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## Policy Brief on Climate-Smart Forestry for Pakistan: Carbon Sequestration, Environmental Health, Economic Analysis, and Policy Design for a Sustainable Green Economy

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### Abstract

Pakistan is also facing high deforestation and climate risks, as it has a forest cover of less than 5%. Climate-smart forestry can help Pakistan to increase its carbon sinks, promote ecosystem restoration, and achieve economic growth through sustainable practices such as afforestation and REDD+. This policy brief discusses the issues, current policies, results, and recommends a green economy policy through an integrated policy approach to achieve 10-15% emission cuts by 2030 through targeted investments.

**Keywords:** Afforestation Strategies, Stabilization of Carbon, Environmental and Economic Dimensions, Policy Mechanisms.

### Problem Statement: Issues Observed

Pakistan's forests, which comprise an area of about 2.9 million hectares or about 4% of the total land area, have been experiencing deforestation at an annual rate of 1.5%. This is attributed to illegal logging, agricultural expansion, and an increasing human population (Ansari et al., 2025). This leads to low rates of carbon sequestration, estimated at 10-15 tC/ha/year in coniferous forests. This also leads to biodiversity loss, increased erosion, and flood risk, as experienced in the recent floods that displaced millions in 2022. Economic costs are estimated at PKR 50 billion due to scarcity of timber. Climate change also affects forests in this region through increased temperatures that

decrease sequestration by 20-30% in arid regions (IPCC, 2022).

### Current Policies and Alternatives

Pakistan's National Climate Change Policy (NCCP) 2021 includes afforestation through the 10 Billion Tree Tsunami program, which began in 2018, to achieve 6% forest cover by 2030 (GoP, 2021). Pakistan's REDD+ strategy (2021) also supports carbon payments, sustainable forest management, and community forestry, including provincial strategies such as Khyber Pakhtunkhwa's Billion Tree Afforestation (MoCC, 2021). Alternatives to current practices involve agroforestry, such as eucalyptus intercropping, as well as financial incentives such as carbon credits, compared to business-as-usual practices such as timber harvesting. Gaps persist in enforcement, funding (only 20% of needs met), and integration with agriculture (FAO, 2024; Bukhari et al., 2012).

**Table-1: Economic Estimation: Present Statistics and Possible Viable with Climate-Smart Forestry**

Aspect	Current State	Potential with Climate-Smart Forestry
Carbon Sequestration (MtCO <sub>2</sub> /year)	40-50	80-100 (GoP, 2021)
Forest Cover (%)	~4	6-10 by 2030 (FAO, 2024)
Economic Value (PKR billion/year)	200 (timber)	500 (incl. services) (World Bank, 2024)
Jobs Created	Minimal	500,000 rural (Shah et al., 2025)

### Key Findings

Climate smart activities in coniferous/mangroves store 12-20 tCO<sub>2</sub>/ha/year, with commercial plantations possible on 20% of degraded land (294,600 ha by 2030) (CDKN, 2014). Economic studies indicate benefit-cost ratios of 1.5-3.0 for REDD+ projects, creating employment (potential 500,000) and PKR 100 billion in credits (Shah et al., 2025). Environmental health is enhanced through biodiversity creation (30% in protected areas) and emission reductions (50% through avoided deforestation). Regression models verify policy enforcement and rainfall increase sequestration by 15-25%, despite land conversion to agriculture (Khan et al., 2025).

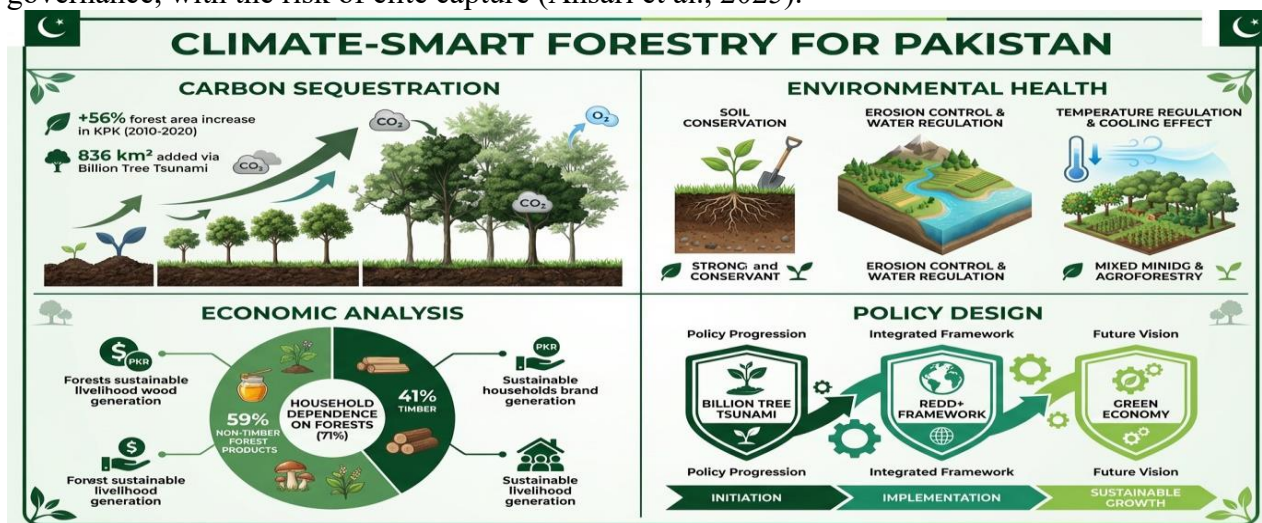
**Table-2: Carbon Sequestration Potential through Different Forests (Projected MtCO<sub>2</sub>/year)**

Forest Type	Area (ha, 2030)	Sequestration Rate (tCO <sub>2</sub> /ha/yr)	Total (MtCO <sub>2</sub> /yr)
Coniferous	1,473,000	15	22 (CDKN, 2014)
Mangroves	200,000	20	4 (FAO, 2024)
Plantations	294,600	12	3.5
<b>Total</b>	<b>~2M</b>	<b>-</b>	<b>29.5</b>

### Policy Implications

Prioritizing forestry is consistent with Pakistan's NDCs (50% reduction in GHG emissions by 2030)

and the country's SDGs on climate change (13) and biodiversity (15), promoting green GDP growth with a projected 2-3% growth in ecotourism/carbon markets (Hussain et al., 2021). Prioritizing forestry would involve a reallocation of the budget from subsidies to incentives, building resilience against droughts with a projected 20% yield loss. However, there are concerns about poor governance, with the risk of elite capture (Ansari et al., 2025).



**Fig. 1: Climate-Resilient Forestry in Pakistan: Sequestration Strategy for Carbon, Environmental Benefits, Economic Insights, and Policy Frameworks**

### Policy Recommendations and Scientific Solutions

Create a National Forestry Carbon Authority to monitor REDD+ using GIS/remote sensing techniques (> 90% accuracy) (MoCC, 2021).

Apply a carbon pricing mechanism (PKR 500/tCO<sub>2</sub>) and a PES system to subsidize community plantations (cost: PKR 50,000/ha; ROI: 15%) (Shah et al., 2025).

Use drought-resistant tree species such as Acacia and Pinus with biochar amendments to increase sequestered C by 25%; integrate AI technology for stock assessment (FAO, 2024).

Expand Billion Trees to mangrove plantations (50,000 ha), monitored by satellite imagery; collaborate with FAO for capacity building.

### Conclusion and Future Thrusts

Climate smart forestry is a strategy for a resilient green economy in Pakistan, where carbon, health, and growth are balanced. Future research areas include species trials under IPCC AR7 scenarios, economic modeling of carbon markets, and gender-disaggregated impacts. Thrusts include nano-amendments for saline soils and blockchain technology for credit verification by 2030.

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