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Drivers of Deforestation and Forest Degradation in Pakistan: A Review and Gap Analysis

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Abstract
Deforestation and forest degradation pose significant environmental and socio-economic challenges in Pakistan, threatening its limited forest cover. This review synthesizes current knowledge on the drivers of deforestation and forest degradation in Pakistan, examining the complex interplay of governance failures, socioeconomic factors, population dynamics, and land-use changes. The review identifies gaps in the literature, including the need for integrated socio-ecological models, long-term monitoring studies, community-based research approaches, and a better understanding of market dynamics, climate change interactions, illegal logging networks, and gender dimensions. We also need policy research to see how well current conservation strategies, economic incentives, community-based management models, and the use of traditional knowledge are working. If these gaps were filled up, it would be of great assistance in developing more effective strategies to put an end to deforestation and to promote sustainable forest management activities in Pakistan. It is important for this type of research to concentrate on methods that integrate ecological, social, economic, and political perspectives in order to provide a comprehensive understanding of the factors that lead to deforestation and the potential solutions to this problem.
Keywords: Forest Cover, Population Growth, Fuel Consumption, Policy Framework, Livelihood Dependence
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1. Introduction

Forests are extremely significant for Pakistan's social, economic, and ecological well-being. On the other hand, individuals do actions that are very damaging to these ecosystems, which ultimately contributes to the depletion of forests and the loss of their quality. According to M. Tufail et al. (2021), Pakistan has minimal forest cover, only about 4% of the country's total land area. The situation gets worse because the interactions between economic, social, political, and environmental issues are getting more and more complicated. When it comes to developing successful policies to protect forests and promote sustainable forest management in Pakistan, it is vital to identify the drivers that are driving the situation. This review compiles the existing body of information concerning the factors that lead to deforestation in Pakistan, investigates the research approaches utilised in relevant studies, and finds substantial gaps in the existing body of literature that call for additional research. The authors Noreen Raza and Faiza Ashraf (2023) highlight the necessity of understanding deforestation and the environmental consequences it has in areas such as the Malakand Division of Pakistan, where anthropogenic activities put the ecosystem in jeopardy. They highlight the importance of implementing long-term conservation policies in order to protect biodiversity as a response to these concerns.

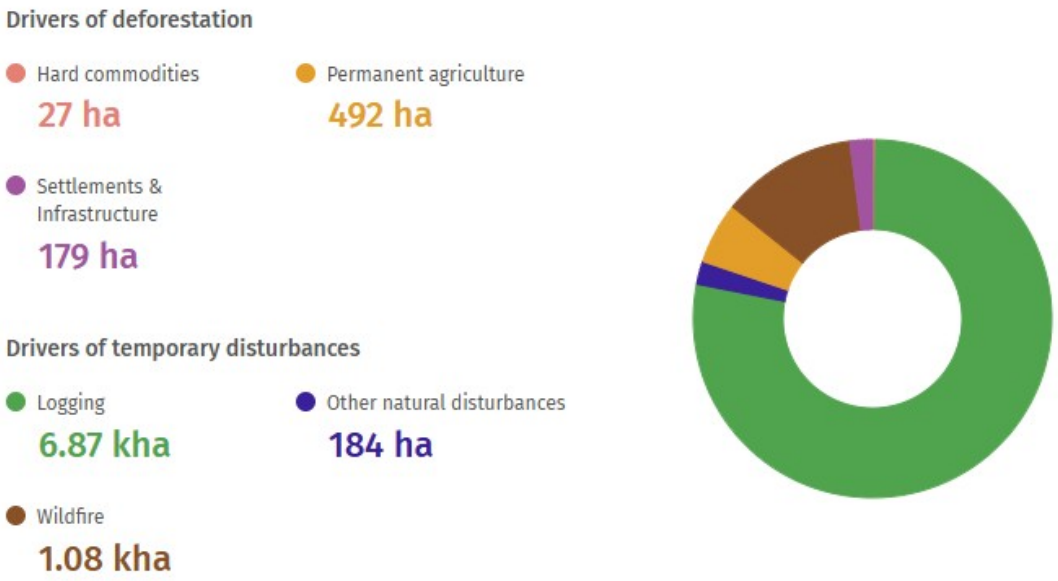

Figure 1. Source: Global Forest Watch (GWF), In Pakistan from 2001 to 2024, 7.9% of tree cover loss occurred in areas where dominant drivers of loss resulted in deforestation.

2. Governance and Institutional Factors

2.1 Property Rights and Regulatory Frameworks

The key factors that contribute to the degradation of forests in Pakistan are problems that are associated with property rights and legislation. According to R. Azhar (1993), the forests in northern Pakistan, which are typically referred to as "guzara forests," are considered to be "regulated commons." This suggests that restrictions were put in place to limit the amount of logging that could be done in order to accomplish the goal of ensuring the sustainable management of these forests. However, the apparent enforcement failure reveals a more complex scenario involving the delineation of property rights and rent-seeking behavior by both those subject to regulation and the regulators themselves. The regulatory framework has created a discordant structure of property rights involving the government and local inhabitants. Despite early indications that this structure was unenforceable, no rectifying changes were introduced, allowing the problematic structure to persist into the postcolonial era. In fact, some potentially beneficial institutional changes introduced toward the end of the colonial period were reversed. While the process of degradation began with discordances in property rights delineation, rent-seeking behavior adequately explains its persistence and subsequent reversals.

2.2 State Failures in Forest Management

State failures in forest management represent another significant institutional driver of deforestation in Pakistan. Lubna Hasan (2007) argues that since most forests in Pakistan are state-owned and managed, the responsibility for their protection and conservation rests with the state. Therefore, any inquiry into forest degradation must analyze the state's role, as attributing the entire burden to 'other factors' diverts attention from more critical causes, leading to flawed policy conclusions. Many policymakers have blamed local communities for the destruction of forests. L. Hasan (2007) says that planners think that overpopulation is the main problem and that people who live near forestlands act irresponsibly and use them in ways that aren't good for the environment. This idea has made policymakers look for ways to keep people away from forest resources while giving the government more power. This approach doesn't take into account the state's role in failing to manage forests properly.

3. Socioeconomic Drivers of Deforestation

3.1 Poverty and Livelihood Dependencies

Pakistan's deforestation and forest degradation are both significantly influenced by socioeconomic issues, which are substantial contributors. It was determined by M. Tufail and colleagues (2021) that the formal sector was not adequately established, that wages earned off the farm were insufficient, and that access to credit was restricted, all of which acted as barriers to the transfer to alternate sources of income. Because of these considerations, the cost of social services became more expensive. The economic difficulties that communities face make it difficult for them to maintain their livelihoods without being dependent on the resources provided by forests.

In the course of research conducted on the ecosystem of Margalla Hills National Park, it was discovered that more than fifty percent of the families make use of wood from the forest as a source of fuel, Saleem et al. (2014). In light of this, it is clear that they are extremely dependent on forest resources. Not having enough education (odds ratio, OR = 2.6, 95% confidence interval, CI = 1.0–6.7), having a large family size (OR = 5.0, 95% CI = 1.5–16.6), and the type of fuel that was used (OR = 3.5, 95% CI = 1.2–9.9) were all significant predictors of faster deforestation, according to the findings of the researchers [5]. In addition, they reported that the bulk of the men in the group were illiterate and had a propensity for construction, which indicated a lack of concern for the conservation of resources. According to the findings of the research, the key problems are a severe lack of awareness and an excessive reliance on natural resources. It was argued that individuals could be motivated to change their conduct by providing them with alternate fuel sources, improved educational chances, and steady economic prospects. Mazhar Biland et al. (2021) agree with Mazhar Biland and state that it is important to understand the decision-making processes of households that are dependent on income obtained from forested areas that are next to the household.

3.2 Energy Demand and Fuelwood Collection

The enormous need for energy in Pakistan, in particular the use of fuelwood for domestic and commercial purposes, is one of the key factors that contributes to the deforestation that is occurring around the country. According to the findings of M. Tufail and colleagues (2021), the acquisition of up to 8,501,720 kilogrammes of fuelwood to fulfil the energy needs of businesses and households was a substantial contributor to the process of deforestation. There is a large amount of strain placed on forest resources as a result of the significant demand for wood energy. Researchers in the forest-rich region of Swat, Pakistan, found that the majority of households surveyed derived the most of their income from activities that were not related to farming (37%), while the forest-related activities accounted for the least amount of revenue (16%). The majority of forest income came from fuelwood, which accounted for 66% of the total, followed by medicinal plants, which accounted for 20%, and fodder, which accounted for 13%, Mazhar Biland et al. (2021). This demonstrates the relevance of firewood gathering for the population that lives in the forest.

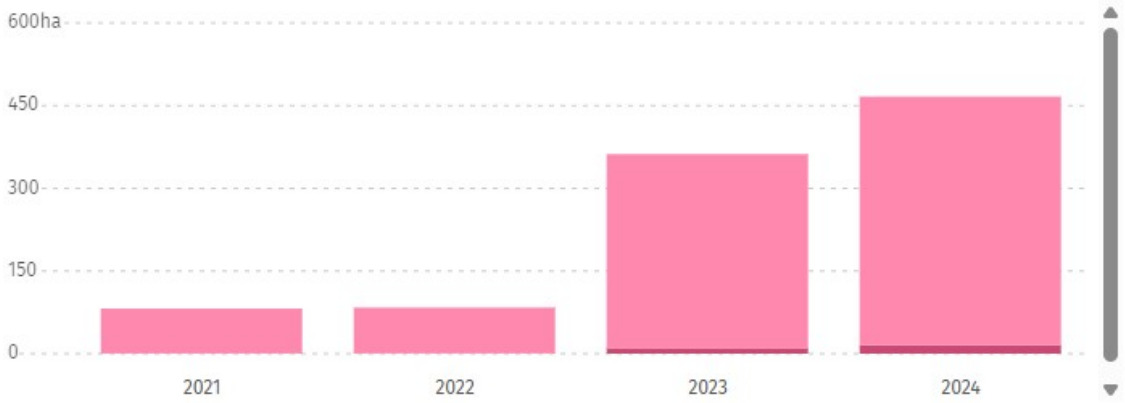

Figure 2. Source: Global Forest Watch (GWF), From 2021 to 2024, 97% of tree cover loss in Pakistan occurred with natural forest, The total loss within natural forest was 968ha, equivalent to 183 kt of CO_2e emissions.

3.3 Identified Socioeconomic Factors in Recent Studies

Recent research has taken a more in-depth look at the socioeconomic elements that are contributing to the deforestation that is occurring in Pakistan. Saif Ullah and colleagues (2023) found a number of socioeconomic factors that contribute to deforestation in northern Pakistan. These factors include forest fires, expanded agriculture, low literacy rates, the advent of the wood mafia, population expansion, and poverty. Subsidies for forest crops, increased taxes on exploited forest products, hunting licenses that are strictly controlled, new employment opportunities, access to financing, and limits on the export of round logs are some of the economic incentives that were presented in the study as a means of addressing these problems. Through the utilisation of logistic regression analysis, it was determined that socioeconomic characteristics proved to be statistically significant variables ($p < 0.05$). The authors came to the conclusion that economic incentives have the potential to act as effective methods for mitigating deforestation, provided that they are implemented and regulated in an acceptable manner.

4. Population Dynamics and Demographic Factors

4.1 Population Growth and Pressure on Forest Resources

Deforestation and forest degradation in Pakistan have been repeatedly acknowledged as key contributions to the country's growing population and shifting demographics. According to N. Haq et al. (2022), the forest cover in the Hindu Kush Himalayan ranges of northern Pakistan has seen major changes as a result of a number of reasons, including population expansion, changes in the dynamics of households, and increased efforts to maintain livelihoods. The principal element that influences changes in forest cover in locations that were previously sparsely inhabited is the development of the number of people living there. A quick increase in population has been shown to have a negative impact on the natural resources of the area, particularly forests, according to the research. A population rise, an extension of human settlements, and a decline in forest cover were all seen throughout the course of time, according to data collected from 1980 to 2017. Through the use of geospatial analysis, the researchers were able to ascertain that the majority of the alterations took place within a distance of one to three kilometres of the settlements during each time. When compared to other areas of the research area, the changes in forest cover were substantially more pronounced in the areas that were located in close proximity to population centres. According to the findings of their research, the uninhabited Palas valley has experienced the loss of 17,076 hectares of forest cover as a consequence of the excessive pressure that is exerted on vegetation cover by population increase as well as different social and economic reasons.

4.2 Urbanization and Settlement Expansion

It is important to note that urbanisation and the growth of settlements are two prominent factors that are contributing to the reduction of forest cover in Pakistan. Zahraa M. Hassan and colleagues (2016) found that there was an increase in the amount of agricultural land, developed land, and water bodies in Islamabad and the surrounding areas between the years 1992 and 2012. Despite this, the amount of land that was both treeless and wooded was decreasing. The key contributors to these shifts were the expansion of the economy, the alteration of the environment, and the increase in the population. According to the authors, increased urbanisation and deforestation have a number of negative consequences on the environment, one of which is the deterioration of habitats for various species of wildlife. According to the findings of a study conducted in Abbottabad, Pakistan, the developed area increased from 178 square kilometres to 477 square kilometres between the years 1990 and 2016. Whereas the water areas shrunk from 524 square kilometres to 360 square kilometres, the area that was covered by vegetation shrunk from 770 square kilometres to 602 square kilometres. During the same time span, the area of land that was previously uninhabited increased from 494 square kilometres to 742 square kilometres. Based on the findings, it appears that urbanisation has a substantial impact on the decline of forest cover. The authors Liaqat Ali Waseem et al. (2021) say that high population increase in urban areas is leading to rapid expansion, which in turn modifies the microclimate due to deficient urban planning, Waseem et al. (2021).

5. Spatial and Temporal Analysis of Deforestation

5.1 Remote Sensing and GIS Applications

Researchers have been using remote sensing and Geographic Information System (GIS) techniques more and more to look at and keep an eye on deforestation and forest degradation in Pakistan. F. Qamer et al. (2016) used satellite images and national expert validation to make statistics about forest cover at the sub-district level in the Western Himalaya, Pakistan. This area has about 67% of the country's total forest cover. Their study of forest cover maps from 1990, 2000, and 2010 showed a lot of deforestation, with about 170,684 ha of forest lost, or 0.38% per year, clear-cut or severely degraded over the 20-year period [11]. The researchers saw that the rate of deforestation went up a lot in the second half of the study period. Most of the loss happened along the western borders with Afghanistan. This study was the first systematic and thorough attempt to map changes in forest cover in Northern Pakistan. It found deforestation hotspots at the sub-district level, which gives us important information about how forests are being cut down that could help us come up with better ways to protect and manage forests.

5.2 Quantification of Forest Cover Change

Several studies have quantified forest cover change in different regions of Pakistan. S. Owais and S. Siddiqui (2019) analyzed forest cover change in Swat, Khyber Pakhtunkhwa, using Landsat data processed through the Carnegie Landsat Analysis System. Their temporal analysis between 2011 and 2016 showed significant changes in forest cover, with about 11 km² of forest converted to barren land and approximately 9,985 km² of forest cover degraded. In another study focusing on Khyber Pakhtunkhwa (KPK), M. A. Goheer et al. (2023) analyzed forest change from 1990 to 2020, finding forest area reduction from 1990 to 2009, followed by a sharp increase in the next decade (2010-2020) by 56% [13]. Around 836 km² of land was found to be covered with forests during the Billion Tree Tsunami Afforestation Project (BTTAP), resulting in a net change of 32% increase in forest land over the three decades. This highlights the potential positive impact of large-scale afforestation projects on forest cover.

6. Gaps in the Literature and Future Research Directions

6.1 Methodological Gaps

Several methodological gaps exist in the current literature on drivers of deforestation and forest degradation in Pakistan:

Limited Integration of Socio-ecological Models: There is a lack of studies that integrate socio-economic and ecological models to comprehensively assess the complex interactions between human activities and forest ecosystems. A. Contreras-Hermosilla emphasizes that forest decline is a complex socio-economic, cultural, and political event with many underlying causes operating in numerous and variable combinations. It is a mistake to attribute forest decline to a simple cause-effect relationship or assume that a relationship will remain unaltered over time. A single force, such as agricultural intensification, may operate in diametrically opposite ways, depending on the context of other variables and circumstances prevailing in a particular situation.

Insufficient Long-term Monitoring: I. Khan et al. (2021) point out that the data on carbon stock and biomass in Pakistan's forests is incomplete and inconsistent. This shows that we need more systematic long-term monitoring studies to better understand the causes and trends of deforestation over time.

Noreen Raza and Faiza Ashraf (2023) emphasise the necessity of community-based research that addresses knowledge deficiencies through exploratory studies, examination of spatial and temporal dynamics, and community engagement. Insufficient research has involved local communities in identifying the causes of deforestation and devising strategies for environmental protection. Shiekh Marifatul Haq et al. (2024) assert that local and indigenous knowledge and practices regarding forests could significantly enhance forest conservation and adaptation efforts.

6.2 Thematic Gaps

Several thematic areas require further research:

Market Dynamics and Economic Policies: As highlighted by M. Tufail et al. (2021), there is a limited understanding of how market dynamics, economic policies, and financial incentives influence deforestation [1]. The study calls for providing alternative livelihood opportunities and effective forest management on the REDD+ mechanism to protect forest resources.

Climate Change Interactions: K. M. Siddiqui et al. (1999) point to the possibility of forest dieback and time lags before dominant plant types can adjust to changed climate and migrate to new sites [17]. In the intervening period, they would be vulnerable to environmental and socio-economic disturbances such as erosion, deforestation, and land-use changes. The overall impact of climate change on forest ecosystems in Pakistan could be negative. More research is needed on the interactions between climate change and deforestation.

Illegal Logging and Timber Mafia: N. Allan (1987) observed that in the context of Afghan refugees' impact on forests, Pakistan nationals took advantage of the ensuing confusion to indulge in illegal logging, causing extensive environmental damage, much of it probably irreversible. There is limited research on the role of illegal logging networks and their connections to political and economic power structures.

Gender Dimensions: Research by Aansa Rukya Saleem et al. (2014) mentions that male members were mostly illiterate and in favor of promoting construction activities, reflecting low concern for conservation, but there is limited research on gender-specific roles, attitudes, and impacts related to deforestation in Pakistan.

6.3 Policy Research Needs

Future research should address several policy-related gaps:

Effectiveness of Current Policies: Banafsha Javeed et al. (2024) found that among national park policies in Pakistan, those related to the preservation of ecological processes are least effective, suggesting that laws related to national parks need to be revised to preserve biodiversity and ecological processes. More research is needed on the effectiveness of forest conservation policies.

Economic Incentives for Conservation: Saif Ullah et al. (2023) suggest economic incentives like forest crop subsidies, an enhanced system of taxes on exploited forest products, well-monitored hunting licenses, alternative job opportunities, and credit provision. The authors concluded that deforestation activities cannot be entirely eradicated but can be reduced to the barest minimum by properly enforcing forest policies in terms of efficient forest policing. Research is needed on which economic incentives are most effective.

Community-Based Forest Management: Mazhar Biland et al. (2021) found that households with membership in joint forest management committees (JFMCs) were significantly and negatively associated with households' total income obtained from forests. The study recommends the creation of off-farm opportunities and inclusion of local people in the management of forests through the establishment of JFMCs, particularly for large and poor families. More research is needed on effective community-based forest management models.

Integration of Traditional Knowledge: Shiekh Marifatul Haq et al. (2024) suggest that local and indigenous forest knowledge and practices could significantly contribute to forest conservation and ecological transition if stakeholders generate clear frameworks and biocultural conservation strategies aimed at both dynamically preserving natural habitats and ways of traditional management of local natural resources. Research on integrating traditional knowledge into forest management is limited.

7. Conclusion

By looking at how governance, socioeconomic factors, population changes, and land-use changes all work together, this review has put together what we know about the causes of deforestation and forest degradation in Pakistan. The literature shows that there are many reasons for deforestation in Pakistan, such as problems with governance, property rights, poverty, energy needs, population growth, and urbanisation.

Research suggests that in order to put an end to deforestation in Pakistan, it is necessary to implement a comprehensive plan that concurrently addresses several drivers of the problem. It is suggested, that providing alternate fuel sources, improved education, and steady income may serve as an incentive for individuals to change their behaviours. Although deforestation cannot be completely eliminated, it may be greatly reduced by ensuring that forest rules are effectively enforced and by putting in place rigorous forest police. Significant gaps

exist in the research that require addressing, including the necessity for integrated socio-ecological models, long-term monitoring studies, community-based research methodologies, and an enhanced comprehension of market dynamics, the impact of climate change on these markets, the functioning of illegal logging networks, and the influence of gender on these factors. To determine whether or whether the conservation measures, economic incentives, community-based management models, and the application of traditional knowledge that are now in place are beneficial, policy research is required.

If future research were to fill in these gaps, it would be of great assistance in developing more effective strategies to put an end to deforestation and to promote sustainable forest management in Pakistan. Research of this kind ought to centre on interdisciplinary approaches that bring together ecological, social, economic, and political perspectives in order to provide a comprehensive understanding of the factors that lead to deforestation and the potential solutions that may be implemented to halt it. Environment managers and decision-makers are provided with valuable information, which they may utilise to combat climate change by planting trees and protecting the forests that are already present in the country. It is necessary to utilise geospatial tools in order to make progress towards sustainable management, detection, and monitoring of national forest reserves at the national level. Additionally, local communities ought to be involved in the decision-making process regarding the safeguarding of forest resources.

References

Allan, N.. 1987. "IMPACT OF AFGHAN REFUGEES ON THE VEGETATION RESOURCES OF PAKISTAN'S HINDUKUSH-HIMALAYA". . https://doi.org/10.2307/3673193

Azhar, R.. 1993. "Commons, Regulation, and Rent-Seeking Behavior: The Dilemma of Pakistan's "Guzara" Forests". Economic development and cultural change. https://doi.org/10.1086/452067

Biland, Mazhar, Zeb, A., Ullah, Ayat, and Kaechele, H.. 2021. "Why Do Households Depend on the Forest for Income? Analysis of Factors Influencing Households' Decision-Making Behaviors". Sustainability. https://doi.org/10.3390/su13169419

Contreras-Hermosilla, A.. n.d.. "The underlying causes of forest decline". . https://doi.org/10.17528/CIFOR/000626

Globalforestwatch.org/dashboards/country/PAK/

Goheer, M. A., Fatima, Laraib, Farah, H., Hassan, S. S., and Abbas, Nazir. 2023. "Assessment of change in forests land, carbon stock and carbon emissions of KPK, Pakistan for past three decades using geospatial techniques". Journal of Water and Climate Change. https://doi.org/10.2166/wcc.2023.315

Haq, N., Kontakiotis, G., Janjuhah, H., Rahman, F., Tabassum, I., Khan, U., Khan, Jamilu T., Ahmad, Zahir, and Jamal, Naveed. 2022. "Environmental Risk Assessment in the Hindu Kush Himalayan Mountains of Northern Pakistan: Palas Valley, Kohistan". Sustainability. https://doi.org/10.3390/su142416679

Haq, Shiekh Marifatul, Khoja, Aadil Abdullah, Waheed, Muhammad, Pieroni, Andrea, Siddiqui, M. H., and Bussmann, R.. 2024. "Plant cultural indicators of forest resources from the Himalayan high mountains: implications for improving agricultural resilience, subsistence, and forest restoration". Journal of Ethnobiology and Ethnomedicine. https://doi.org/10.1186/s13002-024-00685-w

Hasan, Lubna. 2007. "An Anatomy of State Failures in the Forest Management in Pakistan". . https://doi.org/10.30541/V46I4IIPP.1189-1203

Hassan, Zahraa M., Shabbir, R., Ahmad, S., Malik, A. H., Aziz, Neelam, Butt, Amna, and Erum, Summra. 2016. "Dynamics of land use and land cover change (LULCC) using geospatial techniques: a case study of Islamabad Pakistan". SpringerPlus. https://doi.org/10.1186/s40064-016-2414-z

Javeed, Banafsha, Huang, Delin, Shangguan, Donghui, Mukhtar, Muhammad Ahsan, Sajjad, Wasim, Banerjee, Abhishek, Yang, Qin, and Butt, A.. 2024. "Assessing the effectiveness of national park's policies and laws in

promoting biodiversity conservation and ecological development in Pakistan". Frontiers in Environmental Science. https://doi.org/10.3389/fenvs.2023.1333650

Khan, I., Khan, W., Ali, Anwar, and Nazre, M.. 2021. "Assessment of Above-Ground Biomass in Pakistan Forest Ecosystem's Carbon Pool: A Review". Forests. https://doi.org/10.3390/F12050586

Owais, S. and Siddiqui, S.. 2019. "Appraisal of Deforestation and Forest Degradation in District Swat, Pakistan". . https://doi.org/10.46660/ijeeg.vol10.iss3.2019.301

Qamer, F., Shehzad, Khuram, Abbas, Sawaid, Murthy, M., Xi, C., Gilani, H., and Bajracharya, B.. 2016. "Mapping Deforestation and Forest Degradation Patterns in Western Himalaya, Pakistan". Remote Sensing. https://doi.org/10.3390/RS8050385

Raza, Noreen and Ashraf, Faiza. 2023. "Deforestation And The Ecological Implications: The Consequences Of Deforestation On The Biodiversity Of Malakand Division, Pakistan". Journal of Advanced Zoology. https://doi.org/10.53555/jaz.v44i5.3978

Saleem, Aansa Rukya, Rashid, Fakhra, Rashid, A., Mahmood, T., and Nisa, W.. 2014. "Impact of population dynamics on Margalla Hills Ecosystem: a community-level case study". . https://doi.org/10.1080/10042857.2014.969363

Siddiqui, K. M., Mohammad, Iqbal, and Ayaz, Mohammad. 1999. "Forest ecosystem climate change impact assessment and adaptation strategies for Pakistan". . https://doi.org/10.3354/CR012195

Tufail, M., Alvi, Shahzad, Khayam, Umer, and Ahmed, A.. 2021. "How Do Energy Demand and Socioeconomic Factors Drive Localities Towards Deforestation and Carbon Emissions in Pakistan?". . https://doi.org/10.21203/RS.3.RS-465144/V1

Ullah, Saif, Wu, Yixiong, and Khan, A.. 2023. "Evaluating the Socioeconomic Factors on Deforestation in Northern Pakistan: A Study on Existing Economic Incentive Tools for Reducing Deforestation". Sustainability. https://doi.org/10.3390/su15075894

Waseem, Liaqat Ali, Khokhar, Malik Abid Hussain, Naqvi, S. A. A., Hussain, D., Javed, Z., and Awan, Hisham Bin Hafeez. 2021. "Influence of Urban Sprawl on Microclimate of Abbottabad, Pakistan". Land. https://doi.org/10.3390/LAND10020095