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Can planting trees mitigate climate change?

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As the world is struggling to combat climate change, one idea – planting trees – seems to be taking hold as a panacea for curing the ills of pollution, soaring carbon emissions, and degrading soil health.

But just planting trees is not a cure-all for tackling global warming and climate change, multiple studies have found. Right from selecting the correct species to then monitoring and maintaining saplings and planning for large-scale tree plantation, effective tree plantation goes beyond just planting of the tree.

Ill-planned and unscientific tree plantation programs could in fact lead to maladaptation, as pointed out by some authors of the United Nations' Intergovernmental Panel on Climate Change (IPCC) Working Group II report. Maladaptations are actions that may lead to increased risk of adverse outcomes such as increased greenhouse gas emissions, increased or shifted vulnerability to climate change and inequity. Such actions can also dent biodiversity and ecosystem resilience and constrain ecosystem services.

What happens after trees are planted?

Most saplings, after being planted, also need to be watched over and nurtured before they grow strong and independent, and begin their work in sequestering carbon. Caring for and monitoring planting efforts over time are critical, but have not yet become a core part of tree-planting drives and programs.

According to studies in the Central Himalayas and the Coromandel coast (southeastern coast of India), planted trees showed hugely variable survival rates over 5-10 years. Depending on whether these were native or exotic species, in mixed- or mono-species plantations, the planted saplings' survival ranged from 51–87% at one site, 0–100% in another, and 35–100% in yet another. While 100% sapling survival over 5 years sounds like a positive trend, this is true only for very few species.

Krutika Ravishankar, Co-founder and Executive Director Farmers for Forests, who is working to turn barren, degraded pieces of land in Maharashtra into thriving forests, writes in an article about the challenges her team faced, from financing operations to bargaining with vendors for setting up drip irrigation systems and chasing sapling vendors to provide the right species of trees for planting. In the 2020 article she recommends that when one pays to plant a tree somewhere, hold the organisation accountable by asking for not only the geo-tag but also regular data on the health and status of the tree, satellite indices and if a visit to the plantation site is possible.



A Miyawaki plantation at Barapullah, Delhi. Photo by Arnold Joyce/Mongabay.

What makes some plantation efforts fail while others succeed?

One of the main reasons why saplings often do not survive much longer than a year or two after mass planting drives, is because they are unsuited for the places they are planted in. In many cases, this is due to a lack of good quality seeds and saplings, but in others, it is simply a lack of good planning. For example, planting the wrong kinds of trees in the wrong places.

A 2022 study on afforestation in Himachal Pradesh showed that nearly 40% of the money spent on planting efforts were centred on places that already had moderate to high tree density. Only 14.1% of the budget was spent on recovering degraded forests that had high reforestation potential. Yet another study conducted between 2012 and 2016 in the same state shows that following afforestation undertaken to compensate for hydropower development, not only was there less than 10% survival of planted saplings over a span of 10 years but only 36% of the funds budgeted for mitigation work had been used. The projects have further been riddled with issues ranging from interspecies conflict, infringement on local land use, and damage by wildfires and landslides. One of the key reasons that the afforestation targets have not been met is the lack of suitable land for reforestation, the author of the study has noted in a news report. A third study published

in Nature in 2021 further finds that large-scale tree planting in Himachal Pradesh has neither met climate mitigation goals nor is it supporting local livelihoods.

Despite these setbacks, there are some afforestation efforts that have seen some success. The afforestation of the Aravalli hills – a project dubbed as ‘rewilding’ a former mining site in Haryana – has brought together citizens, corporates and local administration to create a natural forest that stands in the bustling city of Gurgaon. In the neighbouring state of Rajasthan, local efforts are exploring the Miyawaki method of plantation using native trees to combat desertification, groundwater salinity, and soil nutrient loss.

In other places, however, it is reported that many of the compensatory afforestation programs that the environment ministry has used to allow forest clearance for mining or industrial projects, simply do not exist. These ghost plantations have either never seen any planting activity or are no longer being taken care of; and in one worst-case scenario, the plantation shows up on the map as located in the middle of the Arabian Sea.

In other places, a rush to plant trees ‘for regenerating the ground water table’ or to ‘increase biodiversity’ are leading to unscientific mass tree-planting frenzies using fast-growing eucalyptus, pine, or acacia. Such plantations often consume more water than they help to conserve. In some cases, such planting activities may even reduce biodiversity, rather than improve it, as has happened in Chile, where planting commercially valuable trees has led to losses of biologically valuable forests. Worse still, many of these plantations are in areas that are primarily grasslands or savannahs, which are misclassified as wastelands or degraded forests. Far from being such, savannahs are better at carbon sequestration than artificial forests, harbour unique biodiversity niches, and provide sustenance to pastoral communities.



Sholas are patches of stunted tropical montane forest found in valleys amid rolling grassland in the higher montane regions of South India; this ecosystem is now getting damaged due to invasive trees. Photo by Divinwrct/Wikimedia Commons.

The potential of trees to mitigate climate change is overestimated

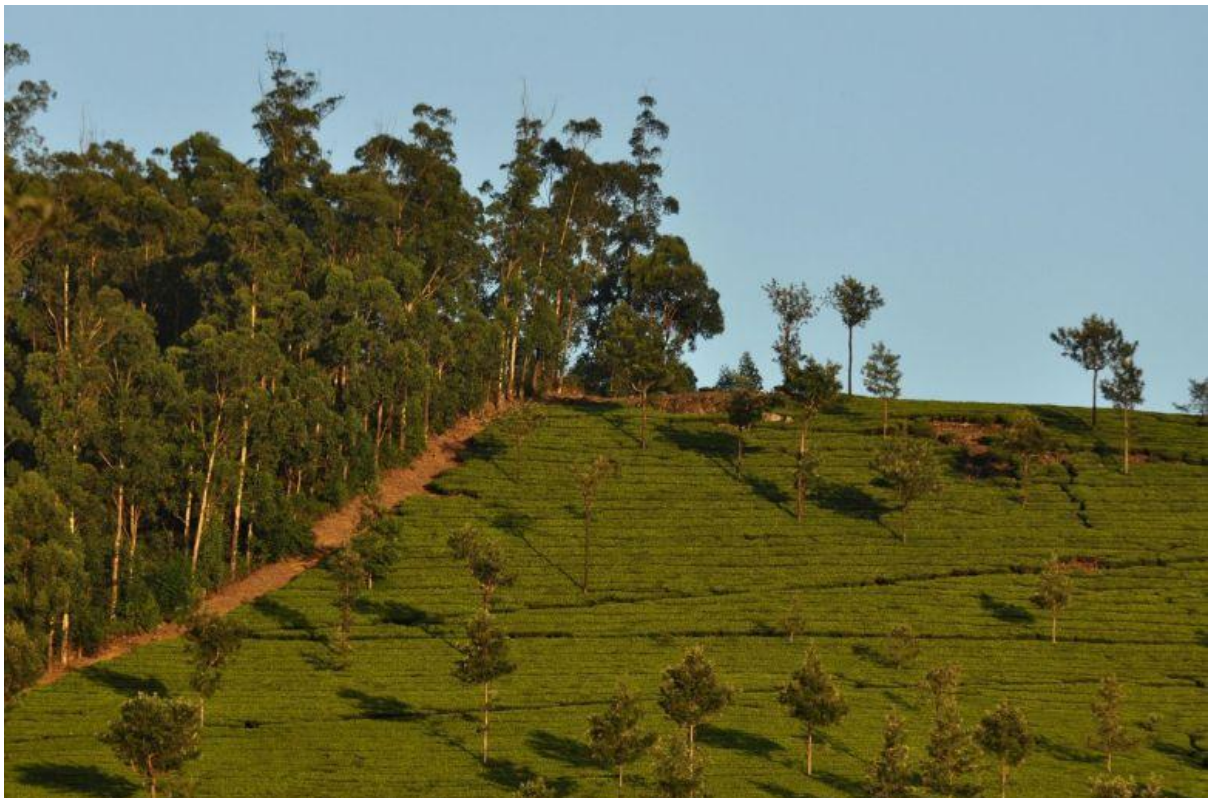
The global fascination for planting trees – be it local projects, national-level programs by corporate entities, or global initiatives like the Trillion Trees campaign – is rooted in the belief that trees perform essential services. While it is common belief that planting trees and reforestation can suck the carbon out of the atmosphere, scientists warn that it may not be so simple. While it is true that trees are important carbon sinks, there is much data that shows that the global potential for trees to mitigate climate change – by absorbing up to 200 gigatons of carbon – is grossly overestimated.

This estimate, which was made in a broad, sweeping paper published in 2019 in *Science*, projected that the Earth could support an additional 0.9 billion hectares of forest. However, in a series of four separate comments, published by *Science*, different groups of scientists pointed out several serious concerns about the assumptions in this paper. For example, much of the land described as ‘available’ for tree plantation, turned out to be savannahs, which are ecosystems that are already substantial carbon sinks. In all, it was argued that the study had overestimated the carbon storage potential of trees by a factor of five.

A study in January 2022 in *Conservation Letters* used a machine learning framework to demonstrate that the climate mitigation potential from forest restoration in India has also been exceptionally overestimated. The results of the study indicate that India’s ability to create more carbon sinks via afforestation will meet less than one-fourth of the country’s commitments to the 2015 Paris Agreement.

In addition to this, there is another worrying trend that scientists have noted in a 2020 *Nature* article. As increased carbon dioxide (CO₂) levels in the atmosphere are stimulating tree growth, the faster growth rate will also lead to trees dying at younger ages. This is due to a universal growth-lifespan trade-off (faster growth is associated with earlier deaths) that is seen in almost all species in all environments. This means that at current rates, although there will be a net carbon uptake by trees in the short term (this century), a lagged pattern of mortality will eventually neutralise these carbon gains over a longer period of time.

How do we plant trees in an effective manner?



A peepal tree plantation activity in Aarey, Mumbai in 2019. Photo by Kartik Chandramouli/Mongabay.

Despite these concerns, planting trees can be beneficial in many ways; however, the focus needs to move away from afforestation (planting new forests) to reforestation (restoring forests). Active restoration efforts can help fragmented forests recover and if properly planned, could even support

local livelihoods. A study in Valparai, Tamil Nadu has shown that reforestation efforts with native species rather than monoculture tree plantations, yield forests that are better at sequestering and storing carbon.

In addition to reforesting, much greater efforts need to be made to halt deforestation. In 2017, changes in land use, primarily deforestation, contributed nearly 1.5 gigatons of carbon (GtC; roughly 10%) to the global total of 11.3 GtC. A new study in Nature Sustainability now shows that this may have been a underestimation – that between 2015–2019, carbon emissions due to deforestation were double those in 2001-2005. Much of this loss has been from tropical regions; scientists fear that if deforestation in this region does not slow down, the Amazonian rainforests could soon turn into carbon sources rather than remaining as carbon sinks by 2050.

In India, major changes need to be made in how forests are managed. Not only does India have no clear national forest policy, but the costs of clearing out forests are appallingly low. India's policies on forest cover are also outdated, having been based on French estimates during the colonial period. Despite all these setbacks, which also include issues with poor on-ground data and research, difficulties in correctly identifying available areas for tree planting, conflicts of interest with stakeholders, poverty, and finance, there are still great opportunities for reforestation in India. However, these opportunities must be developed hand-in-hand with input from local communities at the grassroots level to be effective. By looping in the private sector and attracting corporate players, especially through corporate social responsibility spending, India can do much to restore its degraded forests and turn them into active carbon sequestration units.

But it is amply clear that nature-based initiatives are not going to be enough, whether it be planting trees or encouraging blue carbon-based approaches to climate change mitigation. All these efforts must be synchronised with strategies that work towards decarbonising economies.

Source: <https://www.eastmojo.com/environment/2022/07/06/can-planting-trees-mitigate-climate-change/>