our climate problems." Chen helped launch the ambitious study while a graduate student at Princeton University about a decade ago.

Inspired to find better data

The research was inspired by a 2010 workshop at Princeton, which led to a high-profile publication on the global forest carbon sink in Science by U.S. Forest Service scientist Yude Pan. In the absence of better data sources, the scientists had used a fixed ratio between tree biomass and soil carbon to estimate total soil organic carbon stocks—a measure that Chen and and Peking University collaborator Shilong Piao suspected was not accurate. This method can be even more problematic, Chen said, for estimating afforestation carbon sequestration potential because land-use changes are often associated with soil disturbances.

As Chen and Piao sat in the workshop, they decided to try and find a new way to estimate below-ground soil carbon changes, and designed a field study to investigate their hypotheses.

In 2012-13, researchers from the U.S. and China led by Chen and Piao collected comparative soil samples at various depths from 619 pairs of afforested plots and control plots across northern China. The Chinese government has run extensive afforestation campaigns as both climate mitigation strategies as well as an attempt to reduce dust from the Gobi desert.

The researchers found that in carbon-poor soils, afforestation did increase soil organic carbon density. But in soils already rich in carbon, they found that carbon density decreased. Their findings concluded that fixed biomass-to-soil organic carbon ratios assumed in previous studies might be

overestimating the overall soil organic carbon enhancement features of afforestation practices in general.

The results have implications for forest managers and policymakers. For example, a site that's already above a certain threshold of soil organic carbon underground may be best left alone for natural forest regeneration rather than planted with trees, Chen said.

"Our results strongly suggest that estimated afforestation carbon sink potentials that do not account for background soil carbon stocks or the potentially negative effects of afforestation is overly optimistic," the authors wrote. "These findings also indicate that the assumption of a fixed ratio between soil and biomass carbon, which has been widely used in previous studies for estimating soil carbon stocks, is unreliable."

The paper is titled "Divergent responses of soil organic carbon to afforestation."

More information: Divergent responses of soil organic carbon to afforestation, *Nature Sustainability* (2020). DOI: 10.1038/s41893-020-0557-y , www.nature.com/articles/s41893-020-0557-y

Provided by Colorado State University

APA citation: Planting new forests is part of but not the whole solution to climate change (2020, June 22) retrieved 21 June 2021 from https://phys.org/news/2020-06-forests-solution-climate.html