

## **Is a land restoration boom required in India?**

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### **Abstract**

*India's forest policy aims to achieve a 33% tree cover nationwide, yet the current tree cover stands at 24.56% as reported in the ISFR 2021 report. As per official sources, a major focus for achieving this target has been put on the Trees outside forest (TOF) regions. Despite witnessing extensive tree planting within short durations, concerns about their sustainability persist. Research has highlighted the dismal failure of such initiatives due to factors such as inadequate maintenance, low survival rates, insufficient study on suitable saplings, and the absence of post-evaluation reports. This paper thereby proposes land restoration companies as a potential solution to assist India in realizing its ambitious targets. Their maintenance ethic is what differentiates them and gives them a comparatively higher success rate. Further, by breaking down the economics behind these companies, the paper tries to prove how they are more cost-effective than initiatives taken up by the government in the long run. Lastly, the research delves into the challenges encountered by such companies, specifically examining funding and land-related issues. The study culminates by proposing measures necessary to bolster a restoration boom in India.*

**Keywords:** Tree plantations, land restoration, forest cover, climate change, SDG

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## 1. Introduction

Land Restoration is a process of restoring landscapes to sustain humans, wildlife, and plants (“Land restoration”, UNCCD). The process enhances and restores biodiversity and helps mitigate climate change impacts. It includes improving soil and water conditions, increasing tree cover, using fertilizers, and creating sustainable value chains for farmers to harvest organically. This study focuses on processes of land restoration that aim to increase tree cover.

India aims to increase its forest and tree cover to 95 million hectares by 2030 (Government of India 2015, 38), but this is unlikely due to several challenges (Singh 2020, 47). This is because the utilization of land resources encompasses a multifaceted political economy. Within this framework, various stakeholders oversee forest and urban lands earmarked for green endeavors yet encroachments on wastelands persist by the affluent rural and urban populations. Moreover, a dearth of financial resources and bureaucratic impediments further exacerbate these challenges. Finally, institutional capacity inadequacies hinder progress, with local communities granted limited autonomy vis-à-vis the forest department.

According to the India State of Forest Report (ISFR), 2021, the total forest and tree cover of the country stands at 24.62%, which is a 0.28% increase compared to the previous assessment in 2019. With this rate compounded annually, India will need more than 60 years to achieve its commitment of a 33% tree cover. Considering this ambitious target and the current rate of progress, it's important to delve into how India categorizes its tree cover, as this plays a crucial role in the nation's forestation efforts.

Tree cover can be identified under two categories as per Forest Survey of India, Ministry of Environment, Forest and Climate Change (MoEF & CC):

- Forest covers in Recorded Forest Areas (RFAs) and outside RFAs (ORFA)
- Tree cover Outside Forests (TOFs)

The Expert Committee Report by the Ministry of Environment, Forest, and Climate Change emphasizes the need to focus on Tree Outside Forest (TOF) areas due to limited Recorded

Forest Areas(Ministry of Environment, Forest and Climate Change, 2018; Yadav, 2022). Hence, it is clear that India needs massive tree plantation drives to achieve these ambitious targets. These need to be properly executed to ensure a high survival rate. The study thereby objectively tries to construe a comparative been government initiatives and the private sector hence proving why privatization is required in this space and how could it be made possible.

To provide a comprehensive analysis concerning the emergence of such companies/NGOs, this paper is structured in a sequential manner. Section 2 delves into an examination of the current efforts undertaken by the government, along with an assessment of their current performance. Section 3 addresses the complex challenges faced by tree plantations in India, including issues such as unsuitable locations, land disputes, incorrect species selection, community exclusion, fund misappropriation, data inaccuracies, and slow growth rates. Section 4 even though focuses on an in-depth case study of Arunachal Pradesh (AP), a northeastern state, ends up construing valuable insights into the somberness of the overall situation in India as it lies in the region which contributes the most to the overall decline in tree cover within the RFA.

Subsequently, Section 5 undertakes an analysis of the potential benefits that arise from the establishment of land restoration companies, despite their inherent costliness. This section addresses the critical question of why there is a compelling need to establish a dedicated land restoration industry. Through Section 6, the paper delves further into the intricate challenges that impede the effective functioning of land restoration companies. This analysis underscores the essential role these companies can play in helping India achieve its restoration targets. Finally, Section 7 offers a set of recommendations derived from the research findings, providing actionable insights to address the issues discussed throughout the paper.

## 2. Government efforts so far

The Indian government has undertaken several initiatives to bring the country closer to achieving its aspirations. This section discusses the government's initiatives aimed at restoring land, their implementation, and their current status. Table 1 summarizes the steps.

Table 1: Initiatives taken by Government of India

Name	Description	Current Status
<b>Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)</b>	MGNREGA, since 2005, guarantees rural jobs for 100 days, emphasizing tree planting, water conservation, and land regeneration. Changes in 2014 prioritize 60% of spending on agriculture and allied activities.	Maintenance lapses post 100-day employment hinder tree projects. Audit finds 990 crore incomplete in Punjab. Past 4 years: 5-10% less funds for resource management (Comptroller and Auditor General of India 2023, 168).
<b>Compensatory Afforestation Fund Management and Planning Authority (CAMPA)</b>	CAMPA, created by the Supreme Court in 2009, oversees afforestation funds. Companies redirecting forest land must plant trees elsewhere as compensation, feeding National and State Afforestation Funds ( <i>Chapter I – About Compensatory Afforestation in India</i> )	States often have under-utilized funds (“Demand for Grants 2022-23 Analysis: Environment, Forests and Climate Change”, n.d.); Supreme Court mandated central fund pooling via Compensatory Afforestation Fund. Ad-hoc CAMPA funds surged from ₹1200 cr (2006) to ₹23,608 cr (2012).
<b>Green India Mission (GIM)</b>	GIM aims to annually restore 5M ha of trees, enhance 5 Million (M) hectares (ha) of land, and boost forest-based incomes for 3M households. Despite implementation by multiple agencies, results fell short due to various reasons. Only ₹144 crores were spent by 2017-18, covering just 44,000 ha. (Singh, 2020)	Green India Mission combines with MGNREGA, CAMPA, and NAP. Budget 2023 allocates ₹167.28 crores, lower than last year. Sovereign Green Funds cover this allocation. (Ministry of Environment, Forests and Climate Change, n.d.)
<b>National Afforestation Programme (NAP)</b>	NAP is a centrally sponsored scheme aimed at increasing	Recent NAP funds fall short, hindering afforestation goals.

	tree cover in non-forest areas of the country. The programme provides financial assistance to state governments, NGOs, and individuals for afforestation and reforestation activities	Poor coordination left allocated funds unused. In 2021-22, 88% of Mission funds were used (Demand for Grants 2022-23 Analysis: Environment, Forests and Climate Change).
<b>Joint Forest Management (JFM)</b>	JFM involves locals and the government managing forests together for protection and benefits. Committees safeguard forests, get non-timber products, and share wood sales. Aims: restore forests, build community ties, and ease conflicts. Examples: Bishnois, Mundas, Santhals. (Joint Forest Management: A Handbook, 13)	JFM aids forest recovery but faces issues: elite control, uncertain results. As donor funds shrink, and committees fade, JFM work strains resources on a small forest area, posing risks to long-term biodiversity conservation. (Sundar B., 2017, 495)

Source: Authors' compilation

### 3. Why are tree plantations failing?

One of the major reasons why tree plantations suffer from low success rates is the lack of favorable sites for tree plantations. Rana et al. (2022), pointed towards how during a tree plantation project in Himachal Pradesh, nearly 38% of the allocation was made to places with already a high density of trees. Having to compete for their nutritional needs, the plantations face a reduction in their chances of survival. Out of the \$5.67 million spent on plantations, a significant portion went to non-forest productive areas where environmental conditions act as natural barriers to the growth of trees. Apart from these, 28.9% of the total budget was spent on un-demarcated protected forests. These are forest lands designated for protection but have not been officially marked as protected forests. As they overlap with private or village-owned lands, disputes with local communities often arise, finally affecting the success rate of tree campaigns. (Rana, Fleischman, Ramprasad, & Lee, 2022)

Another reason is the lack of proper research which goes behind deciding which type of species needs to be planted and where. For instance, new eucalyptus trees may effectively

store carbon and are water-intensive crops, but new eucalyptus plantations were established in areas that experience severe droughts.<sup>2</sup>

Even though the under-utilization of funds has been observed through various aforementioned government programmes, there also have been instances where misuse of funds was reported. CAMPA funds are one such example where a small chunk of the total budget disbursed by the state is spent while the rest is pocketed by the officers. Funds are sought in the name of better quality of soil, soil replacement, better seeds, and fertilizers. In reality, the funds remain unutilized (“Odisha forest officer's arrest puts focus on CAMPA funds' misuse - The Sunday Guardian Live” 2020). Meredith P. Martin et al. (2021) also mention how a lack of consistency in reporting and monitoring leads to embarrassing success rates which directly equates to pecuniary losses.

Data discrepancies also form a factor in causing tree plantations to fail as they mislead the authorities into projects being accomplished. The Supreme Court in 2009 ordered the setting up of a website, e-Greenwatch that provides information about compensatory afforestation projects taken up by the government (Kukreti, 2022). The state forest department has to put information like the location of the site, funds disbursed, and photographs of the work done. However, only one-fourth of the data provided is correct. Extreme cases of data inaccuracy have also been observed. For instance, Bihar's forest department claimed to plant 10,000 trees on account of tree cover loss due to repairing NH57, but the plantation when viewed on Google Earth showed a straight line between India and Nepal. Figure 1 gives the depiction.

Furthermore, disputes between local communities and authorities also form a reason. Tree campaigns majorly favor monoculture, and more lucrative trees are planted in large numbers. Young teak saplings in the Ambagad Chowki Forest Range were planted by the government, while local communities preferred bamboo plantations and opposed teak plantations. Bamboo can be used locally, while teak is used commercially for furniture. The local

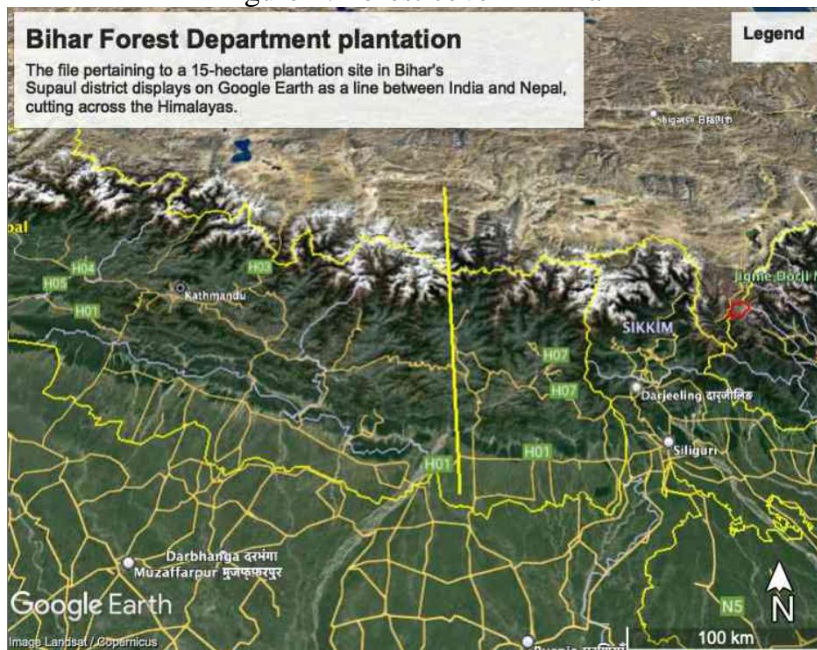
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<sup>2</sup> <https://thewire.in/environment/why-a-government-campaign-to-plant-more-trees-cant-be-a-good-idea-by-default> (accessed in December, 2023)

community's apprehension was that teak trees inhibit the growth of other plants around them due to their dense roots, thereby also disturbing the biodiversity of the area.<sup>3</sup>

Usually, when a new forest project is approved, the area is fenced off from local communities, which leads to conflicts with the authorities as these communities are highly dependent on these forests for grazing, collecting firewood, and fruits. B. D. Obiri et al. and many other researchers have argued about how the local communities are highly effective and necessary during tree plantation projects through their case studies based out of Ghana. Through their research, it has been proven that involving local communities in tree plantation projects ensures initiatives to remain aligned to their needs, cultural practices, and environmental dynamics. This approach not only enhances the sustainability and success of such projects but also empowers communities to take ownership of their natural resources and improve their overall well-being (Obiri et al., 2011). Hence, local communities must be given a say in the decision-making process as they know the locality better and can be resourceful in making a campaign successful.

Figure 1: Forest cover in Bihar



Source: <https://scroll.in/article/1014823/indias-ghost-plantations-in-which-millions-of-rupees-have-been-sunk> (accessed in December, 2023)

<sup>3</sup><https://thewire.in/environment/why-a-government-campaign-to-plant-more-trees-cant-be-a-good-idea-by-default>. (accessed in December, 2023)

Last but the most daunting factor contributing to the perceived failure of tree plantation initiatives pertains to the inadequate pace of implementation. A nuanced examination of the data reveals a nominal increment of merely 5000 square kilometers in the expanse of tree plantations in the past 10 years from 2011-2021 (Appendix: Table A3). Notably, this expansion is predominantly concentrated within two or three states situated in the western and central regions.

Strikingly, the northeastern region of India demonstrates a disconcerting decline in extant forest cover, highlighting the limited efficacy of the tree plantation endeavors in this locale. Accounting for 76% of the total tree cover loss that has happened in the past 20 years, these states have been brought under more scrutiny not just under the ISFR reports but also by various researchers (Potapov et al., 2022). Because the states have the largest tree cover (in percentage terms) with more than 75%, such a decrement in tree cover would implicate impediments in India's growth potential.

Table 2: Tree cover change (in sq. km) in the northeastern states

Year → States ↓	2001	2003	2005	2007	2011	2013	2021	Forest cover change (RFA+ ORFA) (2011-2021)	Tree cover change* (TOF) (2011-2021)
Arunachal Pradesh	68,045	68,019	67,777	67,353	67,410	67,321	66,431	-979	452
Mizoram	17,494	18,430	18,684	19,240	19,117	19,054	17,820	-1,297	254
Meghalaya	15,584	16,839	16,988	17,321	17,275	17,288	17,046	-229	120
Tripura	7,065	8,093	8,155	8,073	7,977	7,866	7,722	-255	44
Nagaland	13,345	13,609	13,719	13,464	13,318	13,044	12,251	-1,067	43
Manipur	16,926	17,219	17,086	17,280	17,090	16,990	16,598	-492	-24

Source: ISFR (2001-2021). \*Refer to Appendix: Table A.3

Arunachal Pradesh (AP) evidently gives us insights into the severity of the situation in the northeastern states which contribute the highest to the total fall in tree cover in the RFA across India. Through the table, we can simply see how all the states have been going downhill. To analyze this volatility and have a much deeper look into the northeastern region, we decided to take up AP as the most relevant example.



#### 4. Case study of Arunachal Pradesh (AP)

Taking the example of AP, we see that it had a total loss of 1,614 sq. km with almost all the loss coming from the RFA and ORFA. At the same time, AP also recorded the highest growth of 523 sq. km of tree cover in India (ISFR, 2001-2021) which can directly be credited to the tree cover increase due to plantations in the state, as depicted by the following figures.

Figure 2

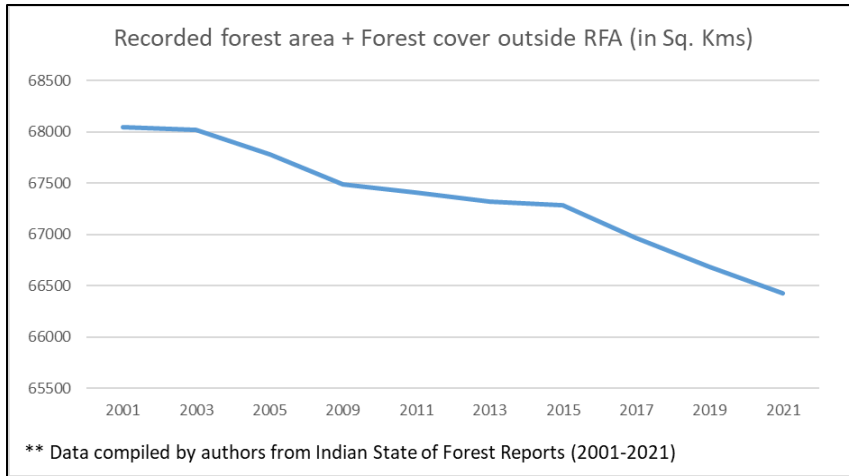
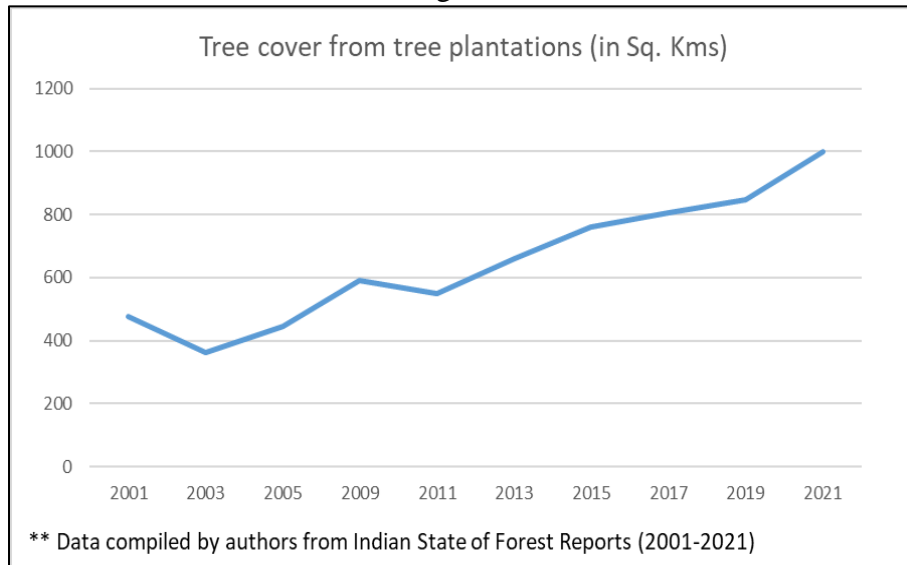


Figure 3



The declining forest covers in Arunachal Pradesh can be attributed to motley of factors but the most significant are as follows:

- Increase in capital expenditure and development across the state

Arunachal Pradesh has been witnessing an increased amount of capital expenditure along with infrastructural development for the past 20 years. North East Special Infrastructure Development Scheme (NESIDS) and the North East Region Textile Promotion Scheme (NERTPS) were implemented to develop the region, and have been allocated more than 221.11 sq. km of forest land in the past 10 years ("The Weather Channel", 2022)<sup>4</sup>. Illegal logging for private development cannot be shown through exact figures but has also been said to be a huge contributor to the loss of tree cover in Arunachal Pradesh.

- Increased demand for timber, shifting cultivation, and expansion of palm oil plantations in Arunachal Pradesh

The expansion of palm oil plantations (Conservation India, n.d), illegal felling of trees for timber, and shifting cultivation have been significant contributors to deforestation in Arunachal Pradesh. Palm oil plantations require vast areas of land, leading to the clearing of forests, which can have severe consequences for the ecosystem and biodiversity (Sagar, H. S. Sathya et al, 2019). Even though cutting trees for timber was banned by the Supreme Court a long time back (T.N Godavarman Thirumulpad against The Union of India, Civil writ petition no 202, 1995), illegal felling of trees for timber, often carried out without proper regulations, has also led to the loss of valuable forest resources. Recently, army personnel seized several truckloads of illegal timber and later handed over to the Deomali forest division. The forest department already had information about the illegal timber mafias but was not keen to take any action. Hence, the army had to intervene to stop illegal timber operations in Arunachal Pradesh. (Roy, 2023)

Additionally, shifting cultivation, which involves clearing areas of forest for agricultural purposes, has led to deforestation in many parts of the state (highlighted in ISFR 2019).

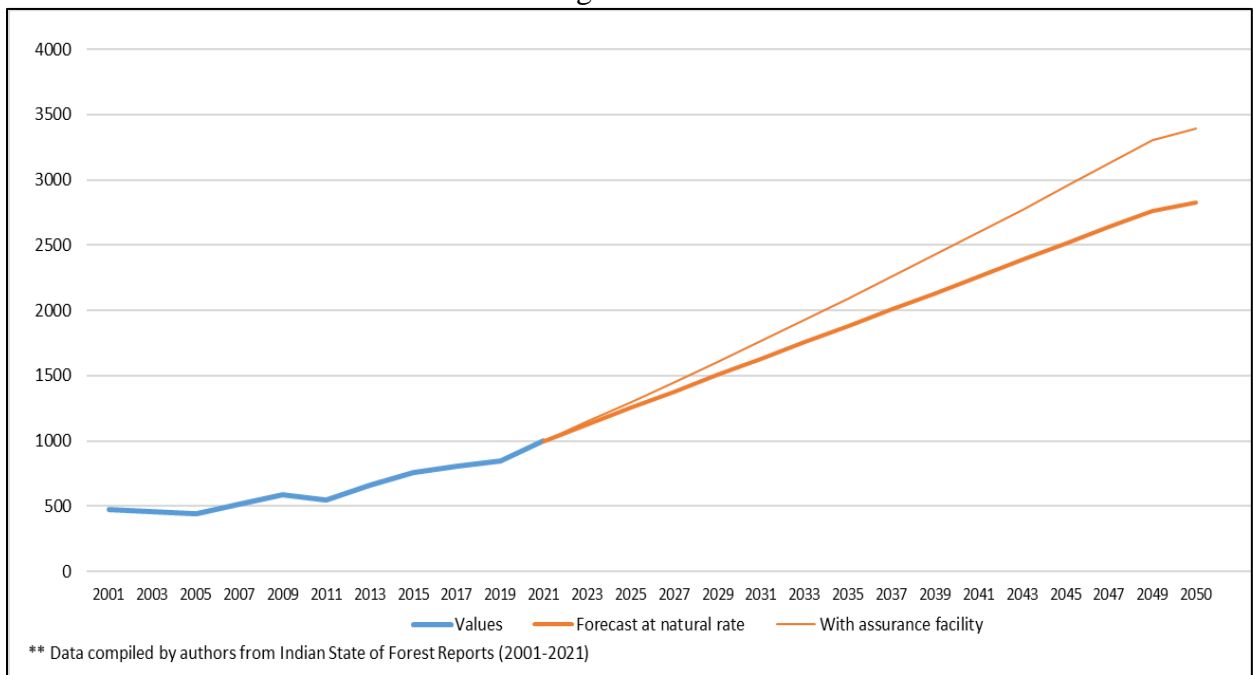
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<sup>4</sup><https://weather.com/en-IN/india/biodiversity/news/2022-01-17-arunachal-pradesh-losing-its-primary-forests-at-large-scale> (accessed in December, 2023)

These activities have not only caused significant damage to the environment but have also threatened the livelihoods of local communities which rely on forests for their survival.

At the same time, it also presents us with evidence towards how the tree cover outside the forest regions has been on the rise. This rise can directly be accredited to NGOs like SankalpTaru, Grow Tree “Project purpose”, and other successful afforestation programmes along with Compensatory Afforestation Fund Management and Planning Authority (CAMPA) organized by the forestry department in that state between 2000-2020. If outsourcing the task to land restoration companies is rightly planned with stricter actions taken to improve the forestry department, the growth path for tree cover in Arunachal Pradesh can look as follows:

Figure 4



This would not only replenish the forest cover loss in the past years but would also help the state flourish ecologically and economically. Land restoration companies like SankalpTaru, Say Trees, Acacia Eco, Green Yatra, Project Green Hands, etc. are still emerging and are

very few. They are limited to specific geographical areas only and plan to expand PAN India. Several challenges are also faced while partnering with the government. Hence, initiatives like introducing the land regeneration industry in such a rich atmosphere will not just do wonders but can also lead to a complete reversal of the falling RFA graph with better-planned development initiatives. The ‘With assurance facility’ line depicts an increase of approx. 18% growth rate of tree cover for every tree plantation done through a land restoration company/NGO which will be proven in the next section. (For the exact data regarding the forecast, refer to the Appendix: Table B).

## **5. Why do we need to set up a land restoration economy?**

If we analyze the net growth data from all the countries in Asia, we see Kyrgyzstan and Tajikistan recording net forest area growth of more than 5% and 10% respectively in the past 20 years (*The Global 2000-2020 Land Cover and Land Use Change Dataset Derived From the Landsat Archive: First Results*, 2022). When further analyzed, the pictures become clearer. Both the countries’ economies heavily depend upon these forests as a natural resource and any growth in the tree cover directly means growth to their GDP and provides opportunities for the growing population. Additionally, if we go beyond the scope of central Asia, another such example is Uruguay. Being the only country in South America with a net positive change in tree cover between 2000 and 2020, the tree cover growth can be considered nothing less than a miracle. From being non-existent, the industries that are dependent on forests have increased their share to 3.5% and are predicted to grow the GDP by 2% through their expansion plans. The tree cover growth in this country can hence be directly correlated to the growth of the industry present (Burbano, 2020). This proves one very basic argument i.e. if we need a substantial increase in the tree cover around India, an industry needs to be present around this area and opportunities have to be generated in this sector.

Instead of the government bearing all the burden of improving the tree cover across India, it is much more feasible if this is outsourced to private entities and they are provided with the right incentive to pursue it.

Land Restoration Companies are private firms that generally take up three types of projects:

- Government projects, the government sometimes releases tenders to carry out massive tree plantations in community spaces and nurture green belts.
- Private corporations, land restoration companies take up projects to enhance the aesthetic value of campuses of private corporations.
- Residential and commercial projects, these companies take up projects to develop parks, boundary plantations, and mini forests in lawn areas of residential societies, schools, universities, etc.

These companies use scientific methods like the Miyawaki method. The Miyawaki method was developed by Japanese botanist Akira Miyawaki. The method helps to create a self-sustaining plantation in two to three years while any plantation with traditional methods requires a much greater time to be self-sustaining. In this method, the saplings are closely planted. Since the closely planted trees compete for sunlight, they tend to shoot upwards to catch up most of the sunlight. This process hinders them from growing sideways. 40 to 50 per cent of the plants need to be native species as they will grow faster in the most favorable environment. Plants grow ten times faster when the Miyawaki method is used. (*The Miyawaki Method for Creating Forests – SUGi*)

Land restoration companies have large teams including scientists, researchers, a public relations team, mediators, and both skilled and unskilled execution teams to bridge the gap that exists in India whether it is in the form of species-region mismatch or resolving the maintenance issue that persists in all tree plantation drives.

Plantations by land restoration companies have a greater survival as they use scientific methods, have efficient execution teams, and take up maintenance immensely. While signing a project, the land restoration companies also agreed to deliver a minimum success rate of 85-95% per plantation. Even if the saplings fail, they replace them and ensure that the agreed success rate is delivered. These organizations will not be allotted any project if they do not deliver such a high success rate and hence this “assurance facility” gives them an edge over the government authorities and other local vendors currently working in this field.

The following section presents a cost analysis of government project juxtaposition to the same project if taken up by a land restoration company. This analysis aims to compare the incurred costs and assess the direct tangible benefits associated with engaging a land restoration company. This analysis is motivated by the observed lower success rates in large-scale plantations by government authorities.

Table 3: Cost analysis per 1000 saplings

Initial cost of planting the saplings	₹1,69,104 <sup>^</sup>
Maintenance cost for year 1	₹71,752 <sup>^</sup>
Maintenance cost for year 2	₹65,123 <sup>^</sup>
Maintenance cost for year 3	₹59,488 <sup>^</sup>
Maintenance cost for year 4	₹58,528 <sup>^</sup>
Maintenance cost for year 5	₹57,384 <sup>^</sup>
Total	₹4,81,379 <sup>^</sup>

Source: [Scheme for Diversion of Forest Land for Non-Forestry Purpose in Madhya Pradesh, 2016](#) (accessed in December, 2023). <sup>^</sup>

The prices specified may be subject to fluctuations based on geographic location and annual variations

Similarly, If 1 lakh saplings are planted during a typical plantation drive, the total cost incurred can be approximately ₹5 crores. But because the project is being taken up by the government authorities themselves, it lacks the “assurance facility” that the land restoration companies provide.

Considering a success rate of 60% per plantation drive, the government encounters a minimum loss of ₹2 crores. Land restoration companies though expensive costing 15-20% more than the unprofessional vendors can save up to 50% of this loss i.e. close to ₹1 crores by increasing the success rate to a of minimum 85% (*SankalpTaru*, n.d.; Nirupama, 2016; Gopal, 2021) and also assuring added benefits like high-quality plants and better lifeline (Refer to Appendix 3 for the calculations).

So, for every tree plantation project taken up involving a plantation of 1 Lakh trees, the actual number of trees being planted increases by 25,000 (considering the success rate

improves from 60% to 85%) eventually saving the government crores in expenditure as the amount of such plantations increases.

Even when these tangible benefits are directly available, we believe India will still require a little more time than expected to bring in these necessary changes and establish a land regeneration industry. The next section explains why.

## **6. Implementation challenges faced by land restoration companies**

In India, energy accounts for about 73% of the total greenhouse gas (GHG) emissions, making renewable energy generation a top priority for the country's climate action. Therefore, climate finance in India tends to focus more on the energy sector, and sectors contributing to the remaining 27% of emissions receive less attention (The State of Climate Finance in India, n.d). Land restoration does not get enough focus as agriculture accounts for only 16% of the total carbon emissions. This results in various implementation challenges for land restoration companies, which are discussed in detail in the subsequent part of the paper.

### **a. Funding**

The biggest hurdle for these land restoration companies is securing funding for their projects. Funding can come from government bodies, philanthropic sources, or private finance, but each type of funding presents its own set of challenges. We interviewed Ms. Pooja Shah, one of the core team members of Acacia Eco (Refer to Appendix B), one of the few land restoration companies in India, who explained that getting government projects initially can be tough. Authorities are often hesitant to give projects to these companies, but once they gain confidence in a firm, they are more likely to allot additional projects. When asked about how companies establish their reliability, Ms Pooja Shah stated, “Companies ask authorities for the land and do not take funds from them. They regenerate the land and monitor it for 2-3 years before handing it back over to the authorities. This helps companies build trust with the government, which can lead to more projects being granted.” Government bodies also float tenders under their green schemes, providing land and proper funding. Companies have to compete with each other to win these tenders. Another source of funding is Corporate Social

Responsibility (CSR) funds. However, only a few companies currently support ecological projects through CSR funds, as most funds go towards areas like education and healthcare which can showcase tangible results in a shorter time frame, improving the company's reputation (Ministry of Corporate Affairs, n.d). Land restoration projects, on the other hand, take more than 5 years to demonstrate desired results. However, the trend is changing, with more companies beginning to diversify their CSR funds and providing land restoration companies with a head start. With that being said, land restoration projects are characterized by environmental and social benefits, lacking financial benefits. This discourages private investors from investing in land restoration companies, especially since restoration projects are often too small to attract private investors. Additionally, restoration projects are multi-year projects, and this long time frame can further discourage investment as profits earned in the distant future have a lower value than profits in the near future.

#### **b. Land issues**

Obtaining land from government bodies for restoration projects is fraught with bureaucratic challenges. As previously mentioned, authorities are often reluctant to sanction land for these projects. Companies have to seek permission from urban forest authorities, rural forest departments, and local bodies, causing delays in project implementation. In the case of agro forestry projects, companies must educate farmers about how agro forestry can improve soil quality and benefit them. Convincing farmers to support the project can be a difficult task. Disputes with farmers can lead to poor implementation and, ultimately, project failure. Land tenure issues are another implementation challenge in agro forestry projects, as changing ownership of land can prevent farmers from claiming benefits derived from agro forestry (*The Business of Planting Trees: A Growing Investment Opportunity*, 2018, Ghosh et al., 2022).



## **7. Recommendations**

It is certain that the land restoration companies can help India achieve its targets smoothly and quickly. These companies are already flourishing in developed nations and a land restoration economy boom is needed in India.

The government schemes must be implemented through these land restoration companies due to the advantages they bring to the table as pointed out in the paper. Through this process, the companies will get enough funding and hence the restoration economy can prosper. The government must address bureaucratic challenges in the whole process and allow a single clearance window for the projects. Companies must be encouraged to diversify their CSR funds to sectors other than education and healthcare.

The government can launch a portal where these land restoration companies can be listed, and connect these companies with the Ministry of Environment, Forest and Climate Change. This will allow state governments and private corporations taking up land restoration programs to easily locate the 'right' land restoration companies. As various frauds restoration companies are also prevalent as pointed out in the interview conducted with the core member of Acacia Eco.

In conclusion, the need for a significant change in India's forest industry is evident. The achievement of goals set for 2030 is implausible but what lies in front of us right now is if the government can take proactive steps to identify and implement the right methods. The land restoration industry presents a potential solution to the challenges faced by India's forest department. If this industry experiences a boom, what we can guarantee is that it will be able to make better and more achievable promises at international forums, which will help preserve the country's reliability. It is, therefore, essential for the government to become vigilant and take necessary actions to realize the full potential of the land restoration industry and the country's forest resources.

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## Appendix 1

TABLE A1: Data representing Arunachal Pradesh's growth of tree cover outside forest area and the decline in forest cover in both Recorded forest areas (RFA) and Trees outside forest (TOF) (in sq. kms)

<b>Years</b>	<b>Type of tree cover</b>	<b>Data</b>
2001	Outside forest area	478
	RFA + TOF	68045
2003	Outside forest area	363
	RFA + TOF	68019
2005	Outside forest area	446
	RFA + TOF	67777
2009	Outside forest area	592
	RFA + TOF	67484
2011	Outside forest area	549
	RFA + TOF	67410
2013	Outside forest area	660
	RFA + TOF	67321
2015	Outside forest area	761
	RFA + TOF	67284
2017	Outside forest area	807
	RFA + TOF	66964
2019	Outside forest area	848
	RFA + TOF	66688
2021	Outside forest area	1001
	RFA + TOF	66431

Source - <https://fsi.nic.in/forest-report-2021-details> (Reports from 2001-2021)

TABLE A2: The Forest cover of India for RFA, ORFA, and TOF (in sq km)

States	2001	2003	2005	2007	2011	2013	2021
Mizoram	17,494	18,430	18,684	19,240	19,117	19,054	17,820
Nagaland	13,345	13,609	13,719	13,464	13,318	13,044	12,251
Arunachal Pradesh	68,045	68,019	67,777	67,353	67,410	67,321	66,431
Manipur	16,926	17,219	17,086	17,280	17,090	16,990	16,598
Tripura	7,065	8,093	8,155	8,073	7,977	7,866	7,722
Meghalaya	15,584	16,839	16,988	17,321	17,275	17,288	17,046
Madhya Pradesh	77,265	76,429	76,013	77,700	77,700	77,522	77,493
Uttarakhand	23,938	24,465	24,442	24,495	24,496	24,508	24,305
Sikkim	3,193	3,262	3,262	3,357	3,359	3,358	3,341
Haryana	1,754	1,517	1,587	1,594	1,608	1,586	1,603
Lakshadweep	27	23	25	26	27	27.06	27.1
Puducherry	36	40	42	44	50	50.06	53.3
Chandigarh	9	15	15	17	17	17.26	22.88
Dadra & Nagar Haveli and Daman& Diu	219	225	221	211	211	213	227.75
Delhi	111	170	176	177	176	179.81	195
A & N Islands	6,930	6,964	6,629	6,662	6,724	6,711	6,744
Goa	2,095	2,156	2,164	2,151	2,219	2,219	2,244
Chhattisgarh	56,448	55,998	55,863	55,870	55,674	55,621	55,717
Punjab	2,432	1,580	1,558	1,664	1,764	1,772	1,847
Maharashtra	47,482	46,865	47,476	50,650	50,646	50,632	50,798
Gujarat	15,152	14,946	14,715	14,620	14,619	14,653	14,926
Uttar Pradesh	13,746	14,118	14,127	14,341	14,338	14,349	14,818
Bihar	5,720	5,558	5,579	6,804	6,845	7,291	7,381
Rajasthan	16,367	15,826	15,850	16,036	16,087	16,086	16,655
Assam	27,714	27,826	27,645	27,692	27,673	27,671	28,312
Jharkhand	22,637	22,716	22,591	22,894	22,977	23,473	23,721
Himachal Pradesh	14,360	14,353	14,369	14,668	14,679	14,683	15,443
Jammu & Kashmir	21,237	21,267	21,273	22,686	22,539	22,538	23,659
Karnataka	36,991	36,449	35,251	36,190	36,194	36,132	38,730
Tamil Nadu	21,482	22,643	23,044	23,338	23,625	23,844	26,419
Odisha	48,838	48,366	48,374	48,855	48,903	50,347	52,156
West Bengal	10,693	12,343	12,413	12,994	12,995	16,805	16,832
Kerala	15,560	15,577	15,595	17,324	17,300	17,922	21,253
Andhra Pradesh + Telangana	44,637	44,419	44,372	45,102	46,389	46,116	50,998
<b>Total</b>	<b>6,75,538</b>	<b>6,78,333</b>	<b>6,77,088</b>	<b>6,90,899</b>	<b>6,92,027</b>	<b>6,97,898</b>	<b>7,13,789</b>

Source - <https://fsi.nic.in/forest-report-2021-details> (Reports from 2001-2021)

TABLE A3: Tree cover for Indian territories (TOF)

State/UT	Tree Cover in Indian States and Union Territories								
	Assessment Year (Area in Sq. Km)								
	2001	2005	2009	2011	2013	2015	2017	2019	2021
Andhra Pradesh and Telangana	9,011	7,640	7,191	7,152	7,187	6,514	6,422	6428	7,617
Arunachal Pradesh	478	446	592	549	660	761	807	848	1001
Assam	1,942	1,484	1,590	1,564	1,582	1,613	1,496	1408	1,630
Bihar	3,693	2,522	2,495	2,369	2,164	2,182	2,263	2003	2,341
Chhattisgarh	3,535	4,492	4,027	3,866	3,463	3,629	3,833	4248	5,355
Delhi	40	107	123	120	118	111	113	129	147
Goa	62	268	286	286	334	325	323	272	244
Gujarat	4,036	7,621	8,390	7,837	8,358	7,914	8,024	6912	5,489
Haryana	1,526	1,565	1,409	1,395	1,282	1,355	1,415	1565	1,425
Himachal Pradesh	397	709	638	623	697	757	822	829	675
Jharkhand	2,694	3,080	3,032	2,914	2,629	2,783	2,922	2657	2,876
Karnataka	7,446	5,467	5,683	5,733	5,920	5,552	5,713	6257	7,494
Kerala	1,146	2,632	2,801	2,755	3,146	2,951	2,959	2936	2,820
Madhya Pradesh	5,751	6,267	6,871	7,090	7,087	7,773	8,073	8339	8,054
Maharashtra	8,269	8,978	9,466	9,079	9,142	9,558	9,831	10806	12,108
Manipur	95	142	197	193	224	243	220	173	169
Meghalaya	140	405	542	578	668	710	657	710	698
Mizoram	95	122	172	190	223	535	467	441	444
Nagaland	70	238	300	322	372	381	379	362	365
Orissa	4,364	4,598	4,435	4,301	4,013	3,986	3,993	4648	5,004
Punjab	1,634	1,823	1,699	1,699	1,499	1,544	1,622	1592	1,138
Rajasthan	5,286	8,379	8,274	8,272	7,860	8,269	8,266	8112	8,733
Sikkim	14	27	20	25	31	35	35	36	39
Tamil Nadu	6,054	5,621	4,968	4,718	4,866	4,505	4,671	4830	4,424
Tripura	68	134	171	184	213	233	215	231	228
Uttar Pradesh	7,545	8,203	7,381	7,382	6,895	7,044	7,442	7342	7,421
Uttarakhand	448	658	665	642	703	752	767	841	1,001
West Bengal	3,264	2,269	2,458	2,335	2,144	2,088	2,136	2006	2,349
A & N Islands	83	53	44	39	41	37	35	41	23
Chandigarh	2	9	11	10	10	9	10	25	15
Dadra & Nagar Haveli + daman and diu	31	36	36	36	36	37	37	32	981
Jammu & Kashmir	2,217	5,633	6,764	6,550	7,664	8,354	7,815	7944	3,511
Lakshadweep	0	4	4	5	5	4	2	0.29	0
Pondicherry	35	42	34	31	29	27	27	23	23
<b>Total</b>	<b>81,472</b>	<b>91,663</b>	<b>92,769</b>	<b>90,844</b>	<b>91,267</b>	<b>92,571</b>	<b>93,815</b>	<b>95027</b>	<b>95,748</b>

Source - <https://fsi.nic.in/forest-report-2021-details> (Reports from 2001-2021)

TABLE B1: Forecasting of the tree cover growth data till 2050 for Arunachal Pradesh with upper bound considering an 18% increase in efficiency of every tree plantation drive executed

<b>Timeline</b>	<b>Values</b>	<b>Forecast at natural rate</b>	<b>With assurance facility*</b>
2001	478		
2003	462		
2005	446		
2007	519		
2009	592		
2011	549		
2013	660		
2015	761		
2017	807		
2019	848		
2021	1001	1001	1001
2023		1126.73	1148.64
2025		1252.68	1296.78
2027		1378.62	1448.89
2029		1504.57	1604.53
2031		1630.52	1763.38
2033		1756.46	1925.14
2035		1882.41	2089.61
2037		2008.35	2256.62
2039		2134.30	2426.01
2041		2260.25	2597.67
2043		2386.19	2771.48
2045		2512.14	2947.35
2047		2638.08	3125.21
2049		2764.03	3304.97
2050		2827.00	3396.46

Source: Authors' compilation. \*Assuming minimum success rate of plantations 85% compared to average 60% success rate of government initiatives (Appendix 3)



## Appendix 2

An interview was conducted with Ms. Pooja Shah, Core Team Member, Acacia Eco (<https://www.acaciaeco.com/>). Acacia Eco aims to create sustainable urban forests using scientific methods like Miyawaki. Since its inception in March 2016, Acacia Eco has been promoting Miyawaki Forests in urban spaces like schools, factories, green belts, residences, community spaces, etc.

The description of Acacia Eco perfects aligns with our ideal definition of a land restoration company. Hence, an interview was scheduled with one of the core members and the questions covered in the interview are listed below.

1. What are the steps involved in the completion of a project, how a site is selected, and species to be planted? Elaborate on the steps involved in a project.
2. How many years of maintenance a project requires?
3. While partnering with the government, were there any bureaucratic challenges that the company faced? If yes, how does it overcome those challenges?
4. As our research concluded, one of the biggest hurdles in the industry is funding, what are other challenges that the industry faces?
5. Most of the projects by Acacia Eco are concentrated in Gujarat, how the company plans to expand PAN India?
6. How can the government help such an industry to grow?
7. Maintenance is one of the reasons for massive tree plantations. How does Acacia Eco tackle this issue and how it handovers the project after completion?
8. How do you feel about the upcoming future of the land restoration industry?
9. Do you think it is the right solution for India to reach its goal of 33% tree cover by 2030?
10. Have you ever thought about raising funds for your business and expanding it?
11. How do you think a group of students can help this industry grow?

### APPENDIX 3

Table C1: Cost analysis of planting 1 Lakh saplings for both land restoration companies and government authorities

Cost incurred by the government authorities	Rs. 5 crores
Number of trees survived based on a success rate of 60%	60,000 out of 1,00,000
Cost per tree	Rs. 833.34
Cost incurred by the government to plant 85,000 trees @ Rs. 833.34	Rs. 7.08 Crores (Approximately)
Cost for the same project taken up by a land restoration company	Rs. 6 Crores (20% additional cost)
Number of trees survived based on a minimum success rate of 85%	85,000 out of 1,00,000
Cost per tree	Rs. 705.88

Source: Authors' compilation

For planting the same amount of trees that land restoration companies do at Rs. 6 crores even after charging 20% extra, the government authorities have to incur approximately Rs. 7 crores. Hence, the approximate costs government authorities save by employing land restoration companies would be approximately Rs. 1 crore for every 85,000 actually planted and maintained (variable to success rates).