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SWOT Analysis of Forestry Sector in Pakistan: A Comprehensive Review

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Abstract

This review article presents a comprehensive SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of Pakistan's forestry sector, synthesizing current research and policy frameworks. The methodology of systematic literature review focusing on integrated forest management, climate change and policies, specifically from Pakistan, reveals critical insights into the sector's current state and future prospects. Pakistan is among those countries which have a remarkably high deforestation rate, making this analysis particularly urgent for sustainable development planning. The review examines institutional frameworks, community participation models, economic incentives, and policy interventions while identifying key strategic directions for sustainable forest management. Over the past decade, community-based forest landscape restoration (FLR) has gained policy attention in Pakistan, suggesting evolving approaches to forest governance that warrant systematic evaluation through SWOT methodology.

Keywords: SWOT analysis, forest management, deforestation, forest policy, sustainable development

1. INTRODUCTION

Pakistan is located between 24° and 37° North latitudes and 61° and 76° East longitudes (Mufti et al., 2003). It covers an area of 88.430 million hectares (Bukhara et al., 2012). Pakistan is mostly a mountainous country. Its elevation ranges from sea level to 8,611 meters, and almost 65 percent of its land is covered by mountains. About 49% of the area is dry, getting less than 250 mm of rain a year. About 35% of the area is semi-arid, getting between 250 and 500 mm of rain a year. The other 16% of the area is in the sub-humid zone in the northern mountainous tract and has productive coniferous forests. So, the forestry sector is very important for sustainable agriculture in Pakistan because most of the water used for irrigation comes from these forest lands.

Pakistan has very few forests, covering only 4.478 million ha (5.1 percent) of its land. That works out to 0.021 hectares per person, which is less than the world average of 1 hectare per person. According to official estimates, the forestry sector's contribution to the GNP and GDP is very small. This is mostly because country don't

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take into account the many non-timber forest products (NTFPs) and intangible environmental and ecological benefits of the forests. Trees on farmlands are an important source of wood stock that helps in bridging the huge gap between demand and supply and in fulfilling domestic requirements of farming families for forest products, besides producing sizeable income for households in Pakistan. The figure-1 contains information pertaining to the legal classification of forests, which shows that an area of 5.931 million ha is under management of Forest Departments of which 4.507 million ha contain forests and 1.424 million ha is rangeland. Of this area 2.264 million ha i.e. 50 percent area is covered by work plans (Shah and Mohammad, 2016). Thus for another 50 percent forests requisite estimates/statistics are not available even with the forest departments.

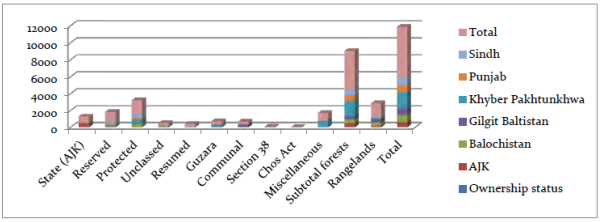

Figure 1. State-controlled Forest and rangelands areas by legal classification (in ha) by Province

Pakistan's forestry sector represents a critical component of the country's environmental and economic landscape yet faces unprecedented challenges in the 21st century. Deforestation is a common threat to the environment that has a substantial impact on the forest's distribution across territorial boundaries. (Ullah, 2023) It is simply defined as the loss of forest cover, which most commonly occurs as a result of deforestation for several reasons. The application of SWOT analysis to Pakistan's forestry sector provides a structured approach to understanding the complex interplay of internal capabilities and external pressures that shape forest management outcomes. Forests are a crucial element of ecosystem which provide a range of ecological, economic, and social benefits, and play a significant role in mitigating climate change. (Rana, 2023) Integrated Forest management (IFM), which involves the sustainable use of forests through a combination of conservation and development activities, is an important strategy for ensuring the long-term health and productivity of forest ecosystems. The strategic importance of forests in Pakistan's context extends beyond environmental conservation to encompass rural livelihoods, climate change mitigation, and economic development. Pakistan also joined board put forth policy interventions mitigation adaption risks maintain symmetry between environmental quality economic development. government (GOP) formulated National Climate Change Policy (NCCP (2012)) passed Act (PCCA (2017)) provide impetus implementation NCCP (Ahmed, 2020). These policy frameworks provide the institutional backdrop against which current forestry challenges must be understood and addressed.

The objective of this review is to synthesize existing research on Pakistan's forestry sector through a SWOT analytical framework, identifying strategic priorities for sustainable forest management and policy development. This analysis builds upon exploring anthropological insights with reference to national policies on integrated

forest management and climate change, while addressing the specific contextual factors that influence forest management outcomes in Pakistan.

2. METHODOLOGY

This review employs a systematic literature review methodology to synthesize available research on Pakistan's forestry sector within a SWOT analytical framework. SWOT is an investigative procedure that gives answers to the questions related to each of the four words of SWOT (Herliana et al. 2018). This method (SWOT) able the researcher to bring out the strengths (advantages and excellence) weaknesses (things to improve the meagre performance) opportunities (existing empowering factors and comparative advantages) whereas threats (obstacle that affect the success). Analysis using SWOT framework in any field can be useful to highlight the activities into areas of strengths and where the greatest opportunities are available (Sanchez et al. 2012)

The methodology of the study was systematic literature review (SLR), focusing on the themes of integrated forest management, climate change and policies, specifically from Pakistan. The SWOT analysis framework was applied to categorize findings into four key dimensions: internal strengths and weaknesses of Pakistan's forestry sector, and external opportunities and threats that influence sector performance. This approach enables systematic evaluation of strategic factors that influence forest management outcomes and policy effectiveness. Data sources include peer-reviewed academic literature, policy documents, and empirical studies specifically focused on Pakistan's forestry sector. The analysis prioritizes studies that provide quantitative evidence of forest management outcomes, policy effectiveness, and stakeholder perspectives on forest governance challenges.

3. RESULTS: SWOT ANALYSIS OF PAKISTAN'S FORESTRY SECTOR

3.1 Strengths

3.1.1 Community-Based Management Initiatives

Community-based forestry (CBF) refers to forest management approaches where local communities participate directly in conserving, managing, and utilizing forest resources. The central principle underpinning CBF is the empowerment of local people to have rights and responsibilities over the forests they depend on for their livelihoods, knowledge, and cultural practices. This model contrasts notably with traditional centralized forest management systems, which often exclude local communities from decision-making and resource ownership. CBF emphasizes participatory governance, sustainable use, and equitable benefit-sharing, thereby aligning environmental conservation goals with socio-economic development (Nafees et al. 2021). Community-based conservation and natural resource management contribute significantly to the climate resilience of vulnerable mountain and forest communities by strengthening social-ecological systems. In northern Pakistan, proactive community governance systems have enhanced local adaptive capacities through improved knowledge sharing, disaster preparedness, and ecosystem-based adaptation practices, demonstrating that forest management can be a critical climate adaptation strategy (Zafar et al. 2022). Conservation and livelihood programs benefit from integrating traditional knowledge with modern management approaches, promoting biodiversity preservation, and enhancing community resilience (Adnan et al. 2012). Programs like BTTAP

demonstrate the importance of coordinated environmental strategies that place communities at the center of forest restoration and ecosystem protection (Javed et al. 2024).

Strength factors such as income generating activities are visible, thus forest income plays a vital role in livelihood diversification and improvement. (Jabeen, 2024) Trust building is the most powerful opportunity among communities perspectives in terms of awareness about JFM. The development of community-based forest management systems represents a significant strength in Pakistan's forestry sector, with established mechanisms for stakeholder engagement and participatory decision-making. From an ecological perspective, community forestry enhances biodiversity through participatory protection and sustainable resource use, which is essential for the conservation of sensitive species and forest ecosystems. For instance, Pakistan's recent afforestation efforts such as the "Billion Trees Tsunami Afforestation Project" in KP highlight the critical role community involvement plays in the restoration and expansion of forest cover, demonstrating a significant increase in forested lands where communities participate actively (Haq, 2024). Community forestry contributes critically to biodiversity conservation by integrating local ecological knowledge and stewardship into management practices. In Pakistan's northern districts, community-based conservation of endangered species like the markhor (Capra falconeri falconeri) within protected and community-managed areas has led to observed population increases and sustainable trophy hunting programs that generate community income (Kakakhel et al. 2020).

The study revealed that community members perceived various impacts of FLR on their livelihood assets. (Ullah, 2024) FLR helped restore the ecology, improved access to food, education, and health facilities, developed infrastructure, and initiated ecotourism in the study area. These positive outcomes demonstrate the potential for community-based approaches to deliver multiple benefits beyond forest conservation. Community participation has emerged as a cornerstone of contemporary forest management approaches in Pakistan. To fill this gap, study by (Ullah, 2024) investigated the livelihood impacts of FLR in the Hindu Kush Himalaya (HKH) region of Pakistan. To understand the role of FLR in livelihood restoration, focus group discussion (FGDs) was utilized along with field observations. The integration of community perspectives into forest management planning represents a significant shift from traditional top-down approaches. Study by Jabeen et al. (2024) focuses on how Joint Forest Management (JFM) has provided opportunities to the forest departments and communities for sustainable management of the forests and what challenges have been faced while implementing JFM in Siran valley of Khyber Pakhtunkhwa. By applying a mixed method approach, a total of 169 (120 male and 49 female) respondents including 23 forest department officials and the community members; JFM committees heads, forest owners and users, and key respondents. This comprehensive stakeholder engagement approach provides valuable insights into the practical challenges and opportunities associated with participatory forest management. Forest landscape restoration (FLR) activities were executed through several institutions, particularly extension services, Village Development Committees (VDCs), and Joint Forest Management Committees (JFMCs), through the process of equity, accountability, and collaboration. (Ullah, 2024) The study recommended continuing the implementation of FLR initiatives through extension services to maximize positive impacts on social, natural, human, financial, and physical capitals. Beyond government agencies, donor-led projects, international NGOs, and civil society organizations play significant roles in

Pakistan's forestry sector. Numerous donor-funded initiatives aim to support forest conservation, community forestry, capacity building, and institutional reform. These actors bring valuable technical expertise, financial resources, and participatory approaches that complement state efforts (Suleri, 2008).

3.1.2 Research and Monitoring Capabilities

Pakistan's forestry sector faces unprecedented challenges in the 21st century, necessitating robust research and monitoring capabilities to ensure sustainable forest management and environmental conservation. This alarming trend underscores the critical importance of developing comprehensive research and monitoring systems to guide evidence-based forest management policies and practices. Pakistan has developed significant research capabilities in forest assessment and monitoring, as evidenced by comprehensive studies of forest biomass and carbon stocks. Advanced monitoring studies in Pakistan utilize Landsat and SRTM DEM satellite imageries exported to ERDAS software for pre- and post-processing, with further analysis conducted using ArcGIS 10.5, where vegetation density changes are computed using vegetation indices like VCI, NDVI, and SAVI (Sohail et al. 2022). This technical capability demonstrates Pakistan's adoption of internationally recognized remote sensing methodologies for forest monitoring. Pakistan's position within the South Asian context provides opportunities for comparative analysis, with research exploring adaptation and mitigation potential across Asia and examining key enabling and constraining conditions for mainstreaming agroforestry systems to fulfill Nationally Determined Contributions submitted by Asian countries under the United Nations Framework Convention on Climate Change (Dhyani et al. 2021). Pakistan has embraced the evolution of spatio-temporal analysis using satellite remote sensing data aided with Geographic Information System (GIS) platforms as the country stepped into the corridor of the 21st century (Sohail et al. 2021). This technological advancement represents a significant leap forward in the country's forest monitoring capabilities.

Advanced remote sensing technologies, including Landsat and Sentinel-2 satellite imagery, have been systematically employed to quantify spatiotemporal changes in Pakistan's forest cover over recent decades. These technologies offer high-resolution, multi-temporal observations critical for detecting deforestation trends, rates, and patterns. For example, in the Malakand Division, Landsat-derived data revealed a deforestation rate of approximately 0.74% annually between 2000 and 2017, equating to a total CO2 emission of over 1.3 million MgCO2 equivalent per year (Tufail et al. 2021). Similarly, studies in the Malam Jabba region of district Swat demonstrated forest cover reduction at average rates of about 2.1 km² per year during the past four decades, coupled with shifting land use toward agricultural and built-up areas (Junaid et al. 2023). Sentinel-2 imagery analyses have also quantified a 16.88% forest cover change over a 15-year period in moist temperate forests, indicating annual deforestation at an estimated rate of 2.51% (Khan et al. 2020). Methodologically, these studies typically employ supervised image classification supplemented by vegetation indices such as NDVI, SAVI, and VCI to enhance detection accuracy, which commonly exceeds 90% agreement and is validated using kappa coefficients (Sajjad et al. 2015). Such data inform not only the spatial extent but also the temporal dynamics of deforestation, enabling evidence-based forest conservation planning. Technological advancements in remote sensing, GIS, and artificial intelligence have enhanced deforestation monitoring capabilities. Cutting-edge forecasting models using deep learning, such as Long Short-Term Memory (LSTM) networks, enable prediction of fire events and deforestation

hotspots with high accuracy, facilitating pre-emptive management (Jamshed et al. 2022). These data-driven strategies support policy implementation and improve responsiveness to emerging threats, highlighting the critical role of interdisciplinary research in forest conservation.

3.2 Weaknesses

3.2.1 Policy Implementation Challenges and Institutional Framework Development

The establishment of multi-level institutional frameworks provides a solid foundation for coordinated forest management activities. Developing cross-sectoral mechanisms and policy frameworks can improve institutional coherence and resource use efficiency. The institutional development of forestry in Pakistan is deeply rooted in its colonial past, particularly under British rule. The British colonial administration established formal forestry governance mechanisms primarily aimed at maximizing economic exploitation of forest resources, while implementing early conservation measures to sustain timber supplies. Following independence in 1947, Pakistan retained many of these colonial institutions, including the forest departments and legal frameworks. Although Forestry was a provincial subject since 1935, due to its linkages with the environment on concurrent list and following pre-partition arrangements, the offices of IGF (Inspector General of Forests) and PFI (Pakistan Forest Institute) were established as Federal Institutions, and policies were developed by the office of IGF at the federal level. Thus, the legal instruments developed during the pre-partition era have been adopted since then and continue to be practiced. However, the nascent state faced the challenge of integrating these inherited institutions into its political and administrative context, where colonial priorities shifted toward national development objectives. Early forest governance structures continued under the provincial forest departments, guided by legislation that initially reflected colonial-era policies. This continuity led to a rigid institutional environment, deeply influenced by the imperial forestry ethos that had shaped forestry education and practice in the subcontinent (Roche et al. 2008: Asif et al. 2023).

The gap between policy formulation and implementation represents a fundamental weakness in Pakistan's forestry sector, affecting the effectiveness of conservation initiatives. The integration of these international norms into national legislation has driven some policy reforms and institutional adjustments, including commitments to environmental performance and forest conservation. For example, Pakistan's adherence to global initiatives enhances institutional mandates on forest governance and encourages capacity building efforts aligned with international environmental expectations. However, actual compliance and implementation remain inconsistent due to institutional weaknesses and limited enforcement mechanisms (Shahzad et al. 2025). The contested political environment in Pakistan's forested areas involves a complex interplay of local communities, civil society organizations, religious and traditional authorities, state agencies, and international actors, each wielding varying degrees of influence and power. Weak communication channels between these actors hinder transparency and cooperation, exacerbating conflicts and diminishing institutional responsiveness (Suleri et al. 2008). Forestry management intersects significantly with agriculture and water resource institutions due to overlapping land use and ecosystem service dependencies. Integrated natural resource management policies require institutional linkages that align forest management goals with agricultural development and water governance to avoid

conflicting objectives (Qureshi et al. 2020). In Pakistan, institutional silos prevail, impeding coordinated planning and implementation across sectors. This fragmentation undermines sustainable landscape management and exacerbates environmental degradation, calling for institutional reforms that enhance inter-sectoral collaboration (Islam et al. 2023).

3.2.2 High Deforestation Rates

Pakistan ranks as the second highest in Asia for deforestation rates, with limited forest resources experiencing significant annual losses (Sohail et al. 2022). The Food and Agriculture Organization (FAO) reported that Pakistan's annual forest cover change rate was 1.8% during 1990-2000, which subsequently increased to 2.2% between 2000-2010.

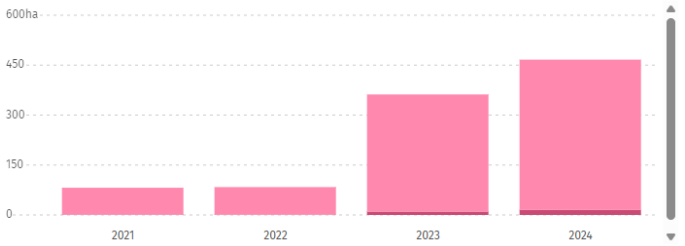

Figure 2. Source: Global Forest Watch (GWF), From 2021 to 2024, 97% of tree cover loss in Pakistan occurred with natural forest, The total loss within natural forest was 968ha, equivalent to 183 kt of CO_2e emissions.

Pakistan's forest resources are critically limited, constituting less than 5% of the nation's total land area, with substantial pressure resulting in an ongoing loss of forest cover. Historically, Pakistan experienced significant deforestation rates, particularly pronounced during the late 20th century and early 21st century. According to recent satellite and remote sensing studies, Pakistan's deforestation rate has been estimated at approximately 0.74% to 4.6% per annum, which ranks among the highest in Asia (Tufail et al. 2021: Junaid et al. 2023). For instance, between 1980 and 2020, the Khyber Pakhtunkhwa (KPK) province alone experienced significant forest area fluctuations, demonstrating both decline and recovery phases depending on regional interventions (Haq et al. 2024). Pakistan's forests are concentrated in northern mountainous regions such as the Western Himalayas, the Hindu Kush, and other high-altitude zones, making conservation in these ecologically sensitive areas paramount (Qamer et al. 2016). The overall shrinkage of forest cover in Pakistan generates serious concerns about the sustainability of these ecosystems, given their pivotal role in biodiversity, livelihood security, and environmental stability. The importance of forests in Pakistan transcends mere ecological value; they serve critical functions including the provision of timber, fuelwood, medicinal plants, biodiversity reservoirs, and regulation of hydrological cycles.

Deforestation not only releases stored carbon but also diminishes the carbon sequestration capacity of the forests, thereby exacerbating the atmospheric greenhouse gas concentration and fostering a feedback loop detrimental to both local and global climates (Somani et al. 2023). Land surface temperature studies have documented warming trends in regions undergoing aggressive deforestation and urbanization, such as Punjab's Sheikhupura district and the Murree hills, where deforestation correlates

strongly with elevated temperatures and altered microclimates (Ansari et al. 2022). The degradation of natural vegetation through clearing and forest cover change contributes to local and regional environmental stresses, including soil erosion, altered hydrological regimes, loss of biodiversity, and increased vulnerability to floods and droughts (Somani et al. 2023). The persistently high deforestation rates in certain regions indicate significant weaknesses in forest protection and management systems (Ahmad, 2022). The results showed that, with regional-wise management regimes, the overall annual rate of deforestation was recorded much higher in the sub-tropical Chirpine forest, Murree (0.8 yr1) compared to the Himalayan and Karakoram ranges of Azad Kashmir (0.13% yr1), Punjab (0.20% yr1), and Gilgit Baltistan (0.31% yr1).

3.2.4 Socioeconomic Drivers of Deforestation

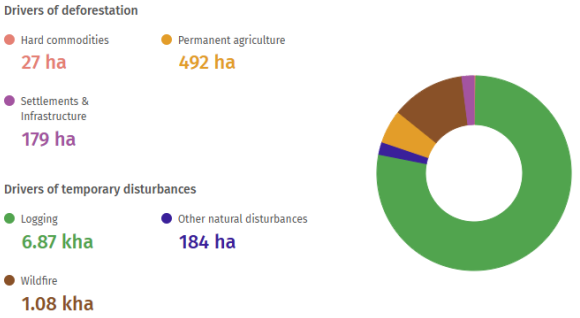

Figure 3. Source: Global Forest Watch (GWF), In Pakistan from 2001 to 2024, 7.9% of tree cover loss occurred in areas where dominant drivers of loss resulted in deforestation.

Deforestation rates in Pakistan exhibit considerable spatial heterogeneity, influenced by regional ecological, socioeconomic, and governance conditions. The northern mountainous areas, including the Hindu Kush-Himalayas and Western Himalaya, have experienced distinct deforestation dynamics. For instance, the Western Himalaya has seen an annual forest loss rate of approximately 0.38% over two decades spanning 1990 to 2010, amounting to the loss of roughly 170,000 hectares (Qamer et al. 2016). Contrastingly, regions like Karakoram Highway and Murree have observed substantial reductions in forest cover within localized zones due to infrastructure development and urban encroachment (Rashid et al. 2018: Ansari et al. 2022). The Tribal District of Kurram, located in northwestern Pakistan, reported a near 48% decline in forest cover over five decades, heavily impacted by population growth and improved road accessibility (Hussain et al. 2022). In Punjab and KPK provinces, forest losses differ in magnitude, with KPK comprising 31% of national forest resources yet facing significant land cover changes driven by both natural and anthropogenic factors (Ansari et al. 2022). Identification of deforestation hotspots within these regions is fundamental for targeted interventions and mitigating environmental degradation.

Rising population growth remains a principal driver of deforestation in Pakistan, exacerbating demand for forest-derived energy resources. Pakistan, as the world's sixth most populous country, witnesses increasing rural households heavily reliant on fuelwood to meet their daily energy needs, often in the absence of accessible alternative energy sources (Tufail et al. 2021). Studies indicate that fuelwood collection can reach staggering amounts, exceeding several million kilograms annually in villages

adjoining forest land, contributing directly to biomass depletion (Tufail et al. 2021). The Gujars, a predominant mountain ethnic community, exemplify how traditional livelihoods dependent on livestock herding and subsistence agriculture intensify forest use, given their socio-economic marginalization and cultural practices (Irfanullah et al. 2022). These demographic pressures are compounded by limited off-farm income alternatives, compelling communities to exploit proximate forest resources unsustainably. Such patterns underscore the nexus between demographic growth, energy poverty, and forest degradation in Pakistan's rural hinterlands (Ullah et al. 2023).

Urban expansion and infrastructure development, particularly road construction, are significant contributors to forest loss by improving access to previously remote forest areas. The construction of roads in districts like Kurram has facilitated easier access to forest resources, triggering extensive deforestation and accelerated land cover change over recent decades (Hussain et al. 2022). Concurrently, rapid urbanization in areas such as Murree and Sheikhupura has resulted in conversion of forest land into built-up areas, aggravating fragmentation and ecosystem stress (Ashraf et al. 2024). The Urban Heat Island effect documented in some urbanizing districts is partly attributed to deforestation linked to land cover transformations and expansion of impervious surfaces (Ansari et al. 2022). These developments result in complex trade-offs between economic development and environmental conservation. Without adequate environmental planning and enforcement, infrastructure-induced access invariably leads to forest exploitation and degradation. Similarly, in the Margalla Hills National Park, fuelwood collection remains a prominent cause of forest degradation despite regulatory protections (Ahmed et al. 2023). These extraction patterns typically fall outside formal energy markets and are inadequately monitored, promoting persistent deforestation pressures. Furthermore, the reliance on wood energy is linked to limited access to alternative, sustainable energy solutions, as subsistence energy use remains embedded in local socioeconomic conditions (Ali et al. 2023). Setting the forest ablaze, increasing farming activities, low level of literacy, increasing timber mafia, growing population, and poverty were the socioeconomic factors found. (Ullah, 2023) The economic incentives listed were for forest crop subsidies, an enhanced system of taxes on exploited forest products, the acquisition of well-monitored hunting licenses, alternative job opportunities, credit provision, and a limited ban on round log exports. The complex socioeconomic drivers of deforestation highlight systemic weaknesses in addressing underlying causes of forest degradation.

3.2.3 Limited Stakeholder Engagement

Pakistan's forestry sector operates within a complex governance framework that involves multiple levels of government and diverse stakeholder groups. The findings reveal significant gaps in community participation, characterized by top-down decision-making processes, limited stakeholder engagement, and inadequate representation of local needs. (Jan et al. 2024). This pattern reflects broader challenges in Pakistan's public sector governance, where traditional hierarchical structures often limit meaningful community participation.

A study by Ullah, 2023 showed the gender distributions, the majority (65.9%) of the respondents were male while 34.1% were female (Ullah, 2023). The underrepresentation of women in forest management decision-making processes represents a significant weakness that limits the effectiveness of participatory approaches and excludes important perspectives from forest governance. Women's

participation in forest management faces considerable challenges, including social restrictions, lack of access to decision-making forums, and limited access to training and financial services. Rural women frequently remain invisible in formal governance processes while being heavily dependent on forest resources for household livelihoods. The scarcity of advanced training, modern technologies, and microfinance availability further exacerbates their marginalization and dependency (Muhammad et al. 2020). Empowerment through capacity building and ensuring meaningful inclusion in governance structures remain imperative for equitable and sustainable forest management.

3.3 Opportunities

3.3.1 Climate Change Mitigation Framework

The relationship between climate change mitigation frameworks and forestry sector development presents a unique opportunity for countries like Pakistan to address multiple challenges simultaneously. The two different but interlinked approaches that are used to meet climate change-induced challenges are climate change mitigation and adaptation. (Khurshid et al. 2024) Climate change mitigation centres on addressing the root cause of climate change i.e., the sources of greenhouse gas (GHG) emissions. As for climate adaptation, it entails taking measures that are critical to protecting the environment, populations, and the overall ecosystem from the adverse effects of climate change. Pakistan is one of the developing countries in South Asian that are most vulnerable to climate change and disasters. (Ullah et al. 2024) This vulnerability necessitates urgent action through both mitigation and adaptation strategies, with forestry emerging as a critical sector capable of contributing significantly to climate change mitigation while simultaneously strengthening national resilience. The issue of ecologically sound and commercially viable strategies for adaptation and mitigation of climate change is being addressed by agroforestry, which is intensive, integrated, intentional, and interactive (Amrutha et al. 2023).

3.3.2 REDD+ Implementation

Pakistan has explored economic incentive tools such as REDD+ which financially rewards conservation efforts by assigning value to forest carbon stocks (Tufail et al. 2021). Studies analysing economic incentives highlight the potential for integrating subsidies, tax reforms, and credit access to encourage sustainable forest practices and income diversification (Ullah et al. 2023). Yet, challenges remain in governance, verification, and equitable distribution of benefits, limiting full REDD+ implementation efficacy (Hosonuma et al. 2012). Tailoring incentive mechanisms to local socioeconomic realities and strengthening institutional frameworks are necessary to leverage these mechanisms successfully.

Financial mechanisms such as reducing emissions from deforestation and forest degradation and the role of conservation of forest carbon, sustainable management of forests and enhancement of forest carbon stocks (REDD+) also emphasize the quantification of forest biomass and carbon. The total Carbon Stock of KP Forests has been estimated at 153.312 million tons, of which 46 percent stock has been held up in above ground biomass, 14 percent in below ground biomass, one percent in leaf/ litter and 39 percent in the soil. In KP 96.5 percent carbon stock is held up by coniferous forests and alpine scrub, while only 3.5 percent by low lying forests (Ali, 2017). It has been reported that KP forests can sequester annually 6.001 million tons of

CO2 emit 6.4 million tons of CO2 from timber extraction as per historical data and has the potential of sequestering more than 2,00 million tons of CO2 through plantation and regeneration induced by "*Billion Trees Afforestation Project*". KP has about 40 percent of forest area and carbon sequestration potential of 14.4 million tons of carbon dioxide (Ali, 2017**).** The Carbon stock of GB forests is estimated at 16.95 million tons of which 80 percent is above ground and 20 percent below ground. It was estimated that the forests of Gilgit Baltistan can sequester 1 283 406 tons CO2 per year (Ali et al. 2017).

These studies could be valuable information while designing sustainable management plans and afforestation programmes for the future and also for accessing nature-based funding such as REDD+ (Qasim, 2023). The availability of international climate finance mechanisms such as REDD+ presents opportunities for scaling up forest conservation and restoration activities.

3.3.3 Integrated Forest Management Approaches

The application of SWOT analysis to forest management has gained recognition as a strategic planning tool that enables systematic evaluation of internal and external factors affecting forest systems. The SWOT methodological approach has been successfully applied across various forest management contexts, providing insights into policy effectiveness and strategic planning requirements. The SWOT framework along with the analytic hierarchy process (AHP) model were applied to analyse the primary data (Jabeen, 2024). The results show that the strength and opportunity factors are inclined toward JFM if the institutional setup is utilized appropriately. This demonstrates the practical utility of SWOT analysis in evaluating specific forest management interventions and their potential for success. Regular monitoring and evaluation of IFM practices may help to promote sustainable integrated forest management which will in turn improve our environment and ecosystem friendly climate and a better human life (Rana, 2023). The growing recognition of integrated forest management approaches provides opportunities for holistic sector development that addresses multiple objectives simultaneously.

3.3.4 Economic Incentive Mechanisms

The economic aspects of forest management in Pakistan encompass both direct revenue generation and broader socioeconomic impacts on rural communities. Conclusively, if adequately controlled and applied, economic incentives can be an important instrument for reducing deforestation (Ullah, 2023). Therefore, deforestation activities cannot be entirely eradicated but they can be reduced to the barest minimum by properly enforcing forest policies in terms of efficient forest policing. The potential for developing effective economic incentive mechanisms provides opportunities for aligning economic interests with conservation objectives. Trees growing on farmlands are an important source for bridging the gap between demand and supply and to provide fuelwood at the doorstep of consumers in rural areas. As a result of increasing price of fuelwood and timber, farm forestry has become a highly profitable business to the extent that instances of production of industrial timber by replacing traditional agricultural crops are not uncommon in rural areas of Pakistan. Consequently, cultivation of trees on farmlands has increased over the last few years. The State of Forestry in Pakistan reports the annual production of 8.83 million m3 wood on farmlands, of which; 5.38 million m3 is timber and 3.45 million m3 is fuelwood (Shah and Mohammad, 2016). The conservation of forest in the northern areas of Pakistan is the major priority of the

national environmental policy to fight against global warming (Ullah, 2021). Despite the policy for the protection of forest, rural residents' behaviour toward economic incentives for deforestation may undermine their conservation goals. This highlights the complex relationship between economic incentives and conservation outcomes, requiring careful policy design to align economic interests with environmental objectives.

Due to the vast territorial expanse and diverse ecosystems, Pakistan is home to a large array of Non-Timber Forest Products (NTFPs), which play an important role in the livelihoods of forest-dependent communities. Income from non-timber forest products is much more regular and sustainable than that of timber. Some of the important products are medicinal, aromatic and culinary herbs, forage and fodder, barava, Kana resin, oils, gums, *mazri* leaves, honey, silk, mushrooms, wild fruits, chilgoza nuts, pistachio nuts, wild almonds, wild pomegranate and Barva plant. Unfortunately, given their importance, these products were not duly considered in earlier forest policies and management regimes. Instead, they were considered trivial and minor compared to timber and fuelwood, which were seen as the major products. *Mazri,* resin, and Ephedra are the only three NTFPs for which production data has been officially compiled, whereas for the rest of the products only guestimates can be made. Kana is another important grass with a viable market. The latest national-level data for these three items are also from 2003-2004. The resin extraction has been stopped since 1990. Production of Ephedra has also stopped; however, mazri leaves are being collected on a small scale. It is estimated that a single standing Chilgoza pine tree can produce nuts worth Rs 4 500 per year making it an important source of income for many poor households (Bari, 2017). During 2012, a total of 1 461.1 tons of nuts were exported generating approx. 13.56 million USD, while in 2013, 1 738 tons were exported with revenues of about 20 million USD (Bari, 2017). The people living in poverty pockets and remote rural areas largely depend on forestry and rangelands for their livelihoods; particularly for getting timber, fuelwood, fodder NTFPs, and grazing livestock. The Forestry Department employs 17 280 staff with a large number of labourers engaged regularly as chainmen of forest check posts, labourers in forest nurseries, plantations and timber watchmen, firewood and NTFPs depots, or, as seasonal labourers working on planting, soil conservation, felling conversion and firefighting. It has been reported that 600 000 workers were engaged annually by the Forestry Departments (Jan 1992). A large number of people earn their livelihoods from farm forestry, a collection of NTFPs, processing of forest-based products (both cottage and industries) and eco-tourism. It has been reported that about 100 000 people are involved in the wood fuel trade in Pakistan and this business generates about Rs.11.3 billion annually (OIGF, 2009). Similarly, more than half a million workers are reportedly engaged by wood-based industries.

Forestry impacts other economic sectors. The mangrove forests, for example, provide most important but unquantifiable benefits, which include protection of the coast from wind and sea currents, protection of coastal villages against the tidal action, cyclones, and erosion. They support the breeding of prawns and fish and act as a natural barrier against ecological and climatic disasters to safeguard the life, land, and property of coastal people. Conservation of biodiversity, recreation, ecotourism and camouflaging naval infrastructure are other services being provided by these forests.

3.4 Threats

3.4.1 Ineffective Management Regimes and lack of comprehensive planning

Forestry data originates from lower field formations of Forestry Departments in the country. Forestry statistics were compiled through annual administration reports by the Departments and consolidated by PFI into Forest Statistics annually. However, lately, the compilation of such important data has been discontinued, resulting in of the lack of availability to crucial information. In addition, the data collected is seldom reliable. The only reliable data on a national level was developed by OIGF in 1992 through FSMP. Data generated in 1992 continues to be used to project figures for vital forestry statistics. However, being grossly outdated, this data has been rendered unreliable as a basis for resource management decisions. Consequently, neither the exact extent of resource and magnitude of challenges is known in order to devise adequate response strategies, nor can policymakers be apprised of the actual situation so that they may allocate proportionate funding. More than 50 percent of forests in the country are being managed without proper working plans. Existing plans are drafted in haste, and doesn't meet the demands of current situation. The cross-national and site-regional findings highlighted that lowest deforestation was associated with management regimes characterized by effective monitoring and law enforcement with the inclusion of conservation and community (Ahmad et al. 2022). Deforestation was higher in forest management regimes that aimed to maximize economic growth, unstable rights, weak law enforcement, and exclusion of conservation and community-based management/use. The persistence of ineffective management regimes represents a significant threat to forest conservation outcomes.

Legal studies have criticized that despite the introduction of new regulations; the execution of community forestry remains hampered by weak governance structures and insufficient political will. There are existing gaps in clearly defined property and tenure rights, which undermine local empowerment efforts and restrict the full realization of community forestry's benefits (Asif et al. 2023). Moreover, forest sector reforms in Pakistan often lack harmonization with broader policy and institutional frameworks, leading to fragmented authority and limited cross-sectoral coordination. Institutional fragmentation has persisted despite structural revisions aimed at effective decentralization and community engagement. Notably, local-level forest officials and bureaucracies frequently maintain centralized decision-making powers, diluting community authority and participation (Nizami, 2013). Community-based forestry programs must also address the operational constraints faced by social forestry institutions, including limited manpower, inadequate training, and insufficient financial independence of field staff. These limitations obstruct targeted outreach and awareness campaigns crucial for gender inclusion and social development. Strengthening the legal status and financial autonomy of community development units is essential to amplify their role in mobilizing communities, particularly empowering women and vulnerable groups (Muslim, 2024). The financial challenges extend to micro-level community groups and grassroots institutions, which often lack access to external credit and financial services necessary for forest-based entrepreneurial activities. In the absence of diversified funding sources and microfinance options, local communities remain vulnerable to poverty and are unable to leverage forest resources sustainably for livelihood improvements (Luqman et al, 2016).

3.4.2 Economic Pressures

In Pakistan, timber is mainly used in construction, mining, furniture industries, match and transport sectors, village carpentry, wooden crates, boxes, paper and pulp factories. The fuelwood is normally used for cooking, heating, brick kilns, cottage industries, tobacco curing, lime, and pottery. The total demand of wood and wood-based products in the country is estimated at 40.93 million m^3; of which 6.06 million m^3 is demand for timber and of 34.87 million m3 for fuelwood. The estimated annual supply of wood from forests is 8.2 million m3, from farmlands it is 18.8 million m^3, while the import is about 0.417 million m^3. Hence about overall supply is estimated at 27.417 million m3. Whereas the demand for wood is estimated at 40.93 million m^3, thereby, causing a deficiency of about 6.06 million m3. In view of the scarcity and resultant high prices of timber and fuelwood, per capita consumption of timber in Pakistan is estimated at 0.032 m^3 and that of fuelwood as 0.184 m^3 per annum. In addition to improving supply, demand needs to be reduced as best as possible by introducing energy efficient alternatives. One way to curtail the demand for fuelwood is to improve the efficiency of stoves used for cooking and heating and the kilns used in tobacco curing and bricks. Efforts have been made in this respect with positive outcomes. Therefore, it is imperative that such initiatives be be replicated on a larger scale. Further, not only are these improved cooking stoves more efficient, but they are environmentally friendly and emit less smoke representing a considerable health benefit (Shah and Mohammad, 2016).

4. DISCUSSION

The SWOT analysis reveals that Pakistan's forestry sector faces a complex set of challenges that require integrated policy responses. In conclusion, the best forest conservation outcomes are associated with management regimes that include conservation and community and stable and secure rights supported by high-ranking monitoring and law enforcement (Ahmad et al. 2022). Therefore, the inclusion of community and conservation supplemented with stable rights and high-rank monitoring and law enforcement into the existing management regimes is suggested. The analysis indicates that while Pakistan has developed significant institutional capacity and community-based management approaches, critical weaknesses in policy implementation and high deforestation rates continue to undermine conservation objectives. The identification of economic incentive mechanisms as both opportunities and threats highlights the need for careful policy design that aligns economic interests with conservation goals. The goals of this study are to help with the implementation of appropriate policies and decision-making in forest management, as well as to provide a foundation for future scenario analysis of deforestation potential or to investigate potential environmental and human implications. The SWOT analysis suggests several priority areas for policy intervention:

Strengthening Implementation Capacity: The findings of the study suggest that rural communities support for compliance with policies is vital for the long-term efficacy and protection of the forest in the region. Further, change in the behaviours of inhabitants toward the ecosystem through training can be improved to manage the forest.

Enhancing Stakeholder Participation: Addressing the significant underrepresentation of women in forest management decision-making processes is crucial for improving both equity and effectiveness of forest governance.

Developing Economic Incentive Frameworks: The potential for economic incentives to reduce deforestation should be systematically developed through policy instruments that provide alternative livelihood opportunities while maintaining forest conservation objectives.

5. CONCLUSION

This comprehensive SWOT analysis of Pakistan's forestry sector reveals a complex landscape of opportunities and challenges that require strategic policy interventions. The sector's strengths in community-based management and institutional development provide a foundation for sustainable forest management, while significant weaknesses in policy implementation and high deforestation rates demand urgent attention. The opportunities presented by climate change mitigation frameworks and international funding mechanisms offer pathways for scaling up conservation efforts, while threats from ineffective management regimes and socioeconomic pressures require systematic policy responses. The analysis underscores the importance of integrated approaches that address both technical and governance challenges in forest management.

The insights gained from this research can inform the development of national policies that take into account the needs and perspectives of forest-dependent communities and promote sustainable forest management practices that are responsive to the impacts of climate change. Future research should focus on developing specific policy instruments that leverage the identified strengths and opportunities while addressing critical weaknesses and threats. This requires sustained commitment to integrated forest management approaches that address the complex interconnections between environmental, social, and economic factors affecting forest management outcomes.

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