

Green Illusions: The Tree Planting Dilemma

Ritam Ghosh^{1*}, Manas Das¹, Purnendu Dutta¹ and Samprity Paul¹

¹Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal-731236 India

ARTICLE ID: 15

Abstract

Tree planting is considered a key solution to mitigate climate change. But, many of these efforts have been disturbed by different factors. Despite ongoing extensive campaigns to plant trees in large areas around the world, the impact cannot solve rising global warming problems. Tree planting is considered a key solution to mitigate climate change. But, many of these efforts have been disturbed by different factors. Despite ongoing extensive campaigns to plant trees in large areas around the world, the impact cannot solve rising global warming problems. If not, the impact may disturb an ecological balance, create a water crisis, and in some worst situations, soil disturbance might increase carbon emissions. Many a time, due to poor follow-up, the aftercare support and planting condition do not become site-specific, and the survival percentage of mass plantation shrubs and trees is nominal. This will require a move from a quantity-based approach to one which centers on qualities, focusing on natural regeneration, local species adaptation, and community involvement. So, the success of the reforestation project needs maintenance for a long time, active monitoring, and good funding. The use of advanced technologies and policy and governance actions would further make efforts in the landscape restorative. It thus advocates a holistic approach that will include reforestation as part of bigger schemes of environmental, social, and economic strategies aimed at securing effective and long-term impacts of climate change mitigation.

Introduction

Generally, tree planting and reforestation are the most effective ways to reduce the emission of Carbon dioxide while helping to cool down the environmental temperature. So many campaign in large as well as small scale have been conducted in all over the world. But in reality, it's often different. Is plantation the effective way to control this situation or is it just a wastage of time? In decades we planted billions of plants year after year but global warming is continuously increasing. Particularly the consumption of fossil fuel costs us roughly 10 billion tons of CO₂ annually but in return not enough plants are planted annually to compensate



those. As trees are not sole source of O₂ and also, several critical limitations of reforestation reduce its effectiveness as a beneficial solution of global warming and this climate crisis. That's why now it is very important now to discuss about if and how tree planting is reasonable?

Another example ocean plants or aquatic plant like phytoplankton, red algae, kelp, seagrass and sargassum quickly taken up more than 3 billion tons of CO₂ but at the same time the terrestrial plants or trees absorbed one quarter to one third amount of CO₂ i.e. less amount of CO₂. Similarly, xerophyte is adapted to grow in desert soil or soil having less water, halophyte plants can tolerant high salinity. Without considering the above discussed factors or proper maintenance, no plants can grow well or survive.

Negative impacts of afforestation

The FAO report (2018) shows a continuous decline of global forests by 3% between 1990 and 2015 which arises the need for more afforestation, forest protection and restoration. Though having many positive aspects i.e. carbon sequestration, slowing down climate change, etc, it has some downsides as well. In many instances without the consideration of local factors and ecology might bring some negative consequences to the ecosystem. Similarly faulty planting, not correlating species and local factors may be detrimental to the pre-existing biodiversity, for example, planting in grassland like savannahs may be disastrous which might cause loss of local biodiversity and their survival.

Often it is understood that reforesting would mitigate the water shortage problem, planting trees cannot be observed separately from long-term sustainable land and water management, and still the impact of planting is at best unclear (Andreassian, 2004; Calder, 2007; Ellison et al. 2012; Filoso et al. 2017). Afforestation in Andean highlands of Ecuador reduced the water yield by 50% (Buytaert et al. 2007). In a study on impacts of a large-scale afforestation on the water storage balance of Southeast Asia, Xiao and Xsiao (2019) planted forests results with more water shortages, less rainfall, and higher evapotranspiration rates, compared to natural forests.

1. No awareness in choosing suitable plant type and species: Selecting suitable species and their mixtures and planting them in irregular pattern can be a better approach to resemble natural forests. Lu et al. (2018) showed that planting of inappropriate plant species for local environment with evapotranspiration exceeding regional precipitation, there has been a increased depth of groundwater in arid and semiarid northern China. Plant species selected for withstanding aridity in dryland area had lead to harming the natural ecosystem. The

study in Ireland reported that due to afforestation run-off has reduced up to 20%, recharge rates under forests can be reduced to one tenth under grass or heathland, and the quality of groundwater is compromised by enhanced acidification and nitrification.

2. Negative impact on water source:

Afforestation often reduces water yield in catchments and eventually increases water security risk, in tropical rainforests. Consequences like fluvial erosion, enhanced rainfall infiltration, ground water recharge and aquifers, water supply distribution regulation, enhancement of moisture recycling has been mitigated. Generally forests have high evapotranspiration rate compared to other land uses, reducing water yield. With the age of forest rate of evapotranspiration decreases and it influence in favour to increase water yields but it takes a long time.

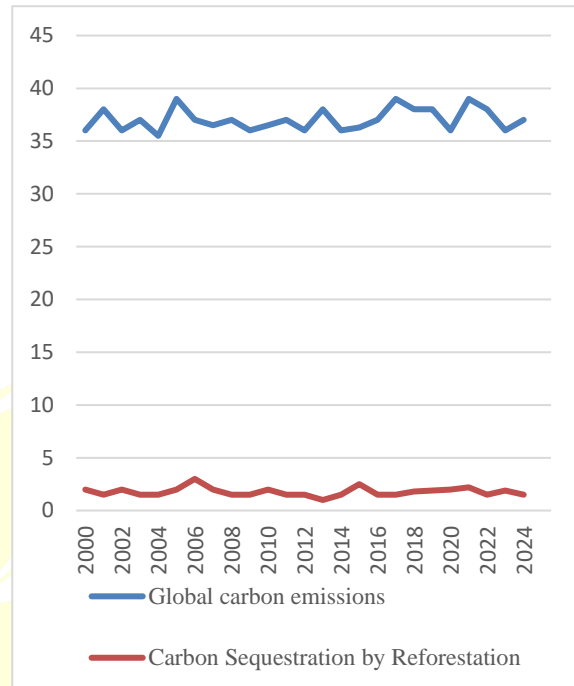


Figure 1 Impact of afforestation on water yield

3. Not being able to absorb enough CO₂ in limited time span: Replacing the pastureland or grassland. The carbon is stored in the grass and the soil is intact with it, when removed the release of stored carbon as CO₂ increases the greenhouse gas in the atmosphere. Newly planted sapling takes many years to absorb this CO₂, making it a long-term process to get benefits. To resist global warming, we need to stop rising temperatures more than 1.5°C from average, a huge amount of greenhouse needs to be eliminated from the atmosphere.

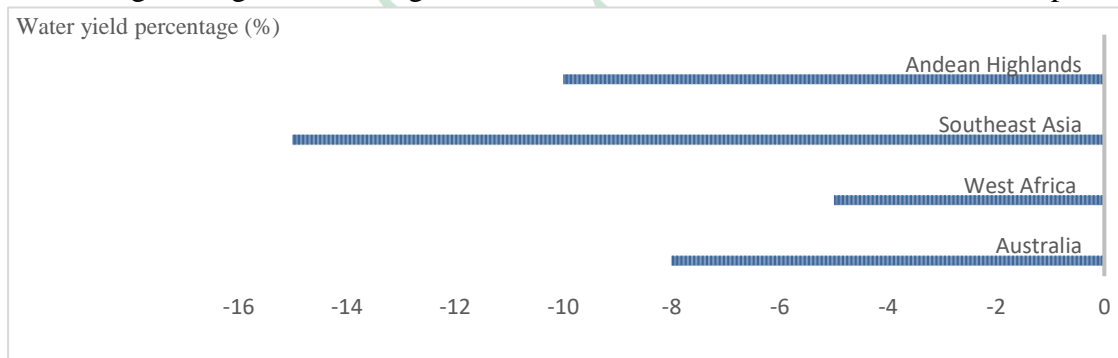


Figure 2 Global carbon emissions vs. Carbon Sequestration by Reforestation

4. **High requirements of fund:** Another problem is obviously the fund requirements for tree plantation programs, and not only for planting it requires a great amount for maintenance of those plants. Even after taking great care, most of the plants do not survive so it's a huge loss in monetary aspects.

Challenges in campaigns of Mass Tree Planting:

Planting trees is a great solution to all environmental problems, but actually, it's way more complicated. The mass tree-planting project that the world is alluding to, where this act would help offset climate change, reverse biodiversity loss, and take on environmental degradation. Several ambitious targets have been set by many countries and organizations, including India's National Mission for a Green India and the authority for Compensatory Afforestation Fund Management and Planning. Truly, the stakes involved are much greater than just planting trees, requiring it to be planned meticulously and efforts to be continued in order to get worthwhile results and environmental benefits.

1. **"Breath for the Future" Campaign in Turkey:** On November 2019, 11M trees were planted, representing a record by the number of saplings planted in one hour. Unfortunately, up to 90% of those planted in November are dead in less than three months due to the mismatch of the timing and the insufficiency of rainfall.
2. **Mexico's "Sembrando Vida" Program:** It is a government incentive program started in 2018 that planted trees on farmland but has been accused of deforestation in some areas.
3. **Pakistan's "Billion Tree Tsunami" campaign:** This massive planting campaign initiated in 2014, it is said that, amongst the unintended consequences, have been the erasure of a historical nomadic husbandry amongst the nomadic community.
4. **Reforestation Programs, India:** In India, Himachal Pradesh has planted almost 50 million within a prolonged time period, but it was successful. Whereas, the state of Uttar Pradesh had done a massive plantation of 50 million trees in just one day, out of which only 60 per cent survived.

Issues with Unmanaged Mass Tree Planting

1. **Low Survival Rates:** Turkey's "Breath for the Future" campaign highlights mass planting challenges: poor survival due to planting timing, water shortages, maintenance gaps, soil issues, and vegetation competition.

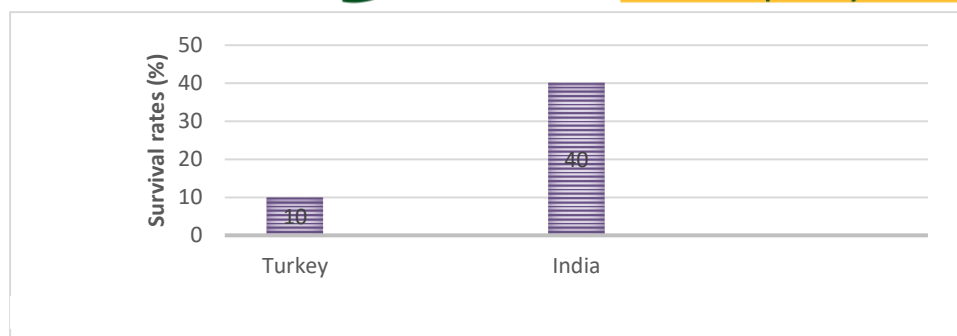


Figure 3 Survival rates of Mass tree planting campaigns

2. Ecological Imbalance: Mass planting of fast-growing species often leads to monoculture, reducing biodiversity. Species like eucalyptus, acacia, or mango, despite their human benefits, can introduce invasive species and disrupt non-forest ecosystems like grasslands. They also consume significant water, depleting local resources in arid areas.

3. Ineffective Carbon Sequestration: While trees do absorb carbon dioxide, the actual climate benefit from mass planting may be exaggerated because most of the trees that are planted die. Additionally, land preparation before plantation is quite carbon-intensive yet often not accounted for, and there is poor carbon storage in long-term, short-rotation plantations.

4. No Long-term Planning: Efforts often prioritize short-term planting targets over the long-term goal of establishing forests, leading to inadequate monitoring, maintenance, and failure to achieve ecological benefits.

5. Socioeconomic Impacts: Agriculture is losing appeal to the younger generation seeking secure non-agricultural jobs, exacerbated by government neglect of farming needs. Large-scale planting can displace local communities' traditional uses like grazing or small-scale farming, without involving them in benefits. It disrupts socio-economic systems tied to land use, creating conflicts.

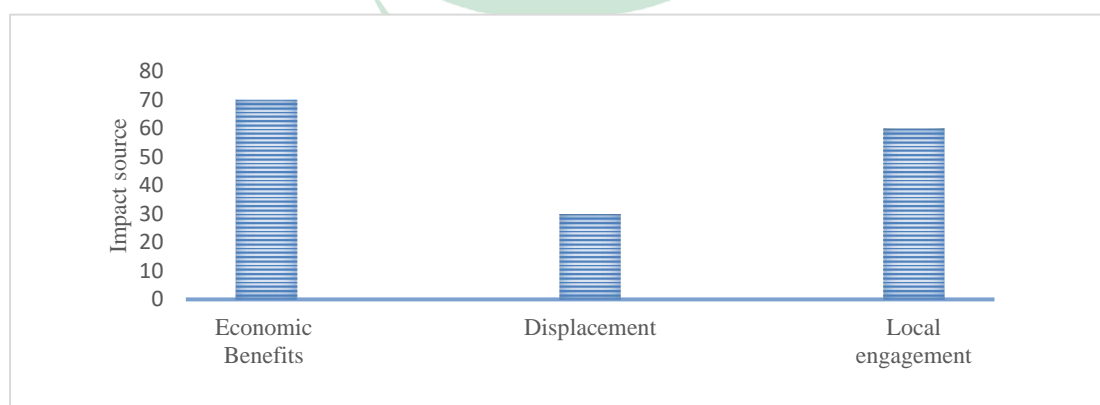


Figure 4 Socioeconomic Impacts of Tree planting Initiatives

Solutions and best practices

But till now, the government has not initiated any plans for the after-care of the trees. So, we need to bring this attention to some of the solutions that can be taken up. Some of the solutions include:

1. **Prioritize natural regeneration:** It's better to take care of the plants as much as possible rather than planting new trees. This method is often more cost-effective and helps to create resilient ecosystem.



Figure 5 Natural regeneration vs Traditional planting

2. **Improve tree seed sourcing:** Second, produce resilient tree seed systems that will provide sureness in using local and adapted species, genetic diversity within the planted populations, and quality control over seeds and seedlings.
3. **Involve Local Communities:** Training people from the local communities in how to plant and job creation in those specific areas is equally crucial. Site-specific intervention will take cognizance of local conditions and land-use practices for attaining sustainable management with community support.
4. **Anti-deforestation government policies:** There is a requirement for well-defined land tenure and use rights to allow sustainable reforestation. Policies on anti-deforestation must be made clear, and pro-conservation measures must be availed to protect the efforts and the overall integrity of the ecosystem. Government-led initiatives should ensure to have maximum amount of reforestation.
5. **Monitoring and Maintenance in Long Term:** Provision must be made for post-planting maintenance. The survival and ecosystems should be tracked, monitored, and evaluated to allow adaptive management in response to changing conditions to promote 'healthful' growth.



6. **Quality first before numbers:** The focus should be diverted from numerical targets of planting to outcomes in terms of ecology. Set goals based on increased Preterm Forest cover, improved biodiversity, or ecosystem services rendered. Invest in few well-managed planting sites rather than many poorly maintained ones.
7. **Sustainable funding mechanisms:** Reforestation can be supported by long-term finance, including carbon credits and payment for ecosystem services. Public-private partnerships expand the scope of efforts, pooling resources for environmental and social imperatives.
8. **Technology and Data:** The use of new advanced techniques, including remote sensing, GIS, and apps for mobile phones, will offer optimal planting results. RS and GIS help to identify site suitability and hence support decisions on tree planting. Mobile apps help to identify the species and to monitor in real time. With drones, seeding can be done and the areas of the site assessed effectively and precisely, even in sites far away or difficult to reach.

By applying these methods and practices we may gain success like these approaches –

1. **Atlantic Forest Restoration, Brazil:** The Atlantic Forest Restoration approach aims to restore 15 million hectares of degraded Brazilian Atlantic Forest by 2050. It emphasizes biodiversity, community involvement, and a blend of active planting and natural regeneration.
2. **Farmer-Managed Natural Regeneration, Niger:** Since the 1980s, this low-cost, sustainable land restoration approach has regenerated over 5 million hectares in Niger by managing natural tree seedlings, improving soil fertility, and enhancing crop resilience to climate change.
3. **Pontal do Paranapanema approach, Brazil:** In 35 years, Pesquisas Environmental Research Institute planted 2.7 million native trees with local communities, benefiting people and creating wildlife enhancements for endangered species like the black lion tamarin monkey.

Conclusion:

Many tree-planting efforts fail due to poor planning, inadequate care, and superficial solutions to forest and ecosystem decline. Effective reforestation demands a shift from simplistic planting goals to holistic, sustainable strategies: understanding local ecosystems, engaging communities, ensuring ongoing tree care, and integrating with conservation efforts.



Emphasizing quality over quantity and promoting natural regeneration, while addressing deforestation drivers, can establish resilient forests. A science-based, context-sensitive approach with a long-term perspective is crucial for forests to combat climate change and biodiversity loss effectively.

References

<https://climatefeedback.org/the-potentials-and-limitations-of-tree-plantings-as-a-climate-solution/>

<https://www.csiro.au/en/news/all/articles/2023/june/oceans-absorb-emissions>

<https://www.bbc.com/future/article/20200521-planting-trees-doesnt-always-help-with-climate-change>

<https://www.bbc.com/future/article/20210524-the-reason-wild-forests-beat-plantations>

https://www.researchgate.net/publication/356870675_Is_planting_trees_good_or_bad

<https://climate.mit.edu/ask-mit/how-much-human-produced-carbon-dioxide-taken-faster-plant-growth-around-world>

<https://www.csiro.au/en/news/all/articles/2023/june/oceans-absorb-emissions>