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Pakistan's Commitment to the Paris Agreement 2016: A Case Study of Ten Billion Tree Tsunami Program in Khyber Pakhtunkhwa (KP)

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Abstract

This research study evaluates Pakistan's commitment to the Paris Agreement with a specific focus upon the Ten Billion Tree Tsunami Program (TBTTP) in Khyber Pakhtunkhwa (KP). The study finds that although, the program aligns with Pakistan's Nationally Determined Contributions under the Paris Agreement 2016, and has changed considerable amount of land into forests and arable lands, yet it faces challenges such as funding constraints, inconsistent political support, and uneven community inclusion. The Clean and Green Initiative, and TBTTP while ambitious in scope, also suffer from institutional and monitoring limitations. The research concludes that while these programs mark critical progress in Pakistan's environmental strategy, their long-term effectiveness depends on stronger governance, sustained political will, equitable benefit sharing, and integration into broader climate policy frameworks.

Key Words: Paris Peace Agreement, TBTTP, Climate Change, Clean and Green Pakistan

Introduction

Building upon the Paris goals, the Government of Pakistan launched the Clean Green Pakistan (CGP) Initiative in 2018 as a flagship national campaign. This five-year program, recognized by the Prime Minister, aims to make Pakistan pollution free and tackle climate change at the grassroots level (kagawa, 2022). The CGP Initiative is structured around five pillars that integrate environmental and public health objectives (kagawa, 2022). Afforestation (Plantation) large scale tree planting to restore green cover and capture carbon. Solid Waste Management improving garbage collection, recycling and disposal to reduce urban pollution. Liquid Waste & Sanitation expanding sewerage systems and wastewater treatment to improve hygiene and water quality. Safe Drinking Water ensuring access to clean drinking water and protecting water resources. Total Sanitation & Hygiene promoting sanitation facilities, clean schools and hygiene awareness. These pillars safe water, solid waste, sanitation/hygiene, liquid waste, and tree planting reflect a comprehensive clean and green vision (kagawa,2022). As part of CGP, the government even instituted a Clean Green Index in 2019 to rank major cities on criteria like street cleanliness, park maintenance, sanitation coverage, and green space, encouraging local authorities to improve performance (Abubakar, 2025). In schools, the CGP Initiative has promoted Clean Green Clubs and environmental education, engaging youth in tree planting and waste management activities (kagawa, 2022). The CGP Initiative represents Pakistan attempt to translate high-level commitments into concrete action on the ground. It has been incorporated into federal and provincial development plans, and is promoted as a cross-party goal e.g. even opposition leaders have publicly acknowledged its importance (Abubakar, 2025). By targeting both infrastructure sanitation, water supply and nature-based solutions afforestation, Clean Green Pakistan seeks to advance many of the mitigation and adaptation objectives of Pakistan's

Paris commitments. A centerpiece of the Clean Green Pakistan campaign is the Ten Billion Tree Tsunami Program (TBTTP) an ambitious afforestation effort that builds on Khyber Pakhtunkhwa's earlier success. The original *Billion Tree Afforestation Project* 2014-2017, KP only had already made headlines it planted over one billion trees, increased KP's forest cover from 20% to 26%, and created hundreds of thousands of green job (Maqbool, 2024). Inspired by that outcome, the federal government launched the TBTTP in 2018, aiming to plant and regenerate 3.29 billion tree seedlings during its Phase 1 (2019-2023) and eventually exceed 10 billion by 2028 (Maqbool, 2024). The program is funded through a co-financing model 50% federal, 50% provinces and is implemented by provincial forestry departments under the Ministry of Climate Change (Maqbool, 2024). The TBTTP is the largest afforestation drive in Pakistan's history and among the largest worldwide Within this national framework, Khyber Pakhtunkhwa (KP) keeps a special focus. The KP government set aside PKR 30 billion to plant an additional 1.1 billion trees in the province over 2019-2025 (Maqbool, 2024). Upon completion, this project is expected to raise KP forest cover by a further 4 percentage points from the 26% achieved earlier and to generate over one million green rural job (Maqbool, 2024). Ecologically, the TBTTP promises significant benefits: Pakistan's Nationally Determined Contribution notes that the combined effect of KP initial project and the Ten Billion Tree Tsunami could sequester on the order of 500 million tonnes of CO_2 by 2040 if fully implemented (UNFCCC, 2015). In carbon terms, even the first phase would lock up nearly 149 $MtCO_2$ over ten years helping offset a sizeable fraction of Pakistan annual emissions 490 $MtCO_2$ in 2018 (UNFCCC, 2015). In addition, expanded forest cover in KP enhances watershed protection, reduces erosion, and contributes to flood buffering crucial ecological services given Pakistan water challenges.

The TBTTP also carries important political dimensions. It was a flagship manifesto initiate of the Pakistan Tehreek-e-Insaf (PTI) party and enjoyed strong support from the then-prime minister and the KP chief minister. After federal government changed in 2022, the project was included under a new Green Pakistan Program but its momentum largely continued in KP where PTI still governs. The initiative has been celebrated internationally as an example of nature-based climate action (Bhatti, 2022). However, it has also become politicized opposition figures in the new federal government publicly accused the TBTTP of corruption and threatened to punish officials involved (Bhatti, 2022). Proponents have countered that undermining the program for partisan gain would only hurt Pakistan's environmental interests. In practice, bureaucrats note that even with federal support, forest departments often face budget shortfalls and capacity constraints during implementation (Bhatti, 2022).

The Ten Billion Tree Tsunami in KP is symbol of the Clean Green Pakistan effort. Ecologically, it aims to rebuild green cover, sequester carbon, and improve ecosystem health in a critical province. Politically, it shows how climate initiatives in Pakistan can become mixed up with party rivalries and resource debates. Understanding its achievements and obstacles is therefore key to assessing Pakistan's overall climate commitment (Bhatti, 2022).

Research Problem

Despite ambitious commitments and high-profile programs, Pakistan faces a persistent implementation gap in its climate and environmental policies. On paper, the country has comprehensive plans including an updated NDC, a National Adaptation Plan and Policy, and the Clean Green Pakistan campaign to mitigate and adapt to climate change. In reality, experts warn that these plans often stall at the implementation stage. As one report noted, even though Pakistan possesses a National Adaptation Plan, the question now is of implementation of this plan and other adaptation and disaster risk reduction plans currently in place in Pakistan. On the mitigation side, projects like the TBTTP have encountered logistical delays and funding shortages (Bhatti, 2022). Furthermore, recent analyses suggest that while initiatives such as the 10 billion Tree Tsunami demonstrate commitment, these efforts remain insufficient given the scale of the problem (Qadri, 2024). The core problem addressed by this research is thus the disconnect between Pakistan's stated climate objectives and the on the ground outcomes of its

initiatives. Pakistan's struggle to translate international obligations into effective action due to constraints of financing, governance, institutional capacity and political continuity raises concerns about whether programs like Clean and Green Pakistan and the TBTTP can deliver their intended impact. This study will examine these implementation challenges in depth, focusing on the case of the Ten Billion Tree Tsunami in Khyber Pakhtunkhwa as a lens for understanding broader obstacles in Pakistan's climate strategy.

Literature Review

Lily Hess (2021) has conducted study about the Ten Billion Tree Tsunami and writes that TBTTP is large scale forestation initiative launched in 2018 under the Pakistan Tehreek-e-Insaf (PTI) government. The program builds on the success of Billion Tree Tsunami in Khyber Pakhtunkhwa, which added 350,000 hectares of forest with an 89% survival rate, earning international recognition, including from the WWF. The initiative aims to restore ecosystems, combat climate change, and create green jobs, while also addressing Pakistan vulnerability to climate induced disasters like floods and droughts. Despite contributing little to global emission, Pakistan remains of the countries most effected by extreme weather events. Hess notes that the program include both planted and naturally regenerated forests, and emphasize community involvement through nursery development, local hiring such as forest watchers and village development councils. While native species are prioritized nonnative eucalyptus trees are also used for economic purposes, through this has raised ecological concerns among experts. NDC Partnership, (2020**)** This climate partnership report describes the 10 Billion Tree Tsunami as scaling up KPK's success. It notes that after independent validation of the KP project's success, the federal government set a target of 10 billion trees. The article emphasizes broad co-benefits: cleaner air, reduced greenhouse gases, flood or drought moderation and biodiversity support are expected outcomes of the expanded planting. It also mentions plans for tracking carbon sequestration and developing a future carbon market around these forestry projects. UNEP, (2021) A UN Environment Program news story highlights the TBTTP as a flagship restoration effort. By mid-2021 the program marked the planting of its first billionth tree, aligning with the UN Decade on Ecosystem Restoration. UNEP stresses Pakistan's urgent need (only 5% forest cover nationally and portrays the tree planting initiative as key to climate adaptation. This source underscores international support and frames the program as central to Pakistan's ecosystem goals.

Maqbool, (2024**)** A case study of the Ex-FATA now merged into Khyber Pakhtunkhwa KP reports substantial forest gains. It documents KP forest cover rising from 20% to 26% (6 percentage point gain) under the program, and Pakistan's overall tree cover up by 1 point. The report notes that 4,509 enclosures were created with local caretakers and that 88% of planted saplings survived. The project also came in under budget (Rs.16.5 billion vs. Rs.22 billion planned). These figures highlight the program's tangible impact on reforestation in KP.

Haq et al., (2024) Focusing on a Hindu Kush mountainous forest region in KP, this study shows dramatic regrowth. It finds that intensive measures (tree planting, logging bans, community patrols) drove forest cover in that area from 2% in 2010 to 35% by 2021.The decades of deforestation were largely reversed. The authors conclude that if protection and planting continue, the project could achieve historic-scale forest restoration. This indicates very strong environmental effectiveness of the TBTT approach in KP uplands. Aleem et al. (2024) This satellite-based analysis quantifies the program's climate effects. The authors report a 3.36% increase in KP forest area after implementation. They also observe that land surface temperatures, which had been rising in 2019, declined slightly after the project, and annual precipitation rose by 15.3% post planting. These changes suggest that increased vegetation cover from the TBTTP has begun to moderate local climate (cooling the land and enhancing rainfall). The study concludes that coordinated reforestation under TBTTP significantly mitigated local warming and improved ecosystem health in KP. Kamal and Shah, (2023) A policy analysis highlights both strengths and social challenges. It notes the program's fantastic success in restoring forests through fenced enclosures, but reports growing community

resistance. Nearby villagers often feel excluded from enclosures forbidding firewood or grazing, leading to tensions and even vandalism. The authors also identify funding cuts, frequent caretaker turnover, and weak monitoring as obstacles. They recommend deeper community engagement, transparent caretaker selection and stronger monitoring systems to sustain trust and long-term success.

Ashraf, (2022) An IIED country report examines social outcomes and equity. It notes that the TBTTP claims to have created about 165,000 jobs, but finds a clear pattern of winners and losers. Wealthier landowners who could dedicate land for planting captured most benefits, while pastoralists and the landless were largely excluded from job and income opportunities. This analysis implies that without deliberate inclusion measures, large scale tree programs may exacerbate socioeconomic inequities. It underscores a challenge ensuring genuine local participation and fair benefit-sharing in implementation. Government of Pakistan, (2021) In Pakistan's updated NDC, the TBTTP is explicitly presented as a flagship nature-based climate solution. The NDC projects that, if fully implemented, the Billion Tree and Ten-Billion-Tree programs together could sequester roughly 500 $MtCO_2e$ by 2040. By quantifying this carbon sink effect and listing TBTTP among its key climate actions, the government formally aligns the program with Paris Agreement goals and multiple SDGs especially life on land. The NDC thus frames TBTTP as central to Pakistan's mitigation commitments and resilience strategy.

In conclusion, the literature on climate change policies in Pakistan reflects significant progress in terms of policy formulation yet highlights the persistent challenges in the effective implementation and long-term sustainability of these initiatives. While programs like the Clean Green Pakistan initiative and the Ten Billion Tree Tsunami Program have garnered attention for their ambitious goals, there is a noticeable gap in research assessing their local-level impact and effectiveness, particularly in terms of community engagement, institutional capacity, and coordination between federal and provincial entities.

Furthermore, current research fails to sufficiently examine the alignment of these program with the overarching clean and green framework, particularly concerning how their objectives, design, and implementation correspond to the sincere needs of local communities. This research seeks to address this shortcoming by analyzing the objectives, framework, and implementation of the Ten Billion Tree Tsunami program, assessing its integration into the wider Clean and Green Pakistan initiative. By concentrating on these aspects, the study intends to provide a comprehensive insight into the program's effectiveness, its sustainability over time, and the role of local governance in enhancing climate resilience and promoting environmental sustainability in Pakistan.

Methodology

This study outlines the qualitative methods used to investigate Pakistan's Clean and Green initiative and its Ten Billion Tree Tsunami Program in KP, ensuring that the research design aligns with the study's objectives. It explains how data are collected and analyzed, providing transparency and consistency (McCombes and George, 2022). They emphasize that the methodology explains what you did and how you did it, allowing readers to assess the study's reliability and validity (McCombes and George, 2022). This research also demonstrates how the chosen methods suit the research objectives i.e. examining Pakistan's climate commitments and the implementation of the tree planting program in its real-world context (McCombes and George, 2022),

Discussion and Analysis

Introduction of TBTTP

The Ten Billion Tree Tsunami Program (TBTTP) is a large-scale national afforestation initiative launched by Pakistan's federal government in 2019, building on the earlier Khyber Pakhtunkhwa (KP) Billion Tree Tsunami of 2014-2018 (NIPA, 2025). The KP program, initiated under the PTI provincial government's Green Growth Initiative, aimed to combat deforestation, mitigate climate change impacts, and promote sustainable development by

planting one billion trees by 2023 (NIPA, 2025). After PTI came to power at the federal level in 2018, Prime Minister Imran Khan expanded the KP model nationwide. In September 2018 he formally initiated the Ten Billion Tree Tsunami, with the goal of planting ten billion trees across Pakistan by 2023 (NIPA, 2025). The program is administered by the federal Ministry of Climate Change in coordination with provincial forest and wildlife departments. Its scope and scale make it Pakistan's largest ever forestry effort an 11.5-year campaign (2019–2029) divided into two phases, with Phase I (2019–23) targeting 3.29 billion seedlings on about 1.2 million hectares, and Phase II continuing at 750–850 million plants annually through 2030 (UNFCCC, 2021). The projects budget is roughly US$800 million (approximately PKR125 billion) funded from domestic resources (UNFCCC, 2021). TBTTP builds on the Billion Tree Afforestation Project (BTAP) in KP, which had planted about 1.2 billion trees (including natural regeneration) during 2014–18, increasing KP forest cover from 20.3% to 26.6% (NDC, 2021). Thus, the origin of TBTTP lies in provincial success with forest restoration, scaled up to a national climate initiative. It represents Pakistan commitment to reversing deforestation and building climate resilience through nature-based solution (NDC, 2021).

Ten Billion Tree Tsunami Program (TBTTP) in the Context of the Paris Agreement

Under the Paris Agreement, Pakistan, as a signatory (2016), committed to reduce its greenhouse gas emissions and adapt to climate impacts. The TBTTP is explicitly framed as a nature-based solution to help meet these goals (NDC, 2021). The Paris framework encourages reforestation and land use change actions as part of national climate strategies, and Pakistan's NDCs emphasize natural capital restoration including tree planting (NDC, 2021). In its 2021 updated NDC, the government highlighted the role of ecosystem restoration Ten Billion Tree Tsunami Program, Protected Areas Initiative, etc. in meeting mitigation and adaptation objectives (NDC, 2021). TBTTP is thus a flagship Paris aligned program it is designed to increase carbon sinks through massive afforestation, improve watershed stability and food security, and create green jobs. The United Nations Environment Program notes that TBTTP sets out to plant ten billion trees by 2023 and is a key national contribution to the UN Decade on Ecosystem Restoration (2021–30) (UNEP, 2021). By building on KP success with afforestation, TBTTP signals Pakistan's willingness to leverage forest restoration in its climate strategy. In sum, the program is a practical manifestation of Pakistan's Paris commitments to low-carbon growth it explicitly aims to help limit warming impacts while also providing co- benefits flood control, livelihoods that align with the Agreement's broad objectives.

TBTTP directly advances Pakistan Paris Agreement contributions by increasing carbon sinks, protecting ecosystems, and generating the NbS benefits stipulated in the NDC e.g. carbon sequestration, climate resilience, jobs (NDC, 2021).

Key Objectives in Khyber Pakhtunkhwa

Within KP the origin province of the initiative, TBTTP's objectives echo national goals but with local emphasis. According to official descriptions, the program aims to improve forest cover and restore damaged landscapes, conserve biodiversity, protect watersheds, and generate green jobs **(**NIPA, 2025). Specifically, it targets planting large numbers of trees to achieve sustainable landscape cover, preserving native flora (plants) and fauna (Animals), and stabilizing soil to reduce destruction and floods (NIPA, 2025). Other stated objectives include institutional strengthening, restructuring agencies like the Zoological Survey and safeguarding protected areas by enhancing wildlife habitats (NIPA, 2025). The program also aims to renew forest resources for eco-tourism and livelihood for example, one report notes revitalizing forest resources to enhance tourism as a key objective (NIPA, 2025). In effect, KP TBTTP is designed not only to raise tree numbers, but to holistically improve ecosystem health, plans include forestation of multiple ecological zones nine forest categories ranging from mangrove to mountain watershed rehabilitation, and the creation of a green economy through nurseries and forest initiatives (REDD, 2025). The policy white paper in KP described the original Billion Tree Tsunami as seeking to reform existing forest and wildlife resources and create job opportunities at the local level (NIPA, 2025). Thus, at the provincial level the objectives merge

climate mitigation carbon uptake with adaptation flood control, water security, biodiversity conservation, and rural development. The KP Forest Department explicitly counts job creation and ecosystem improvement among the project's outcomes, reflecting a socio-ecological objective set (Government of Pakistan 2019).

Implementation Strategy in Khyber Pakhtunkhwa

The TBTTP in KP is implemented through a coordinated multi-tier structure and seasonal drives. At the federal level, the PM's Climate Change Adviser oversees the program in coordination with the Federal Ministry of Climate Change, while day-to-day execution is handled by the KP Forest, Environment and Wildlife Department and local stakeholders (NIPA, 2025). A Project Steering Committee and a Project Management Unit (PMU) were established, with responsibility distributed among three Chief Conservators of Forests one in each forestry region of KP and their teams (NIPA, 2025). Ground level implementation involves Joint Forest Management committees and Village Development Councils (VDC), where local communities participate in planning and protecting plantations. Planting is conducted during scheduled seasonal campaigns often monsoon season, using both government staff and hired local labor. For example, tens of thousands of seasonal workers often including women and youth were engaged to set up nurseries, plant trees, water and guard forests (Javeria Haris, 2023). The strategy also combines active planting with passive natural regeneration certain degraded areas are socially fenced left fallow to allow forest recovery. According to reports, KP TBTTP Phase I has aimed to plant 3.29 billion trees on 1.2 million by 2023 (NDC, 2021). These efforts are funded through provincial budgets (PKR125B) and emphasize low-cost, community driven methods. Officials note significant private sector involvement: over 13,000 private nurseries were established often by local women, supplying saplings for the drive (Javeria Haris, 2023). For monitoring implementation, provincial departments collect data on sapling counts and survival, and third-party observers IUCN, WWF, FAO have been enlisted to standardize reporting Down, (Aslam 2019). KP implementation strategy centers on widespread grass-roots engagement, use of local nurseries, and integration of traditional forest guards and new social fencing, digital tracking methods to achieve the planting targets (NIPA, 2025).

Ecological Impact in Khyber Pakhtunkhwa

Early assessments indicate that the TBTTP has measurably increased forest cover and carbon storage in KP mountainous regions. Official KP data report that the 2014–18 Billion Tree project added roughly 676,000 hectares of forest cover about 6.3 percentage points of provincial land area (REDD, 2025). Remote-sensing studies corroborate substantial greening for example, one recent analysis found that in select forested districts of KP, canopy cover grew from just 2% in 2010 to 35% by 2021 following the afforestation efforts (Fazlul haq et.al 2024). This re-greening has positive benefits for biodiversity creating habitat corridors and for slope stability analysts note that reforestation helps reduce landslide risk and soil erosion in this rugged terrain (Fazlul haq et.al 2024). On the carbon side, the combined BTAP and TBTTP are projected to sequester on the order of 500 $MtCO_2e$ by 2040 (NDC, 2021). In the medium term (2030), the ten-billion-tree phase alone is estimated to capture roughly 148.8 $MtCO_2$ (NDC, 2021) a sizable offset relative to Pakistan's 2018 emissions 490 $MtCO_2e$ (REDD, 2025). Thus, the program significantly enhances KP forest carbon sinks. Ecologically, the plantations have aimed for species mix: mission documents list varied species e.g. chir pine, acacia, mulberry across different zones, and natural regeneration is encouraged in enclosures (REDD, 2025). In practice, implementation has included planting both native trees and some fast- growing species. Anecdotal reports suggest that many areas once barren or degraded are now green e.g. some barren ridges and buffer zones of parks (Ahmed, 2021). However, the ultimate ecological success depends on sapling survival rigorous survival rate data are still emerging. Nonetheless, the reported expansion of forest cover and creation of vegetated lands an estimated 350,000 in BTTAP (Shahid, 2020). indicate a positive ecological impact to date in KP.

Socioeconomic Benefits for Rural Communities

The TBTTP has delivered notable rural socio-economic gains alongside its environmental goals. One of its explicit aims is to provide green jobs and livelihoods. The program claims to have created on the order of tens of thousands of jobs in KP for example, official sources cite roughly 84,000 daily workers employed with an additional 7,000 promised long-term positions through planting, nursery and forest protection activities (Javeria Haris, 2023). Many of these jobs went to previously unemployed youth and women in rural areas. Local media and UN reports note that a network of private tree nurseries around 13,000 in KP sprung up under the program, boosting household incomes and entrepreneurship (Javeria 2023). According to the World Economic Forum, these nurseries have boosted local incomes and generated green jobs, including for unemployed young people and women (Ahmed, 2021). Such income support was especially valuable during economic shocks e.g. COVID-19 lockdowns, when rural jobs were scarce (Javeria, 2023). Beyond direct wages, village communities have benefited from improved access to tree-based resources: domestic fuelwood, fodder, and non-timber forest products NTFP though rigorous data on these uses are scarce. Reforestation of communal lands and protected areas also holds promise for eco-tourism and climate resilience, which can underpin rural economies over time. One study concluded that participants generally experienced increased assets and capabilities housing, tools, etc. due to their involvement (Fahad, 2020). However, distribution of benefits has not been even research indicates that wealthier landowners have tended to benefit more through contracts and land access while landless herders and the poorest have been relatively excluded (FAO, 2021). In sum, while the program generated substantial short term rural employment and income estimated 165,000 jobs nationwide (FAO, 2021). The long-term goal is to sustain these economic gains via stable forest-based livelihoods. Critics emphasize the need to ensure that benefits wages, tenure, NTFP reach marginalized groups, but overall, the TBTTP has demonstrably injected jobs and income into rural KP communities.

Monitoring, Transparency, and Accountability

To ensure credibility, TBTTP included multiple monitoring and oversight mechanisms. Recognizing past controversies in tree planting schemes, the government invited independent monitoring, in 2019 the Prime Minister's Climate Change Adviser announced a consortium of IUCN, WWF and FAO to independently audit the 10-billion-tree campaign nationwide (Shahid, 2018).This consortium was tasked with developing a monitoring plan and standardizing data collection protocols across provinces (Shahid, 2018).The plan involved training provincial forest departments in consistent reporting and engaging Pakistan's space agency (Suparco) to verify plantation sites via satellite imagery (Shahid, 2018). At the provincial level, the KP Forest Department established a Project Management Unit with a dedicated MIS/logframe system and appointed forest officers to supervise plantation enclaves. There are regular progress reports submitted to the federal government. For instance, the Economic Survey 2020-21 reported that roughly 815 million saplings 350 million trees, plus 465 million wildings had been planted nationwide (Shahid, 2018). Additionally, civil society and journalists have periodically raised data queries, prompting government transparency efforts e.g. sharing site coordinates. Nevertheless, many details of monitoring remain internal. Satellite evidence and ground inspections have been ordered by the Supreme Court (Shahid, 2018). To date, the consensus is that broad numbers claimed are plausible given budgets and timelines (Shahid, 2018). but long-term tree survival rates are still being assessed. Overall, a combination of official audits, third-party observation, and digital data collection is in place, though analysts note that true accountability will require continued independent field verification beyond mere sapling counts.

Issues and Challenges

Despite its acclaim, TBTTP faces several criticisms and practical challenges. One key concern is sustainability of plantations, many experts warn that without continued care watering, protection, a large fraction of saplings may die. Skeptics also note that some sites e.g. deserts

or degraded farms present harsh conditions, and questions remain about survival rates under water stress. Linked to this is the monoculture issue, critics point out that planting fast-growing exotics like eucalyptus or poplar can undermine local ecosystems by depleting groundwater or altering soil at least one analysis notes that certain controversial species were used to meet targets, risking impacts on arid areas (Williams, 2021). The social inclusiveness of the project has also been challenged: as noted, wealthier landowners often captured disproportionate benefits, while marginalized groups landless herders, women in remote villages sometimes saw little gain (FAO, 2021). Transparency concerns have arisen too. For example, the Supreme Court in late 2020 demanded forensic scrutiny of the government planting claims, asking for satellite proof of millions of trees supposedly planted (Asad, 2020). Officials had reported 430 million trees in a year, which the Chief Justice found hard to believe, saying if such a huge number of trees had been planted, the entire climate and fate of the country would have been changed (Asad, 2020). This, highlights fear of inflated or fake plantation reports. Some analysts note that Pakistan lacks a full baseline, so verifying added forest cover is inherently difficult. Other challenges include funding and security, in the former tribal districts of KP, a report found that only 7/27 billion rupees budgeted were disbursed in two years, hampering targets (Ahmed, 2021). Local insurgency and community mistrust (over land rights also slowed enclosure establishment only 3,600 of 6,250 planned plots in ex-FATA (Ahmed, 2021). while the program's ambition is widely praised, critics caution that achieving long-term environmental outcomes will require addressing these issues, ensuring species diversity, confirming tree survival, involving local communities equitably, and rigorously verifying reported results (Asad, 2020).

Recommendations

Building on the study's analysis, several evidence-based recommendations emerge to strengthen future implementation of the Ten Billion Tree Tsunami program and related climate initiatives. First, improving institutional coordination and governance mechanisms is critical. Clearer delineation of responsibilities among federal, provincial, and local agencies would enhance efficiency. The government should establish robust multi-level coordination bodies with representation from relevant stakeholders, and ensure continuity of leadership and funding even when administrations change. Strengthening the capacity of local forest departments and community organizations is also recommended to maintain momentum and manage plantations effectively. By clarifying mandates and institutional roles, the program can avoid duplication of efforts and sustain progress over time. Second, the program's monitoring and evaluation framework should be enhanced. The findings indicate a need for systematic tracking of survival rates, species diversity, and overall ecosystem outcomes. Integrating modern remote sensing tools, geographic information systems (GIS), and mobile data collection can allow for regular, transparent assessment of tree growth and forest health. Conducting independent third-party audits or scientific assessments would improve accountability and credibility of reported results. By ensuring accurate and timely monitoring data, program managers can adapt strategies in response to ecological feedback, correct underperforming sites, and demonstrate progress toward climate and forest restoration targets. Third, recommendations focus on increasing community inclusion and equitable participation. The research emphasizes that future phases should incorporate more inclusive planning by engaging diverse stakeholders from the outset, including women's groups, indigenous communities, and other marginalized populations. Ensuring that benefit-sharing mechanisms accompany plantation activities – for example, by providing livelihood support, training, or fair compensation for land use – will incentivize broader participation and local stewardship. The program should also invest in social mobilization and awareness campaigns to foster a sense of collective ownership and to highlight how environmental restoration serves both local well-being and national goals. These measures would help build public trust and long-term support for the program. Finally, the study suggests that policy and strategic alignment be strengthened. The Ten Billion Tree Tsunami program should be more tightly integrated with Pakistan's broader climate and

development policies. This includes aligning afforestation targets with the Nationally Determined Contributions and incorporating tree-planting objectives into sectoral plans (such as water management, agriculture, and urban development). Financial strategies should be refined by exploring innovative funding sources, such as public-private partnerships, international climate finance mechanisms, or debt-for-nature swaps, to ensure sustainable financing. By embedding the initiative within a coherent policy framework and securing diverse funding, Pakistan can amplify the program's impact on climate commitments and sustainable development outcomes.

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