ECONOMIC CONTRIBUTION OF FORESTRY SECTOR

National Level Assessment of Demand & Supply of Forest Products & Services in Pakistan

Ministry of Climate Change

REDD+ Pakistan

Pakistan Institute of Development Economics

DISCLAIMER

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Message

Forests are an important feature of life on earth because of their intricate relations with human dependence on forestry goods and services and overall social wellbeing. Pakistan is relatively a forest poor country with approximately 5% of its geographical area under forest cover. Yet, the limited forest resource base provides a multitude of ecosystem services, including various timber and non-timber forest products (NTFPs) and green jobs. The real contribution of forest ecosystems to the economy is often undervalued as the conventional accounting systems fail to capture the monetary values of intangible nature of various forest ecosystem services. In particular, forest ecosystems play an important role in climate change mitigation, biodiversity conservation, nature-based tourism, livestock grazing, and regulating water supplies.

I am glad to state that the current study has attempted to assess monetary values of key tangible and non-tangible products and services provided by the forestry sector. The study has determined that the forestry sector contributed 11.48% to national GDP. This is much significant than the previously perceived contribution of mere 0.41% to overall GDP (GoP, 2020)[1] which was mostly based on marketed wood products.

The Government of Pakistan has assigned high priority on the environment and forestry sectors with the aim to steer "climate resilient development". The importance of forest ecosystems has been emphasized in the National Forest Policy 2015 and Climate Change Policy 2012. The National Forest Policy 2015 aims at expansion, protection, and sustainable use of national forests, protected areas, natural habitats, and watersheds for restoring ecological functions, improving livelihoods and human health.

The federal and provincial governments are taking various measures to protect natural forests and expand tree cover in the country. At the national level a cross-sectoral 'landscape approach' is being promoted to address the drives of deforestation and forest degradation as part of the federal government's resilience building agenda.

I am thankful to the Forest Carbon Partnership Facility (FCPF)-World Bank for their financial support and Pakistan Institute of Development Economics for their technical support in preparation of this report. I am sure, the findings of this study will lead to integration of real values of services provided by our natural ecosystems in the national accounting system and decision-making processes.

Musaddiq Ahmed Khan
Additional Secretary (In charge)
Ministry of Climate Change Islamabad

[1] Government of Pakistan, 2020. Pakistan Economic Survey 2019-20. Islamabad: Finance Division, GoP

Preface

Pakistan is mainly a dryland country with low forest cover — 80% of its territory falls under arid and semi-arid regions. Forest ecosystems are an integral part of Pakistan's national economy, especially rural economy which is highly dependent on forestry resources for meeting their livelihood needs.

The limited natural forest resource base is inadequate to meet the national needs of wood and wood products, thereby inducing significant reliance on wood imports. The per capita forest cover in Pakistan is as low as 0.023 ha against the world average of 1.0 ha. There is a big gap between demand and supply which is required to be curtailed. In the given situation, the wood supply has steadily increased from the farm trees only; whereas, the pressure on natural forests continues to rise. The population pressure, poverty and livelihood dependencies are the key demographic factors contributing to deforestation and degradation in the country.

The National Forest Policy 2017 emphasizes on protection and restoration of degraded natural forests and expansion of tree cover on farmlands, roadsides, canal sides and the urban areas. In collaboration with the provincial/territories forest departments, the Ministry of Climate Change is undertaking several initiatives for conservation of forestry resources through donor and domestic funding for meeting the National Forest Policy objectives.

I am encouraged to note that this report has assessed contribution of ecosystem services provided by the forestry sector to the national economy which appears highly significant than previous estimations based on marketed wood products. I am sure this will help in setting out national priorities and policies related to forestry and environment sectors for rural economic development and resilience building to the impacts of climate change.

The findings of the report will also help towards preparation of national reports against the various multinational conventions and treaties related to forestry, biodiversity and climate change to which the Government of Pakistan is a signatory.
Lastly, I am thankful to FCPF-World Bank for their financial support to conduct this important national study. I would also like to appreciate the technical support provided by the sub-national forestry departments, REDD+ Focal Points, REDD+ project team and PIDE for completion of this study.

Syed Ghulam Qadir Shah
Inspector General (Forests)
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Acknowledgements

The Ministry of Climate Change, Government of Pakistan acknowledges the support of the Pakistan Institute of Development Economics (PIDE) in conduct of this study across the country. The report has assessed the economic contribution of forestry sector in Pakistan which goes beyond wood to include the ecosystem services provided by forests and rangelands in Pakistan.

The Ministry of Climate Change acknowledge contribution from several professionals towards the completion of this important national study. In particular, this report is the product of outstanding collaboration of sub-national forestry departments of all the provinces and federal territories and other relevant stakeholders of Azad Jammu & Kashmir (AJK), Balochistan, Gilgit Baltistan (GB), Khyber Pakhtunkhwa (KP), Punjab and Sindh during the preparation of this report, including the collection and verification of related data. The support provided by the provincial REDD+ Working Groups representing forestry experts, local communities, civil society, and academia is also acknowledged.

This report has been prepared by a group of Pakistan Institute of Development Economics (PIDE)'s experts' team. Their contributions are gratefully acknowledged, particularly to Dr. Shujaat Farooq who lead the Team. The other team members include Dr. Durr-e-Nayab (Economist), Mr. Alamgir Khan Gandapur (Forestry/NRM Expert), Dr. Anwar Ali (Value Chain Expert), Mr. Saddam Hussein (Qualitative Expert/Statistician), Dr. Imran (GIS Expert), Ms. Nabila Kunwal, Mr. Niqash Ahmed & Mr. Farhan Ahmad (Research Associates). The Provincial Forestry Team provided secondary data and helped in preparing specific case studies. Their efforts are acknowledged: Mr. Liaqat Ali Khan (Punjab), Mr. Tauheed Ul Haq (Khyber Pakhtunkhwa), Mr. Amjad Ali Shah (Sindh), Mr. Abdul Jabbar (Balochistan), Mr. Abdur Rauf Qureshi (AJK) and Mr. Khalil Ahmed (Gilgit Baltistan).

A special note of thanks to Dr. Nadeem Ul Haque, Vice Chancellor PIDE for overall motivating, supervising and monitoring the team to ensure a good quality report.

In particular, the support of provincial REDD+ focal points is greatly acknowledged and appreciated, including Mr. Irtiza Qureshi (AJK); Mr. Niaz Khan Kakar (Balochistan); Mr. Mohammad Essa (GB); Mr. Gohar Ali (KP); Mr. Tariq Naseem and Mr. Iftikhar ul Hassan Farooqui (Punjab); Mr. Riaz Ahmed Wagan and Mr. Abdul Jabbar Kazi (Sindh).

The technical support and coordination provided by Mr. Syed Ghulam Qadir Shah, Inspector General of Forests/National REDD+ Coordinator and his team including Dr. Raja Muhammad Omer (DIGF), Mr. Parvez Manan (NFI Expert), Mr. Muhammad Afrasiyab (GIS/MRV Expert), Ms. Farhat (Research Associate), Mr. Nadeem Nisar (Contract Management/Procurement Officer), Mr. Rizwan Munir (Finance Manager), and Mr. Kaleem Khan (Admin Assistant) is greatly acknowledged.

Last but not least, the work would not have been possible without the grant provided by the Readiness Fund of the Forest Carbon Partnership Facility (FCPF).

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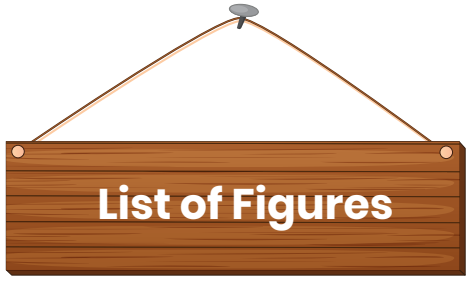


Abbreviations

ACD	Additional Custom Duty
AJK	Azad Jammu & Kashmir
APPTA	All Pakistan Timer Traders Association
DEM	Digital elevation model
DFOs	Divisional Forest Officers
DHS	Demographic Household Survey
DP	Digestible Protein
EM	Ecosystem Management
FAO	Food and Agriculture Organization
FATA	Federally Administered Tribal Areas
FBR	Federal Board of Revenue
FBS	Federal Bureau of Statistics
FD	Forest Department
FDC	Forest Development Corporation
FGDs	Focus Group Discussions
GB	Gilgit-Baltistan
GDP	Gross Domestic Product
GIS	Geographic Information System
GNP	Gross national product
HH	Household
HIES	Household Integrated and Economic Survey
ICIMOD	International Centre for Integrated Mountain Development
ICT	Islamabad Capital Territory
IDIs	In depth Interviews
KP	Khyber Pakhtunkhwa
LFS	Labor Force Surveys
m^3	Cubic meters
MICS	Multiple Indicator Cluster Survey
MoCC	Ministry of Climate Change
NGO	Non-Governmental Organization
NTFPs	Non-Timber Forest Products

PARC	Pakistan Agricultural Research Council
PBS	Pakistan Bureau of Statistic
PFI	Pakistan Forest Institute
PIDE	Pakistan Institute of Development Economics
PSLM	Pakistan Social and Living Standards Measurement
PSU	Primary sample units
RAs	Research Associates
RRI	Rangelands Research Institute
RUSLE	Revised Universal Soil Loss Equation
SBP	State Bank of Pakistan
SFM	Sustainable Forest Management
STATA	Statistical software for data science
TCM	Travel cost method
TDN	Total digestible nutrients
TORs	Terms of Reference (s)
TPs	Transport Passes
UAE	The United Arab Emirates
UNCBD	UN Convention on Biological Diversity
UNCCD	UN Convention on Combating Desertification
UNCED	United Nations Conference on Environment and Development
UNFCCC	UN Framework Convention on Climate Change
USA	United States of America
WCED	World Commission on Environment and Development

Executive Summary

The human dependence on forests is as old as the beginning of times. Thus, the conservation of forests is important, both for the existence of human beings and the protection of renewable natural resources. The forest ecosystems play a significant but often unrecognized role at multiple scales of human organization. At the mirco-level, this extends from households to community. On the macro level, it encompasses overall human well-being inhabiting the Earth's biosphere.

The current study aims to estimate the economic contribution of forestry sector in GDP. To accomplish the study, both the primary and secondary data is used to quantify the value of forestry products and services including carbon and non-carbon products. Both the timber and non-timber forest products have been quantified in this report.

Forests and plantations play an important role in supplying timber and fuelwood for meeting the demands of the ever-growing population of Pakistan. The total wood supply in the country is estimated at 52 million m³, out of which timber is 29% (15 million m³) and fuelwood is 71% (37 million m³). The government-managed forests provide 12% and private land supplies 88% of the total wood. Public forests provide 2% of timber and 16% of the fuelwood requirements in the country. On the other hand, plantations on private lands provide 98% of the timber demand and 84% of fuelwood demand.

The annual fuelwood supply from the public forests has been estimated at 5.94 million m³, out of which the shares of KP, Sindh, and Punjab are 35%, 34%, and 14% respectively. The average annual out-turn of timber from the government-managed forests has been estimated at 0.289 million m³ for the period 2017-2021. About 84% of the total out-turn of the timber is contributed by the forests of KP, AJK, and GB with respective shares of 43%, 28%, and 13%.

The total wood supply from private lands has been assessed as 45.34 million m³, out of which timber is 14.34 and fuelwood is 31 million m³. Farmlands provide 32.59 million m³ and wasteland supply 12.75 million m³. Wood production on farmlands has increased from 7.7 million m³ per year in 1992-93 to 32.6 million m³ in 2021. The highest wood production on farmlands is found in Punjab (55%), followed by KP (20%) and Sindh (15%). The remaining 10% of production has been recorded in Balochistan (6%), AJK (2%), and GB (2%).

Apart from this, the total wood demand in the country has been estimated at 69 million m³. Out of this, total timber demand is 19 million m³ and fuelwood demand is 50 million m³. About 65% of the timber is used by major wood-based industries and 35% is consumed by small wood-based industries. The household sector consumes 90%, the commercial sector uses 7%, and the industrial sector 3% of the total fuelwood. Per capita consumption of timber is estimated at 0.084 m³ per year and fuelwood consumption is 0.240 m³. Currently, there is a gap of 17 million m³ which is met from import and un-recorded supply from urban settings, roadside plantation pro-

jects, such as the Billion Tree Afforestation Project in KP and Ten Billion Trees Afforestation Project in the country, the gap is expected to narrow down in the future and the country is expected to become self-sufficient by 2035.

Regarding industrial utilization of wood, it is estimated that the timber consumption within the industry across Pakistan is 19.122 million m³ with per capita 0.084 m³, showing an increase of 56% over the last 20 years vis-à-vis a population increase of 47% during the same period. This can be further segregated into major and small wood-based industries, consuming 12.50 million m³ and 6.63 million m³ respectively. The production value shows that the overall monetary value of the major wood-based industry is around PKR 1,165 billion, excluding the industrial value of brick-kiln, tobacco curing, and charcoal kiln industry. If we add these industries the value is around PKR 1842 billion. Moreover, there are around 293,439 small wood-based industries within the country. The analysis reveals that overall the consumption of wood in these industries is around PKR 825 billion and the total value of products generated is around PKR 1,421 billion.

The study also estimated that 45% of households across the country still use firewood for cooking purposes. On an aggregate level, the household consumption of fuelwood is around 46 million cubic meters. Across provinces, the per capita rate is the highest in Gilgit Baltistan province. The estimates suggest that province-wise, Gilgit Baltistan, AJK, Khyber Pakhtunkhwa, and Balochistan are the major consumers of firewood for cooking purposes with a whopping 81%, 71.8%, 66.2%, and 53%, respectively. The estimates reveal that domestic fuelwood consumption in 2021 stood at PKR 871 billion. In addition, the commercial fuelwood (catering, hamam and tandoor) was around PKR 189.4 billion. It is worth mentioning that the estimates of fuelwood consumption has not covered the hotels and restaurants.

Pakistan is a net importer country of wood and its products. Over the last 15 years, the exports are almost stagnant, whereas imports has a rising trend. For the year 2020/21, the exports stood at USD 36 million, whereas imports were USD 161 million. The major imports are from USA and Germany. The estimates reveal that demand will remain high than the supply till 2030; however, the ongoing projects will help the country to meet the demand by 2035.

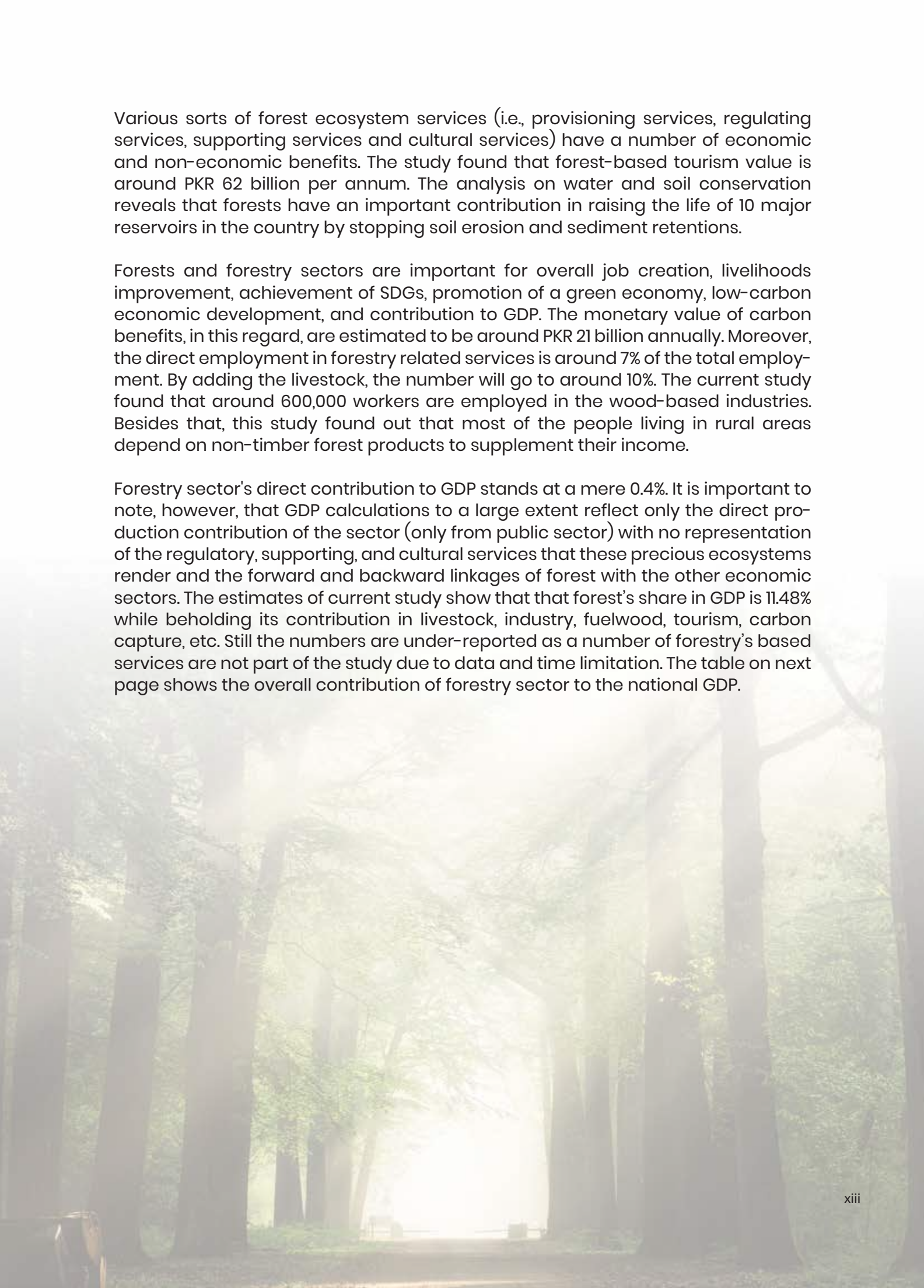
Non-Timber Forest Products (NTFPs) meet the traditional income, livelihoods, health, and nutritional needs of local communities as well as the raw material requirements of herbal, pharmaceutical, and cosmetic industries in the country. NTFP sector lacks any policy and proper registration. The average monetary value of herbal industry is estimated to be PKR 8.1 billion and the wholesale market value is estimated to be around 0.3 billion. The sector has a comprehensive supply-chain but it has been facing a number of constraints, especially lack of a clear government policy, research and development and proper marketing.

57% of the total land is used as grazing purpose where the rangelands have an important contribution in the livestock sector. The estimates reveal that overall, 88 million of the livestock is dependent on rangelands which provide an annual fodder value of PKR 1394.10 billion to the country.

Various sorts of forest ecosystem services (i.e., provisioning services, regulating services, supporting services and cultural services) have a number of economic and non-economic benefits. The study found that forest-based tourism value is around PKR 62 billion per annum. The analysis on water and soil conservation reveals that forests have an important contribution in raising the life of 10 major reservoirs in the country by stopping soil erosion and sediment retentions.

Forests and forestry sectors are important for overall job creation, livelihoods improvement, achievement of SDGs, promotion of a green economy, low-carbon economic development, and contribution to GDP. The monetary value of carbon benefits, in this regard, are estimated to be around PKR 21 billion annually. Moreover, the direct employment in forestry related services is around 7% of the total employment. By adding the livestock, the number will go to around 10%. The current study found that around 600,000 workers are employed in the wood-based industries. Besides that, this study found out that most of the people living in rural areas depend on non-timber forest products to supplement their income.

Forestry sector's direct contribution to GDP stands at a mere 0.4%. It is important to note, however, that GDP calculations to a large extent reflect only the direct production contribution of the sector (only from public sector) with no representation of the regulatory, supporting, and cultural services that these precious ecosystems render and the forward and backward linkages of forest with the other economic sectors. The estimates of current study show that that forest's share in GDP is 11.48% while beholding its contribution in livestock, industry, fuelwood, tourism, carbon capture, etc. Still the numbers are under-reported as a number of forestry's based services are not part of the study due to data and time limitation. The table on next page shows the overall contribution of forestry sector to the national GDP.



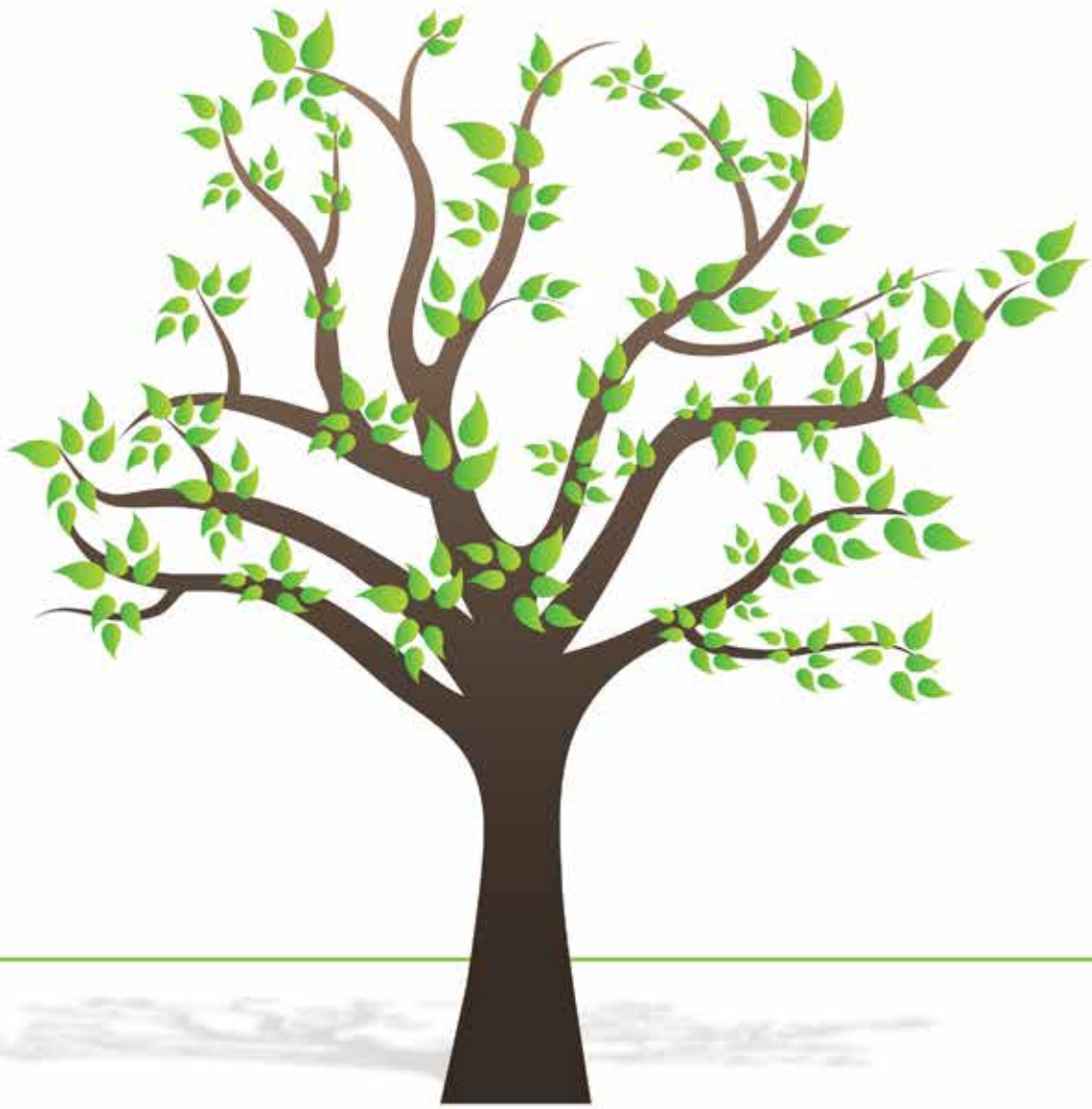
Contribution of forestry products in GDP

Sector	Value in PKR billion	% share
 Wood-based industry	2,930	6.14
 Household's fuelwood consumption	871	1.83
 Commercial fuelwood consumption	189.4	0.40
 Herbal industry & NTFPs	8.4	0.02
 Tourism	62.4	0.13
 Carbon benefits	21	0.04
 Livestock on rangelands	1394.1	2.92
Total	5476.3	11.48

Note: The GDP at current market price is taken for year 2021-22, which is **PKR 47,709 billion.**

Section 1

Introduction



1.1. Introduction

The conservation of forests is important, both for the existence of human beings and the protection of renewable natural resources. The forest ecosystem has an extended value-chain in the economy by providing a range of direct and indirect goods and services that benefit humankind in numerous ways. This includes livelihoods support - not only to the communities living in and around the forest but also to those located far away from forests. Thus, forestry products and services play a significant but often unrecognized role at multiple scales of human organization - from households, and the community at the macro level to overall human civilization inhabiting the earth's biosphere.

For centuries, humans are dependent on forests to acquire a variety of services. Despite deforestation, economic growth has further raised its importance as it provided a significant economic contribution to various economic sectors [1]. Empirical evidence suggests that sustainable benefits to human being and the economy largely depend on how forests are managed and governed and how they are connected with the economy to retrieve the benefits for food and nutrition [2], wood production for industry [3], soil conservation, watershed protection and flood control [4]. The direct share of forestry and its products in a global economy is about 1% of the GDP and 0.4% of employment (FAO, 2019).

Forest ecosystem services can be categorized into provisioning services, regulating services, supporting services, and cultural services. Provisioning services include forest products, such as timber, fuelwood, fodder, and a wide range of non-timber forest products (NTFPs) which are often termed as forest products or goods. Traditional valuation of the forestry sector mostly takes into account only timber, which is normally quantified and documented by government agencies. Other ecosystem services, though play a more important role, are often ignored while calculating the contribution of forestry to the country's developmental statistics.

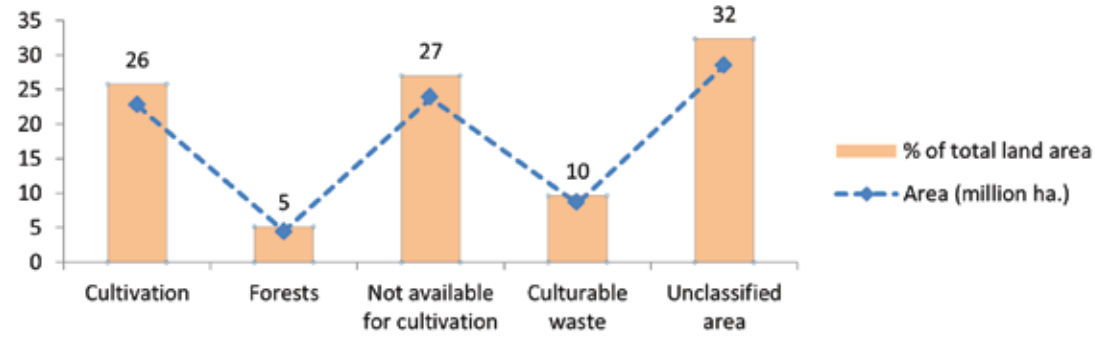
Reliable and timely statistics on forest products and services are essential to ensure a sustainable flow of associated benefits. It ultimately facilitates governments and private stakeholders in making evidence-based decisions, and in devising effective monitoring mechanisms, policies, and programs for sustainable forest ecosystems. However, data is a major issue in estimating both the economic and non-economic benefits, especially on NTFPs. It is worth mentioning that non-economic benefits are largely ignored and underestimated due to a lack of data. Various studies suggest that they are 3 to 5 times higher than the economic benefits. Women and poor communities are among the main economic beneficiaries of forestry products. Keeping this in view, it is necessary to recognize and appropriately value the outstanding economic contributions of forests to human welfare and development.

Quantifying the amount of biomass from forests used for the construction of wood, furniture, fuelwood, paper, or other wood products requires vigilance on industrial

round-wood and fuelwood uses. Trends in production, consumption, trade, marketing mechanisms and prices can be analysed through tracking the different products and services produced and the types of forest that supply timber, industrial wood and fuelwood. Further, other provisioning, regulating, supporting, and cultural, informational, and recreationel services may inform such trends. They also help in assessing the multiple use of forests and the long-term security of different forest products and services including carbon and non-carbon products.

The geographic area of Pakistan including Azad Jammu Kashmir (AJK) and Gilgit-Baltistan (GB) is approximately 88 million hectares, out of which land pattern is available for 67% of the area. The rest of the area is still unclassified and it mostly falls in Balochistan (59%), GB (21%), and Punjab (11%). 35% of the area is cultivable while around one-third of the area is still arid. Forests only cover 5% of the total area as retrieved from provincial forest reports. Across provinces, AJK has the highest forest-covered area (32%), followed by Khyber Pakhtunkhwa (18%), Sindh and GB (5% each), Punjab with 3.3%, and Balochistan with only 1.4%. A significant area has been afforested and regeneration has also been carried out overtime.

Figure 1: Land use pattern in Pakistan



Source: Agricultural Statistics of Pakistan 2010-11

As far as the agriculture sector is concerned, Pakistan has achieved significant rural transformation where the share of livestock has been rising. It is around 70% of the agriculture-based economy. Rangelands is an important source of livestock fodder. According to the Landcover Atlas of Pakistan (2012), the total area of Pakistan is 88 million ha, out of which rangelands is 42.99 million ha (48.6%), agricultural land is 25.78 million ha (29.1%) and forest land is 4.55 million ha (5.1%).

The significant role of forest ecosystems generally remains unrecognized and unappreciated. The country mostly lacks data on the forest, its products, and services. Consequently, policymakers tend to develop a rather uninformed approach toward the protection and sustainability of forest ecosystems. Unfortunately, the forest sector's contribution to Pakistan's GDP has been on a continuously declining trend, always remaining below 1% of the GDP, and currently stands at a

mere 0.4%. It is important to note, however, that GDP calculations to a large extent reflect only the direct production contribution of the sector (only from the public sector) with no representation of the regulatory, supporting, and cultural services that these precious ecosystems render and the forward and backward linkages of forest with the other economic sectors. For example, the 2018 Household Integrated and Economic Survey (HIES) shows that 40% of the population (55% in rural areas and 14% in urban areas) use wood as the main cooking fuel. Such is the level of importance and contribution of forest ecosystems to our daily lives.

Rapid urbanization has seen Pakistan's urban population increase by 4 percentage points from 1998 to 2017. Consequently, the demand for wood-based products has also increased to accommodate this population shift. Improved urban lifestyles further increase demand for wood-based products like paper, kitchen items, furniture, doors, etc. Subsequently, a much higher demand is generated for using wood, and timber in the housing industry and other home appliances manufacturing.

As the construction sector is expanding, especially following the special construction sector package by the government to enhance economic activity in the country, there is huge demand for skilled workers, e.g., local carpentry that is associated with timber and wood products. Ecotourism is another untapped potential in Pakistan and forest-based ecosystems are at the helm of ecotourism. Ecotourism too unfortunately remains a highly overlooked domain while quantifying the sector's economic contribution. Most of the tourism in Pakistan, especially in the northern areas of the country, is solely linked with the forest endowment of the region while there is great promise for it in central and southern regions as well.

Forest ecosystems have directly contributed to establishing various wood-product related market places across Pakistan, thus, generating great economic activity and providing livelihoods to thousands of households. The history of the Bhabra bazaar in Rawalpindi explains for how long humans have used wood-products to better their living standards, while the furniture markets in Chiniot and Gujrat show that modernization too has not reduced the importance of wood products in our lives. Additionally, Pakistan has around a hundred paper mills operating in the country, supplying around 80% of the country's paper requirements. All wood-product industries are highly labor intensive, and their importance to the households of labor associated with these industries has never been adequately quantified. The long-standing use of wood for the manufacturing of essential and high-demand products without any effective forest ecosystems protection and sustainability measures has put them at a high-risk of quick depletion.

With depleting forest ecosystems and wood supplies, the livelihoods of individuals and households associated with these industries maybe at risk unless sustainability measures are adopted.

As mentioned above, data is the backbone of any analysis, planning, and informed decision-making. Comprehensive data, however, on the demand and supply of different forest products and services are not available in Pakistan, while adequate relevant information regarding any of its different provinces/sub-national units is not available either. As a result, this data scarcity limits the ability to analyze and

provide credible and transparent information that can be used to guide markets, help formulate and implement public policies to manage drivers of changes more effectively in the forest, attract potential private investors, bring employment to local communities, and identify targeted priorities and projects. The lack of forest product statistics in Pakistan is characterized by low reporting rates by provinces/-territories, partial coverage of statistics in provincial and national surveys, and a lack of systematic assessment of the majority of forest product-related information and scientific databases.

1.2. Objectives of the Report

The objective of this report is to provide useful information to forest resource users, managers, policymakers, and other stakeholders, especially at the sub-national tier of the public sector. Besides data collection, there is also a need to harmonize data collection at the sub-national level as different provinces may follow different formats and codes for data collection which results in issues of comparability across provinces.

The analysis of this report covers following objectives;

- To analyze the demand and supply of forests for provisioning a number of services such as, carbon and non-carbon products.
- To measure the role of forestry products and services in employment and livelihoods provision.
- To quantify the value of forestry products and services and its contribution in national GDP.

Section 2

Analytical Framework, Data and Methodology

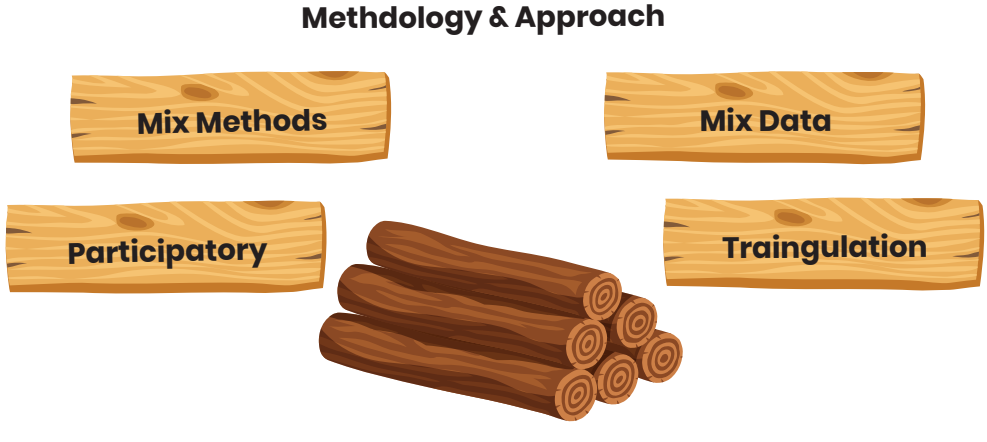
The below sub-sections explain the details related to the analytical framework, data collection, sample size, and methodology against each task as specified in the TORs.

2.1. Analytical Framework

Keeping in view the objectives, the study requires comprehensive data to evaluate both the carbon and non-carbon products associated with forestry. The ultimate objective is to quantify the forestry products and services and calculate their contribution to the economy and share in GDP. The study approach and methodology are based on four pillars as explained in Figure 2:

1. Mix-data, wherein, to the extent possible, both the primary and secondary data sources have been used coherently to bring depth and richness to the analysis;
2. Mix-methods, wherein generalized trends of demand and supply and other aspects obtained through quantitative analysis are substantiated by qualitative methods including but not limited to focus group discussions (FGDs), in-depth Interviews (IDIs), and official data;
3. Data triangulation which essentially is generating a 3D view of the phenomenon under investigation regarding data, investigator, theory, and method as an attempt to study it from more than one standpoint; and
4. Participatory, wherein different stakeholders, e.g., communities, provincial forest departments (FDs) and REDD+ offices, relevant NGOs, and communities are engaged throughout the process not only to increase the chances of the study's ownership but also to ensure their voices are heard and incorporated.

Figure 2: Approach and methodology for the study



2.2. Data and Methodological Framework

The analysis in this report has covered seven domains. Table 1 links each major and sub-analysis with data type and sources.

Table 1: Data sources for analysis

Sr. no	Major Analysis	Sub Analysis	Data Type	Data Description
1	Production & consumption of timber & fuelwood	Government & private forest production	Secondary	Official information on timber, fuelwood & NTFP production
		Inter-provincial movements of wood	Secondary	Information on inter-provincial government departments
		Farmland production	Primary & secondary	Market data for timber, fuelwood supply & its sources: data on wood production in farmlands
		Major urban industry	Primary	Industrial survey (wood-based big industry)
		Small rural industry	Primary	Small & medium rural industry survey (PSU level)
		Fuelwood consumption	Primary	Market survey for fuelwood consumption
		Household fuelwood consumption for cooking & heating	Secondary & primary	HIES & PSLM data HH survey information on fuel-wood prices, quantity, etc.
		Commercial consumption	Primary	Wood consumed at tandoor, restaurants & catering
	Non-timber Forest Products	Wholesale market analysis	Primary	NTFP & herbal supply chain for local & industrial consumption
2		Community analysis in forest areas	Primary	Community FGDs & case studies
3	Forest ecosystem services, water & soil conservation	Ecotourism analysis: soil & water conservation	Primary & secondary	Eco-tourism survey and GIS analysis: Assessment and valuation of soil and water conservation using data from secondary sources
4	Export & import	Analysis forest trade Duty & tax structure Review of RE technologies	Secondary	Federal Bureau of Statistics (FBS), Custom House, Central Board of Revenue, literature survey
5	Forest-based employment	Gender & province-disaggregated analysis of forest livelihoods	Secondary & primary	LFS & other datasets Case studies & community survey
6	Rangelands & pastures' GDP contribution	Dependence of livestock on rangelands	Secondary	Rangeland areas, forage production and livestock grazing in rangelands
7	Overall valuation	Forest contribution to green jobs & GDP	All above data & information	

Besides secondary data, both quantitative and qualitative datasets are required to accomplish the objectives of the study. Keeping this in view, overall 08 quantitative primary surveys were conducted (Table 2) along with 20 case studies as listed in Annexure A. The FGDs were managed with the communities to analyze Non-tim-

ber Forest Products (NTFPs), their price structures, livelihoods dependence, etc. A special focus of the qualitative analysis was to review the dependence of various marginalized, ethnic groups including gender on various forestry resources and agro-forestry systems for livelihoods.

Table 2: Various primary surveys and sample sizes (in numbers)

Sr. no	Data Source	Proposed Sample Size	Actually Conducted
1	Market survey for timber production and consumption	390	403
2	Wood-based major urban industry survey	390	1,068
3	Small rural industry survey	900	954
4	Market survey for fuelwood	307	316
5	NTFP wholesale market survey & herbal industry survey	200	205
6	Household survey for fuelwood	1,500	1,912
7	Tandoors/catering/hamams survey	307	730
8	Ecotourism survey	780	703
	Total	**4,774**	**6,291**

2.3. Task-Wise Methodology

In line with the major and sub-analysis (as detailed in Table 1), this section explains the methodology used for the assessment of key products and services of the forestry sector.

2.3.1. Production of Timber and Fuelwood

The study has two major components, i.e., assessment of the production of fuelwood, timber, and non-timber forest products (supply side) and consumption of fuelwood, timber, and non-timber forest products (demand side). There are three major sources of wood supply, i.e. public forests, private lands, and imports.

2.3.1.1. Production from Government Forests

Government forests or public forests include all designated forests whether owned by the government or the community. Government-owned forests include reserved forests, public forests, demarcated forests, un-demarcated forests, protected forests, resumed lands, village forests, and un-classed forests. Privately-owned forests include Guzara forests, community forests, protected wastelands, Section 38 forests, and Chos Act areas.

Data on timber supply from the public forests are normally recorded and documented by Provincial Forest Departments. However, data on the supply of fuelwood is not properly recorded by Forest Departments. Though public forests provide a large quantity of fuelwood to the surrounding populations there is no mechanism with the Forest Departments to keep a proper record of this data. Data on the production of timber and fuelwood from the public forests for the last five years (2017- 2021) was estimated by collecting data from all the Provincial Forest Departments through a pre-designed questionnaire. Complete data is available for Pun-

jab, Khyber Pakhtunkhwa, and AJK. However, partial data was available for Sindh, Balochistan, and GB.

2.3.1.2 Production from Private Lands

Data on wood supply from private lands is mostly not available as no agency properly records or maintains such data due to innumerable supply channels to the end users. A substantial quantity is collected directly by the landholders in the rural areas which remain unaccounted for assessment. To cope with this challenge, wood supply from private land was estimated by quantifying wood consumption through field surveys covering households, tandoors, restaurants, catering, and timber markets. The sample size is listed in Table 2.

Data was collected through pre-designed survey tools having questions about the source of wood supply whether it is from the public forests or private lands. Data about wood production on private land was further enriched and cross checked by the data collected from the offices of Divisional Forest Officers. It is worth mentioning here that DFOs issue Transport Passes (TPs) for the transportation of timber and fuelwood produced on farmlands/wastelands. However, this data is not properly recorded and documented. Efforts were made to collect this data from the offices of DFOs wherever this was available. Data on wood production on private lands particularly farmlands and wastelands was mined from literature including technical reports, research papers, and other documents, and used to derive the latest wood production on farmlands. Trend analysis of wood production in the country was performed using available data since 1992 when the Forestry Sector Master Plan was developed for Pakistan.

Proxies were used to quantify the timber production from these lands that include a wood-based industry survey, timber market survey, and export/import analysis. A key part of forestry (timber and fuelwood) production in provinces Punjab and Sindh is from the private sector. To quantify farmland production, a Market survey for Timber Production was conducted by interviewing 403 dealers. The profiling of 2,115 dealers was also carried out. The list of visited districts is placed in Annexure B1 where details are also placed of the profiling districts. The questionnaire covered information on the sale and purchase of wood, prices, price trends, etc. Annexure Table D1 details the sample size and profiling of the timber market survey across provinces.

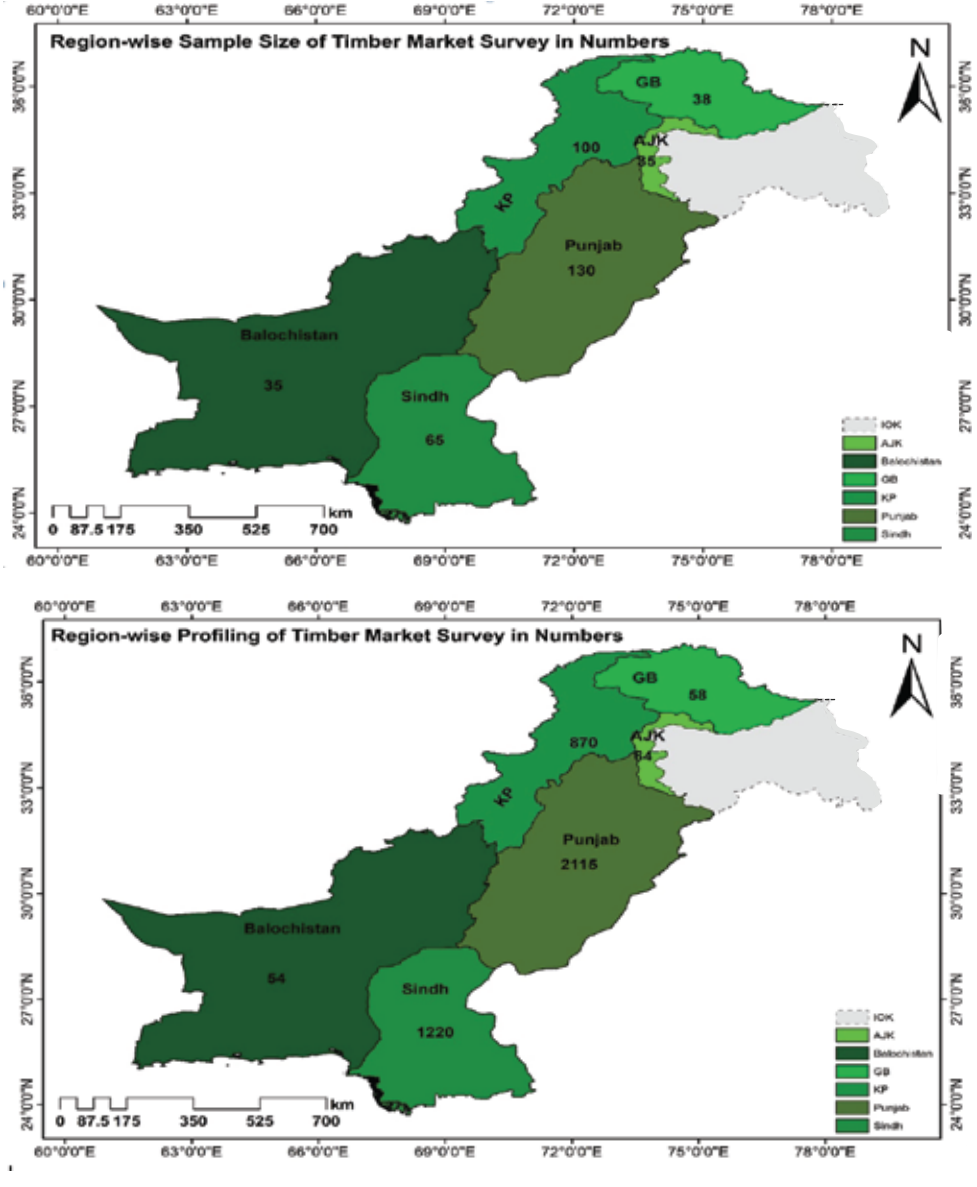
2.3.2. Consumption of Timber and Fuelwood

The per capita consumption of timber and fuelwood has been quantified by the Forestry Sector Master Plan (1992), MAANICS Study (2003), and other studies conducted at a regional and national level, i.e., Provincial Forest Resource Inventory of KP 2000; Timber Harvesting Ban Study of KP, 2010). The production of timber and fuelwood is estimated through a simulation analysis by using the value of timber and population data. The per capita consumption of timber and fuelwood is estimated through secondary data sources and is further verified through primary data to gather information on timber and fuelwood consumption. The consumption analysis is quite comprehensive and it has been divided it into the following five broader categories:

2.3.2.1 Industrial Wood Consumption by Major Urban Industries

It mostly includes round-wood and softwood. This can be consumed directly as industrial fuel and poles or as an input to manufacture other products. A detailed industrial survey was conducted from major urban industries to collect not only quantitative information on the amount of wood used but also other parameters such as value and supply chains. A wood-based industrial survey was managed in 60 districts whereas the profiling was also carried out in other districts that show there are around 28,137 industries. Around 25 kinds of major industries were interviewed (Figure 3). The survey gathered information on gross prices of timber, annual use, value addition, inter-provincial movements, sources of production (government vs. private), taxes, employment provision, etc. The list of visited districts is placed in Annexure B1 along with the districts where profiling was carried out.

Figure 3: Region-wise sample size and profiling of timber market survey (in numbers)



2.3.2.2. Industrial Wood Consumption by Rural Industries

There are many small and medium industrial units in the rural areas that consume wood and wood products. These industries include furniture, carpentry, barbers, brick kiln, etc. A separate survey to gather information from these rural-based industries. Respondents were the owners/managers of these industries and information was gathered on prices, annual use, inter-provincial movements, source of production (government vs private), taxes, employment, etc. The survey was partly household where information acquired from PBS on sampling framework and possible primary sample units (PSUs) and their weights. PBS provided the list of 318 blocks that were representative at the national level. The enumeration team listed all the industries located within the block and interviewed 954 industries. Using the industrial units and weights, the results are generalized at the national level. The block profiling reveals that there are around 293,439 small industries located in rural areas that use timber and wood.

2.3.2.3. Fuelwood Consumption

There are several small and medium fuelwood cutters throughout the country that purchase the wood from farmland and provide fuelwood to various sorts of industrial, commercial, and domestic consumers. A Market Survey was conducted on FuelWood Consumption to analyze the fuelwood consumption in the country. Respondents were the owners/managers of these fuelwood cutters and information was gathered on prices, annual use, supply chain, source of production (government vs. private), taxes, etc. As with the rural industry survey, a block-level methodology was followed where 318 blocks were visited and 316 fuelwood cutters were interviewed. The block profiling reveals that there are around 96,376 fuelwood cutters in the country.

2.3.2.4. Household Consumption

Two sorts of analyses was conducted. Initially, a primary survey was conducted to gather information on sources of cooking/heating fuel, approximate fuelwood consumption, prices, etc. As like above, the survey was conducted from 318 PSUs, and data was gathered from more than 1,912 households throughout the country. The survey provided certain information on prices and the quantity of fuelwood used by the households for cooking, heating, and special occasions.

In the second stage, this information was used and applied it to the existing district and provincial level representative surveys, named Pakistan Social and Living Measurement (PSLM) 2019/20 along with the Census 2017/18 dataset. The proxies calculated from the primary survey were applied to the secondary data to quantify the fuelwood used by the households.

2.3.2.5. Commercial Consumption of Fuelwood

A significant proportion of the fuel-wood is consumed by the tandoors, hamams, and catering sevices. Keeping in view the time and budget constraints, we did not

gather information from tandoors and hotels that were located on the Highways (motorway, national, and provincial highways). Rather, a block (PSU) level methodology was followed where the survey was conducted from 318 blocks/PSUs and data was gathered from tandoors, hamams, and catering units located in these PSUs throughout the country. A total of 264 catering units, 182 hamam, and 284 tandoors were visited. The profiling shows that there are 68,030 catering units, 61,227 hamam, and 124,722 tandoors in the country.

2.3.3. Non-Timber Forest Products (NTFPs)

A variety of NTFPs are offered by Pakistani forests. Food products include, among others, morels/mushrooms, honey, wild fruits, nuts, wild vegetables, condiments, and spices. Indicative animal products include silk cocoons. Industrial products include vegetable tanning e.g., kikar and babul for tanning hides, and bhabar grass. Fiber products may include, Mazari leaves. Other products include oils, latex, resin, walnut bark, gums, basketry, sea-buckthorn, etc. The main stakeholders involved in the NTFP sector are collectors, local intermediaries, wholesale and retail dealers/traders, processors, and exporters/importers.

NTFPs have a variety of medical and non-medical uses and are reported as a million-dollar industry in Pakistan. Despite a well-established supply chain, transactions, and volumes of NTFPs remain undocumented and under-reported. We adopted a value/supply chain approach to gauge information on production volumes, pricing, uses associated employments and its gender dimensions, seasonality, marketing value, and supply chain margins to estimate the overall volume of the business. The following two types of surveys were conducted:

2.3.3.1 NTFP Wholesale & Retail Market Herbal Industry Survey

The herbal pharmaceuticals like Qarshi, Hamdard Ashrafi, etc., may be consuming substantial volumes of medicinal plants. Here, the best entry point however may be retail and wholesale NTFP markets such as Bhabra Bazaar in Raja Bazaar Rawalpindi, Akbari Mandi in Lahore, and similar markets in Mansehra, Chillas, Malakand, Ziarat, Quetta, Karachi, and other major cities in Pakistan. A survey was conducted in 33 major NTFP wholesale and retail markets, as well as herbal industries and 158 dealers were interviewed. Besides pricing, the key information was gathered on the source of origin, volumes and prices, supply chain, and key actors involved in the upstream supply chain. An additional 45 herbal industries were interviewed.

2.3.3.2 Community Survey and Case Studies

FGDs were conducted with specific communities and in-depth interviews (IDI) with key upstream actors and relevant FD officials to document the entire supply chain including the permission processes, production processes, transport mechanisms, associated livelihoods, and price determination. The details of the FGDs are placed in Annexure A. The core focus of the FGD was to identify the:

- Value chains and price variation of timber and NTFPs
- Market and transport mechanisms

- Processing methods, value addition, grading and quality control, packaging mechanisms (if applicable)
- The gender dimension of employment generated throughout value and supply chains
- Problems/trends like cheap substitute availability; and
- Factors affecting prices and demand

2.3.4. Forest Ecosystem Services, Ecotourism, Water, and Soil Conservation

Forests provide several ecosystem services which are broadly classified into provisioning services (timber, fuelwood, forage, water, medicinal and aromatic, genetic resources, etc.), regulating services (climate regulation, water cycle regulation, pollinating service, diseases, and pest regulation services, etc.), supporting services (soil formation, habitat provision, etc.) and cultural/informational/recreational services. Lack of understanding on these functions and subsequent failure to account for them in measures and indicators of macroeconomic health such as GDP means that it will continue with undervaluing the critical role that forests play in our economic, social, and environmental systems. Following two kinds of analyses was conducted:

2.3.4.1. Regulatory Services

Besides timber and non-timber products, forests contribute many ecosystem services, including water conservation, soil erosion stoppage, conservation, and fertility, hydrological, air quality, cycle management, etc. This study targeted particularly the forest ecosystem services about soil and water conservation and ecotourism. For this purpose, the study utilized the secondary data sets obtained through satellite imagery and published documents in the form of research papers, reports, etc. The watershed services of different forest types were assessed, quantified and valued following a step-wise procedure, explained below:

- Identification and assessment (from a watershed viewpoint) of critical catchments of the existing and under-construction dams and other water reservoirs in the country;
- Classification of land-use/land cover and further stratification of forests and grasslands/rangelands based on canopy cover into different canopy cover classes;
- Mapping of these assessed catchment areas;
- Collection of data from relevant national and international studies and literature on the amount of runoff, sediment yield, and water table recharge by different land uses/land cover classes and forest types/strata;
- Comparison of forests with different canopy cover in terms of soil and water conservation functions (percentages); and
- Quantification of the forest ecosystem services in terms of soil erosion stoppages and retention to prevent the national water reservoirs from sediments.

Following the aforementioned procedure, this report quantifies the contribution of

forest areas identified and mapped in the catchment of the major reservoirs in the country, including Diamer, Gomal, Hub, Mangla, Tarbela, Warsak, Khanpur, Sabakzai, Satpara, and Mirani.

2.3.4.2. Cultural and Recreation Services

While the services include ecotourism, use of wood in religious and spiritual activities for certain ethnic groups, aesthetics, etc., This report focused only on ecotourism where a survey, named"Ecotourism Survey" was conducted from 20 major tourist sites throughout the country. These included, 03 from AJK (Neelum, Rawlakot and Mirpur/Mangla), 03 from GB having Skardu, Ghizer and Hunza, 05 from KP having Naran, Swat, Kumrat, Galyaat and Chitral, 03 from Balochistan having Ziarat, Quetta and Kundmalir and 05 from Punjab/ICT having Murree, Islamabad, Kalar Kahaar, D.G. Khan and Changa Manga. The survey gathered information on the total number of tourists who have visited the area as well as tourism demand estimation through the travel cost method (TCM). 704 tourists were interviewed from selected sites. The profiling shows that more than 7 million tourists visited these sites.

2.3.5. Export and Import of Forestry Products

The secondary research methodology was used for the analysis of the export and import of wood and wood-based products. It is a common approach to a systematic investigation and the dependence is solely on existing data. The approach is also known as a desk research method. This research design involves organizing, collating, and analyzing the data samples for ascertaining the trends, patterns, volume, and technical issues related to the inflow and outflow of wood and wood-based products trade.

Data for the analysis was synthesized from many sources. There are both imports and exports of wood and wood-based products into Pakistan. Data on imports and exports of wood and its products are collected, processed, analyzed, compiled, and disseminated by the various organizations in Pakistan, which include; the Ministry of Industries and Production; Ministry of Commerce; Federal Bureau of Statistics; Pakistan Custom Department; Federal Board of Revenue; State Bank of Pakistan; Export Promotion Bureau; Chamber of Commerce and Trade; international agencies like FAO (Food and Agriculture Organization); Provincial Forest Departments, Office of the Inspector General of Forests, Ministry of Climate Change and some international trade portals such as Trend-Economy, Trade Map, Global Edge and World Bank.

The raw data was extracted from the aforementioned sources, refined, then summarized into interpretable information. The key objective was to show an overall trend for a few years, for both exports and imports. Moreover, key trade partners were identified based on the bilateral trade volumes and mapping was done to give a clear picture as to where Pakistan's wood and wood-based products are supplied and also from where such products pour into the country. Afterward, the volume and significance of wood and wood-based products were chalked out, as to which commodity takes the major share of the overall trade volume under this particular category.

2.3.6. Forest-Based Livelihoods and Jobs

Realizing that employment generation is always one of the major arguments for sectoral claims of economic contribution, the gender-disaggregated employment generation from various forest-based activities was the central theme of our data collection and analysis. Forests offer various year-round or seasonal employment opportunities primarily associated with fuelwood, timber, and NTFPs either directly or indirectly through employment generated by forest-based industries. Additionally, forestry services such as raising and maintaining nurseries, preparing afforestation sites, forest protection and guarding, thinning, and pruning, firefighting, and harvesting also generate many employment opportunities.

However, most of the employment generated by forests is informal and difficult to document. This seems one of the reasons why forest sector employment has remained an under- researched area. To cater this, a mixed method approach was appiled to quantify and appraise the forest sector's employment livelihoods contributions. On one hand, in this regard Pakistan Labor Force Survey was used to conduct in-depth analysis on forest-related employment. In addition, community survey/FDGs were conducted for an in-depth understanding of how forest sector employment is generated, how seasonality, gender, and other qualitative aspects impact forest-based jobs and work on the ground, etc.

2.3.7. The Economic Contribution of Rangelands & Pastures

Rangelands, like forests, provide a variety of ecosystem products and services. They are helpful for both nature and society not only in terms of fodder and forage but also play a significant role in regulating the climate and pollution, provide intellectual inspiration and a recreational environment. Some rangelands may also supply many essential goods such as food, fiber, and wood to the local community. Rangelands ecosystem services are often valued differently by different stakeholders interested in livestock production, water quality and quantity, biodiversity conservation, or carbon sequestration. The supply of ecosystem services depends on the biophysical conditions and land-use history, and their availability is assessed using surveys of soils, plants, and animals. Though the demand for direct products may be invariant, still the ecosystem services are mostly determined by societal characteristics including socio-demographic and income profile, behaviors, and socio-economic wellbeing.

The rangelands analysis is based on secondary data, published official reports, and journals to develop an understanding of the current state of rangelands. The most authentic document is of FAO (Food and Agriculture Organization) Report 2016, specifically on the rangelands, which has detailed the province-wise data on range land and livestock. Though this is a relatively recent report but the data sources are from a few years earlier. The Team also talked to Rangelands Research Institute (RRI) located at Pakistan Agricultural Research Council (PARC) in Islamabad and it provided the insight that the rangelands area doesn't change for decades, as its transformation into a forest or something is very difficult. However, encroachment or taking rangelands for housing projects may have caused a decrease in the area. According to rough estimates, it would not be more than 5%. Additionally, it is a massive exercise to survey rangelands and thus cannot be carried out after every 2-3 years.

Keeping this in view, data from a few years earlier can still be more or less valid. Though, to have more appropriate numbers deliberations have been held with relevant stakeholders to get a picture of the real situation, as well as secondary published reports, have been used for the determination of the grazing land area in different provinces.

Since grazing lands include rangelands, shrub and bush lands, as well as forest lands and alpine pastures, these have been added together to arrive at an estimate of the area of grazing lands in different provinces. Livestock statistics have been collected from the Economic Survey of Pakistan. These livestock figures have been used to arrive at the total feed needs of livestock in terms of total digestible nutrients (TDN) and total digestible protein (DP). Past published research studies have been used to assess the proportion of feed that comes in the form of grains and fodder from farmlands, forage production in range lands, and other lands, which include forest lands, shrub and bush lands/wastelands/river banks/roadsides. Based on these sources of livestock feed production, the contribution of these other lands (forest lands, shrub and bush lands, river banks, and roadside vegetation) to the total livestock feed supply sources has been assessed as these lands are under the management of provincial forest departments. The value of this feed that comes from these lands is the value that the forestry sector contributes to livestock sector through its grazing lands.

2.3.8. Future Projections of Demand & Supply of Forest Products

The data collected about production and consumption of timber and non-timber products through market surveys, industrial surveys etc., have facilitated assessing the current situation, demand-supply gap, and projecting the supply and demand of various forest products. For projecting demand into the future, the population census figures and population growth rates have been used to protect the population of each province into the years 2022, 2025, 2030, 2035, and 2040. These projected population figures have been used alongside the per capita consumption of timber and fuelwood in each province. The proportion of timber that is consumed by major wood using industries and small wood using industries that were arrived at through the primary data has been used for future projections.

Similarly, for fuelwood projection, the per capita consumption in rural and urban areas has been done separately. Since the per capita consumption of fuelwood in rural and urban areas is different and also varies by province due to differences in their access to alternative energy sources and climatic conditions, these have been estimated separately to get an accurate picture of the situation. Moreover, fuelwood is used by households, in the commercial sector as well as the industrial sector, the consumption figures that were determined for these three categories of fuelwood users, that were determined through the primary surveys carried out for the purpose, have been used for future projection of fuelwood demand in these three separate categories of users. To arrive at the total demand for wood in the future years, the timber used by major and small wood using industries and the fuelwood used by households, the commercial sector, and industries have all been added together.

The supply of timber and fuelwood is from different sources. The supply sources for timber have been broadly categorized into state-controlled forests, farmlands, wastelands, and imports, whereas for fuelwood the supply sources are the former three and do not include imports. Based on these supply sources, the current supply of timber and fuelwood has been assessed.

Based on a comparison of the current consumption and currently available supply sources, the existing gap between supply and demand has been assessed. The huge gap between supply and demand has been met through unrecorded supply from all the above sources. Since it is very difficult to assess the quantum of unreported supply that comes from different sources, the Forestry Sector Master Plan Study 1992 and the MANIC Study have used the annual sustainable biomass growth estimate for estimation of future supplies as a proxy for future wood production. Both studies have used the same and constant annual sustainable growth estimate.

This study has also adopted the same approach of using the annual sustainable biomass growth estimate. It, however, has revised the growth estimate because there have been substantial plantations done since those studies throughout Pakistan. These plantations have started producing biomass and are currently being harvested to cater to the demand. Therefore, the annual sustainable biomass growth used in this study is double that of the one used in past studies.

2.4. Training, Field Deployment, and Data Entry

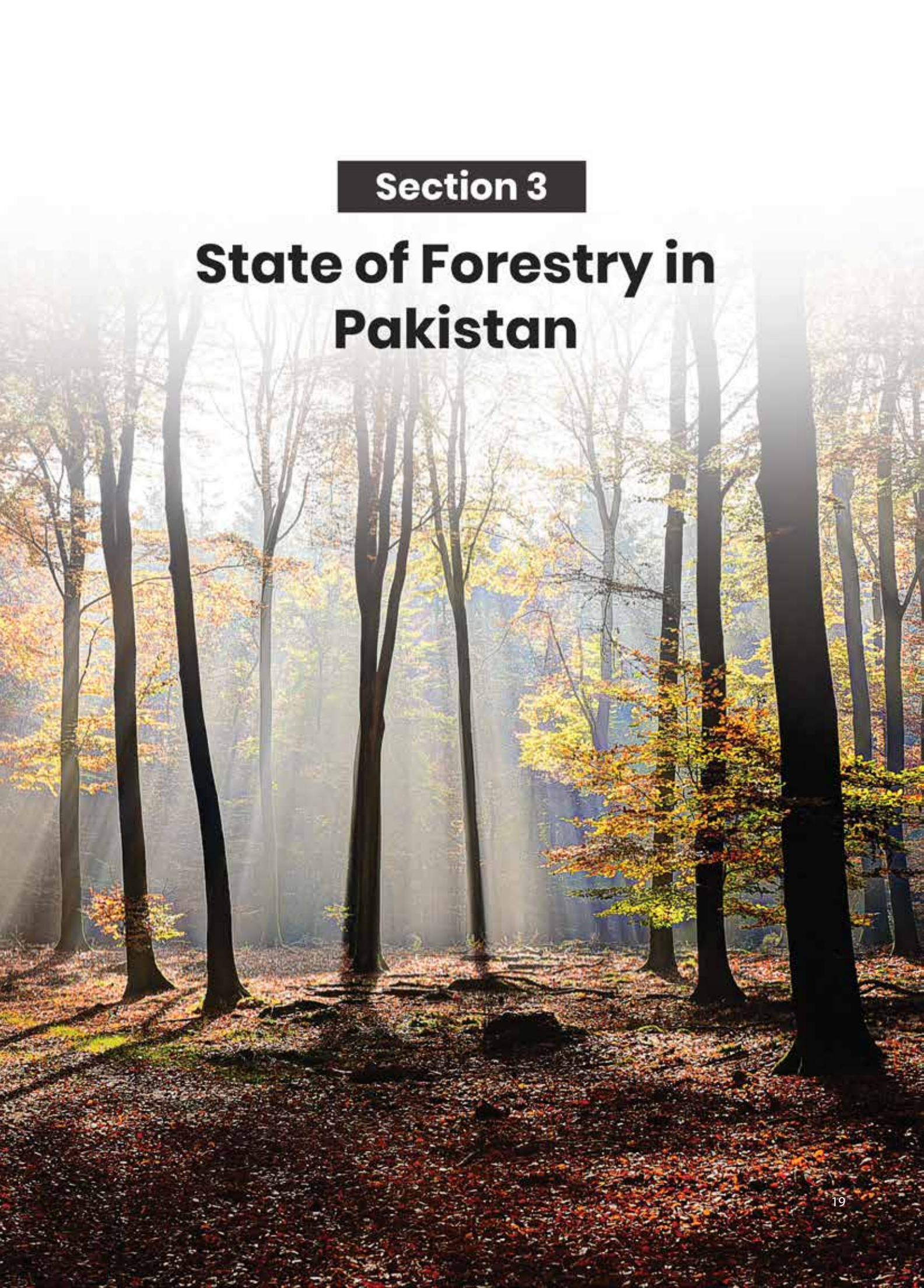
Separate survey tools were developed for each survey. They were discussed in an inception workshop where feedback was given by the provincial forestry departments. After finalizing the tools, the android application was developed in CSPRO to conduct the survey. A mixed method approach was used where both the paper and android tablet based approach was developed for field enumeration.

Before the field, three days training was organized for the enumerators. The training's key objective was to ensure that enumerators had a sound understanding of instruments, correctly implemented the fieldwork protocols, and comfortably used the instrument in the field. The Provincial Coordinators further helped in developing industrial profiling that covered the main existence of industries in certain districts/cities. Accordingly, the field plan was developed for each of the field teams by guiding them about where they would visit. The field survey was carried out from December 2021 to February 2022. The field team visited 74 districts, whereas profiling of 56 districts was also carried out.

Most of the data was directly entered in the field by using the android application. In sensitive places, we avoided surveying through android applications. There the field team entered the data on provided tablets. The three Research Associates (RAs) continuously monitored daily submitted data. Once all the data was entered, it was imported into STATA version 15 for analyses. The technical team of the study did the analyses itself for a more thorough and robust understanding of the collected data.

Section 3

State of Forestry in Pakistan



3.1. Forestry Products and Services

Humans have relied on forests for a variety of products and services. Pakistan, happens to be a forest poor country, with a small forest area of 4.478 million ha (5.1 percent). This amounts to 0.021 ha per person, compared to the world average of 1 ha/person. Yet Pakistan's demand for forestry products is getting higher: the population is growing at 3 percent per year, and increasing industrialization demands more and more construction of wood, fuelwood, and water from forested watersheds. Overall, the area of natural forests has decreased. Though the area allocated for forest use and rangelands, as on the books of the provincial forest departments, has not decreased, rather it has registered a small increase in certain provinces. This area is expected to remain static. Moreover, forest biodiversity, especially in the case of species of wild animals and their habitats, has suffered an irreversible loss of great magnitude. Forests and rangelands face grave management issues due to increasing population pressure. The sharp increase in the prices of livestock products offers an incentive for raising more livestock. This would mean increased pressure on livestock, forests, and rangelands for grazing.

Pakistan is diverse in its forestry products including both timber and non-timber forest products. Due to diverse ecosystems, there is a large array of Non-timber Forest Products (NTFPs) that play an important role in generating livelihoods for the people living in close proximity of the forests. NTFPs generate far more consistent and long-term revenue than timber. Medicinal, aromatic, and culinary plants, forage and fodder, Kana resin, oils, gums, Mazri leaves, honey, silk, mushrooms, wild fruits, chilgoza nuts, pistachio nuts, wild almonds, wild pomegranate, and the Barava plant are just a few of the key forestry products. Regrettably, despite their significance, these products are regarded as tiny and insignificant in comparison to the principal outputs of timber and fuelwood in the forestry management system.

In terms of medicinal plants, Pakistan has more than 6,000 species of wild herbs which are important for medicine making. Pakistan has listed more than 900 drugs made from medicinal plants. There are roughly 30 significant herbal medicine production enterprises that use medicinal plants taken from the forests to make homeopathic medications on a commercial basis. Furthermore, there are over a hundred unorganized homeopathic pharmaceutical firms across the country. Herbal medications are projected to be worth 6 billion rupees per year.

Pakistan imports timber, paper pulp, paper, and certain other wood products to meet the gap in supply and demand. This must continue to meet the gap in supply and demand of forestry products. There is also a dire need to revisit tariff policy on wood-related products.

Participation of local communities and other stakeholders in forestry, rangelands management, and biodiversity conservation is at an initial stage and requires serious efforts and institutionalization in policies and laws for success. Likewise, NTFPs have not received due attention so far. Keeping in view their importance, focused attention is required on sustainable harvesting, value addition, and marketing for ensuring long-term benefits to the local communities. Forest service functions-

have not received any recognition and appreciation so far, but the time is just ripe to take the concept forward.

Furthermore, the use of alternatives for timber, firewood, and other forest products is becoming vital in Pakistan to reduce pressure on forest and rangelands resources but the current number and quantities of alternatives in use is limited. This is likely to increase gradually but conscious efforts and support may promote their use manifold and quickly. Issues external to the forestry sector are important but are complex and require enhanced attention from forest policymakers, planners, and managers in Pakistan; discussions have started, and inter-sectoral interaction is expected to grow in the future.

In a crux, the forestry sector is confronted with many challenges including deforestation and degradation of forests, watersheds, and rangelands; decline in forest productivity; loss of biodiversity; soil erosion and desertification; reduction in environmental and recreational values. The main factor responsible for this situation is the heavy dependence of the ever-increasing population, in particular the rural population, on forests biomass for energy and subsistence. The underlying causes for this situation are: rapid growth in human and livestock populations; heavy dependence of local communities on forest and other natural resources; conversion and degradation of forests into other land uses; imbalance in supply and demand of timber and other wood products, reduced environmental flows in rivers, ambiguous, complex and retrogressive land tenure systems; prolonged droughts, forest fires, floods, earthquakes, pests and diseases and climate change. In addition, other issues including weak institutions and weak enforcement of policies and laws; deficiency of alternatives for wood and efficient wood use practices and general lack of awareness on benefits of forests beyond wood and non-wood products and services. Nevertheless, until the aforementioned issues are addressed, the forestry sector, as well as its products and services will remain an underutilized potential in Pakistan.

3.2. An Institutional and Policy Perspective

Forestry, under the Constitution of Pakistan, is a provincial subject. Therefore, forests located in different provinces and territorial units are managed by the respective Provincial and Regional Forest Departments under their policies, laws, plans, strategies, programs, and institutional arrangements. The role of the Federal Government, which is exercised through the Ministry of Climate Change, is to formulate a national policy, plans, strategies, and programs regarding ecology, forestry, wildlife, biodiversity and desertification, and coordination of different forestry, wildlife, and biodiversity related environmental agreements with provinces, with other countries, international agencies, and forums.

At the federal level, the Office of Inspector General of Forests (OIGF), a wing of the Ministry of Climate Change, looks after the affairs of forestry. The OIGF is assisted by two Deputy Inspector General Forests, Conservator Wildlife, Director Biodiversity, Assistant Inspector General Forests, two Deputy Conservator Wildlife, Deputy Director Biodiversity, and Assistant Secretary-Wildlife.

Within provinces and territories, there are Provincial/Regional Forestry Depart-

ments. Each Provincial Department is headed by a Chief Conservator of Forests, who is assisted by the Conservator of Forests in each forest circle. The basic unit of Forest Administration is Forest Division which is administered by a Divisional Forest Officer, who is assisted by Sub-divisional Forest Officers and Range Forest Officers.

3.2.1. Forest Tenure and Ownership

Provinces and territories in Pakistan have full ownership rights to forests located in their respective jurisdictions. These ownership rights include the right of possession, the right of control, the right of exclusion, the right of enjoyment, and the right of disposition and transaction. In terms of ownership at the provincial level, forests can be divided into two main categories: government owned forests and privately owned forests. Government owned forests include reserved forests, state forests, demarcated forests, un-demarcated forests, protected forests, resumed lands, village forests and un-classed forests. Privately-owned forests include Guzara forests, community forests, protected wastelands, Section 38 forests and Chos Act areas.

Reserved forests, state forests, and demarcated forests are exclusively owned by the Government and free of rights and privileges. These are the strictest categories of forests in terms of governance and access. All acts and activities are prohibited until and unless permitted by the Government. The total area under these categories of forests is 1.53 million ha (34% of the total forest area). Protected forests and un-demarcated forests are those forests where local communities have established rights and concessions. All acts and activities are permitted unless prohibited by the Government through proper notifications or the promulgation of rules in respect of such matters. Resumed lands are those private lands that have been taken over by the Government under various Land Reforms and are under the control of the Forest Department. Similarly, village forests are those forests that have been assigned by the relevant Provincial Government for the use of a village community through proper notification or rules. In KP such forests are managed by the Joint Forest Management Committees. The total area under protected forests, un-demarcated forests, resumed lands and village forests is 1.980 million ha (44% of the total forest area).

Green Pakistan Programme (GPP)

The Government of Pakistan implemented a massive 5-year plantation program to add 100 million plants in the landscape and restore degraded ecosystems on 50 percent cost sharing basis with the provinces/regions. The program was initiated in February, 2017.

Ten Billion Trees Tsunami Programme, Pakistan

GPP was upscaled to the "Ten Billion Tree Tsunami Programme." A 4-year (2019-2023) project was started by the Government of Pakistan in 2018 with the total cost of 125 billion. The project is being implemented across Pakistan by the Ministry of Climate Change in collaboration with Provincial and territorial Forest and Wildlife departments. The main target of the program is to plant 10 billion trees across the country in phases by 2030. The overall objective of the program is to revive forest and wildlife resources in Pakistan, to improve the overall conservation of the existing Protected Areas; encourage eco-tourism, community engagement and job creation through the conservation.

Private forests including Guzara Forests, Community Forests, and Protected wastelands are jointly owned by communities or families and managed by the Provincial Forest Departments. Owners of these forests can only exercise their rights with the permission of the Forest Departments. All acts and activities which harm the trees or forest resources are prohibited by the Forest Department. Right holders are granted timber, fuelwood, and other products for their genuine domestic requirements after permission and proper assessment by the Forest Department. Section 38 are those private lands or wastelands whose owners may hand over the management of these lands to the government to be managed by the Forest Department as a forest on such terms and conditions which may be mutually agreed upon. The total area under private forests is about one million ha (22% of the total area).

3.2.2. Forest Policies

After partition, the 1894 policy of united India became irrelevant for forest deficient Pakistan; hence from 1955 onwards, Pakistan developed its own forest policies. After 1955, different forest policies were framed by various governments in 1962, 1980, 1990, and 2016. The latest National Forest Policy was developed by the Ministry of Climate Change in 2016 and was approved by the Council of Common Interest in 2017.

The current national forest policy strives to shift the main focus of forest management from wood production to securing ecosystem services. It emphasizes upon expansion, protection, and sustainable use of national forests; protected areas; natural habitats, and watersheds to restore ecological functions; improve livelihoods, and secure human safety in consonance with national priorities and international agreements. In addition, all the objectives are tuned to promote ecological, social, and cultural functions of forests through sustainable management and optimum use of forest products including wood and non-wood forest products. It also strives to promote ecological corridors, enhancing the role and contribution of

forests in reducing carbon emissions and enhancing forest carbon pools, facilitating the implementation of international conventions and agreements related to forestry, wetlands, biodiversity, and climate change.

Being a provincial subject, each province and territory has developed and is implementing its own provincial forest policy for the conservation, restoration, and sustainable management of forests located in the province/territory.

Billion Trees Afforestation Project (BTAP) Khyber Pakhtunkhwa

The Government of Khyber Pakhtunkhwa started the mega afforestation project known as Billion Trees Afforestation Project (BTAP) in 2014 which was aimed at restoring the degraded forests of the province through assisted natural regeneration, increasing forest cover from 20 percent to 22 percent through increasing plantations on farmlands and wastelands and promoting green economy in the province. The project was completed during 2018 with a total cost of PKR 19 billion. The project was able to add 1,208 million plants to the province's forests including 311 million from sowing and planting, 732 million through natural regeneration in the existing forests and 165 million on farmlands. WWF-Pakistan (2017) reported 88% survival rate in these plantations.

3.2.3 Forest Management

The management and regulatory oversight of forestry operations in each province/territory in Pakistan are undertaken in accordance with their own legislative and regulatory framework. The legislative and regulatory framework of each province is designed and meant to ensure the protection, conservation, and sustainable management of forests. The laws cover aspects related to forest protection and conservation, planning and review, public participation, and the regulation of forest management activities in government-owned forests, and private/community forests.

The role of forest management plans prepared by different provincial forest departments is to determine, set, express, and realize the objectives of forest management in a specified area of forest and to set out the steps to be taken to achieve those objectives.

This practice needs to be continued as forest management plans are integral to the process of planning and implementing practices for the stewardship and use of forests which are targeted and aim at the achievement of specific environmental, economic, and social objectives of forests.

Both long-term and medium-term development programs are prepared for the rehabilitation, restoration, development, and sustainable management of forests at both federal and provincial levels. Funding for these development programs at the federal level comes through the Public Sector Development Program (PSDP). An example of this is the ongoing GPP/Ten Billion Tree Tsunami Afforestation Program which is being implemented throughout Pakistan through the respective provincial forest and wildlife departments. The Ministry of Climate Change is overseeing the program coordination, execution, supervision, and overall delivery of the program outputs and activities.

Similarly, each province prepares and implements forestry development programs from its own Annual Development Programs (ADPs), which are executed and supervised by the concerned provinces.

As part of this program, Pakistan has produced the following key documents related to REDD+ Readiness and has therefore met the requirements of REDD+ Readiness:

- National REDD+ Strategy and Action Plan
- National Forest Monitoring Systems (including the REDD+ MRV system)
- Forest Reference Emission/Forest Reference Level (FREL/FRL)
- Safeguards Information System (SIS)

3.3. Economic Significance of Forests

Social perception, management, and governance of forests have changed considerably in the past few decades according to the interests and needs of human societies. The initial conceptual framework of forest management having a focus on timber and fuelwood production has been broadened and now recognizes multiple roles that forests play for both population and ecosystems. The concept of forest multi-functionality was born in Germany when the "theory of forestry function" was elaborated. The twin concepts of sustainability and multi-functionality gained further traction when the World Commission on Environment and Development (WCED), published its report on Sustainable Development, commonly known as the Brundtland Report (1987). In this report sustainability is defined as, "Meeting the needs of the present generation without compromising the ability of future generations to meet their needs." This definition represents the conceptual basis of a new forest management paradigm that changed radically the traditional forest management: Sustainable Forest Management (SFM).

Several international documents such as Agenda 21, the Rio de Janeiro Declaration on Environment and Development, and the Statement of Principles for the Sustainable Management of Forests. These three non-binding international agreements were adopted by many Governments at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro (Brazil, 3-14 June 1992). At the same conference, three other legally-binding conventions were also adopted by the United Nations. These include the UN Framework Convention on Climate-

Change (UNFCCC), the UN Convention on Biological Diversity (UNCBD), and the UN Convention on Combating Desertification (UNCCD). As a result of the Statement of Principles for the Sustainable Management of Forests, it was resolved that "forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual human needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks, and reservoirs, and other forest products."

The above definition of sustainable forest management (SFM) underlines the following three fundamental aspects of forest management:

i. First is the multi-functionality concept wherein there is an elevated recognition and consideration of the social, economic, and ecological aspects in the management of forest resources.

ii. Second is the sustainability concept wherein attention is paid to the needs of the future generations.

iii. Third is the enunciation of ecosystems management wherein lies an enunciation of "traditional" (for example wood products, food, fodder) uses of forests as well as "new" products and services (for example biodiversity conservation, watershed protection, recreation, carbon sinks and reservoirs) useful for society and human activities.

The SFM doctrine of forest management as enshrined in these international documents and conventions presents two innovative aspects of forest management in Pakistan: first, the aim of forest management in Pakistan now has to realize the social, environmental, and economic functions of the forests simultaneously and secondly, it mandates forest managers to place a greater emphasis on considering resources beyond timber and tradeoffs between timber and non-timber values. (Luckert & Williamson, 2005). The final evolution of forest management doctrine is Ecosystem Management (EM), which integrates scientific knowledge of ecological relationships within a complex sociopolitical and values framework toward the general goal of protecting native ecosystem integrity over the long term. Under the EM concept, forest resources in Pakistan are now protected, conserved, and managed for their ecosystem services, which include the following four broad categories of ecosystem services:

- Provisioning services: Direct use products derived from forest ecosystems such as timber, fuelwood, fodder, NTFPs, water, genetic resources, and various biodiversity products.

- Regulatory services: Regulatory functions that forest ecosystems provide such as climate regulation, water cycle regulation, hazard regulation, disease and pest regulation, pollination, and detoxification and purification of soils, air, and water including noise pollution.

- Cultural services: Non-material well-being benefits which people gain from forest ecosystems such as nature and landscape connections, recreation and health, education and learning, social development and connections, economy, and symbolic, cultural, and spiritual significance.

- Supporting services: Ecosystem processes that support and underpin provisioning, cegulating, and cultural services. These include primary prod uction, nutrient cycling, water cycling, soil formation, and provision of habitat for biodiversity.

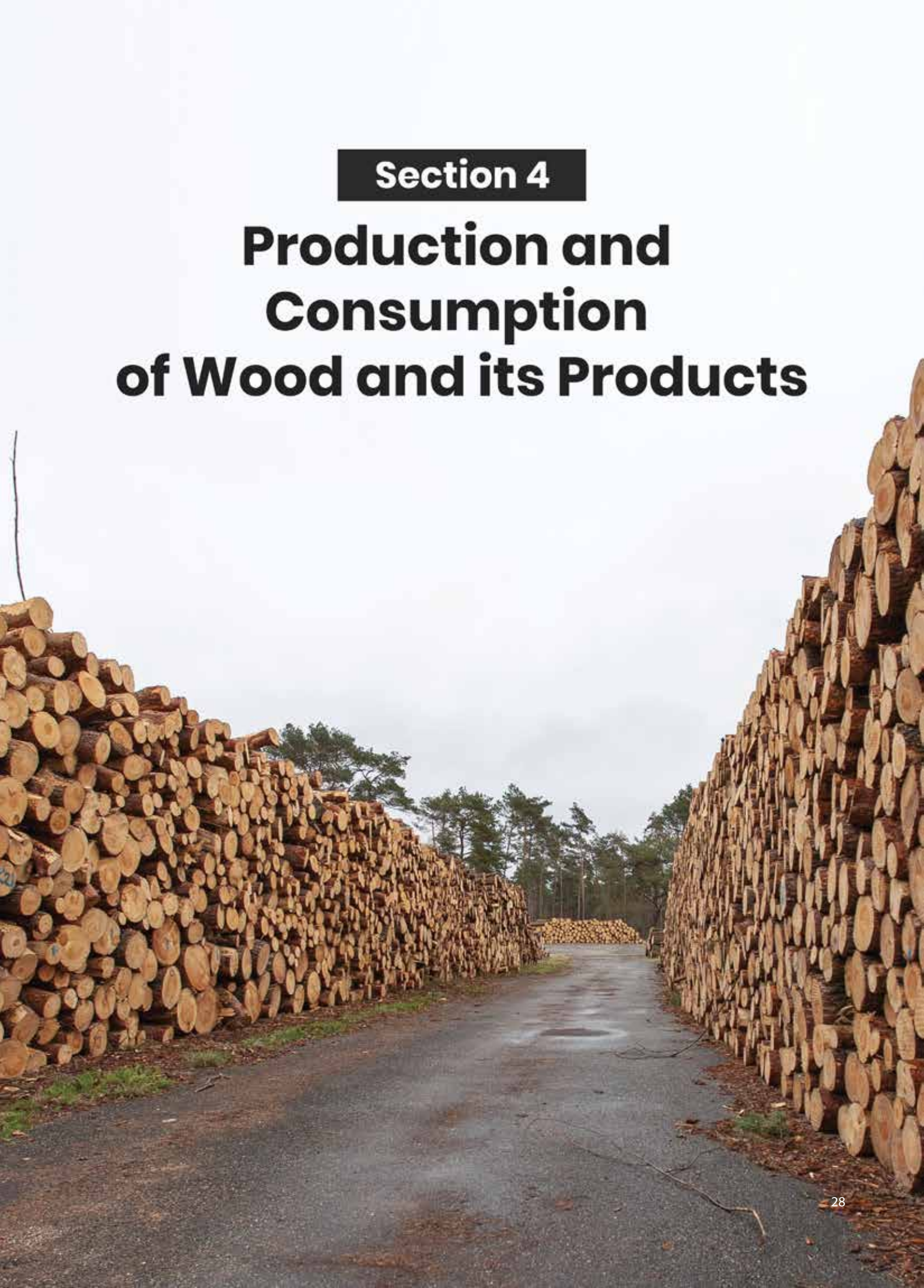
There will be challenges in the future management of forests for their ecosystem services. Future management approaches will have to be resilient and adaptive to societal, environmental, climate change, and land-use changes. This will require an understanding of the drivers and pressures of change, their impacts on forest ecosystem supply and demand, and the response options that are available to forest managers and decision-makers in Pakistan.

In conclusion, the adoption of ecosystem services in forest management in Pakistan would provide consistency in the assessment and valuation of the human benefits of trees, woodlands and forests. This is important because forestry in Pakistan has long been undervalued, and forced to produce timber at the expense of other valuable services which have been compromised in the process. There is considerable tension in land-use planning in Pakistan. The ecosystem services framework can provide a mechanism to assess and quantify the human benefits of forestlands, rangelands, wastelands, and other lands under the management responsibility of forest departments in the country.

Keeping this perspective in mind, the current study aims to assess the supply and demand of provisioning services of forests such as timber, fuelwood, fodder, and NTFPs; regulatory services of forests on soil and water conservation; cultural and recreational services of forests; and the role of forests and forestry in employment, livelihoods, revenue generation and the generation of a green economy in the country.

Section 4

Production and Consumption of Wood and its Products



This chapter provides both national and provincial estimates of timber and fuelwood supply from public forests and private land based on the data of the Provincial Forest Departments. Trend analysis and comparison with previous data are also given. It also quantifies the consumption of timber and fuelwood by different sectors based on the field surveys conducted for the current study. The monetary values of timber and fuelwood consumption by different sectors are also highlighted.

4.1. Wood Supply from Public Forests

The total wood supply from the public forests in Pakistan was estimated at 6.225 million m³. Out of this, timber is 5% (0.29 million m³) and fuelwood is 95% (5.9 million m³). The position of total wood supply at the country and provincial levels is given in Table 3.

Table 3: Annual wood supply from the public forests from 2017 to 2021 (in 000 m³)

Province	Timber	Fuelwood	Total Wood	% of Total Wood
Punjab	30	846	876	14.07
KP	124	2,079	2,203	35.38
Sindh	1	2,036	2,037	32.72
Balochistan	16	547	563	9.04
Gilgit-Baltistan	37	43	80	1.28
AJK	81	385	466	7.48
Total	**289**	**5,936**	**6,225**	**100**

Source: Office Records of Divisional Forest Officers of all Provincial Forest Departments

The public forests' supply of fuelwood is underestimated as it is not properly recorded and documented by the Forest Departments to address this gap, a Household Survey was conducted to estimate the wood consumption and to determine the contribution of forests to fuelwood supply. The survey results showed that 5.9 million m³ of fuelwood is contributed by the public forests, which is significantly higher than the figure reported by the Provincial Forest Departments (Table 4).

Table 4: Annual fuelwood supply from the public forests from 2017 to 2021

Province	Fuelwood Recorded by FD (in 000 m^3)*	Fuelwood Estimated from Survey (in 000 m^3)**	% Contribution
Punjab	66	846	**14.25**
KP	89	2,079	35.02
Sindh	18	2,036	34.29
Balochistan	-	547	9.21
GB	-	43	0.72
AJK	-	385	6.48
Total	173	5,936	100

Source: *Office Records of Divisional Forest Officers of Provincial Forest Departments, **Field Survey 2022

Table 5 indicates the province-wise contribution of timber. Province KP has the largest contribution (43%) in total timber supply from public forests, followed by Azad Jammu & Kashmir (28%) and then Gilgit-Baltistan (13%). These three territories/regions together supply 85% of the total timber.

Table 5: Contribution of timber supply from public forests by province

Province	Quantity (in 000 m^3)	% Contribution
Punjab	30	10.38
KP	124	42.91
Sindh	1	0.35
Balochistan	16	5.54
GB	37	12.80
AJK	81	28.03
Total	289	100

Source: *Office Records of Divisional Forest Officers of Provincial Forest Departments

Timber supply from the public forests fluctuates from year to year, depending upon several factors such as approval of working plans, timely execution of logging and extraction of timber, market demand, and prices. Therefore, an accurate estimation of annual timber supply can only be achieved if the average for the last few years is taken to get a stable and reliable estimate of the timber supply from the public forests (timber supply was estimated for 2017-2021 from the official record of the Provincial Forest Departments). During this period, the average annual supply of timber was 0.289 million m^3. The highest timber supply (0.302 million m^3) was recorded for 2021 and the lowest (0.251 million m^3) for 2018 as given in Table 6.

Table 6: Timber supply from public forests during 2017-2021 (in 000 m³)

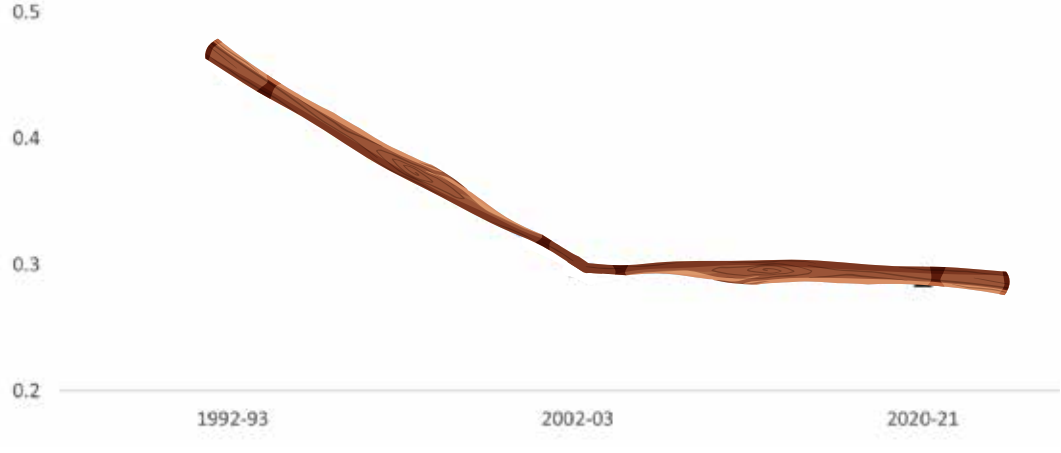
Province	2017	2018	2019	2020	2021
Punjab	30	30	30	40	20
KP	120	120	110	110	160
Sindh	10	10	10	10	10
Balochistan	0	0	50	10	10
GB	50	40	20	20	20
AJK	90	70	90	90	80
Total	290	250	320	290	300

Source: Office Records of Divisional Forest Officers of Provincial Forest Departments

4.1.2. Trend of Timber Supply From Public Forests

Timber supply from public forests has significantly reduced by 37% during the last three decades. It was 0.458 million m³ in 1992-93, which reduced to 0.298 million m³ in 2002-03 and further declined to 0.289 million m³ during 2020-21 (Figure 4). This decline in timber supply from the public forests is mainly due to the ban on the green felling of trees in the forests and the availability of imported timber at lower prices in the market. The government policy is to conserve natural forests for eco-system services, such as biodiversity conservation, climate change mitigation, watershed protection, and recreation instead of timber production. At the moment only dead, dry, and wind-fallen trees are extracted from the natural forests and a very limited number of green trees are harvested in Guzara Forests where communities have the rights. As a result, the outturn of timber from public forests is continuously declining. The trend of timber supply at the provincial and regional levels is given in Annexure Table D2.

Figure 4: Trend of timber supply from public forests (million m³)



Source: Office Records of Divisional Forest Officers of Provincial Forest Departments

4.1.3. Illicit Cutting of Timber from Forests

Though it is very difficult to accurately quantify the magnitude of illicit timber, part of this timber is recorded in the form of damage reports, written by the Forest Guards of Forest Departments. Data on illicit timber was collected from the offices of DFOs. It revealed that on average about 60,000 ㎥ of timber has been cut annually through illicit means during the period 2017-2021. This illicit timber is about 20.6% of the total timber supply from public forests. Of this, 41% has been recorded in KP, 36% in AJK, 16% in Gilgit-Baltistan, and 5% in Punjab (Table 7).

Table 7: Illicit timber supply from public forests during 2017 - 2021 (in m³)

Province	2017	2018	2019	2020	2021	Average
Punjab	3,873	3,394	3,261	3,274	2,176	3,196
KP	22,383	27,821	25,257	30,823	16,852	24,627
Sindh	-	-	-	-	-	-
Balochistan	198	194	200	203	223	204
GB	-	30,603	-	18,356	-	9,792
AJK	27,793	14,237	22,070	25,615	18,598	21,663
Total	**54,247**	**76,249**	**50,788**	**78,271**	**37,849**	**59,481**

Source: Office Records of Divisional Forest Officers of Provincial Forest Departments

4.2. Supply of Wood from Public Forests

4.2.1. Wood Supply from Public Forests in KP

Khyber Pakhtunkhwa (KP) is the most forested province hosting 45% of the total forest area of the country. KP's forests contribute 124,000 ㎥ of timber which is 43% of the total timber produced in the public/designated forests of the country. Timber is extracted either by Forest Development Corporation (FDC) or by the Forest Department through local contractors. However, there is no departmental mechanism for timber extraction in the merged districts which were included in the erstwhile FATA. Hence, there is no record of the timber or fuelwood extracted from the forests in these areas. Deodar and Kail are the most valuable and important timber species of Khyber Pakhtunkhwa which constitute 21% and 19% of the total timber supply, respectively. About 5% of timber consists of Fir and Spruce and 3% consists of Chirpine (Table 8). On the other hand, different broad-leaved species e.g., Eucalyptus, Mulberry, Tamarix, Oak, Kikar, Shisham, Walnut, etc. make up 52% of the total timber supply in the province.

Table 8: Annual timber supply from public forests in KP during 2017 - 2021 (in ㎥)

Species	Quantity	%	Sale Price (Rs. Per cft)
Deodar (Cedrus deodara)	26,493	21.37	3,500
Kail (Pinus wallichiana)	23,715	19.13	2,500
Fir/Spruce (Abies pindrow/Picea smithiana)	6,045	4.88	1,500
Chirpine (Pinus roxburghii)	3,829	3.09	2,000
Broad-Leaved Species	63,918	51.55	400
Total	**124,000**	**100**	-

Source: Office Records of Divisional Forest Officers of KP Forest Department

Khyber Pakhtunkhwa's forests also supply a large quantity of fuelwood which is not properly recorded by the Forest Department or any other agency. Most of the fuelwood is directly collected by the local communities and hence is not accounted for. Only a partial record of the fuelwood supply from the forests is available with the Forest Department. According to this data, the total annual volume of recorded fuelwood supply from the forests was 89,000 ㎥ during 2017-2021, with 2.079 million ㎥ estimated under this study. Similarly, according to a study by the Research and Development Directorate of the KP Forest Department, the total fuelwood supply from the forests was 5 million ㎥ in 2014-15.

4.2.2. Wood Supply from Public Forests in Punjab

Public forests in Punjab mainly comprise irrigated plantations and linear plantations in the central and southern zone and coniferous and scrub forests in the northern zone. On average, these forests supplied 30,204 ㎥ of timber per year during 2017-2021 which is equal to 10.4% of the total timber out turn from the public forests in Pakistan. Shisham, Eucalyptus, Mulberry, Kiker, and Semal are the major timber species of Punjab. Though a small fraction (12%) of the total timber supply of the province comprises coniferous species, the major share of the timber outturn is made up of broad-leaved species which are produced in plantations. The annual outturn of fuelwood from public forests of Punjab has been recorded as 66,000 ㎥ by the Forest Department during 2017-2021 as against 0.846 million ㎥ estimated under this study (Table 9). Shisham, Kiker, and Eucalyptus are the main fuelwood species in the province. The outturn of timber has significantly decreased during the last 20 years. The annual outturn of timber from public forests was 68,000 ㎥ during 2002-03 as against 30,204 ㎥ in 2017-2021. This decline is mainly due to the degradation of irrigated plantations, Shisham die-back in linear plantations, and imposition of the ban on green felling.

Table 9: Annual timber supply from public forests in Punjab during 2017-2021 (in m³)

Species	Quantity	%	Sale Price (Rs. Per cft)
Chirpine	3,260	10.79	1,400
Fir/Spruce	432	1.43	1,500
Kail	48	0.16	2,000
Deodar	3	0.01	3,000
Broad-Leaved (Shisham/Eucalyptus/Mulberry/Kiker/ Semal etc.)	26,461	87.61	500
Total	**30,204**	**100**	

Source: Office Records of Divisional Forest Officers of Punjab Forest Department

4.2.3. Wood Supply from Public Forests in Sindh

Public forests in Sindh comprise mangrove forests, riverine forests, irrigated plantations, and linear plantations along roads and canals of these forest types. Riverine forests and irrigated plantations have been a major source of timber and fuelwood supply in the past. The average timber supply from the public forests has been around 1000 m³ during the last five years. The recorded outturn of timber from the public forests was 1,321 m³ during 2018-19. The officially recorded annual outturn of fuelwood was about 18,000 m³ during this period against 2.036 million m³ of household consumption estimated under this study (Table 10).

Table 10: Annual timber supply from public forests in Sindh during 2017 - 2021 (in m³)

Species	Quantity	%	Sale Price (Rs. Per cft)
Kiker (Acacia nilotica)	793	60	1,500
Eucalyptus (Eucalyptus camaldulensis)	264	20	1,000
Shisham (Dalbergia sissoo)	132	10	2,000
Kandi (Prosopis cineraria)	132	10	1,000
Total	**1321**	**100**	

Source: Office Records of Divisional Forest Officers of Sindh Forest Department

4.2.4. Wood Supply from Public Forests in Balochistan

Balochistan is the largest province of Pakistan consisting of 34.7 million ha with only 1.4% forest area (Bukhari et al., 2012). The forest types of Balochistan include dry temperate forests, dry tropical thorn forests, and mangrove forests. Almost all of these forests are protective forests and they are primarily managed for watershed protection, soil conservation, and NTFPs e.g., Chilghoza nuts. Though, these forests provide fuelwood for the local communities, regular outturn of timber and fuelwood has not been reported.

Table 11: Annual timber supply from public forests in Balochistan during 2017 - 2021 (in m³)

Species	Quantity (in m³)	%	Sale Price (Rs. Per cft)
Ghaz (Tamarix aphylla)	2,240	14	750
Quetta Ash (Fraxinus xanthoxyloides)	2,090	13	800
Mulberry (Morus alba)	1,850	12	900
Poplar (Populus spp.)	1,650	10	700
Juniper (Juniperous macropoda)	1,584	10	900
Mesquite (Prosopis juliflora)	1,287	8	700
Olive (Olea ferruginea)	1,068	7	900
Eucalyptus (Eucalyptus camaldulensis)	974	6	700
Kandi (Prosopis cineraria)	954	6	700
Other	2,103	13	700
Total	15,800	100	
Source: Office Records of Divisional Forest Officers of Balochistan Forest Department			

During 2017-2021 an annual outturn of about 16,000 m³ was reported mainly from cutting of trees due to road construction or other developmental works in the forest areas and confiscation of illicit timber. Ghaz, ash, mulberry, and juniper are the main timber species of the province (Table 11). The total annual fuelwood supply from public forests of Balochistan is estimated at 0.547 million m³ under this study.

4.2.5. Wood Supply from Public Forests in AJK

Public forests of AJK supply 28% of the total timber produced in Pakistan. Deodar, Kail, Fir, and Chirpine are the important timber species of AJK which constitute about 99% of the 81,628 m³ of timber annually produced in these forests. AJK forests also supply a huge quantity of fuelwood to local communities residing in these forest areas. However, there is no proper record of this fuelwood and hence not reported by the Forest Department or any other organization. The total annual fuel-wood supply from public forests of AJK was at 0.385 million m³ estimated under this study (Table 12).

Table 12: Annual timber supply from public forests in AJK duriing 2017 - 2021 (in m³)

Species	Quantity (in m³)	%	Sale Price (Rs. Per cft of round wood)
Deodar (*Cedrus deodara*)	9,821	12.0	668
Blue Pine (*Pinus wallichiana*)	33,281	40.8	281
Silver Fir (*Abies pindrow*)	23,862	29.2	206
Chir Pine (*Chirpine*)	13,661	16.7	269
Broadleaved Species	1,003	1.2	600
Total	81,628	100.0	-
Source: Office Records of Divisional Forest Officers of AJK Forest Department			

4.2.6. Wood Supply from Public Forests in Gilgit-Baltistan

Gilgit-Baltistan has a forest area of 249,205 ha comprising mainly of dry temperate coniferous species e.g., deodar and Blue Pine which are important for timber production (Ali et al., 2017). The productive forests, mostly owned by the local communities, are confined to the Diamer region which has two forest divisions namely Chilas Forest Division and Darel-Tangir Forest Division. On the other hand, forests of other districts are predominantly protective forests and hence not exploited for timber production. Due to the continuous ban on logging in natural forests, timber supply is not regular and mostly comprises of extraction of the dead, dry, and wind fallen trees or illicit cutting.

There is also a dearth of reliable data on the outturn of timber from forests in Gilgit-Baltistan. Based on the available data from Forest Department, it was estimated that about 21,000 m³ of timber was supplied by these forests during 2020, out of which deodar was 66%, Blue Pine 14% and Silver Fir 20%. The sale prices of these timbers are given in Table 13. No official data is available on the out turn of fuelwood from the forests of Gilgit-Baltistan. However, there is no doubt that a huge amount of fuelwood is collected from the natural forests by the local communities. The total annual fuelwood supply from public forests of GB was 0.043 million m³ estimated under this study.

Table 13: Annual timber supply from public forests in GB during 2017 - 2021 (in m³)

Species	Quantity (in m³)	%	Sale Price (Rs. Per cft)
Deodar (Cedrus deodara)	13,903	66.3	2,500
Blue Pine (Pinus wallichiana)	2,899	13.8	1,500
Silver Fir (Abies pindrow)	4,154	19.8	1,300
Total	20,957	100	--

Source: Office Records of Divisional Forest Officers of GB Forest Department

4.3. Wood Production from Private Lands

Trees growing outside the designated forests on wasteland, rangelands, farmland and other land provide a large quantity of industrial timber and fuelwood in Pakistan. There is no mechanism to properly record and document timber and fuelwood outturns from these private lands. However, sporadic surveys have been conducted at provincial and regional levels in the past to assess wood production on farmlands in the country. The current study attempted to quantify wood production on private lands i.e., farmlands and wastelands.

4.3.1. Wood Production on Farmlands

Wood supply from farmlands depends on two factors i.e., area of farmlands and per ha volume of wood stock on farmland. Farmland area has significantly increased in the country over the past three decades due to the efforts to bring more area under cultivation and the availability of good quality satellite data and advanced mapping techniques. The farmland area was 20.58 million ha in 1992-93 which increased to 25.492 million ha in 2020-21 showing an increase of 24% (Table 14). This increase has resulted in an increase in wood supply from the farmlands.

Table 14: Farmland area under different studies (in million ha)

Province	1992-93[a]	2002-03[b]	2020-21[c]
Punjab	12.06	11.27	13.25
KP	1.55	2.26	2.53
Sindh	5.71	3.49	6.59
Balochistan	1.18	2.39	2.75
GB	0.05	0.10	0.12
AJK	0.04	0.32	0.25
Total	**20.58**	**19.84**	**25.49**

[a] Forestry Sector Master Plan 1992 [b] MAANICS International 2003
[c] Bukhari et al., 2012

Wood production on farmlands has been assessed by several research studies in the country. According to a study conducted by Pakistan Forest Institute in 2020, the average wood volume on farmlands of Khyber Pakhtunkhwa is 12.27 m³/ha showing an increase of 51% since 2002-03. However, the latest estimates of wood volume on farmlands of other provinces are not available.

In the absence of the latest data, it was assumed that growing stocks on the farmlands of Punjab, Sindh, and AJK would have grown at the same rate as they grew in KP. The growing stock estimates of Balochistan and Gilgit-Baltistan reported by MAANICS were very high, it was therefore decided to use the mean growing stock values of FSMP and apply a growth rate of 51% in these areas. Applying these growth rates, the total growing stock on farmlands of the country is estimated as 155.2 million m³ in 2021 as against 70.3 million m³ in 1992-93 and 97.5 million m³ in 2002-03 (Table 15).

Table 15: Wood volume on farmlands

Province	1992-93[a]		2002-03[b]		2020-21[c]	
	Total Growing Stock (million m^3)	Mean Growing Stock (m^3/ha)	Total Growing Stock (million m^3)	Mean Growing Stock (m^3/ha)	Total Growing Stock (million m^3)	Mean Growing Stock (m^3/ha)
Punjab	46.1	3.8	48.1	4.3	86.1	6.5
Sindh	8.5	2.3	7.8	2.2	23.1	3.5
KP	8.6	5.2	18.4	8.1	31.1	12.3
Balochistan	3.4	2.2	18.6	7.8	9.1	3.3
GB	1.6	15.9	2.1	20.8	2.9	24
AJK	2.1	12	2.4	7.6	2.9	11.5
Total	**70.3**	**3.6**	**97.5**	**4.9**	**155.2**	**6.1**

[a] Forestry Sector Master Plan 1992 [b] MAANICS International 2003 [c] PFI 2020

The annual harvesting of wood on farmlands is estimated at 32.6 million m³ (21% of the growing stock). Out of this, 14.34 million m³ (44%) is timber and 18.25 million m³ (56%) is fuelwood Table 16). This indicates that wood production on farmlands has increased from 7.705 million m³ per year in 1992-93 to 32.60 million m³ in 2021.

Table 16: Wood supply from farmlands 2021

Province	Timber (million m^3)	Fuelwood (million m^3)	Total (million m^3)
Punjab	7.96	10.13	18.08
Sindh	2.13	2.72	4.85
KP	2.87	3.66	6.53
Balochistan	0.84	1.07	1.91
Gilgit Baltistan	0.27	0.34	0.61
AJK	0.27	0.34	0.61
Total	14.34	18.25	32.59

Source: Pakistan Forest Institute, 2020

4.3.2. Wood Production on Wastelands

Wastelands include rangelands and other lands which are also an important source of fuelwood supply in the country based on the biomass productivity of rangelands in different provinces of Pakistan reported by FAO (2016). It was estimated that these lands produce dry matter of 17.84 million tons per year out of which about 50% consists of wood material that is used as fuelwood in the rural areas. Thus, the fuelwood supply by the wastelands is estimated as 12.75 million m³ which is equal to 23% of the total fuelwood consumption in the country. The province-wise detail of fuelwood supply by the wastelands is given in Table 17.

Table 17: Fuelwood supply from wastelands

Province	Rangelands (million ha)	Other Land (million ha)	Total Wasteland (million ha) [a]	Biomass Productivity (ton/ha) [b]	Biomass Production (million tons)	Fuelwood Production (million m^3)
Punjab	4.46	1.29	5.75	0.75	4.31	3.08
Sindh	2.42	3.84	6.26	0.50	3.13	2.24
KP	2.85	0.91	3.77	1.00	3.77	2.69
Balochistan	29.73	1.50	31.23	0.15	4.68	3.34
AJK	0.23	0.01	0.25	1.00	0.25	0.18
GB	3.28	0.13	3.41	0.50	1.70	1.22
Total	**42.98**	**7.69**	**50.66**	**0.35**	**17.84**	**12.75**

Source: [a] PFI 2012, [b] FAO 2016

4.3.3. Total Fuelwood Supply

The total fuelwood supply in the country has been estimated at 36.94 million m³ of this, 49% is from farmlands, 35% is from wastelands and 16% is from forests. The province-wise position of fuelwood supply from different sources is given in Table 18.

Table 18: Fuelwood supply from wastelands

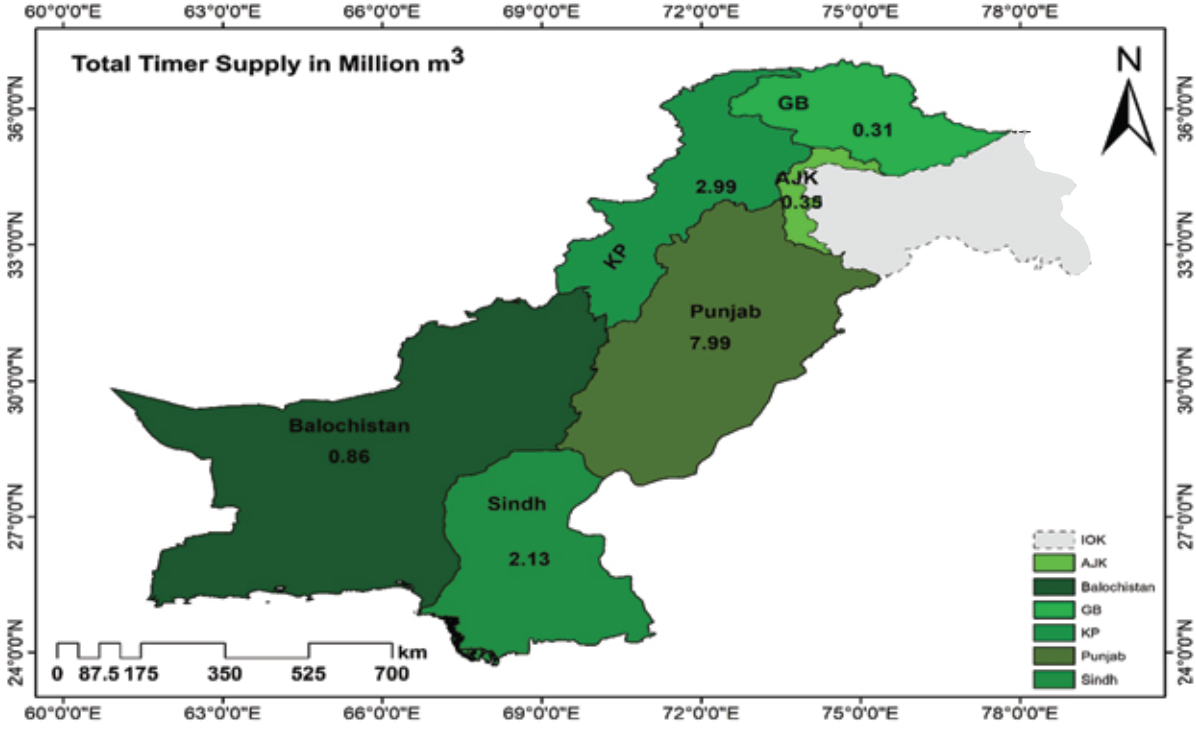
Province	Forests [a]	Farmlands [b]	Wastelands [c]	Total
Punjab	0.85	**10.13**	3.08	14.06
Sindh	2.04	**2.72**	2.24	7.00
KP	2.08	**3.66**	2.69	8.43
Balochistan	0.55	**1.07**	3.34	4.96
AJK	0.39	**0.34**	0.18	0.91
GB	0.04	**0.34**	1.22	1.60
Total	**5.94**	**18.25**	**12.75**	**36.94**

Source: [a] Field Survey 2022, [b] PFI 2012, [c] FAO 2016

4.3.4. Total Timber Supply

The total timber supply in the country has been estimated at 14.63 million m³, out of which 2% (0.289 million m³) is from forests and 98% (14.34 million m³) is from farmland plantations. The province-wise contribution of timber from forests and farmlands is given in Figure 5.

Figure 5: Total timber supply (in million m³)



Source: Office Records of Divisional Forest Officers, bPFI 2020

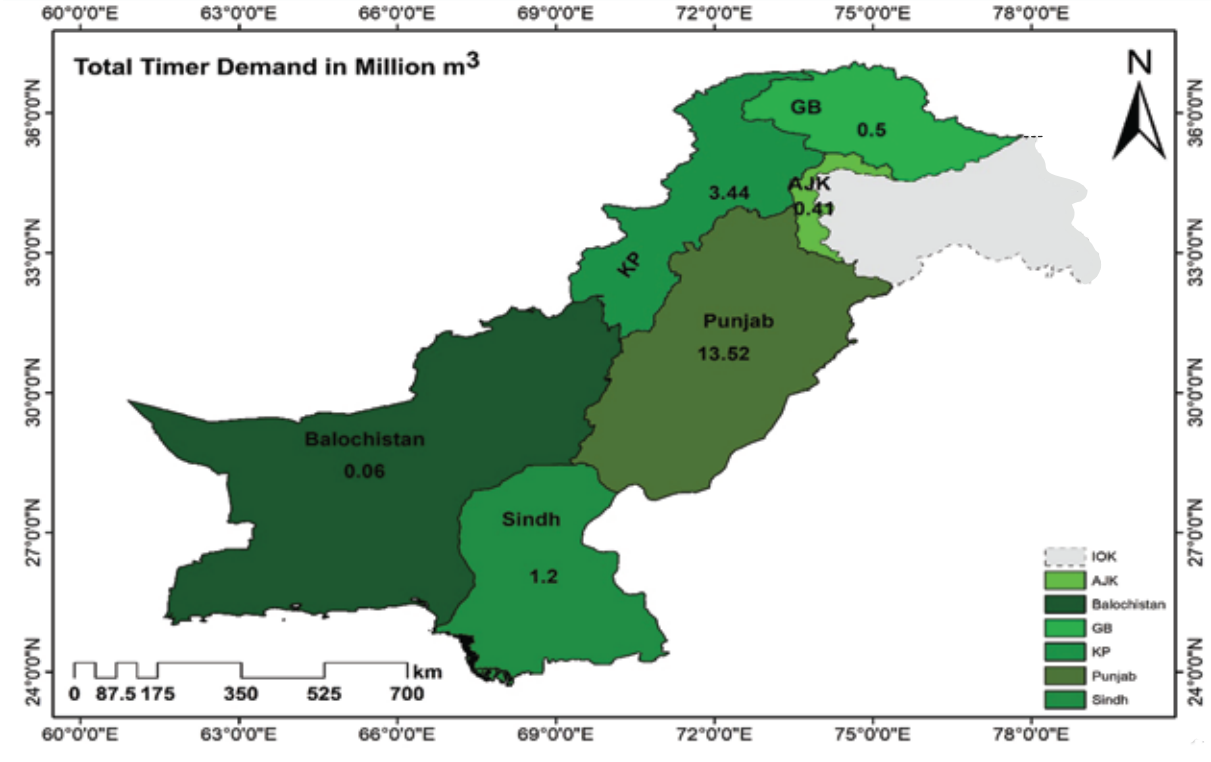
4.4. Inter-Provincial Movement of Wood

There is free movement of goods from one part of the country to another part unless it is restricted specifically through the imposition of a ban. This holds for timber and fuelwood as well. Accordingly, there is a substantial interprovincial movement of timber and fuelwood. Supplies originating from forests are recorded and the trade takes place under a transport pass issued by the concerned forest officer of the origin which mentions the destination place of the forest produce. However, the movement of forest produce originating from farmlands, wastelands, and that which is imported is partially recorded by the forest departments. Thus, part of this trade of timber and fuelwood gets recorded while the other part is not recorded. Hence, an accurate estimate of trade flows is not possible when there is no recording, incomplete or inaccurate recording. Faced with such a situation, a proxy approach has to be relied on for estimation of the quantum of this movement/trade. So, it has been considered prudent to do this estimation indirectly by comparing the quantum of in-house supplies with the quantum of consumption in the province. If a province is in a deficit, it means the gap is filled through inflows from another province or imports.

4.5. Consumption of Timber in Industry

The analysis has focused on two sorts of industries: major industry and small rural industry. The MAANIC's estimate of timber consumption was 12.238 million m³ for 2002-03 with a per capita consumption of 0.079 m³. This study has estimated timber consumption of 19.122 million m³ with a per capita consumption of 0.084 m³. This estimate seems reasonable showing an increase of 56% in the total consumption in the last 20 years. The population was 154 million in 2002 as compared to 227 in 2021 showing an increase of 47%. Figure 6 gives the province-wise estimates of timber consumption by major and small industries. Annexure Table D3 has detailed the industry-wise consumption of Timber.

Figure 6: Timber consumption (in million m³)



Source: Field Survey conducted by PIDE, 2022

4.5.1. Major Wood Based Industry

For the major wood-based industrial survey, a total of 1,068 industries were interviewed. Generally, major wood-based industries are categorized into 25 types (see details in Annexure Table D4). The profiling of major wood-based industries shows that there are 28,137 industries in the country (Annexure Table D5). Most of the interviewed industries are wood artifacts/wood carving, furniture, wood related construction and crate/box. Using the profiling and sampled interviewed industries, the aggregate consumption of wood and economic valuation was carried out. Table 19 exhibits the changes in wood prices during the last five years in percentage. Overall, majority of the owners/managers of industries consider that the prices have either increased or highly increased during the last five years.

Table 19: Trend of price change in last five years (% distribution)

Status	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Highly decrease	0.0	0.0	0.0	0.4	0.5	2.9	0.6
Decrease	0.0	1.2	6.4	0.0	0.9	0.0	0.8
Increase	56.8	28.8	25.5	57.7	19.1	42.9	35.4
Highly increase	35.8	69.4	68.1	40.5	78.5	51.4	61.6
No increase	7.4	0.6	0.0	1.5	0.9	2.9	1.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Field Survey conducted by PIDE, 2022

Table 20 explains the survey responses regarding the shortage of wood supply keeping in view the demand for wood. Generally, respondents acknowledged the presence of a wood supply shortage (44.6%). One-third of them still reported that there is no shortage of wood. Interestingly, province-wise responses are heterogeneous. The majority of respondents in AJK, GB, KP, and Sindh reported a shortage of wood as compared to Punjab and Balochistan.

Table 20: Respondents' views about the shortage of wood supply (% distribution)

Status	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Not at all	25.9	52.4	14.9	19.5	35.6	30.5	32.2
Up to some extent	32.1	34.1	14.9	68.2	35.9	60.0	44.6
Yes, a lot	40.7	12.4	70.2	11.6	26.7	4.8	21.6
Don't know	1.2	1.2	0.0	0.8	1.9	4.8	1.7
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Field Survey conducted by PIDE, 2022

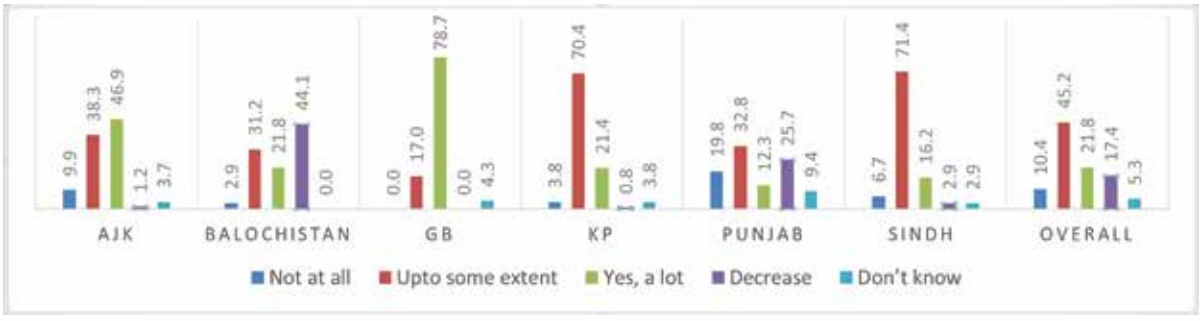
The main sources of wood purchase are the market and middle-man. Around 3% of the wood is imported and 2.3% is purchased from government depots. In AJK, however, the sources also include the government depots and farmlands (Annexure Table D6). Near to half of the interviewed firms reported that they were registered. The registered percentage is highest in AJK and GB, whereas it is lowest in Balochistan (Annexure Table D7). An ominous element is the usage of old technology that leads to the wastage of wood. According to the managers, on average there is around 17% wood wastage during the production process. A higher percentage of respondents in AJK and the least in Sindh have reported such wood losses (Figure 7).

Figure 7: Average loss of wood during the preparation of production (in %)

Source: Field Survey conducted by PIDE, 2022

Around one-third of the industries lack a marketing strategy to run their business. Overall, 39% of them have dedicated showrooms and another 21% have dealers for marketing. Online marketing was found very low (Annexure Table D8). On the whole, the industry considers that the demand for wood in future is expected to increase. About 17% of the industry also think that it may decline in the future (Figure 8).

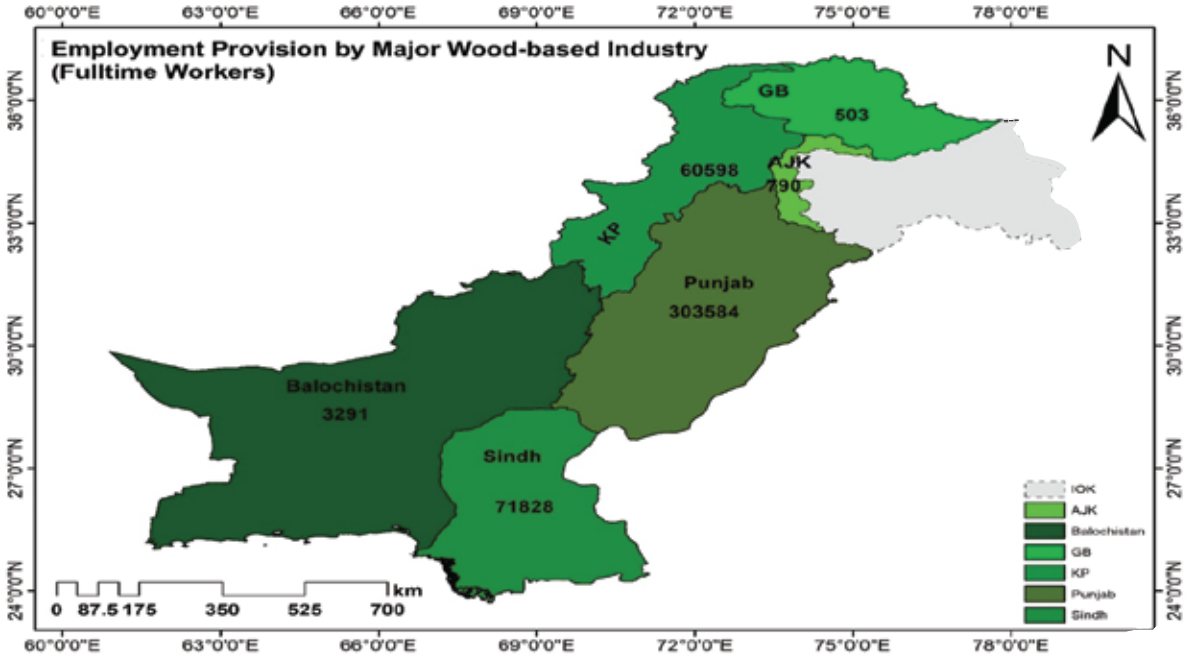
Figure 8: Intention to purchase wood in future (% distribution)

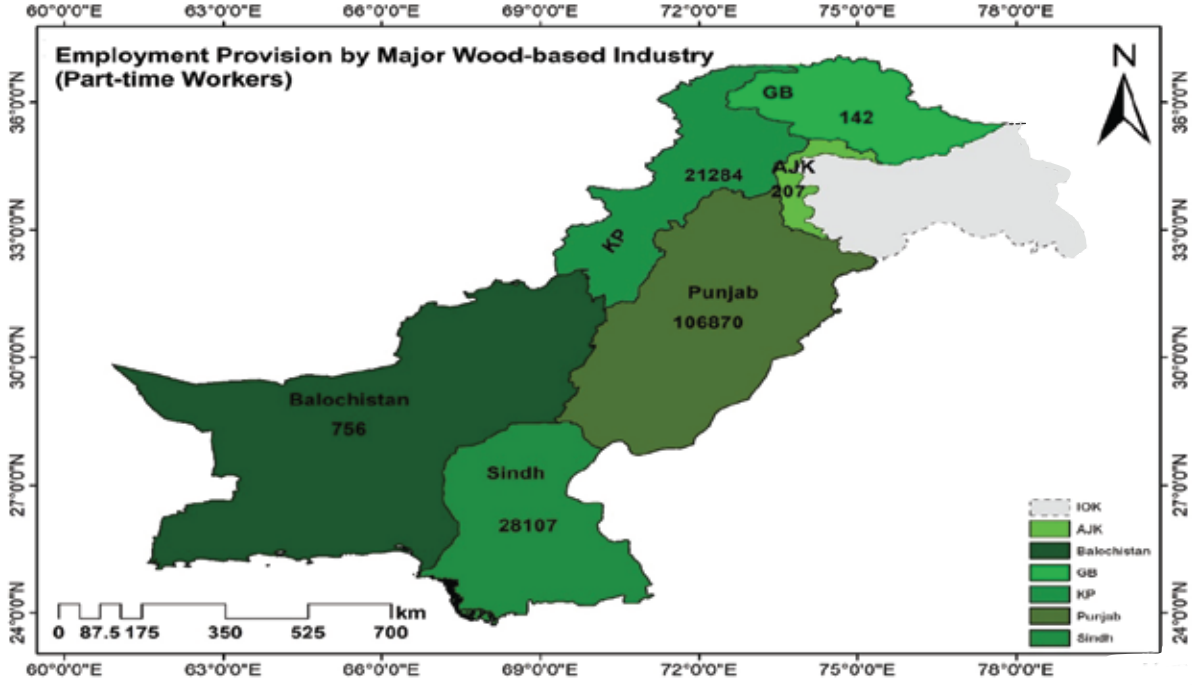


Source: Field Survey conducted by PIDE, 2022

The wood-based industry has an important contribution to providing employment. Using the sampled survey data and profiling, the analysis reveals that there are 0.44 million full-time and 0.16 million part-time employees working in the industry. Overall, employment reaches 0.6 million in the wood-based industry (Figure 9).

Figure 9: Employment provision by Industry (in numbers)





Based on production, the overall value of the wood-based industry is around PKR 1,165 billion excluding brick-kiln, tobacco curing, and charcoal kiln industry which use fuelwood for their operations. If these industries are added, the value would be around PKR 1,842 billion. The province-wise results are placed in Table 21.

Table 21: Total value of major wood-based industry (in Billion PKR)

Region	Total value excluding fuel-wood industries	Total value including fuelwood in dustries
AJK	1.32	1.41
Balochistan	3.84	5.17
GB	1.18	1.18
KP	43.14	133.90
Punjab	1,036.08	1,539.87
Sindh	78.96	160.35
Total	1,164.50	1,841.87

Source: Field Survey conducted by PIDE, 2022

4.5.2. Small Wood-Based Industry

For the small wood-based industrial survey, a total of 954 industries were interviewed. Generally, major wood-based industries are categorized in 25 types. The province-wise sample and profiling (by using block strategy) is placed in Annexure Table D9. The analysis shows that there are around 293,439 small industries in the country. Most of the interviewed industries are wood artifacts/wood carving, furniture, wood related construction and crate/box, agricultural implements etc. The estimates of consumption, price and value were adopted on the blocks and total value is estimated.

Table 22 shows the province-wise consumption of wood in small industries. The analysis reveals that overall, the consumption of wood in small industry is around PKR 825 billion and the total value of products generated by small rural industry is around PKR 1,088 billion.

Table 22: Consumption of wood in small industry (PKR Billion)

Province	Consumption of wood	Product value
AJK	31	43
Balochistan	12	21
GB	11	15
KP	151	233
Punjab	386	584
Sindh	134	192
Overall	725	1,088

Overall, 70% of the industries use either handmade or old technology, whereas 30% use modern technology. About 14% of the rural industries have dedicated show-rooms, 12% have dealers and 69% have no marketing strategy. Table 23 exhibits the changes in wood prices during the last five years. Overall, the majority of the small industries consider that the prices of wood have either increased or highly increased during the last five years. The small industry mostly lacks any marketing strategy to sell its products (Annexure Table D10).

Table 23: Trend of price change as reported by respondeants in the last five years (% distribution)

Status	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Highly decrease	0.0	0.0	0.0	0.5	0.3	0.0	0.2
Decrease	1.9	0.0	0.0	0.0	0.0	1.6	0.4
Increase	54.7	49.8	28.2	43.1	22.3	50.3	34.9
Highly increase	34.0	45.1	70.9	54.0	75.9	37.2	60.4
No increase	9.4	5.1	1.0	2.5	1.5	11.0	4.1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Field Survey conducted by PIDE, 2022

Table 24 explains the survey responses regarding a shortage of wood supply against wood demands. Generally, around one-fourth of the respondents (27%) believed that there is no shortage of wood supply. However, a similar percentage considers a high shortage of wood and 45.6 percent acknowledged wood shortage up to some extent.

Table 24: Respondents' views about the shortage of wood supply in a small industry (% distribution)

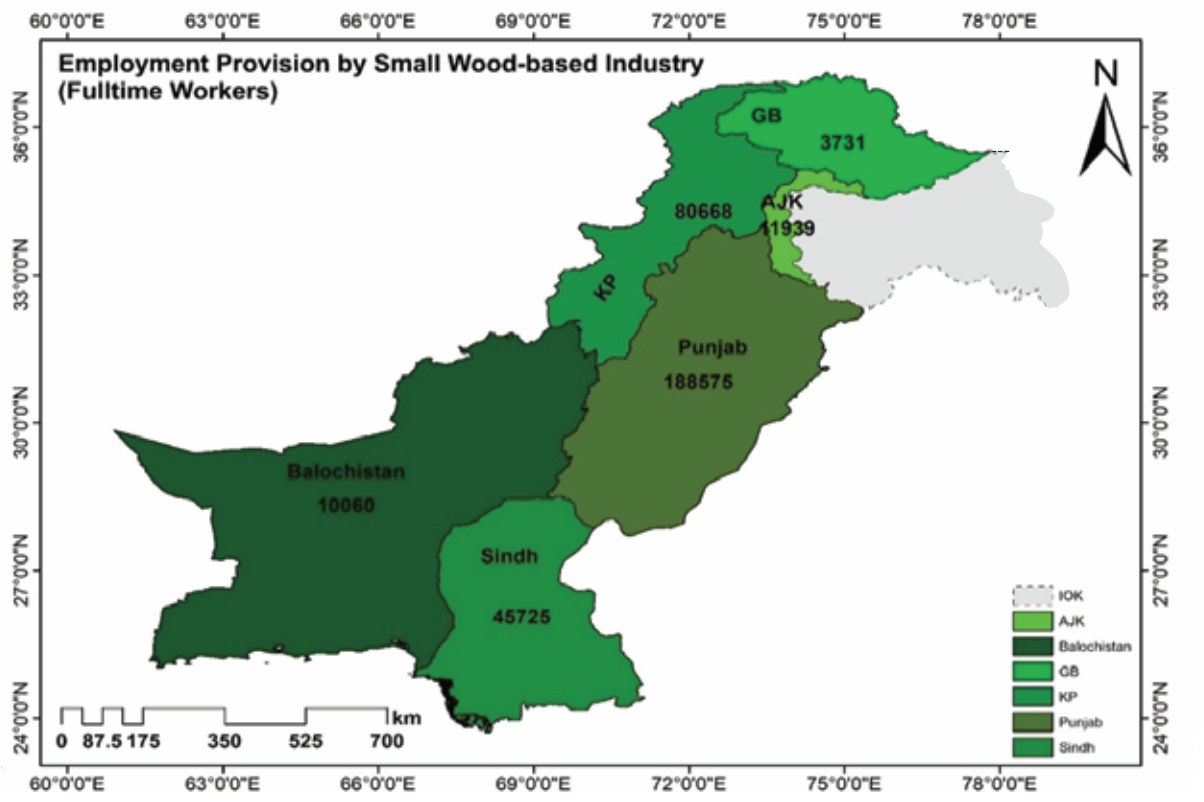
Status	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Not at all	22.6	15.5	13.6	14.4	30.5	42.4	27.2
Upto some extent	43.4	38.9	29.1	62.9	36.4	55.5	45.6
Yes, a lot	34.0	45.6	57.3	22.8	32.3	2.1	26.9
Don't know	0.0	0.0	0.0	0.0	0.8	0.0	0.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

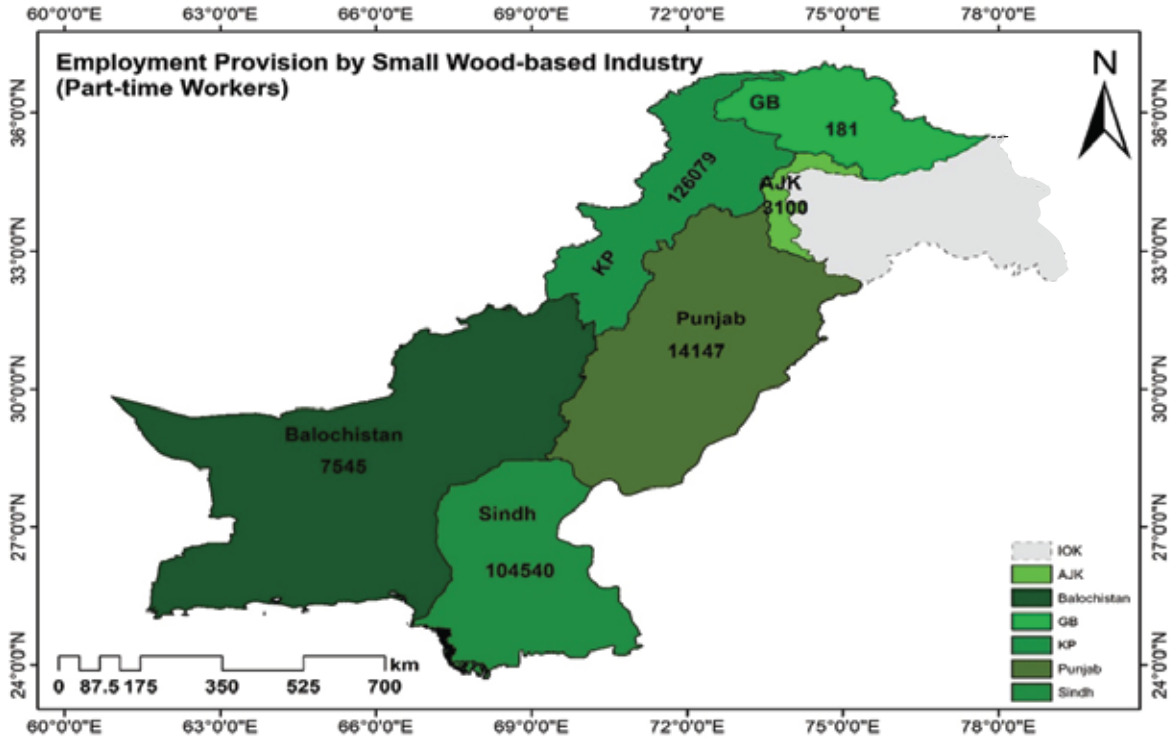
Source: Field Survey conducted by PIDE, 2022

Direct purchase from market/middle-men is the predominant source of wood supply in the small industry as reported by 93% of respondents. Similarly, 5% reported that they directly purchased wood from farm/private land/communal land and only 1% purchased from government depots. About 67% of the small firms were found unregistered and only 19% of them are registered.

The wood-based industry has an important contribution to employment generation. Using the sampled survey data and profiling, the analysis reveals that there are 0.34 million full-time and 0.26 million part-time employees working in the industry, thus reaching 0.6 million (Figure 10).

Figure 10: Employment provision by small industry (in numbers)





4.6. Consumption of Fuelwood

Fuelwood is used by households, commercial and industrial sectors in the country. The current study has quantified the consumption of fuelwood in domestic use, hamams, tandoors, catering, and some other industries including brick kilns and tobacco barns. Table 25 shows that the household consumption of fuelwood is around 45 million cubic meters per year with a per capita consumption of 0.218 m³. Across provinces, the per capita rate is the highest in Gilgit-Baltistan province, followed by Balochistan and AJK.

Table 25: Total fuelwood consumption in households

Province	Total annual fuelwood consumption round wood* (million m³)			Per capita fuelwood consumption round wood (m³/year)		
	Rural	Urban	Overall	Rural	Urban	Overall
Punjab	15.177	1.955	17.132	0.219	0.049	0.157
Sindh	8.105	0.865	8.970	0.354	0.035	0.188
KP	11.382	0.496	11.878	0.390	0.087	0.341
Balochistan	3.946	0.692	4.639	0.446	0.207	0.380
GB	0.957	0.308	1.265	0.933	0.601	0.822
AJK	1.204	0.371	1.575	0.433	0.267	0.378
Total	**40.771**	**4.687**	**45.459**	**0.305**	**0.062**	**0.218**

*Round wood is taken as 56% of the wood consumed.
Source: Field Survey conducted by PIDE, 2022

Table 26 compares the per day and capita consumption of fuelwood with the earlier studies. Our study has attempted to further disaggregate the analysis by summer and winter as well as special occasions.

Table 26: Household fuelwood consumption estimates

Study	Year	Population (million)	Kg/household/ day	Per capita round wood (m^3/year)	Total (million m^3)
FSMP	1992	127	5	0.208	26.0
MAANICS	2002	153	4	0.206	31.5
KP Forest Department	1915	29	15	0.261	15.5
Current Study					
Current Study	2021	209		0.218	45.5
Winter Summer Special Occasion	- - -	- - -	19.0 10.0 26.3	- - -	- - -

* special occasion is for annual
Source: Field Survey conducted by PIDE, 2022

According to MAANICS Report, the Household sector consumes 82% of the total fuelwood, the commercial sector (tandoors, bakeries, restaurants, barbers) consumes 3.3% of the total fuelwood, and the industrial sector (tobacco barns, brick kilns, charcoal) 14.9%. According to the current study, total fuelwood consumption in the country is 50.183 million ㎥ with per capita consumption of 0.240 ㎥, of this the household sector consumes 90.59%, the commercial sector uses 6.87% and the industrial sector 2.54 % of the total fuelwood (Table 27). One major reason for less reporting is the lack of data from hotels, restaurants, and bakeries.

Table 27: Total fuelwood consumption (in million ㎥)

Province	Household Sector	Commercial (Tandoors, Hotels, and Caterings)	Industrial Sector		
			Brick Kilns	Tobacco Barns	Total
Punjab	17.132	1.961	0.639	0.099	19.831
Sindh	8.970	0.369	0.128	-	9.467
KP	11.878	0.827	0.064	0.298	13.067
Balochistan	4.639	0.140	0.026	-	4.805
AJK	1.575	0.121	0.022	-	1.718
GB	1.265	0.032	-	-	1.297
Overall	**45.459**	**3.449**	**0.878**	**0.397**	**50.183**

Source: Field Survey conducted by PIDE, 2022

4.6.1. Use of Fuelwood by Households

The use of wood for fuel purposes is still an important source of energy where households, catering, hotels, tandoors, hamams, etc. use fuelwood for cooking and heating purposes. About 45% of households still use firewood for cooking purposes (Table 28). The estimates suggest that province-wise, Gilgit-Baltistan, AJK, Khyber Pakhtunkhwa, and Balochistan are the major consumers of firewood for cooking purposes with a whopping 81%, 71.8%, 66.2%, and 53%, respectively. The high firewood consumption trend is primarily due to forest abundance, cold weather, and the non-availability of alternatives. On the contrary, Sindh and Punjab are least dependent on firewood for cooking purposes. The results across rural and urban are reported in Annexure Table D11.

Fuelwood is used traditionally in households in fireplaces for space heating and water heating purposes. After gas, it is still the main source for heating purposes. Gilgit-Baltistan, the state of Azad Jammu and Kashmir, Balochistan, and Khyber Pakhtunkhwa remain primarily dependent on firewood and charcoal for heating purposes with 58%, 56%, 40%, and 36%, respectively. The results across rural and urban areas are reported in Annexure Table D12 & D13.

Table 28: Sources of cooking fuel by province (% distribution)

Source	National	Punjab	Sindh	KP	Balochistan	AJK*	GB**
Firewood	45.2	34.2	35.7	66.2	53.5	71.8	81.0
Gas	36.4	42.7	56.3	23.3	29.7	11.6	0.0
LPG	5.9	7.4	1.0	7.1	5.1	5.3	13.7
Kerosene oil	0.0	0.0	0.0	0.0	0.0	0.1	0.3
Electricity	0.0	0.0	0.0	0.0	0.0	0.3	0.9
Dung cake	3.5	4.2	3.3	0.6	1.0	4.5	2.1
Crop residue	7.8	10.7	3.0	2.1	8.0	2.7	1.1
Charcoal/coal	0.9	0.5	0.6	0.3	2.1	3.1	0.9
Others	0.3	0.3	0.1	0.4	0.5	0.4	0.0
Total	100	100	100	100	100	100	100

Source: Estimated from PSLM 2019/20
* *Source:* Field Survey conducted by PIDE, 2022
** estimated from MICS 2020/21 survey

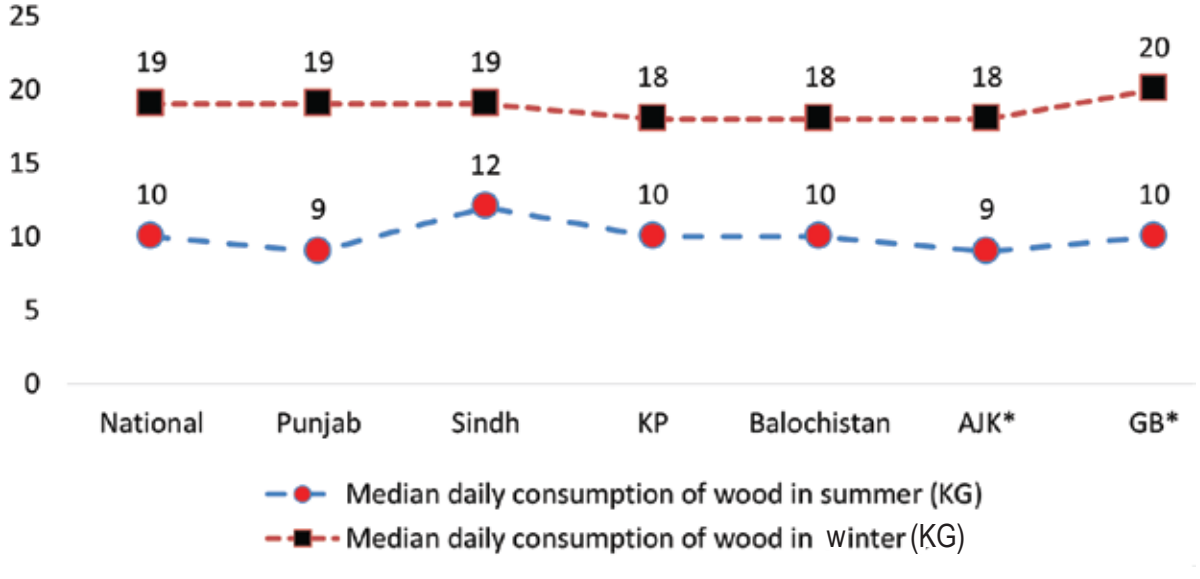
The results of the current study show fluctuations in the price of fuelwood across national and provincial landscapes. Average wood price per 40 kg on a national level remains at PKR 613. AJK and KP, show similar uniformed stable trends of 40kg prices of PKR 620 and PKR 542 for Punjab. On the contrary wood prices reach a peak of PKR 1,060 per 40 kg in Gilgit-Baltistan, while in Balochistan wood prices are estimated at a considerable PKR 702 for the reported quantity (Figure 11).

Figure 11: Median price of wood (in PKR) across provinces for 40 KG

Source: Field Survey conducted by PIDE, 2022

The median daily wood consumption for cooking and heating purposes at the household level exhibits trends for the summer and winter seasons (in kilograms). Winter household consumption patterns portray a period of stability across the national and provincial levels with daily median household consumption resting between 18kg to 20kg. Summer daily wood consumption trends reached a plateau with 9kg to 10kg, although the only exception was Sindh, where summer daily wood consumption surged to 12kg (Figure 12). The rural-urban details across provinces are placed in Annexure Table D14.

Figure 12: Median daily wood consumption by households (in kg)



The prices and quantity from the current study were applied to the larger datasets to estimate the fuelwood cost incurred on cooking, heating, and during special occasions. The total cost was found PKR 871 billion, PKR 781 billion in rural areas, and PKR 90 billion in urban areas.

Table 29: Fuelwood cost (in PKR Billion)

Region	Cooking	Heating	Special Occasion	Total
Rural	645.3	131.9	3.8	781.0
Urban	66.5	21.4	1.9	89.8
Overall	711.8	153.3	5.7	870.8

Source: Field Survey conducted by PIDE, 2022

The major sources of firewood supply can be categorized as owned-land, farmland or private lands, communal forest, government forest land, market, wood purchased from the government and others. Generally, on a national level, purchase from the market remains the primary source of firewood supply, followed by owned land and forests. Balochistan and Punjab are the most market-dependent provinces for their firewood needs with 83%, and 79% of supplies coming from the market. AJK and GB's dependence on the market for its firewood consumption needs is lower than other provinces, as their owned lands provide 43% and 31% of firewood (Table 30).

Table 30: Main sources of fire-wood consumption (% distribution)

Province	Own land	Farm/Private land	Communal	Forest/govt land	Market	Purchased from govt.	Others
AJK	43.2	7.9	0.0	21.6	23.0	2.9	1.4
Balochistan	2.6	0.0	0.5	10.3	83.6	1.5	1.5
GB	30.8	2.5	1.7	3.4	61.2	0.0	0.4
KP	8.9	3.4	3.4	15.6	65.0	1.9	1.8
Punjab	9.4	3.4	1.8	3.5	79.4	1.5	1.1
Sindh	3.6	2.3	6.6	21.7	64.8	1.0	0.0
Overall	**12.5**	**3.3**	**2.3**	**11.7**	**68.1**	**1.5**	**1.1**

Source: Field Survey conducted by PIDE, 2022

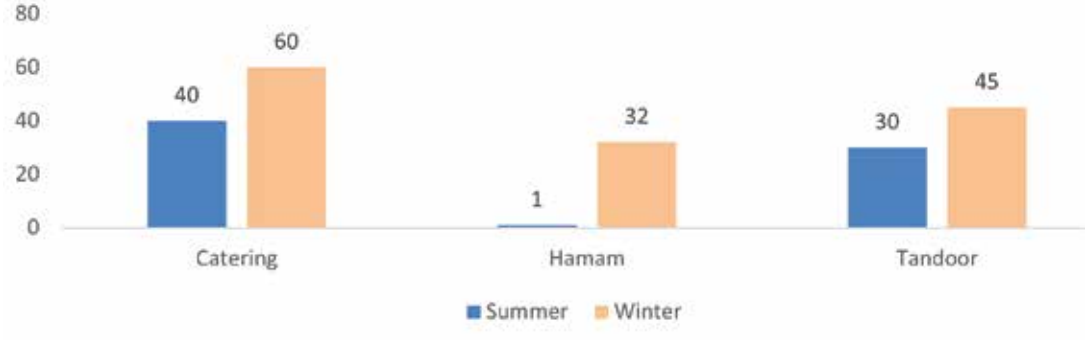
4.6.2. Commercial Use of Fuelwood

This study has analyzed the commercial use of wood for tandoors, hamams, catering, and a a few other industries. The block-level methodology was used for tandoors, hamams, and catering services. The sampled results were applied to the

overall blocks for generalization. Our analysis shows that the average monthly consumption of tandoors, hamams is more in the winter season compared to the summer season. Catering has the highest consumption than tandoor, whereas hamams have consumption only in winter.

Overall, the majority of the owners/manager of commercial units consider that the prices have either increased (37%) or highly increased (57%) during the last five years. Only 5% of the respondents consider that prices are almost the same. 34% of the respondents consider that there is no shortage of fuelwood supply, however, 42% consider that up to some extent the shortage of wood prevails and 19% consider that there is a huge shortage of wood.

Figure 13: Average monthly consumption of fuelwood (paid/unpaid) during summer (in 40 kg)



Source: Field Survey conducted by PIDE, 2022

Commercial entities have an important contribution to employment. Using the sampled survey data and profiling, the analysis reveals that there are 181 thousand employees in catering, near to half a million in tandoor and 280 thousand in hamams, thus totaling one million of the employment (Table 31).

Table 31: Employment provision by commercial industries (in numbers)

Province	Catering	Tandoor	Hamam
AJK	7,011	20,350	7,712
Balochistan	2,928	8,089	3,634
GB	30,185	73,430	33,405
KP	43,451	166,169	56,588
Punjab	5,938	26,267	9,896
Sindh	91,841	199,556	168,375
Overall	**181,354**	**493,861**	**279,611**

Source: Field Survey conducted by PIDE, 2022

The consumption of fuelwood shows that overall the purchase of fuel-wood in the industry stands at around PKR 190 billion, with its 12% share in catering, 3.4% in hamams, 19% in tandoors, and 65% in industry (Table 32).

Table 32: Total purchase of wood by commercial entities (in Billion PKR)

Province	Catering	Hamam	Tandoor	Industry	Total
AJK	0.7	0.5	1.1	2.6	4.9
Balochistan	0.9	0.4	1.4	0.0	2.7
GB	0.1	0.1	0.4	0.0	0.6
KP	4.7	1.3	9.7	48.7	64.5
Punjab	12.8	3.6	21.0	55.4	92.8
Sindh	4.2	0.6	2.2	16.9	23.9
Overall	**23.5**	**6.5**	**35.7**	**123.7**	**189.4**

Source: Field Survey conducted by PIDE, 2022

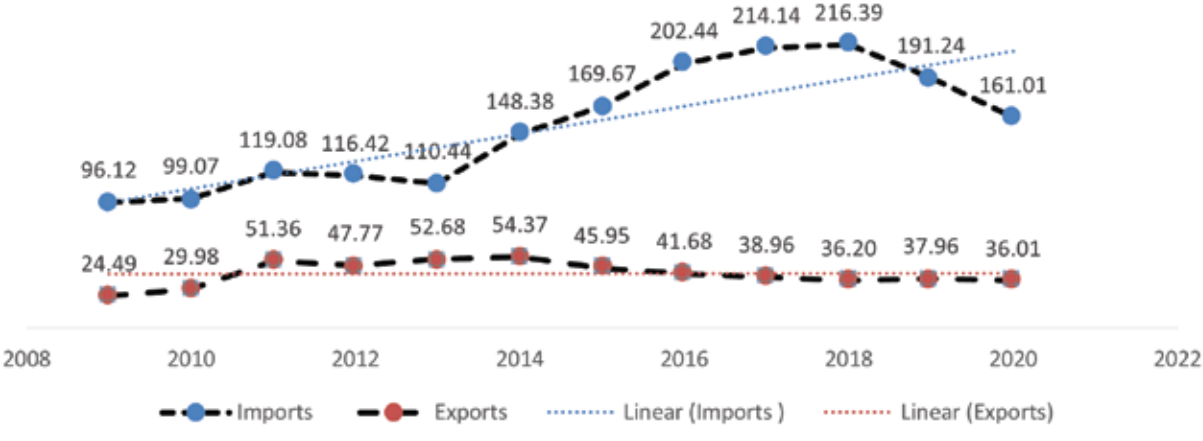
Section 5

Demand - Supply Gap Analysis and Future Projections

5.1. Import and Export of Wood and its Products

The value of wood exports and wood articles from Pakistan totaled $36 million in 2020. Sales in this category from Pakistan decreased by 5.14% in value terms compared to 2019. In parallel, exports of wood and articles of wood decreased by $1.95 million. The cumulative exports in the same category from Pakistan in 2019, amounted to $37 million. The share of export regarding wood-based items makes up 0.161% of the total exports from Pakistan, as cumulative merchandise exports from Pakistan totaled $22 billion in 2020. Thus, the share of the subject category increased by 0.002 percentage points, compared to 2019. It was 0.159% in 2019 and cumulative exports from Pakistan were equal to $23 billion. On the other hand, the value of imports of wood-based products to Pakistan totaled $161 million in 2020. Sales to Pakistan decreased by 15.8% in value terms compared to 2019. Moreover, imports decreased by $30 million. Note that the value of imports of wood-based products to Pakistan was equal to $191 million in 2019. Likewise, imports under this category accounted for 0.351% of the total import flow to Pakistan. In 2020, total imports to Pakistan amounted to $45 billion. The share in total imports to Pakistan decreased by 0.03 percentage points compared to 2019, as it was 0.382% in 2019 and cumulative imports to Pakistan were equal to $50 billion.

Figure 14: Pakistan's wood-based products' trade (in USD million)



Source: Pakistan Trade Office

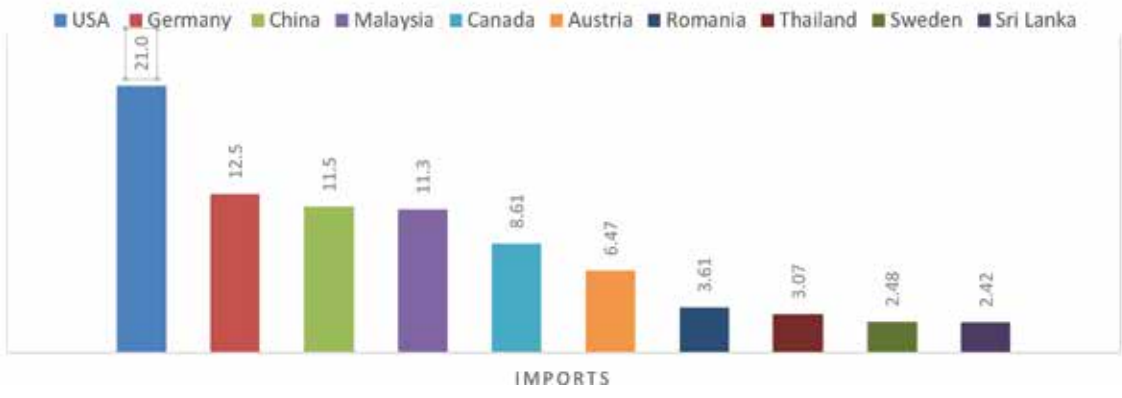
Overall, the trend shows that there is a widening gap between imports and exports of wood-based products, over the years. Imports are much more than exports. On average, there is a deficit of around $1800 million. Exports, remained more or less the same, with a slight increase over the last few years. Whereas, imports increased drastically after 2013 and kept on increasing, until experiencing a dent by a pandemic induced lull in economic activity and supply chain disruptions.

Note:

The data for this chaper is extracted from the websites of the State Bank of Pakistan (SBP), Federal Board of Revenue (FBR), Trend Economy and Pakistan Bureau of Statistics (PBS).

As shown in the graph, more than 50% of Pakistan's wood-based imports come from four countries only. These include $34 million from the USA, $20 million from Germany, $18.5 million from China, and $18.2 million from Malaysia. Moreover, Pakistan also imports $13.8 million and $10.4 million from Canada and Austria, respectively. Imports from the rest of the countries on the list account for around $5 million or less than that each.

Figure 15: Pakistan's major import partners for wood-based trading products (as a % of total wood-based imports)



Source: Pakistan Trade Office

Regarding Pakistan's wood-based exports, Afghanistan is the primary market where Pakistan pours in its biggest chunk of wood-based exports. These exports make up to 91% of the total wood-based exports of Pakistan. Then come UAE, Australia and Saudi Arabia, which import Pakistani wood-based products, up to 1-2% of the total Pakistani exports in this particular category. All other countries receive 1% or less of Pakistan's total wood exports.

Figure 16: Pakistan's major export partners for wood-based trading products (as a % of total wood-based exports)

Pakistan's wood-based exports include fiber-board, plywood, casings, floorings, crates, tableware, caskets, etc. Fibre-board of wood or other ligneous materials accounts for 81% of the total wood-based exports amounting to $29 million. Followed by plywood, veneered panels and similar laminated wood which amounts to $2.49 million and particle/boards worth $1.14 million.

Table 33: Pakistan's wood-based exports classification (2020)

No.	Wood Item	Export Value in $ 1000s	% of Total Wood-based Exports
1	Fibre-board of wood or other ligneous materials	29000	81.00
2	Plywood, veneered panels and similar laminated wood	2490	6.92
3	Particle-board and similar board	1140	3.18
4	Wooden frames for paintings, photographs, mirrors	552	1.53
5	Wood marquetry and inlaid wood; caskets and cases for jewellery or cutlery etc.	525	1.45
6	Other articles of wood	470	1.30
7	Tableware and kitchenware of wood	379	1.05
8	Packing cases, boxes, crates, drums and similar packings of wood	296	0.82
9	Wood wool; wood flour	221	0.62
10	Wood, including strips and friezes for parquet flooring etc.	163	0.45

Source: Pakistan Trade Office

In contrast, Pakistan imports $100 million worth of wood - sawn or chipped lengthwise, sliced or peeled. Fibre-board and other ligneous materials cost Pakistan $25 million. The country also imports rough wood equivalent to $13 million. Builders' joinery and carpentry of wood, including cellular wood panels, assembled parquet panels, shingles and shakes also contribute a lot to the import pie, valuing more than $5 million import bill.

Table 34: Pakistan's wood-based imports classification (2020)

No.	Wood Item	Import Value in $ 1000s	% of Total Wood-based Import
1	Wood sawn or chipped lengthwise, sliced or peeled	100000	62.00
2	Fibre-board of wood or other ligneous materials	25000	16.00
3	Wood in the rough	13300	8.26
4	Builders' joinery and carpentry of wood, including cellular wood panels, assembled parquet panels, shingles and shakes.	5440	3.38
5	Other articles of wood	4000	2.48
6	Sheets for veneering, plywood, similar laminated wood	3120	1.94
7	Plywood, veneered panels and similar laminated wood.	2520	1.57
8	Particle-board and similar boards	900	0.56
9	Tableware and kitchenware of wood	758	0.47
10	Densified wood, in blocks, plates, strips or profile shapes.	690	0.42

Source: Pakistan Trade Office

Pakistan's share of wood imports is 2 percent of total imports, against negligible exports showing a negative trade balance by a big margin. It is worth mentioning, that as per the trade policy of Pakistan, the government imposes varying tariff duties on wood products' imports from different countries. The nature of these tariff duties depends on the various agreements between Pakistan and other countries. The highest tariff is on imported wood from Japan accounting to be 31.49 percent. It is followed by a 20 to 25 percent tariff on countries like Thailand, Turkey, Australia, UAE, Korea, etc. The lowest tariff is usually on wood imports from Asia and the Pacific, European Union, and North American regions. The tariff issue has been discussed and criticized in many policies and civil society circles, but the efforts proved futile.

However, in 2020, the tariff issue resurfaced in the policy discourse when the Ministry of Climate Change (MoCC) recommended that the Federal Board of Revenue (FBR) should abolish the customs duty to reduce the pressure on national forests. The All Pakistan Timer Traders Association (APPTA) showed similar concerns on Additional Custom Duty (ACD) of 2 percent on the already 32-34 percent customs duty, sales tax and withholding tax, and up to 42pc on the import of wood and timber; particularly raw material wood (HS Code 44.03) and timber (HS Code 44.07). The imposition of ACD has led to a drastic reduction in wood imports (as can be observed in PBS 2020 Report on wood and cork for June 2020) and increased the pressure on the national forest through illegal timber cutting and trade. Research shows that duty reduction has a positive effect on Pakistan's economy with regard to wood-based economic activity generation. Specifically, aggregate exports and imports of wood in Pakistan and the volume of merchandised exports and imports of Pakistan will increase, also releasing pressure on the national forests.

5.2. Demand and Supply Gap Analysis

Population projections have been done up to 2040 using an annual growth rate of 1.9% for Pakistan and different provinces. Population growth rates for AJK and GB have been assumed to be 1.63% and 2.87% respectively. Using these growth rates, the population is reported in Table 35. Rural-urban share of the population is reported in Annexure Table D16.

The study has used the average per capita consumption of fuelwood and timber at the provincial level to estimate the future demand projection. Annexure Table D17 has detailed the estimated number of households and household size from 2022 to 2040.

Table 35: Projected population of Pakistan (in million)

Province	2025	2030	2035	2040
KP	41.5	45.6	50.1	55.0
Punjab	128.6	141.3	155.2	170.5
Sindh	56.0	61.5	67.5	74.2
Balochistan	14.4	15.8	17.4	19.1
ICT	2.3	2.6	2.8	3.1
AJK	4.6	5.1	5.6	6.1
GB	1.8	2.0	2.2	2.4
Total	**249.3**	**273.9**	**300.9**	**330.6**

5.2.1. Future Fuelwood and Timber Requirements

Per capita consumption of timber and fuelwood in different uses has been used for the determination of demand for these products over time. Timber's demand in a given province depends on the number of houses constructed and repaired, furniture used by households, other industrial uses of timber (major industries and small industries), and the projected increase in population. Fuelwood demand has three major components, i.e., household sectors, the commercial sector (tandoors, hotels, and catering), and the industrial sector (brick kilns, tobacco barns). Household sector's fuelwood demand depends on the number of households, percentage of households using fuelwood as a source of energy, and per capita consumption as well as whether the household is in an urban area or rural area and the season of the year (winter season vs. summer season).

Depending on the season, an average household in Pakistan consumes fuelwood to the tune of 19 and 10kg/household/day in winter and summer respectively. In addition, each household uses 26.3kg/household on special occasions on an annual basis. Being occasional and on yearly basis, it has not been added to the daily per capita use of fuelwood by households. Using these figures, the weighted average per day per household fuelwood demand has been estimated to be 18.43kg.

This when translated into per capita household fuelwood requirement in the form of round wood/year comes to 0.218 ㎥ in the year 2021 (all the estimations are done for year 2021). For a population of 208.95 million persons, the household sector fuelwood requirement has been estimated to be 45.34 million ㎥, and that of the commercial sector (tandoors, hotels, and caterings) is 3.449 million ㎥. cubic meter and the industrial sector (brick kilns and tobacco barns) is 1.275 million ㎥, which totals 50.183 million ㎥. Overall, fuelwood consumption per capita is 0.240 ㎥. of the total demand, the household sector's share is 90.59%, the commercial sector's use is 6.87% and that of the industrial sector is 2.54%. (Please refere to tables 25, 26 and 27 for details). The timber used by major industries and small industries is 12.497 million ㎥and 6.625 million ㎥ respectively, which totals 19.122 million ㎥. The three majors wood-using industries are furniture (6.587 million ㎥), country sawmills (5.443 million ㎥), and construction (2.244 million ㎥) respectively. The per capita requirement is 0.084 ㎥. (Please refer to Table D3 in Annexure for details).

5.2.2. Projections of Fuelwood Needs

The current household sector fuelwood demand is 45.5 million ㎥ based on a per capita fuelwood need of 0.218 ㎥. Given the per capita requirement of 0.240 ㎥ overall, 0.305 ㎥ in rural areas, and 0.062 ㎥ in urban areas, the demand is projected to increase to 71.7 million ㎥ in 2040. The details of projected future fuelwood need of the household sector in the country are given in Table 36. The provincial results of projection are placed in Annexure Table D18 where certain proxies are used. For example, the proxy of overall per capita consumption of fuelwood in ㎥ for different provinces has been used because of their differential access to alternate energy sources and climate differences.

Table 36: Current and projected fuelwood demand for Pakistan

Item	2021	2025	2030	2035	2040
Household Sector (in million m^3)					
Overall	45.5	54.1	59.4	65.3	71.7
Rural	40.8	47.9	52.6	57.8	63.5
Urban	4.7	6.2	6.8	7.5	8.2
Commercial and industrial sectors (in million m^3)					
Commercial	3.5	4.1	4.5	5.0	5.5
Industrial	1.3	1.5	1.7	1.8	2.0
Total Fuelwood	**50.2**	**59.7**	**65.6**	**72.1**	**79.2**

Table 37 gives detail of projected fuelwood requirements and supply from different sources as well as gaps based on supply and demand estimates. Initially, there is a wider gap between demand and supply which progressively narrows down over time due to the ongoing and future assumed plantation programs. The provincial results are placed in Annexure Table D19.

Table 37: Fuelwood demand, supply comparison and gap (in million ㎥)

Demand/supply	2022	2025	2030	2035	2040
Demand	50.2	59.7	65.6	72.1	79.2
Supply	36.9	38.0	43.1	52.5	66.1
Gap	13.2	21.7	22.5	19.7	13.2

5.2.3. Projections of Timber Needs

Based on estimated supply and demand figures in 2021, the per capita consumption of timber is 0.084 ㎥. Therefore, the existing timber requirements are 19.13 ㎥. The demand increases to 27.77 ㎥ in the year 2040 when the estimated population is 330.605 million. The current supply from all sources is 14.63 million ㎥. Thus, there is a gap of 4.50 million ㎥ in 2021. Due to plantations, the gap narrows down until 2030. From 2035 onwards the supply is expected to exceed the demand. The current gap of 4.50 million ㎥ (which is 24% of the demand) in 2021 is being met from farmlands, wastelands, and imports.

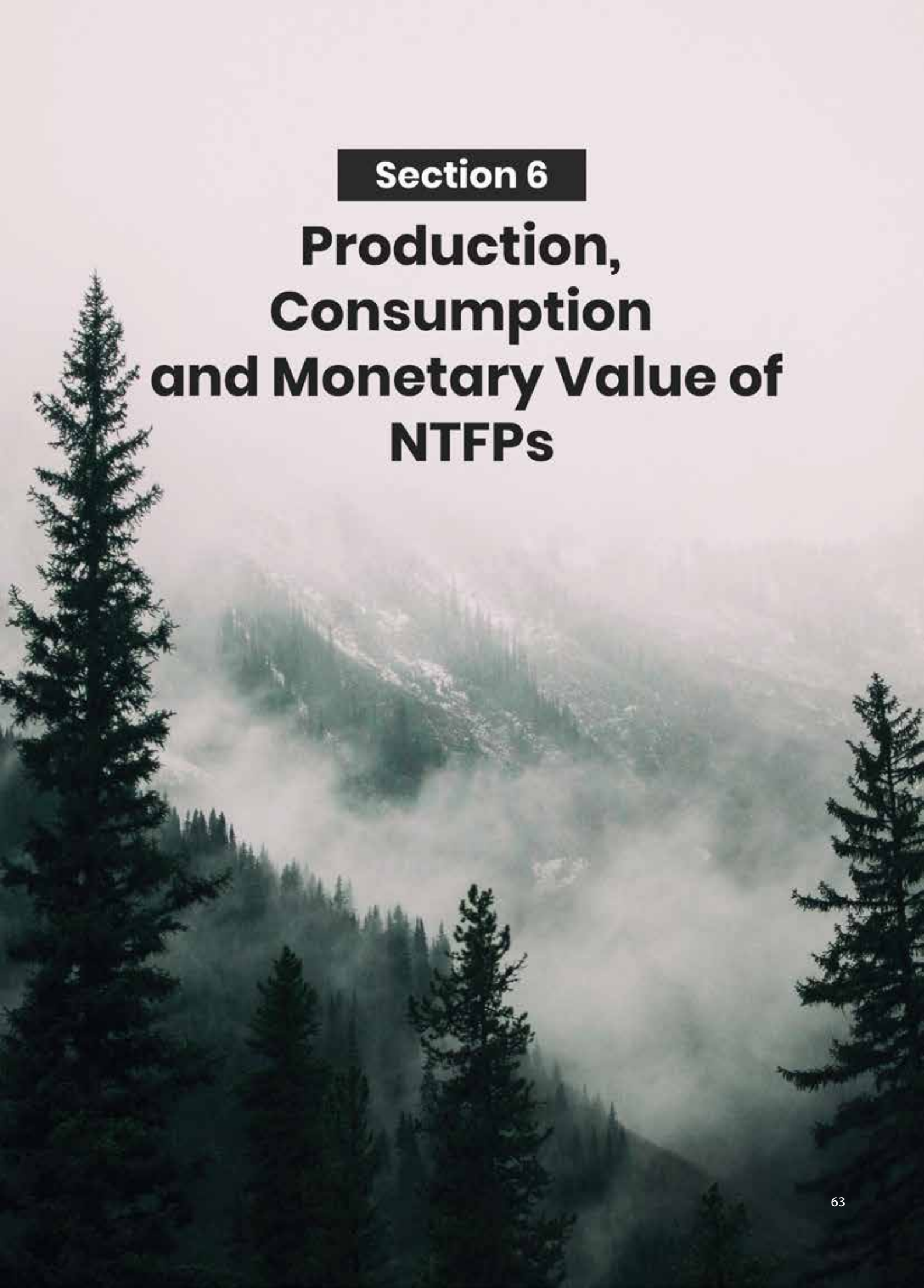
Table 38 gives detail of existing and projected demand, supply as well as the gap situation. Except for Balochistan province which persistently remains in a deficit position over time, in other provinces, the supply catches up with the demand and eventually exceeds it. A special boost is expected in the supply situation because of the large-scale afforestation programs launched in the country, especially in KP, Sindh, and Punjab provinces as well as AJK and GB (Annexure Table D20).

Table 38: Timber demand, supply comparison and gap (in million m³)

Demand/supply	2021	2025	2030	2035	2040
Demand	19.13	20.94	23.01	25.28	27.77
Supply	14.63	15.97	20.64	28.67	40.02
Gap	4.50	4.97	2.36	- 3.39	-12.25

To meet the current gap between demand and supply the government of Pakistan as well as different provinces will have to engage all stakeholders and undertake the following supply and demand side measures. Supply side measures include: raising of energy and industrial plantations, promotion of farm forestry and raising of trees on farmlands, promotion of different kinds of linear plantations (roads, canals, railway lines, river beds, etc.), planting of wood lots, planting of trees in homesteads and urban areas including the premises of various institutions (academic, health, security forces, etc.), increasing tree density and productivity of existing forest lands as well as rangelands/wastelands, and restoration of vegetation in different catchment areas and mobilization of WAPDA for the rehabilitation of catchment areas, and sponsoring the planting of trees on highways and motorways by NHA and Provincial Highways Authorities, etc.

Demand side measures include reduction of wood wastage and increasing efficiency in wood-using industries to reduce timber demand, promotion of fuel-efficient cooking stoves to reduce fuelwood demand, promotion of energy-efficient houses to reduce fuelwood demand for house heating, and promotion of solar, wind and hydropower energy sources to increase the availability of alternative energy sources.



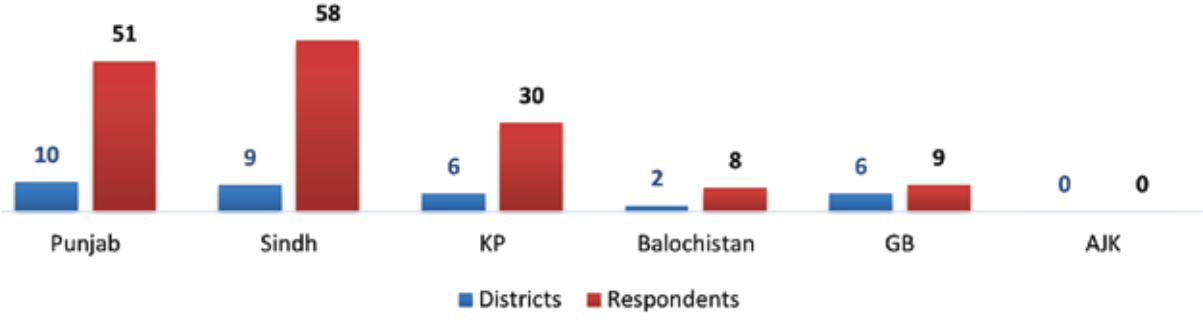
Section 6

Production, Consumption and Monetary Value of NTFPs

6.1. Demand and Supply Trend of NTFPs

For NTFP analysis all four provinces were covered, along with Gilgit-Baltistan and AJK regions. However, no proper functioning NTFP wholesale market was found by the field teams in AJK. Figure 17 shows the number of districts covered in each province. Districts were selected based on systematic sampling – which means that the provinces were divided into north, south, east, west, or central regions first. Afterward, the cities were chosen based on random sampling. NTFP whole markets and respondents were selected via purposive sampling, as was necessary for NTFP wholesale market analysis. In addition, 31 herbal companies in Sindh and 07 each in Punjab and Khyber Pakhtunkhwa were visited based on purposive sampling. Overall, a total of 33 districts were covered for NTFP analysis., comprising 158 respondents. Surprisingly, all the respondents that are involved in NTFP related economic activity were males. This is because females may take part in the primary extraction at the initial stages but they can hardly be seen in wholesale markets. This could be due to the socio-political environment and cultural norms.

Figure 17: Number of respondents and districts for NTFP



Source: Field Survey conducted by PIDE, 2022

Balochistan, AJK, and Gilgit-Baltistan had no proper NTFP-based industry, albeit they have a cottage industry with numerous herbal health practitioners, mixing herbs and making different products, but that was beyond the scope of this study. Moreover, the education level within this sector is observed to be basic. Punjab and KP are doing relatively better as these two provinces have a higher number of graduates, followed by Sindh, where the majority of the workforce is at least matriculated. The workforce in the rest of the regions was mostly below primary level education or is illiterate. In the herbal industry, except for 04 respondents in Sindh who had an intermediate, 01 matriculate, and 01 who had done middle school in Punjab, all the other respondents from all the provinces were graduates or above.

In terms of demand patterns for NTFPs, it can be deduced that overall demand for NTFPs has increased over the last four years. 67% of the respondents said that demand has increased, 18% said that it has decreased and 15% said no change. On shortage of NTFPs, 30% of respondents from across the country responded that there is no shortage at all, 52% said they face shortages to some extent and 19% reported a lot of supply shortages.

The qualitative responses from the field survey show that the price of NTFPs - which are also used in the herbal industry - is usually set according to the market forces/-supply and demand framework. Though, the monopolistic role of big NTFP markets cannot be ignored. Respondents were of the view that bigger markets such as Akbari Mandi in Lahore purchase NTFPs in bulk and have an upper hand in setting the market price. In some places, an auction or negotiated price mechanism also prevails. Moreover, if the product is being imported or exported then the dollar rate and oil prices become significant factors in the equation for price setting. These fluctuations proportionally translate into the herbal industry as well.

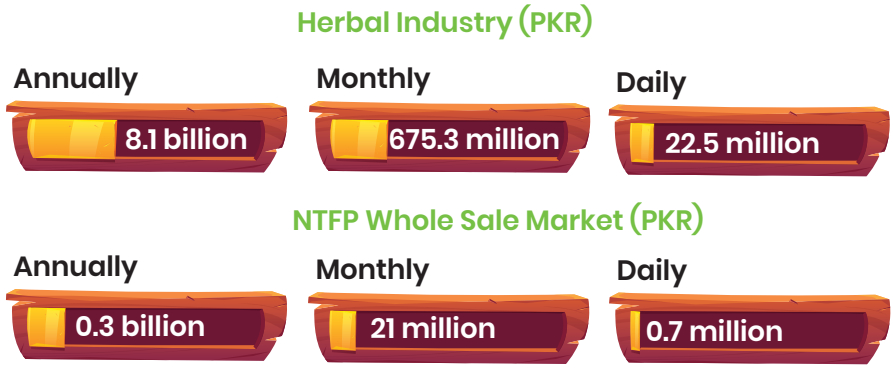
6.2. Monetary Value of NTFPs

For gauging the monetary value of the economic activity related to the herbal industry and NTFPs, field teams visited all the four provinces, Gilgit-Baltistan and AJK. The proposed sample size for this component was 200 but ended up at 203. The teams engaged with 158 respondents for NTFPs wholesale market analysis. The respondents were representatives from the wholesale markets across Pakistan. For herbal industry analysis, 45 herbal companies were visited. Regarding the herbal industry, the calculated monetary value of each company – is taken as the price of their final products and multiplied by the quantity each produced during one year. So, the average monetary value of each herbal company amounted to PKR 64.8 million. The forest officials were consulted and secondary sources explored for the actual number of herbal companies across the country and the number was roughly 125 companies. Though, it is pertinent that these are just registered companies. Hence, multiply the average monetary value of a company from the sample of the study by the total number of registered herbal companies, the number of PKR 8.10 billion emerged. This means that the monetary value of economic activity from the herbal industry is PKR 8.10 billion per year. Implying that PKR 22.5 million of herbal business activity is happening daily in the country.

The average of all the shops of those NTFP wholesale market dealers is PKR 358,465 per year. Afterward, according to forestry officials, a rough estimate of the number of NTFP wholesale markets across Pakistan is around 74. Though, this report supposed the number to be 70 to nullify any exaggeration. Now on average, this report supposed 10 shops at least in each wholesale market. So, with simple multiplication, the estimated monetary value is around PKR 0.25 billion per year, 21 million per month, and 0.70 million per day.

Surprisingly, there is no NTFP market in AJK; though a significant amount of raw material originates from there. Having said that, there seems to be a stark difference between what is visible and what is reported. There was a strong impression that NTFP dealers are under-reporting. Dry fruit, especially pine nuts, almonds, etc. are very expensive and there is huge economic activity regarding exotic dry fruits in Baluchistan and Khyber Pakhtunkhwa. Therefore, the NTFP value appears to be under-reported by a huge margin. In contrast, NTFP usually operates within raw stuff, whereas the herbal industry makes value addition and sells at much larger profitability margins (Table 39).

Table 39: Monetary value of the herbal industry and NTFP wholesale market



Source: Field Survey conducted by PIDE ,2022

The analysis on the provincial level shows that no proper registered herbal company exists in Balochistan, Gilgit-Baltistan, and AJK, though many of the raw materials come from there. The herbal industry is based largely in Sindh, Punjab, and Khyber Pakhtunkhwa. Sindh tops the list with PKR 4.21 billion per year of economic activity – due to a lot of economic activity and demand in the four urban districts of Karachi. It is then followed by Punjab amounting to PKR 3.11 billion per year, and lastly, Khyber Pakhtunkhwa generating an economic activity equivalent to 0.77 billion per year. Similarly, at the provincial-level NTFP wholesale markets, Sindh accounts for PKR 118.28 million per year, followed by Punjab PKR 93.92 million, and KP takes PKR 24.35 million out of the total pie. Then comes GB and Balochistan taking only one percent of the pie each, equivalent to PKR 3.48 million per year.

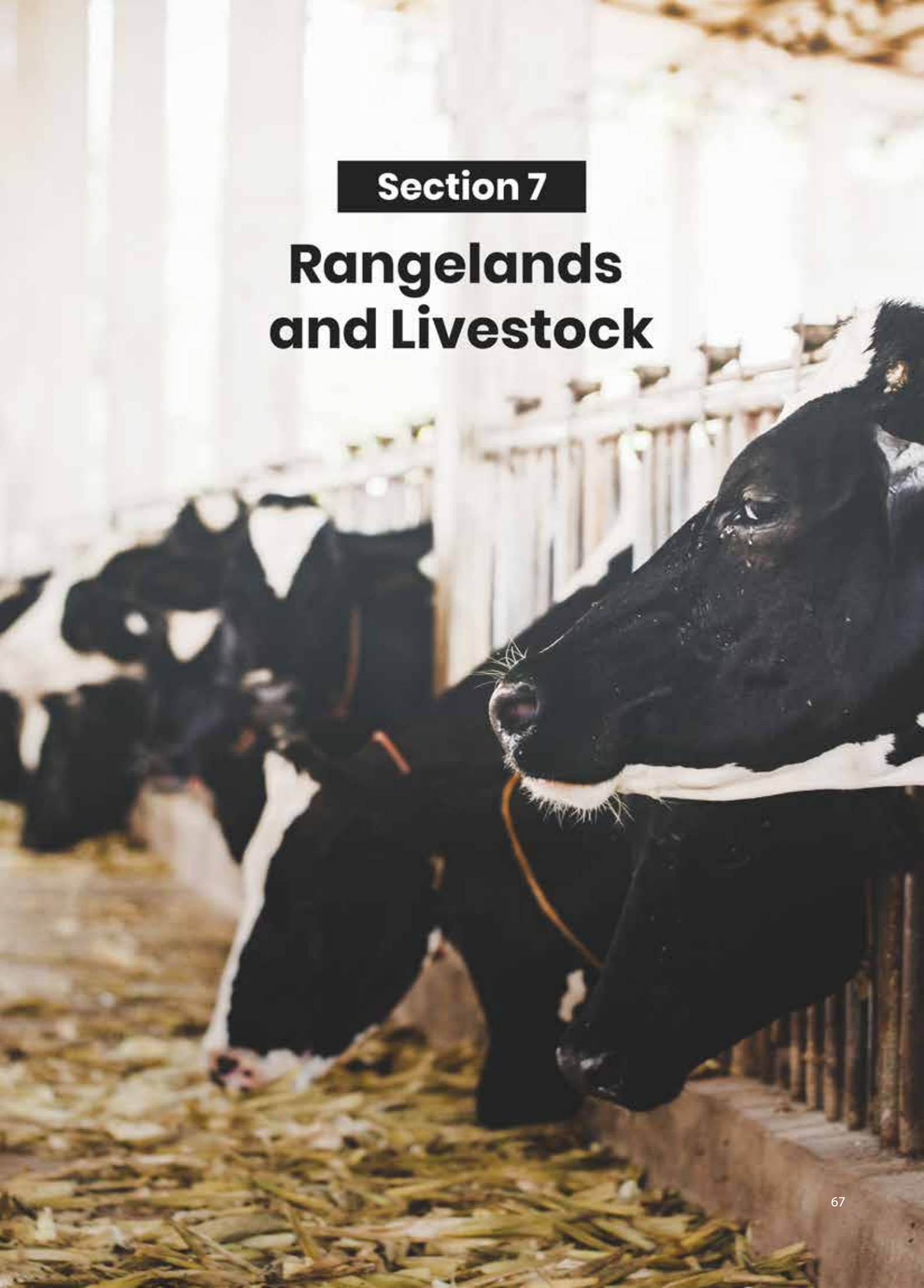
6.3. Sustainability Challenges and Future Outlook

Overall constraints in the purchase of NTFPs and roadblocks in herbal industry that affect the businesses include: road infrastructure, matching skilled human resource, proper transportation mechanism for NTFPS and herbal products, and the absence of a proper market. Besides, stagnant trade relations with India and Afghanistan (as many of NTFPs or herbal products are either traded to or from these two countries) and volatile oil prices add to the miseries of people involved in this business.

The key challenges in NTFP and herbal trade, include no platform for showcasing their products, compliance cost of getting permits, high customs duties on a few products, lack of any proper policy framework to encourage the economic activity related to NTFPs and the herbal industry.

In addition to that, at least 15-20 percent of NTFPs are damaged or perish during transportation from the primary source to the market. This, in part, also happens due to poor quality or poor packaging skills along with little know-how of using dry NTFPS and herbals.

Case studies regarding NTFPs conducted across Pakistan are placed in Annexure E.



Section 7

Rangelands and Livestock

7.1. Forage Production from Rangelands

Rangelands are multifunctional areas and produce a number of products and services, due to which they have economic, ecological, social, and cultural importance. Forage production is an important function of rangelands. Forage production from rangelands, like other ecosystem goods and services from rangelands, depends on the extent, health, productivity, and adoption of proper grazing and management practices. Forage production from rangelands critically depends on many factors, which include: the degree of soil stability and watershed function, the integrity of nutrient cycles and energy flow, and the presence of productive function mechanisms.

Most of the rangelands in Pakistan are not in healthy condition and their ability to produce distinctive kinds and amounts of forage/vegetation is compromised on account of over-exploitative grazing practices and lack of resources invested into the protection, rehabilitation, and restoration of degraded rangelands. As a result, the current forage and other ecosystem services production of rangelands are below their actual potential.

The National Rangelands Policy 2010 recognizes this fact based on the baseline analysis done by the then Ministry of Environment (now the Ministry of Climate Change). It says that the current productivity of the majority of rangelands varies from 25-50% of their potential. Table 40 gives the existing production from and potential from different rangelands types in Pakistan.

Also, there is an adverse trend in the species composition found in these rangelands. Non-palatable weed species which are not consumed by livestock are now occupying up to 40% of the land area in rangelands. It is estimated that the spread of weeds and toxic plants has increased by 30%. Besides, the foliar cover of the majority of rangelands has decreased and gone down to as low as 27% of the potential. These negative trends contribute to not only the low productivity of rangelands but also other negative effects on rangelands such as higher rates of soil erosion (Ahmad et al., 2012).

Table 40: Current productivity and production potential of different rangelands types in Pakistan

Rangelands Type	Area (million ha)	Current per ha dry matter production (tons/ha)	Total dry matter production under existing conditions (metric tons)	Potential per ha dry matter production (tons/ha)	Total dry matter production under improved conditions (metric tons)	Total increase in dry matter production due to improvement measures (metric tons)
Alpine Pastures	1.68	1.5	2.52	2.50	4.20	1.68
Trans-Himalayan Grazing lands	3.50	0.6	2.10	2.00	7.00	4.90
Himalayan Forest Grazing lands	0.67	0.6	0.40	3.00	2.01	1.61
Pothowhar Scrub rangelands	1.68	1.5	2.52	4.00	6.72	4.20
Desert rangelands	7.97	0.5	3.98	2.00	15.94	11.96
Kohistan rangelands	2.38	0.4	0.95	2.00	4.76	3.81
Central Balochistan rangelands	8.00	0.5	4.00	1.00	8.00	4.00
Eastern Balochistan rangelands	5.00	0.4	2.00	1.50	7.50	5.50
Western Balochistan rangelands	18.50	0.3	5.55	0.80	14.80	9.25
Sulaiman Mountain rangelands	1.50	0.3	0.45	2.00	3.00	2.55
Total	**50.88**	-	**24.47**		**73.93**	**49.46**

Source: Mohammad, 1989. National Rangelands Policy of Pakistan, 2010.

7.2. Livestock Dependency on Rangelands

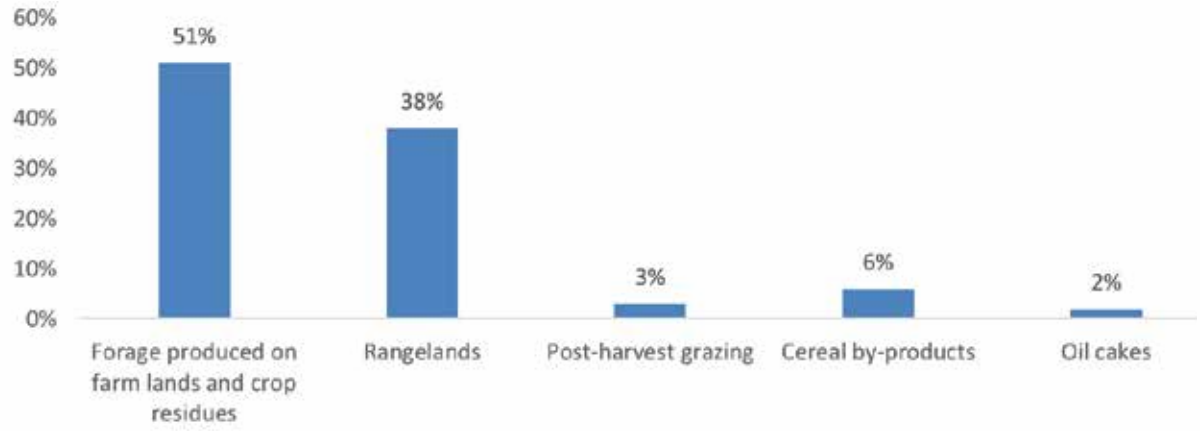
Total livestock feed requirements in the country are estimated at 103.12 million tons of Total Digestible Nutrients (TDN) and 9.36 million tons of Digestible Protein (DP) for an estimated livestock population of 212.9 million heads. These feed requirements have been calculated at 70 to 80 percent of the potential requirements to exploit the full genetic resources of the livestock breeds of the country. The estimated feed requirements exceed the availability of feed from different types of lands.

Available livestock feed resources in Pakistan are estimated to be 81.1 million tons of total digestible nutrients (TDN) and 7.2 million tons of digestible protein (DP). Thus, the existing feed resources cater to only 78% of the feed needs of the livestock breeds found in Pakistan (Iqbal and Iqbal, 2015). Therefore, the availability of feed resources from different types of land, especially rangelands is an important concern for the promotion of the livestock sector in the country, which needs to be addressed on a priority basis.

Livestock feed is obtained from a variety of sources. These include grains and fodder crops grown on farmlands as well as grazing of livestock on stubs of harvested crops, livestock grazed in rangelands and alpine pastures lands, and livestock grazing in other lands which include forest lands, wastelands, roadsides, and riverbanks.

Of the available feed supply sources, it is estimated that the crop sector contributes about 60% of the TDN, while the rangelands and other lands (forest lands, wastelands, riverbanks, and roadsides) respectively contribute 13% and 27% of the total dry matter. Thus, overall, about 40% of the feed resources for livestock rearing come from lands under the management responsibility of provincial forest departments. The dependence of livestock on rangelands, however, varies by type of livestock. For certain types of livestock, such as goats, sheep, and equines in mountainous areas, the feed resources primarily come from rangelands, forest lands, wastelands, riverbanks, and roadsides. For buffaloes and cattle raised on dairy farms and other cattle farms, feed primarily comes from farmlands. At the country level, the shares of different feed sources in the nutrient supply for livestock are given in Figure 18.

Figure 18: Share of different feed sources in nutrient supply for livestock (% distribution)



Source: Iqbal and Iqbal, 2015

livestock raising is the prevailing practice. Table 41 gives the dependence of livestock on different sources of feed in different provinces. The province-wise results are placed in Annexure Table D15.

Table 41: Livestock dependence on rangelands/grazing lands

	Buffalo	Cattle	Goat	Sheep	Camels	Asses	Horses	Mules
Livestock in millions	42.2	51.5	80.3	31.6	1.1	5.6	0.4	0.2
Per capita feed requirement (daily in KGs)*	13.5	9	2.7	2.25	15.3	9	11.7	9
Livestock dependent on Rangelands	1.9	9.6	49.8	23.9	0.7	0.8	0.2	0.7
No. of days in a year stall-fed or raised on feed grown on farmlands	329	36	29	20	20	73	73	73
No. of days in a year fed or raised through open range grazing in range lands, forest lands, shrubs, bush lands, river banks and roadsides vegetation	36	329	336	345	345	292	292	292
Annual fodder production from rangelands (million tons)	1.426	27.603	45.586	18.808	3.581	2.234	0.556	1.912

* Afzal, J., Ahmed, M. and Begum, I., 2008. Vision for Development of Rangelands in Pakistan - A Policy Perspective. Quarterly Science Vision, 14(1), pp.53-58.

7.3. Rangelands Contribution to the Livestock Sector

Out of the total land area of Pakistan of 88 million ha, about 50.88 million ha are grazing lands, which constitute about 57% of the land area of Pakistan. The extent of rangelands in different parts of the country varies. Balochistan has about 97% of its area under grazing lands, while the proportion of grazing land area out of the total land area in AJK, GB, KP, Punjab, and Sindh are 64 %, 61%,35%, 24%, and 21% respectively. Close to about 65% of the land area in the country is under the management responsibility of different provincial departments. All these lands are managed by the provincial forest departments. Add to this the riverbanks and roadside areas where provincial forest departments manage vegetation. The extent of rangelands, shrubs, and bushlands, and forest lands, which are used for livestock grazing in different parts of Pakistan is given below:

Table 42: Extent of rangelands, shrubs, and bushland, and forest lands (000 ha)

Province	Rangelands	Shrubs and Bush Land	Forest Land	Total Area used for livestock grazing	Total Land Area	Proportion of land used as grazing land (%)
KP	1,974	880	2,698	3,578	10,182	35.14
Punjab	3,759	698	534	4,992	20,548	24.29
Sindh	1,837	585	661	3,083	14,364	21.46
Balochistan	29,094	4,597	499	34,190	35,195	97.14
GB	3,096	183	974	4,252	6,981	60.91
AJK	153	80	520	752	1,179	63.79
ICT	10	3	20	33	90	37.20
Total	**37,949**	**3,065**	**5,905**	**50,880**	**88,539**	**57.47**

Source: PFI, 2012.

Feed is recognized as the most important element of the cost of production of livestock, forming 70-90% of the cost of its production, as per the existing literature on the topic. Given that 57% of the total land is used for grazing. Hence, this contribution of the forestry sector to the livestock sector, which is currently reflected as the contribution of the livestock sector, needs to be recognized and duly accounted for when estimating the full GDP contribution of the forestry sector. Table 42 shows the contribution of forage used by livestock in different provinces to the livestock which is currently reflected in the livestock sector but should be reflected in the forestry sector.

Thus, at the national level, a significant amount is reflected as the contribution of the livestock sector, part of this is the contribution of forage produced in grazing lands which are managed by the provincial forest departments. Similarly, the grazing lands of each province are contributing to GDP but are reflected as the contribution of the livestock sector, which is the contribution of the forestry sector to the provincial GDP. This accounting anomaly needs correction.

In addition to their contribution to the livestock sector, rangelands also contribute to timber and fuelwood production, production of various types of NTFPs, biodiversity conservation, watershed protection, carbon sequestration, and provide other social and cultural benefits to the local communities. Relative values of these other goods and services, when estimated systematically and consistently using appropriate economic valuation techniques, can provide information about the total economic, ecological, social, and overall monetary values of rangelands' contribution to GDP.

Since the rangelands provides fodder to the livestock, therefore this report has adopted the following methodology to calculate the value of fodder provided by rangelands to the livestock:

i. The share of livestock was calculated that is dependent on rangelands. The proxies are used by considering the geographical variation, in consultation with experts.

ii. The number of days in a year fed or raised through open range grazing in rangelands, forest lands, shrub and bush lands, riverbanks, and roadsides vegetation are used to quantify the annual value.

iii. The household survey provided the shadow prices of fodder. These prices are used to quantify the annual value.

iv. Using the shadow prices of fodder and above information, the value of fodder produced from the rangelands is calculated.

Table 43 shows that overall, 87.6 million of the livestock is dependent on rangelands which provides an annual fodder value of PKR 1394.10 billion to the country.

Table 43: Economic value of fodder produced from rangelands by cattle

Livestock type	Livestock dependent on rangelands (million)	Value of fodder (in PKR Billion)
Buffalo	1.9	19.5
Cattle	9.6	378.2
Goat	49.8	624.5
Sheep	23.9	257.7
Camels	0.7	49.1
Asses	0.8	30.6
Horses	0.2	7.6
Mules	0.7	26.2
Yaks	0.0	0.7
Total	**87.6**	**1394.10**

Source: Field Survey of PIDE, 2022

Table 44: Economic value of fodder produced from rangelands by province

Livestock type	Livestock dependent on rangelands (million)	Value of fodder (in PKR Billion
Khyber Pakthunkhwa	12,165	190.77
Punjab	16,229	254.33
Sindh	19,435	310.96
Balochistan	34,175	537.32
AJK	2,644	53.15
GB	2,999	47.59
Total	**87.6**	**1394.10**

Source: Field Survey of PIDE, 2022

Section 8

Forest Based Ecosystem Services

8.1. Forest Based Tourism Services

Forests are the main source of tourism in the country as most of the tourism in Pakistan is centered in the northern areas where various attributes of forests prevail including lakes, wildlife, mountain landscape, national parks, etc. The ongoing study has captured the data from 20 sites where both the profiling and interviews with tourists were carried out. The profiling captures the annual visitors whereas the interviews with tourists have captured the cost of tourism. Around more than 7 million tourists have visited the selected 20 sites across the provinces. The highest visited places are Punjab (Murree, Margla hills, Kallar Khar), followed by Khyber Pakhtunkhwa. In Balochistan, three sites were selected, i.e., Quetta and Kund Malir where most of the tourists just spend the daytime; however, in GB, day spending by tourists is the highest. The travel time is also the longest to GB and KP as compared to the other provinces (Table 45).

Table 45: Tourist profiling data

Province	Number of Tourists (in 000)	% share	Average days spend (in number)	Distance traveled (one way in KM)
AJK	670	9.37	1.9	300
Balochistan	209	2.92	0.8	280
GB	728	10.18	6.3	1100
KP	2,282	31.91	2.0	450
Punjab & ICT	3,232	45.19	1.2	66
Sindh	30	0.42	1.7	90
Total	**7,151**	**100**	**2.0**	**200**

Source: Field Survey of PIDE, 2022

Various tourism associated attributes inspire the tourists to visit selected sites. As shown in Table 46, the main attributes of forest-based tourism are mountain landscapes, lakes, hiking, and cultural and archeological heritage. A few issues may also be noted with the data. First, the data was collected in winter, therefore, some reported attributes may be biased due to weather conditions. For example, trekking and forest landscape may change in the summer season.

The convenience attributes also matter as they cover various aspects including affordability, risk behavior, type of tourism (alone or family) along with available facilities. Table 47 shows that the convenience factors vary across regions. For example, the selection of AJK sites highly depends on near home, weather conditions, and financial affordability. Security matters a lot in Gilgit-Baltistan. Road infrastructure matters for Punjab and AJK.

Table 46: Touristic attributes for selecting the tourist point (% distribution)

Attributes	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Forest landscape	1.0	1.9	0.0	13.7	9.1	0.0	4.3
Mountain landscape	31.6	2.5	14.7	26.1	17.1	30.8	20.5
Hiking	3.1	48.1	10.9	8.0	0.5	16.4	14.5
Trekking	3.1	0.6	6.6	5.7	0.0	9.1	4.2
Lakes	53.1	1.3	21.3	11.7	21.6	0.0	18.2
Wildlife	0.0	4.4	13.2	13.4	0.0	0.0	5.2
National parks	0.0	26.0	10.0	2.7	2.5	20.5	8.0
Cultural heritage/archeological	8.2	12.0	9.6	12.3	31.4	9.4	16.1
Sports festival	0.0	0.0	12.0	6.4	16.1	6.1	6.8
Others	0.0	3.2	1.6	0.0	1.7	7.7	2.4
Total	100	100	100	100	100	100	100

Source: Field Survey of PIDE, 2022

Table 47: Convenience attributes for selecting the tourist point (% distribution)

Attributes	AJK	Balochistan	GB	KP	Punjab	Sindh	Overall
Good road infrastructure	11.2	0.0	3.3	2.0	12.1	0.0	5.7
Near to home	24.5	5.7	4.9	2.7	32.8	5.1	15.2
Less land sliding	0.0	0.6	1.6	0.0	1.0	0.0	0.6
Good hotel facility	3.1	0.0	9.8	2.7	0.5	0.0	2.0
Weather condition	27.6	16.5	14.8	56.4	14.1	15.4	25.6
Financial affordability	16.3	73.4	4.9	24.2	27.8	71.8	36.1
Availability of public transport	6.1	2.5	3.3	1.3	1.5	2.6	2.6
Better security	8.2	0.6	36.1	8.1	3.0	0.0	7.0
Availability of emergency services	0.0	0.0	1.6	0.7	0.5	0.0	0.4
Others	3.1	0.6	19.7	2.0	6.1	5.1	4.7
Total	100	100	100	100	100	100	100

Source: Field Survey of PIDE, 2022

Since tourism to GB, AJK, and KP has more distances, therefore, per person cost is also high in these regions. Table 48 has detailed the per person cost and the total value of tourism on selected 20 sites. Overall the cost of tourism is around 62.4 incurred by tourists. It has a lot of spillover effects including a complete value chain of the hotel industry, various shopping activities, and employment in the area. Tourism is the main source of income for the communities residing in most tourist points. Mostly seasonal tourism in various areas, i.e., Neelum, Swat, and GB provides the main livelihoods and contributes to the local economy. However, tourism in Pakistan requires a policy focus where it must be environment-friendly by protecting the environment and culture.

Table 48: Approximate welfare from tourism

Province	Average Per person cost of tourism	Total value of tourism (in Billion PKR)
AJK	12,844	8.6
Balochistan	5,424	1.1
GB	17,964	13.1
KP	13,980	31.9
Punjab	2,333	7.5
Sindh	3,576	0.2
Overall	**8,585**	**62.4**

Source: Field Survey of PIDE, 2022

Table 49 shows the cost incurred by the tourists in various heads. The key components of the cost are transport and accommodation.

Table 49: Cost share by various components (% distribution)

Province	Transport	Hotel	Recreation	Shopping	Medicine	Total
AJK	48.0	49.5	1.0	1.4	0.0	100
Balochistan	46.8	53.0	0.0	0.2	0.0	100
GB	66.4	18.1	0.9	11.9	2.8	100
KP	47.1	45.6	0.2	6.7	0.4	100
Punjab	62.9	23.1	9.5	4.3	0.3	100
Sindh	52.0	43.8	1.1	3.1	0.0	100
Overall	**53.2**	**39.6**	**3.1**	**3.9**	**0.3**	**100**

Source: Field Survey of PIDE, 2022

8.2. Water and Soil Conservation Services

Forests and well-vegetated rangelands/pastures lands play an important role in protecting watersheds and flood plains areas of our river basins by regulating water flows (their timing, quantity, and quality) and protecting landscapes, infrastructure, and soil by preventing, controlling, and minimizing landslides and erosion. Therefore, this case study identifies, assesses, quantifies, and evaluates the forest ecosystem pertaining to soil and water conservation services. For this purpose, the study utilized the secondary data sets obtained through satellite imagery and published documents in the form of research papers, reports, etc. We assessed, quantified, and valued the watershed services of different forest types found in various sub-national units in the country.

Regulating hydrological, soil, nutrient, and sediment cycles are recognized as one of the important forest ecosystem's regulatory functions. Pakistan is one of the most water-stressed countries, and the situation is getting worse due to climate change. According to the Pakistan Council of Research in Water Resources, Pakistan hit the "water stress line" in 1990, and the "water scarcity line" in 2005, and will

reach the "absolute scarcity" level by 2025.

Following the methodology, as detailed in section 2, this section quantifies the contribution of forest ecosystem services to soil erosion and sediment retentions identified and mapped in the catchment areas of the major reservoirs in the country, including Diamer, Gomal, Hub, Mangla, Tarbela, Warsak, Khanpur, Sabakzai, Satpara, and Mirani. Since directly quantifying the exact contribution of these forest ecosystem services in a long-term process (and beyond the project length), the present study primarily evaluated the forest ecosystem services by geographically quantifying the forest cover and rangelands areas in the watersheds. Regarding this, following two proxies were used:

- More vegetative cover in an area decreases the annual soil loss (Zokaib & Naser, 2011).
- Rising forest levels upstream of the pivot point (dam) increase sediment retention (Haq, 2011)

Table 50 shows the intensity of annual soil loss (ton ha-1 year-1) in Pakistan's main watersheds. A watershed is quantified for four intensity classes ranging from Very Weak (0 – 2 t ha-1 y-1), Weak 2-5 t ha-1 y-1, Moderate 5-15 t ha-1 y-1, and Strong (>15 t ha-1 y-1). These areas are then related to the different land use classes to indirectly quantify the contribution of forests to avoid soil erosion and retain sediments.

Table 50: Intensity of annual soil loss (ton ha-1 year-1) in Pakistan's major watersheds

Watershed	Annual Soil Loss (ton ha^{-1} $year^{-1}$)							
	Very Weak ($0 – 2$ t ha^{-1} y^{-1})		**Weak** ($2-5$ t ha^{-1} y^{-1})		**Moderate** $5-15$ t ha^{-1} y^{-1}		**Strong** (>15 t ha^{-1} y^{-1})	
	Area (000 ha)	Area (%)	Area (000 ha)	Area (%)	Area (000 ha)	Area (%)	Area (000 ha)	Area (%)
Diamer	15,915	93.34	987	5.79	142.2	0.83	4.980	0.029
Gomal	3,247	95.76	118	3.46	25.4	0.74	0.830	0.024
Hub	385	90.73	34	8.07	4.4	1.04	0.610	0.142
Khanpur	50	93.00	3	6.05	0.5	0.89	2.278	0.042
Mangla	3,189	96.45	104	3.13	13.2	0.39	0.340	0.010
Mirani	2,265	97.14	58	2.48	8.8	0.37	0.020	0.00092
Sabakzai	68	92.85	5	6.34	0.5	0.73	0.040	0.058
Satpara	11,438	93.71	694	5.68	72.3	0.59	1.480	0.012
Tarbela	18,085	96.72	601	3.21	10.1	0.05	1.280	0.0068
Warsak	6,664	96.56	213	3.08	23.5	0.34	0.310	0.00445

Figure 19: Contribution of forest and rangelands/pastures to soil erosion stoppage in Tarbela dam

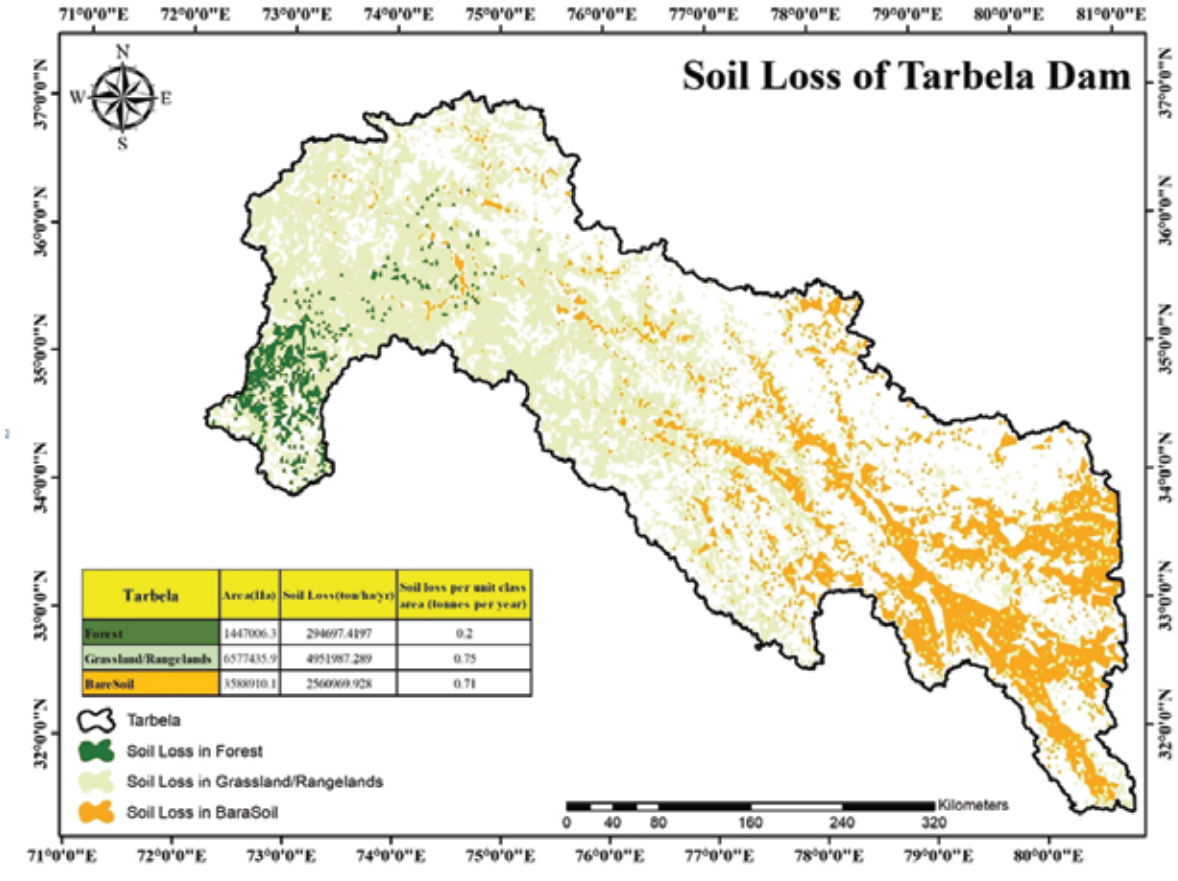
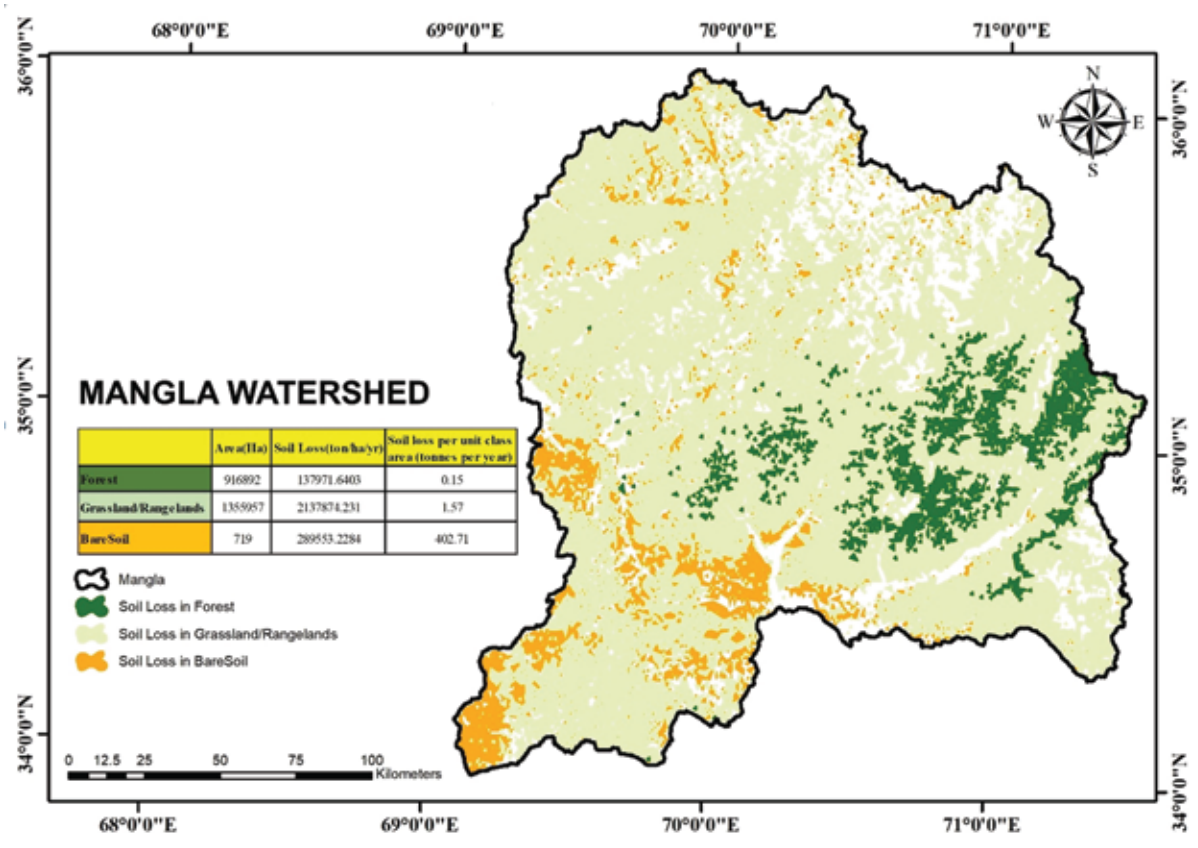


Figure 19 shows the delineated watershed area (19006600 ha) of the Terbela dam. About 1.86% (1447006 ha) of the total area contains forests, whereas 28.3% (6577435.9 ha) provides grasslands/rangelands within the Terbela watershed. A significantly low soil loss (0.2 t ha-1 y-1) for the forest unit class can be seen compared to that for bare soil (0.71 t ha-1 y-1). Dominant forest and Grassland/Rangelands classes have been observed upstream of the dam. However, the total bare lands are relatively higher, indicating low sediment retention contributed by forest and grasslands for the Terbela dam. However, the contribution of forests and rangelands to soil conservation is somewhat more significant.

Figure 20 shows Mangla Dam's delineated watershed area (3,345,100 ha). About 27.13% (916,892 ha) of the total area contains forests, whereas 43.13% (1,355,957 ha) provides the grasslands/rangelands within the Mangla watershed. Soil loss per unit class area is significantly high for the bare soil (402.71 t per year) compared to the forest class (0.15 t per year). Taking the treatment cost of eroded soil in the US ($7.03 per ton of soil), forest area saved about $5,475,814 in preventing soil loss. Table 50 shows a 0.010% (340.97 ha) area with strong intensity of soil loss (>15 t ha-1 year-1), which is significantly low due to the high percentage of forest cover in the watershed. The total vegetation cover is more elevated than bare land, indicating high sediment retention for the Mangla Dam, which is contributed by 70% of the vegetation classes' watershed area.

Figure 20: Contribution of forest and rangelands/pastures to soil erosion stoppage in Mangla dam



	Area(Ha)	Soil Loss(ton/ha/yr)	Soil loss per unit class area (tonnes per year)
Forest	916892	137971.6403	0.15
Grassland/Rangelands	1355957	2137874.231	1.57
BareSoil	719	289553.2284	402.71

Figure 21 shows the forest classes identified in the delineated catchment area of the Diamer water reservoir. Table 50 indicates the forest and rangelands/pastures classes in the Diamer watershed significantly contribute to stopping soil erosion. Soil loss per unit class area of these classes (0.68 t per year) is comparable with that from the bare soils (0.79 t per year). The total area of the watershed is 17,231,000 ha with 1,706,217 ha of forests, whereas the rangelands/pastures class dominates the watershed with 6,076,638 ha. However, 15.64% of the watershed area covers bare soil, which indicates a high contribution of forests and grasslands to sediment retention.

Figure 21: Contribution of forest and rangelands/pastures to soil erosion stoppage in Diamer Dam

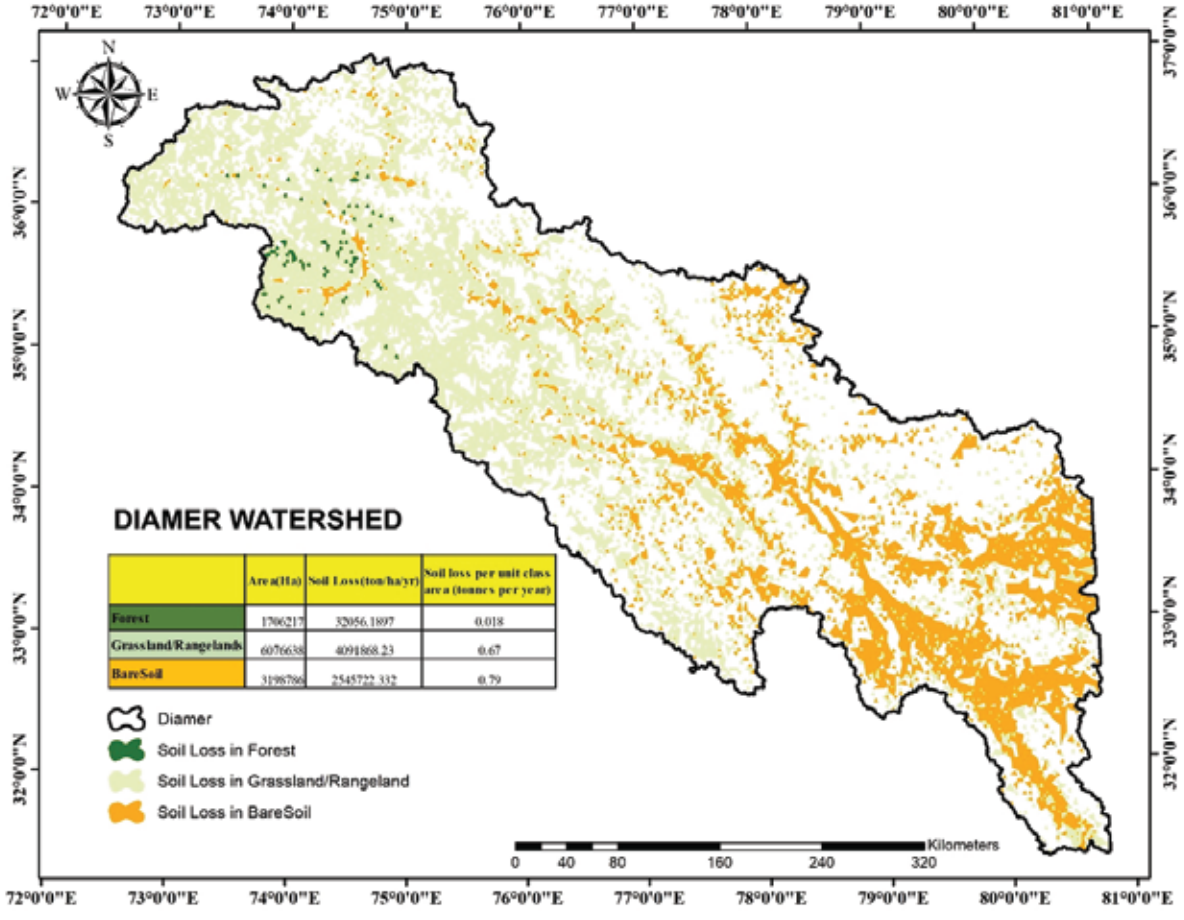
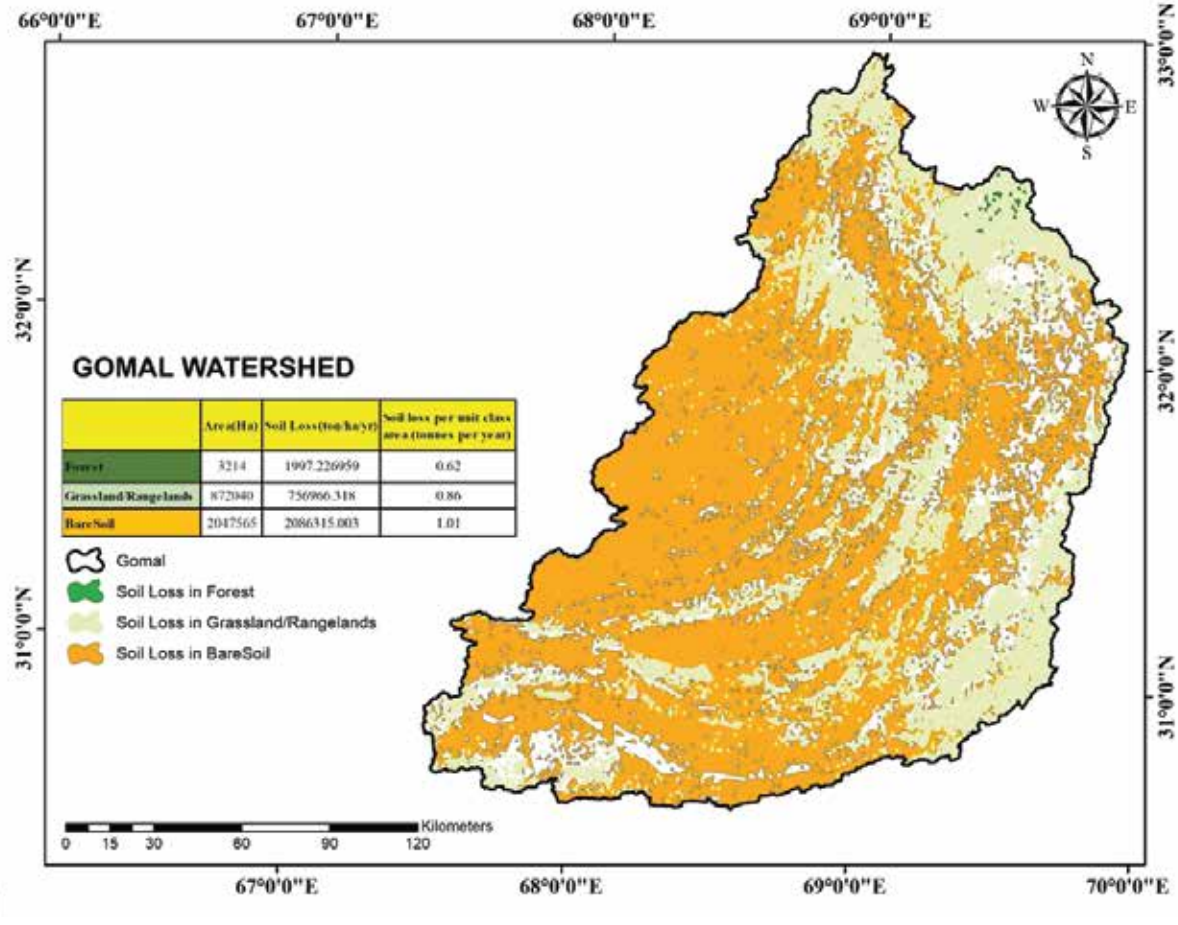


Figure 22 shows the delineated watershed area (3,422,800 ha) of the Gomal dam. Only 3,214 ha of watershed land contains forests (i.e., 0.09%), whereas 25.85% (872040 ha) of the watershed land contains grasslands/rangelands. Table 50 shows a 0.024% (833.75 ha) land with strong intensity of soil loss (>15 tons ha-1 year-1). The bare land is 59% of the total watershed land, which indicates a very low contribution of land use land cover to sediment retention for the Gomal Dam. However, the contribution of forests and rangelands to soil conservation is relatively more significant. Only 833.75 ha of land is currently experiencing strong annual soil loss greater than 15 t ha-1 y-1.

Figure 22: Contribution of forest and rangelands/pastures to soil erosion stoppage in Gomal Dam



The total watershed area of the Khanpur Dam is 78,500 ha (see Figure 23). Out of the entire watershed area, 17.24% of the land, i.e., 13,633 ha, contributes to forests, whereas 29.44% of the land (2,3278 ha) is grassland. Bare soil is negligible compared to the total vegetation land, indicating high sediment retention. Presently, only 2,278 ha of land is expecting strong annual soil loss (see Table 50).

Figure 23: Contribution of forest and rangelands/pastures to soil erosion stoppage in Khanpur Dam

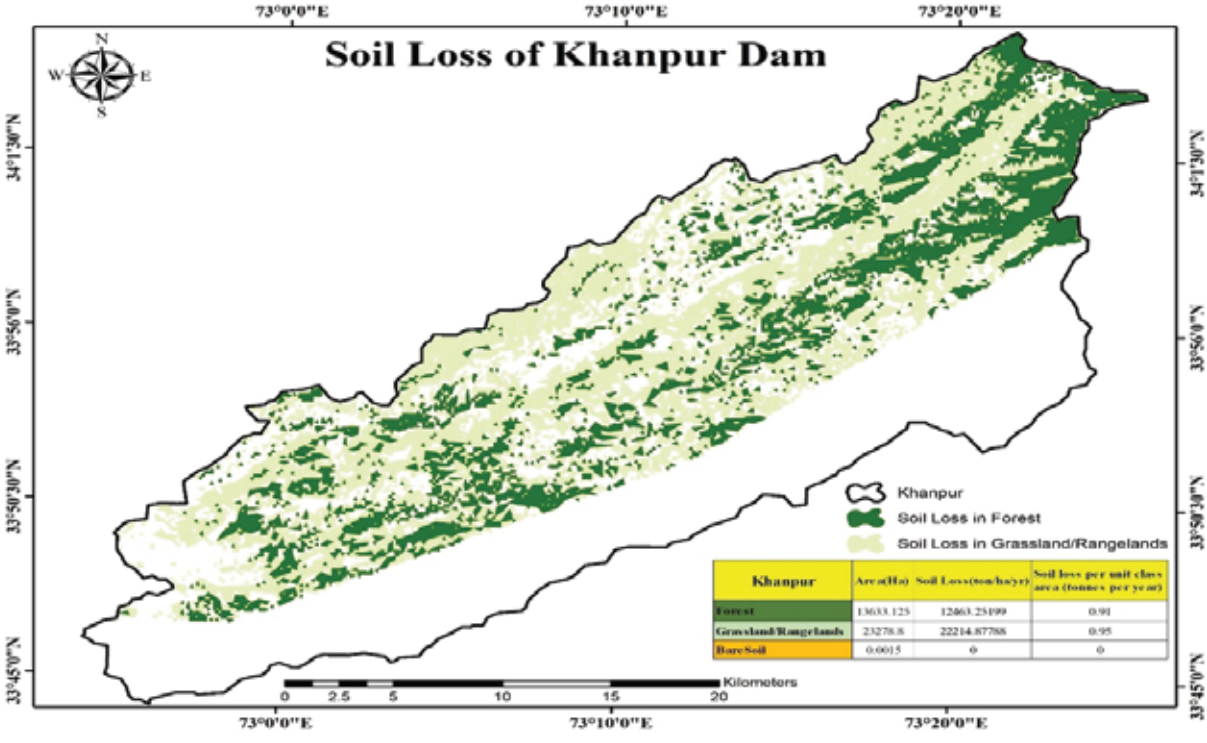
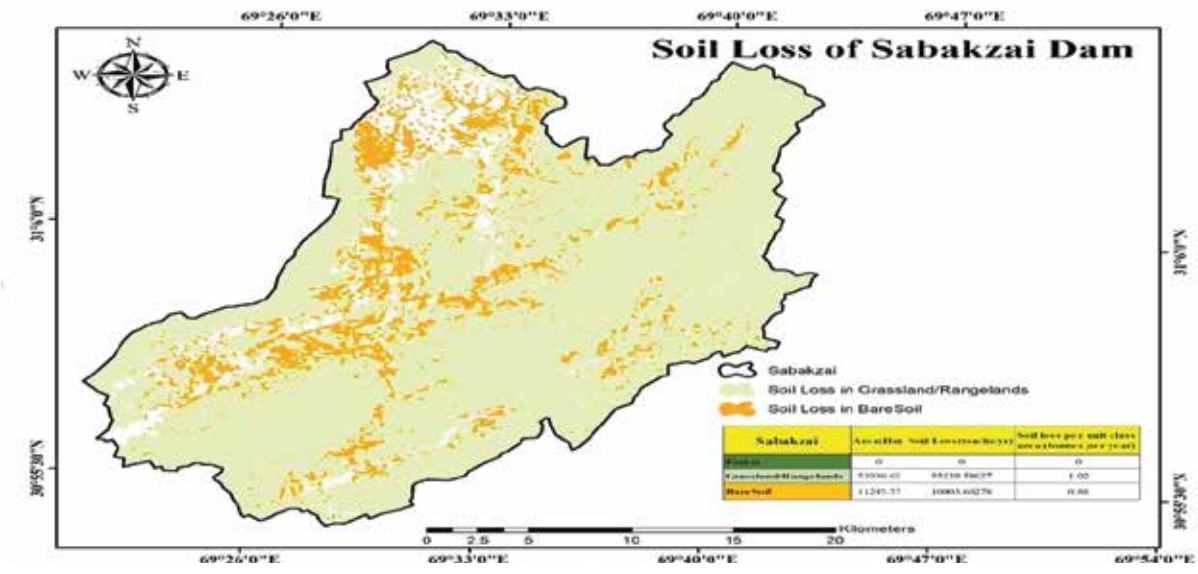


Figure 24 shows the delineated watershed area (74,200 ha) of the Sabkzai Dam. Forest areas (0.09%) in the watershed land are negligible, whereas 25.85% (53,930 ha) of the watershed land contains grasslands/rangelands. About three fourth of the area of the Sabakzai watershed comprises rangelands/pastures. The watershed also contains about 16% of the total watershed area with higher bar soils. However, only 0.058% (42.35 ha) of land indicates the strong intensity of soil loss (>15 tons ha-1 year-1). Higher bare soils show a meager contribution of land use cover to sediment retention for the Sabakzai Dam.

Figure 24: Contribution of forest and rangelands/pastures to soil erosion stoppage in Sabkzai Dam



The total watershed area of the Mirani Dam is 2,352,600 ha (see Figure 25). Out of the entire watershed area, 0.35% of the land, i.e., 7,771.5 ha, contributes to rangelands, whereas the watershed does not contain any forest. Bare soils are 61.15% of the total watershed area and are very high compared to the entire vegetation land, indicating low sediment retention. Only 21.44 ha of land is currently expecting strong annual soil loss (see Table 50).

Figure 25: Contribution of forest and rangelands/pastures to soil erosion stoppage in Mirani Dam

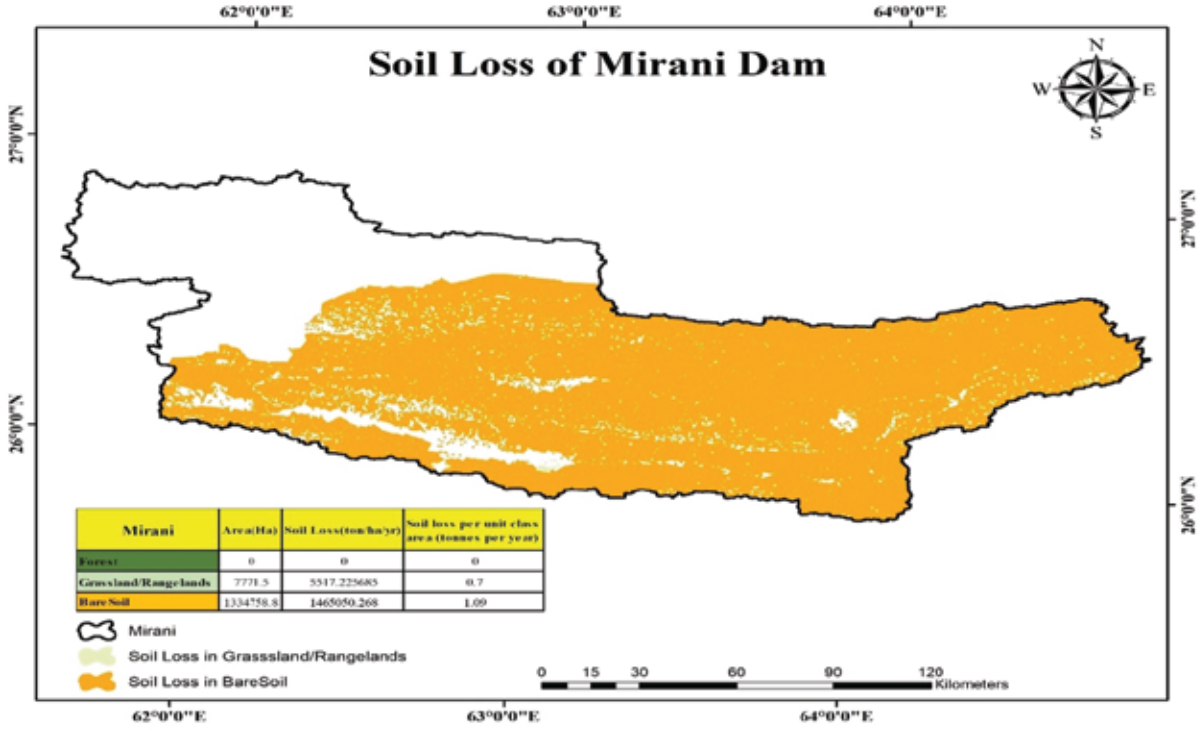


Figure 26 shows the delineated watershed area (7,056,000 ha) of the Warsak Dam. About 753,388 ha of watershed land contains forests, whereas 56.55% (697,4124.5 ha) of the watershed land contains grasslands/rangelands. The bare land is 15.8% of the total watershed land, which indicates a low contribution of land use land cover to sediment retention for the Warsak Dam. However, the contribution of forests and rangelands to soil conservation is relatively more significant. Only 307.67 ha of land is currently experiencing strong annual soil loss greater than 15 t ha-1 y-1 (Table 50).

Figure 26: Contribution of forest and rangelands/pastures to soil erosion stoppage in Warsak Dam

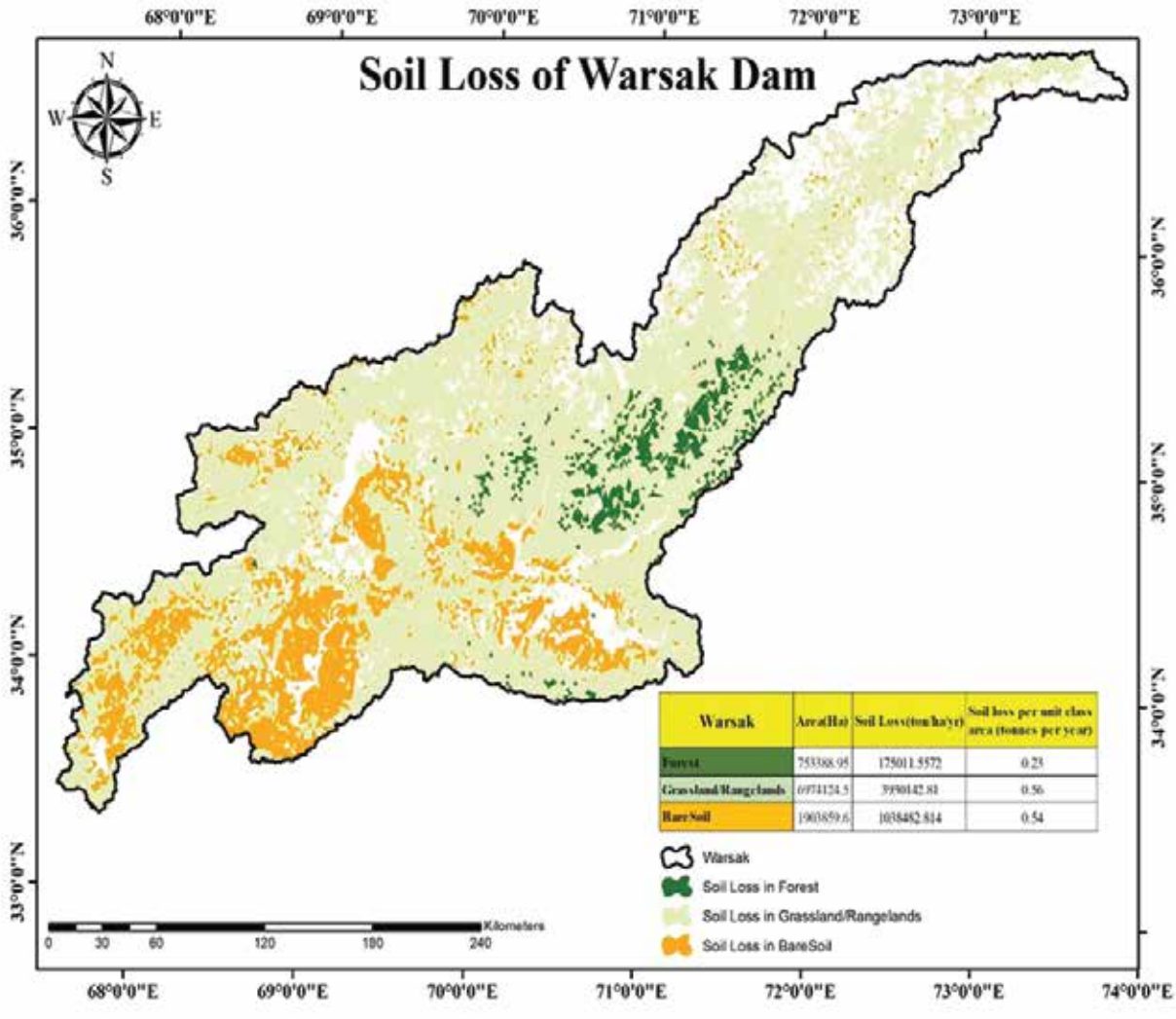
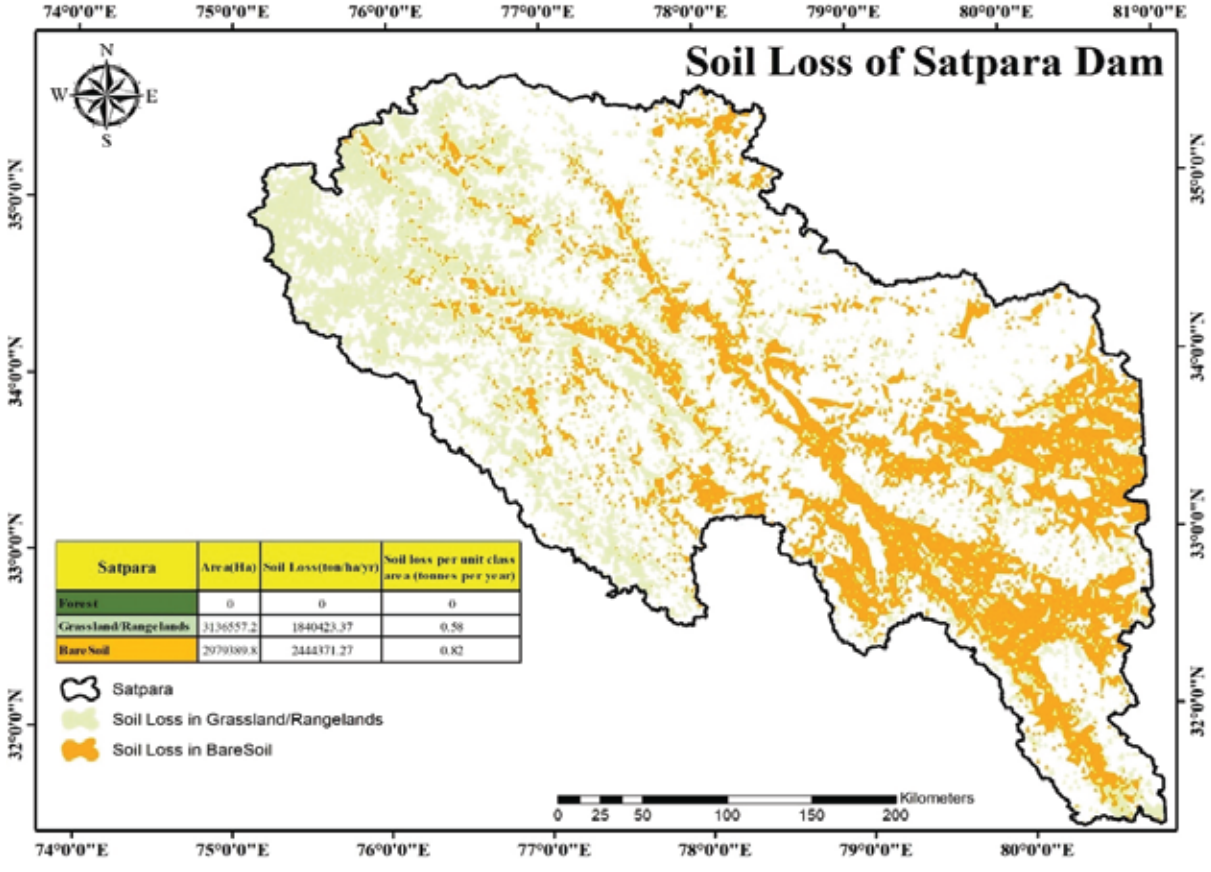


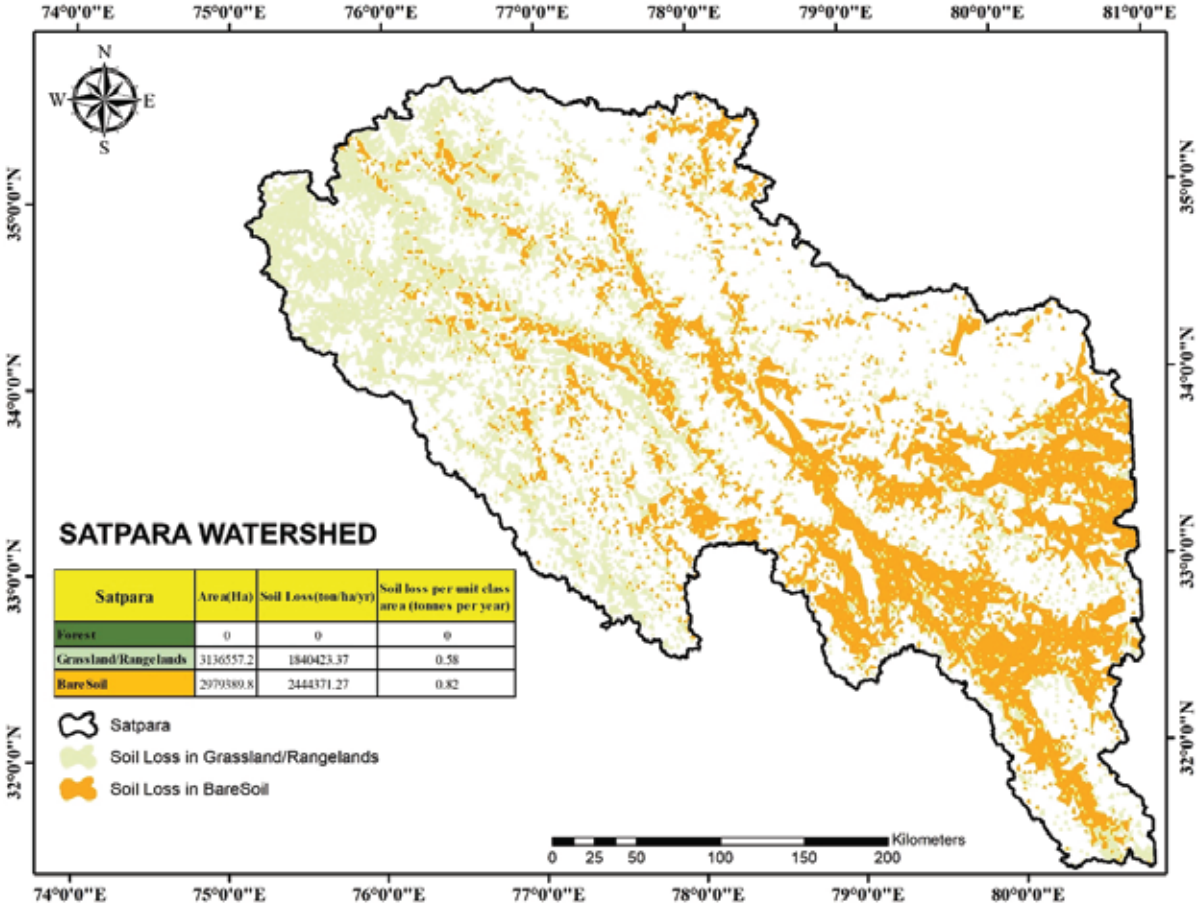
Figure 27 shows the delineated watershed area (12,343,900 ha) of the Satpara Dam. Out of the total watershed area, 17.26% of the land, i.e., 3,136,557.2 ha, contributes to rangeland, whereas the watershed does not contain any forest. Table 50 shows a 0.012% (1,483.40 ha) land with strong intensity of soil loss (>15 tons ha-1 year-1). The bare land is 2,979,389 ha, which indicat-es a meager contribution of land use land cover to sediment retention for the Satpara Dam. However, the contribution of forests and rangelands to soil conservation is relatively more significant.

Figure 27: Contribution of forest and rangelands/pastures to soil erosion stoppage in Satpara Dam



The total watershed area of the Hub Dam is 902,100 ha (Figure 28). Of the entire watershed area, 12.98% of the land, i.e., 107,652 ha, contributes to rangelands, whereas the watershed contains no forest class. Bare soil is very high (i.e., 28.23% of the total watershed) than the whole vegetation land, indicating low sediment retention. Only 605.95 ha of land is currently expecting intense annual soil loss (Table 50).

Figure 28: Forest classes identified in the delineated catchment area of Satpara Dam & contribution of forest and rangelands/pastures classes to soil erosion stoppage



Satpara	Area(Ha)	Soil Loss(ton/ha/yr)	Soil loss per unit class area (tonnes per year)
Forest	0	0	0
Grassland/Rangelands	3136557.2	1840423.37	0.58
Bare Soil	2979389.8	2444371.27	0.82

8.3. Carbon Value of Forests

Forests play an important role in climate change mitigation and adaptation. Forests sequester CO2 from the atmosphere when they grow and store this carbon in the form of biomass and soil organic carbon. Forest ecosystems store large amounts of carbon much more than other terrestrial ecosystems. On the other hand, when forests are cut the carbon stored in the trees is released back into the atmosphere. The climate related benefits of forests in terms of climate change mitigation include the following two important sources:

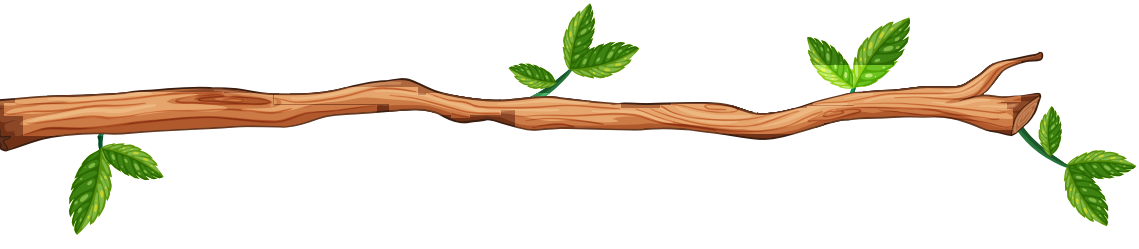
- Avoidance of carbon emissions from deforestation and forest degradation
- Carbon removal or sequestration through biomass growth and enhancement of soil organic carbon mainly arising from establishment of new plantations through afforestation, reforestation and restoration; and protecting the existing forests to attain natural growth.

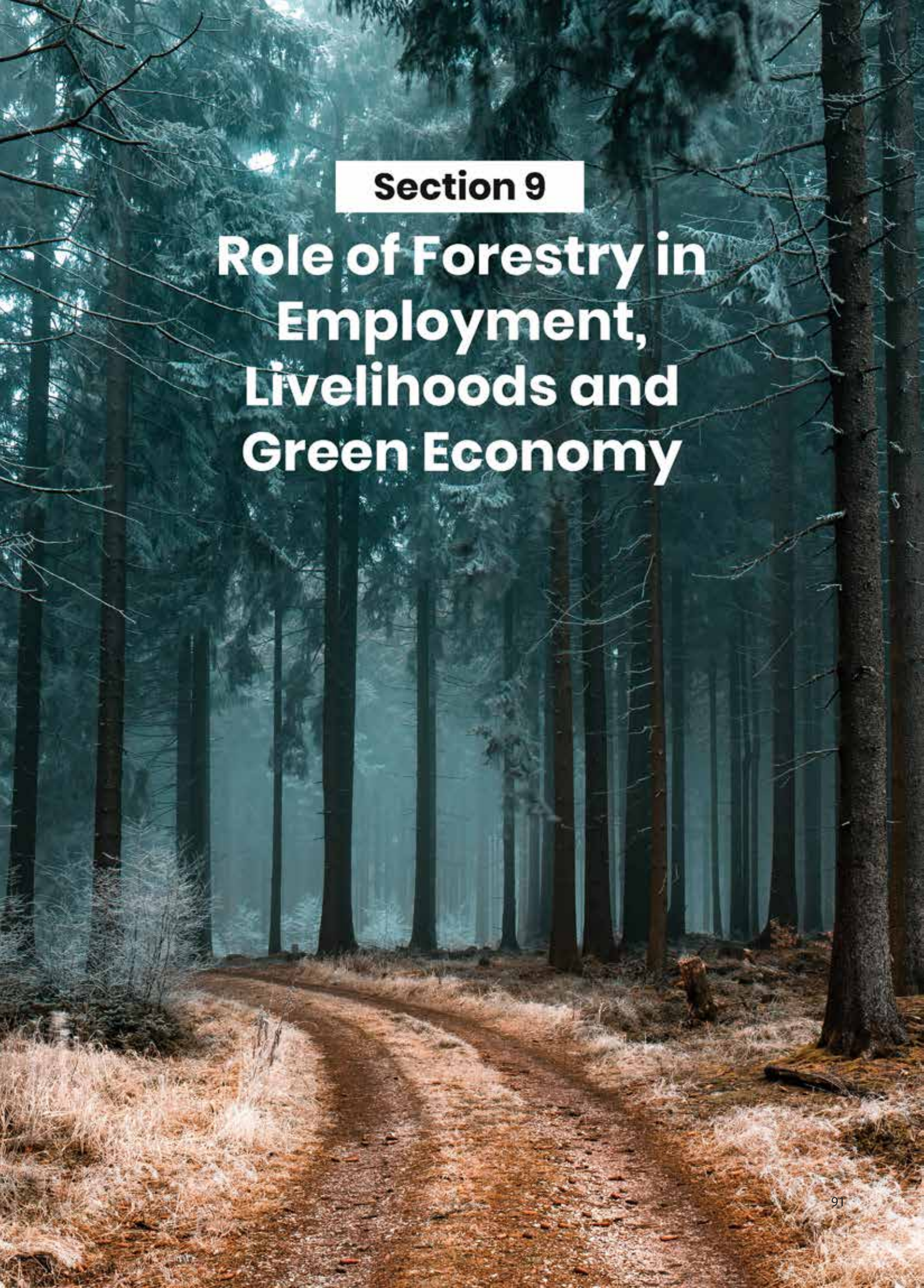
In terms of the above role of forests, the climate related benefits of Pakistan's forests was estimated as 177.10 million USD using the GCF rate of USD 5 per carbon credit under Pilot Programme for REDD+ Result Based Payments. The basis of this calculation is given in the following table.

Table 51: Carbon value of natural forests and plantations

Category	Total Forest Area (million ha)	Carbon Sequestration Rate (tCO_2/ha/year)	Total Carbon Sequestration (tonnes of CO_2 per year)	Price of one tonne of CO_2 removal (USD)	Total Value (in million USD)
Natural Forests	4.11*	5**	20.55	5	102.75
Ten BTTP	-	-	14.87***	5	74.35
Total					177.10

*MoCC and WWF (2022), Reports of Subnational Greenhouse Gas Inventory of Forestry Sector
** PFI (2017). Carbon Stock Assessment of Forests of Khyber Pakhtunkhwa
*** Pakistan's Updated NDCs (2021)





Section 9

Role of Forestry in Employment, Livelihoods and Green Economy

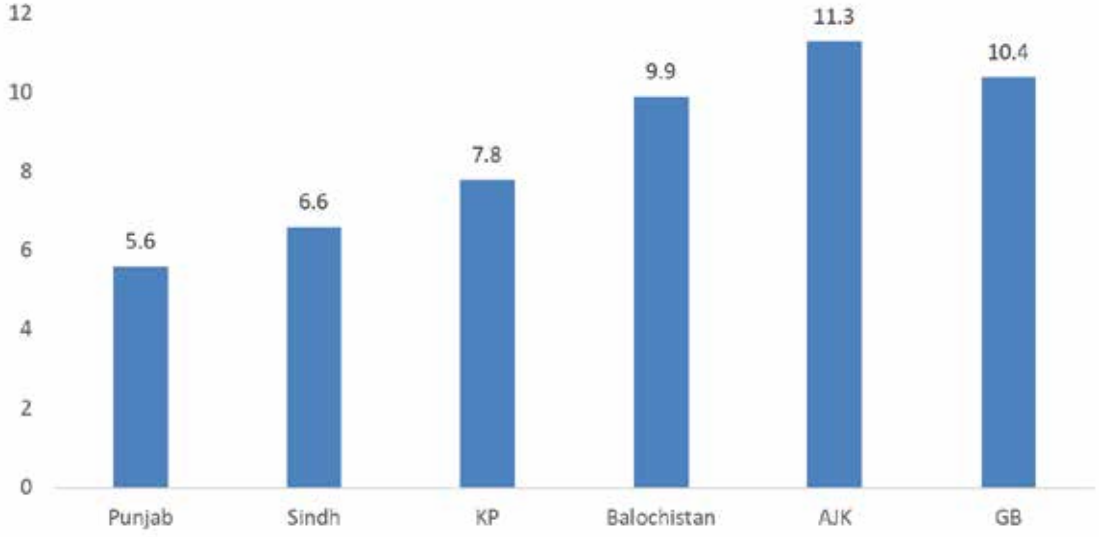
9.1. Role of Forestry Sector in Livelihoods

Forestry has immense value in employment, especially for women and in remote areas. It is quite difficult to quantify direct forestry related employment as our primary survey was not designed to capture employment from forestry and its products. Keeping this in view, the ongoing study has used the 2017/18 Labor Force Survey to analyze the associated employment with forestry and its products. It is worth mentioning that LFS captures the 4-digit occupation and industrial classification which shows various codes that are directly and indirectly related to forestry's goods and services. Some of the codes are listed as: Agricultural and forestry production managers; Recreation and cultural center managers; Farming, forestry, and fisheries advisers; Forestry technicians; Forestry and related workers; Handicraft workers in wood, basketry, and related materials; Woodwork, carpente; Pulp and papermaking plant operators; Wood processing plant operators; Mobile farm and forestry plant operators; Forestry laborers; Water and firewood collectors; Forestry and logging; Sawmilling and planning of wood; Manufacture of veneer sheets and wood-based panels; Manufacture of builders' carpentry and joinery; Manufacture of wooden containers; Manufacture of other products of wood; manufacture of articles of cork, straw, and plaiting materials;
Manufacture of agricultural and forestry machinery.

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 is difficult to quantify the livelihoods opportunities associated with the forestry sector due to informal nature of employment. A careful estimates suggest that the direct employment in forestry related services is around 7% of the total employment. By adding the livestock, the number will go to around 10%. Still the number is under-reported due to data limitation. As found by FAO, only 600,000 workers were engaged annually by the Forestry Departments in 1992. Another study of FAO found that more than 100,000 workers were involved in the trade of fuelwood. The current study found that around 600,000 workers are employed in the wood-based industries. A study of World Bank found that 80% of the people living in rural areas depend on non-timber forest products to supplement their income.

A simple analysis against the above codes shows that overall 7% of the employed labor is working in forestry-related products and services. It is worth mentioning that the reported number lacks the analysis of the hotel and restaurant industry located in northern areas of Pakistan and various other sorts of undocumented activities in herbal, medicinal plants, etc. By adding the livestock, the number will go to around 10%. Across gender, livestock is the main source of female employment across the country.

Figure 29: Direct employment in forestry related services (in %)



Source: Estimated from Pakistan Labor Force Survey 2018/19 and PIDE survey

9.2. Provision of Livelihoods to Women and Marginalized Groups

Forests can be linked to most, if not all of the Sustainable Development Goals (SDGs), through contributions to ecosystem services, green economic opportunities, and social and environmental justice agendas. According to some estimates, 20% of the global population is dependent on forest resources to meet their essential livelihoods needs. For rural households, women, and marginalized groups, living near forests, as much as 22% of their income comes from timber and non-timber forest resources. This contribution is larger than wage labor, livestock, or self-owned businesses. About half of the income from forests is non-cash and includes food, fuel, fodder, construction materials, and medicine. This non-cash contribution, or "hidden harvest," is especially important for extremely poor and women-led households.

FAO, through its 2018 report, showed that 850 million rural poor (83% of which are women) remain dependent on harvesting wood for fuel, medicinal plant collection, and other forest resources for family consumption. This underlines the opportunities for women regarding greater involvement in forest-based programs; they can secure their access to natural resources, develop their skills and knowledge concerning forest biodiversity and participatory forestry management and be able to participate in the public policy process. Women's informal and subsistence-level involvement can also be turned into economic and political empowerment.

However, women's demands and priorities, particularly in connection to natural resources, can easily be disregarded owing to established socio-cultural practices and gendered power dynamics . Resultantly, this situation is exacerbated by power differentials where a few powerful and influential groups tend to benefit more than the poor majority, particularly the most marginalized groups in the community including women. Therefore, the inclusion of women and marginalized groups in forest resource management is very much important, and if we ignore gender, there is no doubt that we will fail in our efforts to strengthen forests' contribution to poverty reduction, biodiversity conservation, and sustainable development.

In the context of Pakistan, forest contributions to women and marginalized groups' livelihoods is predominantly in NTFPs sector. For instance, Mazri Palm cottage industry is providing an important source of livelihoods for a large number of rural people, particularly women, who do the bulk of the weaving of Mazri products. Usually, the products are mats, baskets, ropes, brooms, hand fans, sandals, hats, decorative pottery, and ban (fine ropes for weaving cots or sleeping beds). Mazri-based livelihoods specifically for women is common in northern Balochistan, erstwhile FATA, and southern regions of Khyber Pakhtunkhwa, where it is primarily grown.

Likewise, Munj/Reed in Hyderabad is crucial for the livelihoods of the marginal and poor Jogi community, who are involved in making many products from its different parts. Typically, three to five workers of the family including women and children in the family jointly work on different products from Munj, which may include mats, window frames, wall hangings, cupboards, handicrafts, mirror frames, and decoration pieces. In parallel, the Hindu community in Nangarparker uses Gugul - a shrubby small tree - for their subsistence as well as a source of livelihoods earning. The communities using the plant and the plant itself both have special social and ecological significance.

Whereas in Khushab and Bhakkar, Eucalyptus has proved to be a real game-changer in monetary terms for the local people. Both these districts are dry and have water-logging and salinity issues. Thus, the land hardly offered any economic benefits. But recently, with the inception of Eucalyptus trees, which grow multiple times on their own with little effort in the start, offer very good money. Earlier, marginalized groups, who had a slim livelihoods, now earn a couple of lacs per hectare in a year with exceedingly minimum input. It was observed that due to these earnings, people in the rural and remote areas of these districts, finally started constructing their houses on modern lines and started growing and selling Eucalyptus wood as a proper business.

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In the same context, medicinal plants in Madyan (Swat) and Astore provide a good source of livelihoods for the local community and the women who collect these plants. Though, it is pertinent to note that if proper skills are imparted with regard to handling, value addition, and branding of these medicinal plants, these local communities can earn many times more.

Thus, it is obvious that for those women who do not have access to the formal economy or those marginalized groups who feel it exceedingly hard to enter into the mainstream formal economic activity, the forest provides them a way out. Forests offer economic opportunities, both in cash and without cash as well, that too in their own surroundings. This makes women and marginalized groups key stakeholders of forests. Therefore, the forest is also linked to the livelihoods of thousands of people, any harm or damage to the forest directly hits the livelihoods of these people, which otherwise would be difficult for the government to provide these people with alternate income generation sources. Hence, protecting and promoting forests is the only viable option ahead.

9.3. Way Forward: Forests and Green Economy

Pakistan is amongst the most vulnerable countries to climate change and stands in 8th spot on the Global Climate Risk Index, and faces a loss of at least $04 billion per year due to extreme climatic events. As reported by the UN's Food and Agriculture Organization, Pakistan has one of the lowest forest covers in the world. The global average is 31% of the land, while in Pakistan it is a mere 5.2%. The World Bank has also reported that while the country has a lower percentage of forests in total land area, but it is more than Afghanistan, Bangladesh, and the Maldives. Though the forests of Pakistan are not sustainably managed and are overused, these have been degrading and decreasing over the last few decades. There is a lack of systems and checks to assess, monitor, and share data on the available forest cover along with the growing stock and supply and demand for forest products.

During the last two decades, Pakistan has lost a significant percentage of its forest. This is mainly due to an increase in rapid population growth and overburdening forest resources. The major forest-based industries include paper, furniture, construction material, matches, sports goods, wooden articles, etc. In Pakistan, the economic contribution of forests to the national economy is significant. It creates employment opportunities along with tax and revenue generation. Additionally, in terms of ecological contribution, forests provide important ecosystem services like water regulation, sediment control, and biodiversity conservation. Moreover, in terms of social impact forests are linked to gender issues in rural settlements.

It is pertinent to note that forests are directly linked with the green economy. The terminology and the concept of the green economy were presented by Ms. Laura Altinger, from the UNECE Environment, Housing, and Land Management Division, with a reference to the Global Green New Deal launched by the United Nations Environment Programme in October 2008. The New Deal describes the greening of the economy as the "process of reconfiguring businesses and infrastructure to deliver better returns on natural, human and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using fewer natural resources, creating less waste and reducing social disparities." The green econo-

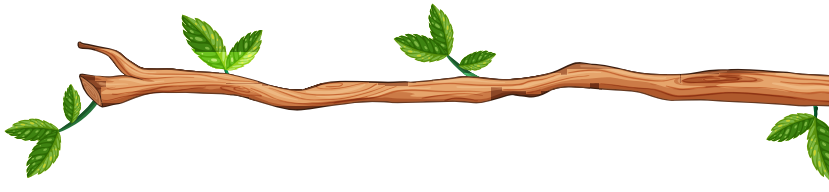
my promotes resource efficiency through reduced carbon emissions and social inclusion.

The wood and forestry sectors can make a significant contribution towards meeting green economy objectives, linked to climate change policies, mainly through the reduction of greenhouse gas emissions and expansion of renewable energy. There are three main routes by which the wood and forestry sectors can contribute: i) Biomass energy ii) Green infrastructure and buildings which are related to forest products and iii) The role of forest resources as carbon sinks, which is related to its resources.

In this context, the Government of Pakistan has begun the first phase of planting 10 billion trees in the whole country. During the first phase, 3.296 billion trees will be planted with a projected cost of 125.184 billion rupees. The initiative is being termed as unleashing the potential of a green economy in Pakistan.

The opportunity to give free rein to the green economy and growth in Pakistan is only possible if the forest sector is sustainably developed. Long-term forest investments are required to utilize the immense potential of forest contributions in terms of resilient ecosystems, rural livelihoods, national economy, and global environment.

Few policy interventions to address the challenges in the forestry sector and the consequent green economy/jobs are proper implementation of National Forest Policy 2015; efficient coordination among provincial and federal institutions for better management; conducive policy environment for private sector participation; effective forest management information system; research and development at the provincial and federal level, increasing the forest cover for the uplifting of socioeconomic status and environmental gains; forest resource-based entrepreneurship and improved and sustainable forest management practices.



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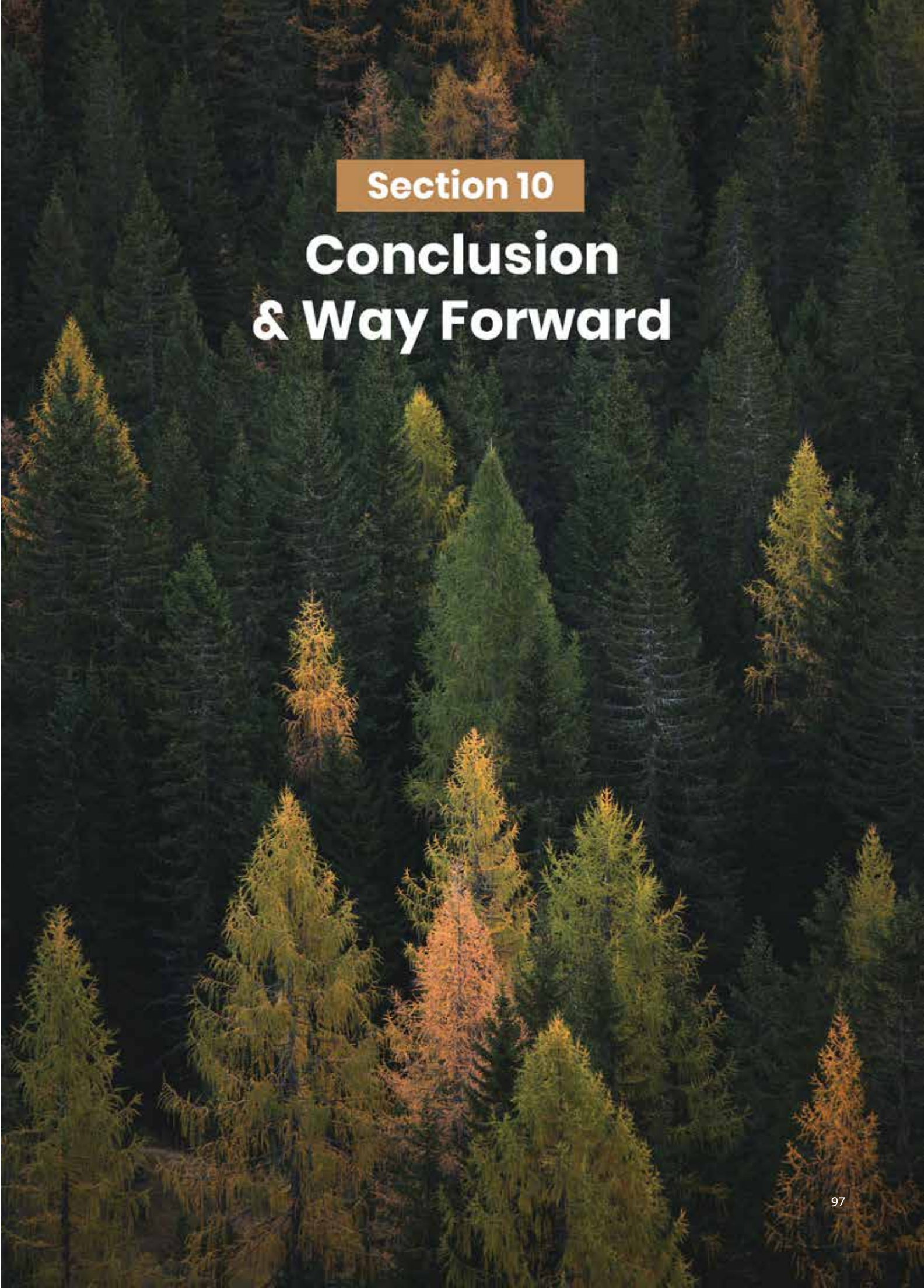

Section 10

Conclusion & Way Forward

10.1. Overall Contribution of Forestry to GDP

Forest ecosystems hold great importance on the economic front. Contribution of any commodity is gauged by assessing the economic activity generated by the commodity over its entire value chain. Unfortunately, the forest sector's contribution to Pakistan's GDP has always remained quite low. It has been on a continuous declining trend, always remaining below even 1% of the GDP, and currently stands at a mere 0.4% of the country's GDP. It is important to note, however, that GDP calculations to a large extent reflect only the direct production contribution of the sector (only from public sector) with no representation of the regulatory, supporting, and cultural services that these precious ecosystems render and the forward and backward linkages of forests with the other economic sectors.

The calculation method of various sectors and sub-sectors in GDP is quite complex and comprehensive. Pakistan Bureau of Statistics (PBS) has the mandate to calculate the GDP of the country where a mixed method is used including production, income, and expenditure approaches, keeping in view the sectoral composition of an activity. The standard GDP calculation method largely depends on two elements: new production in a particular period, and the final product after value addition.

To quantify the share of forestry in GDP, this report has adopted a mixed method approach where various primary and secondary datasets are used to quantify the value-additive rule of forestry in GDP. It is pertinent to mention that our approach has still under-reported the numbers due to various reasons.

i. Various forestry goods and services were not covered where they have an economic role. For example, it is quite difficult to quantify the benefits of non-timber forest products (NTFP) and the non-tangible environmental and ecological benefits of the forests.

ii. Forests have a significant impact on sustainable development through an improvement in the climate. It is complex to quantify such elements. They also have a direct impact on the life of the water reservoir (dam) by stopping soil erosion.

iii. Various datasets were either incomplete or not covered. For example, the old proxies of livestock and rangelands analysis were used.

iv. The analysis of hotels were not covered where a significant percentage of wood is consumed.

v. Tourism data is limited to a few selected sites and not all tourist resorts are covered and analyzed.

Table 52 has summarized the approximate value of various forestry products and services in GDP. The analysis reveals that the overall contribution of forestry products and services in GDP stands at 11.48%. The share is still under-reported and the actual share could be more than the estimated number.

Table 52: Contribution of forestry products in GDP

Sector	Value in PKR billion	% share
 Wood-based industry	2,930	6.14
 Household's fuelwood consumption	871	1.83
 Commercial fuelwood consumption	189.4	0.40
 Herbal industry & NTFPs	8.4	0.02
 Tourism	62.4	0.13
 Carbon benefits	21	0.04
 Livestock on rangelands	1394.1	2.92
Total	5476.3	11.48

Note: The GDP at current market price is taken for year 2021/22 which is. **PKR 47,709 billion.**

Few limitations may be noted in quantifying the contribution of forestry to GDP as listed below:

First, the accurate contribution requires fresh and updated annual data on forestry production and its services. Currently, forestry is a provincial subject in the country and Pakistan lacks detailed data on the stock of forests, production, and various kinds of services. Data is mostly old or proxies are taken.

Second, the concept of GDP believes in the final product. Forest provides a series of services including provisioning services, regulating services, suppor-ting services, and cultural services. Since the value addition of forestry services pertains to vari-ous other sectors, therefore, they are mostly not counted in the forestry sector. For example, the wood-based industrial share falls in the industrial sector and forest-based tourism is counted in the services sector.

Third, non-economic benefits including climate impacts are largely ignored and underestimated due to a lack of data as various studies suggest that they are 3 to 5 times higher than the economic benefits.

10.2. Recommendations

The following recommendations are made in the context of various dimensions related to forestry products and services and their contribution to the economy:

There is a need to review the policy of ban on forest harvesting imposed since 1993 and resume scientific management of forests. This will not only increase timber and fuelwood supply in the country but will also improve the health and productivity of forests, as mature and over-mature trees will be harvested and space will be cre-ated which will accelerate the establishment of regenerationin the forests.

There is also a need to develop management plans for plantations raised under different projects. Implementation of these plans will increase the wood supply in the country and ensure the sustainability of these plantations.

There is a high potential for increasing wood production in irrigated plantations and riverine forests which are currently producing much lower than their potential. These forests should be intensively managed. Sustainable Forest Plans and the pro-vision of sufficient funds and human resources are the key pre-requisites for this purpose.

Wood production on farmlands is also much lower than the existing potential. There are sufficient resources in the form of fertile land, irrigation water, and space for plantations which should be utilized for increasing wood production on farmlands. Awareness raising among farmers, provision of saplings, tree seed, and credit facil-ities can play important roles in the enhancement of tree plantation on farmlands.

The current mega afforestation efforts may be converted to a regular afforestation program to increase tree cover and wood supply in the country.

Wood import is an important source of timber supply in the country. The use of imported timber has increased in the country. An increase in the availability of imported timber in the country will reduce pressure on the natural forests for timber. However, there is a need to check the quality of imported timber and make it available to users at compa-rable prices.

It is also recommended that fuelwood collection from the designated forests may be properly recorded and documented using a robust forest monitoring system to properly determine the quantity of fuelwood supplied by these forests.

Government should facilitate and promote direct linkages between tree growers and the wood industry to reduce marketing-related problems in wood production. This will also enable the farmers to harvest trees at the proper time to get maximum return and fulfill the demands of the industry.

Rangelands and wastelands are also an important source of fuelwood and fodder supply in the country. There is a need to develop and implement proper policies and action plans for these lands to ensure their sustainable management. Inclusion of suitable fodder and fuelwood trees and woody plants in the rehabilitation efforts will increase wood supply as well as fodder supplies from these lands.

Research should be conducted to enhance the quality and durability of hardboard, ply wood, and other wood products.

Sufficient resources may be allocated for research organizations to produce fast-growing tree species for industrial uses. English Bat Willow, Hybrid Eucalyptus and Australian Kiker need special attention from the government, industry, and researchers.

Seed quality is very important for producing wood of the desirable quality. There is also a need to introduce a seed certification system for forest tree seeds in the country. Only certified seeds should be used in public and private nurseries. Seed orchards and seed-producing areas may be given special importance by the Forest Departments. PFI can play an important role in seed certification in the country.

Pakistan Forest Institute (PFI) used to publish Forestry Statistics on a regular basis. However, this system has been discontinued due to the devolution of PFI to Khyber Pakhtunkhwa. There is a need that the central role of PFI in forestry research and collecting forest statistics should be continued to ensure reliable and updated information for effective planning and development.

Encourage public/private partnerships to boost forest products through active participation of the industrial sector in afforestation, rehabilitation, and restocking programs under prescribed rules and regulations.

Proper mechanisms need to be developed for the conservation and sustainable management of NTFPs as these are important for the locals' livelihoods as well as to meet the raw materials requirements of herbal, pharmaceutical, and cosmetic -

industries in the country. There is vast scope for value addition in the sector as well as foreign exchange earnings if proper certification mechanisms are put in place.

Forests provide many other ecosystem goods and services. These include provisioning services (forage production, NTFPs production, genetic materials provision, etc.), regulatory services (such as climate change mitigation and adaption, watersheds protection, pollination of horticultural and agricultural crops, and diseases/insects and pests control), supporting services (e.g., primary production, soil formation and provision of habitat for biodiversity), and culturaland recreational services. There is a need to opt proper valuation methods for forest based ecosystem.

Non-availability of complete and accurate data is an important issue that leads to under-estimation of the forestry sector's contribution to employment generation, livelihoods improvement, promotion of green.

Economy, and over-allcontribution to GDP. It is therefore recommended that in addition to forest inventory programs, proper data collection, analysis, and management systems are developed in the form of a Management Information System (MIS) which regularly collects, analyzes, compiles, and makes use of data for decision-making by the policymakers.

There is a need to strengthen policy and institutional mechanisms for increased coordination with other relevant sectors at the national and provincial levels such as water and power/energy, livestock and agriculture, rural development, climate change and disaster management (NDMA and PDMAs), NHA, Provincial Highways, and private sector. It is therefore recommended to undertake a policy and institutional review at a different level for the effectiveness of coordination mechanisms.

There has to be a paradigm shift in forest management from wood production only to the management of forests for ecosystem goods and services and at the landscape level. Therefore, it is recommended that new Forest Management Plans Codes be developed and adopted for the preparation of Forest Management Plans to account for all these aspects of forest management.

It is proposed that the forestry sector coordinates with the livestock sector, agriculture sector, and Bureau of Statistics to do a proper accounting of the contribution of the forestry sector to the GDP and that the existing accounting anomalies which lead to underestimation of the forestry sector's contribution are removed.

It is further recommended that the forestry sector develops and implements a proper communication and advocacy strategy to effectively communicate with different stakeholder groups, especially industries, the private sector, policymakers, and politicians through the development of policy briefs, fact sheets, and infographics on important aspects to sensitize these key stakeholders.

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Annexures

Annexure A: List of Focus Group Discussions (FGDs)

1. Munj and Reed (Hyderabad)
2. Gugul (Nangar Parker)
3. Medicinal and Aromatic Plants (Astore)
4. Social Forestry (Ghizer)
5. Chilghoza (Diamer)
6. Chilghoza (Waziristan)
7. NTFPs (Madyan)
8. Mazri (Hangu)
9. Honey (Karak)
10. Eucalyptus & Poplar (Mirpur and Bhimber)
11. Poplar (Rawlakot)
12. NTFP (Neelum Valley)
13. Medicinal Plants and Juniper (Ziarat)
14. Gugul (Lasbela)
15. Chilghoza (Sherani)
16. Eucalyptus (Khushab)
17. Tamarix Aphylla (Bhakkar)
18. Patoki Nursery
19. Munj Kana Narowal
20. Changa Manga

Annexure B1: List of Visited Districts by the Teams

District	Province	Household Survey	Tandoor/ catering/ hmam survey	Aara/Toll survey	Small industry survey	Timber market survey	Major Industry Survey	Herbal/ NTFP Survey	Tourism Survey
Abbottabad	KP	NO	NO	NO	NO	YES	YES	YES	YES
Astore	GB	YES	YES	YES	YES	YES	YES	YES	YES
Attock	Punjab	NO	NO	NO	YES	YES	YES	YES	NO
Bahawalpur	Punjab	YES	YES	YES	YES	YES	YES	YES	YES
Bannu	KP	NO	NO	YES	YES	YES	YES	YES	NO
Bhakkar	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Bhimber	AJK	YES	YES	YES	YES	YES	YES	YES	NO
Chakwal	Punjab	NO	NO	NO	NO	YES	YES	YES	YES
Chiniot	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Dadu	Sindh	NO	NO	NO	NO	NO	NO	NO	YES
Dera Ghazi Khan	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Dera Ismail Khan	KP	NO	NO	NO	NO	YES	YES	YES	NO
Faisalabad	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Ghizer	GB	YES	YES	YES	YES	YES	YES	YES	NO
Ghotki	Sindh	NO	NO	NO	NO	NO	NO	NO	YES
Gilgit	GB	YES	YES	YES	YES	YES	YES	YES	NO
Gujranwala	Punjab	NO	YES	NO	YES	YES	YES	YES	NO
Gujrat	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Gwadar	Balochistan	NO	NO	NO	NO	YES	YES	YES	YES
Haripur	KP	YES	YES	YES	YES	YES	YES	YES	YES
Hunza	GB	YES	YES	YES	YES	YES	YES	YES	YES
Hyderabad	Sindh	YES	YES	YES	YES	YES	YES	YES	NO
Islamabad	ICT	NO	NO	NO	NO	NO	NO	NO	YES
Jhang	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Jhelum	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Karachi Central	Sindh	NO	NO	NO	NO	YES	YES	YES	NO
Karachi East	Sindh	NO	NO	NO	NO	YES	YES	YES	NO
Karachi South	Sindh	NO	NO	NO	NO	YES	YES	YES	NO
Karachi West	Sindh	NO	NO	NO	NO	YES	YES	YES	NO
Kasur	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Khanewal	Punjab	NO	NO	NO	NO	YES	YES	YES	YES
Khushab	Punjab	YES	YES	YES	YES	NO	NO	NO	NO
Khuzdar	Balochistan	YES	YES	YES	YES	YES	YES	YES	NO
Kohat	KP	NO	YES	YES	YES	NO	NO	YES	NO
Kotli	AJK	YES	YES	YES	YES	YES	YES	YES	YES
Kurram	KP	NO	NO	NO	YES	NO	NO	YES	NO
Lahore	Punjab	NO	NO	NO	NO	YES	YES	YES	YES
Larkana	Sindh	YES	YES	YES	YES	YES	YES	YES	YES

Lasbela	Balochistan	NO	NO	YES	NO	YES	YES	YES	NO
Loralai	Balochistan	YES	YES	YES	YES	YES	YES	YES	NO
lower Chitral	KP	YES	YES	YES	YES	YES	YES	YES	YES
Mansehra	KP	YES	YES	YES	YES	YES	YES	YES	YES
Mardan	KP	NO	NO	NO	NO	YES	YES	YES	NO
Mirpur	AJK	NO	NO	NO	NO	YES	YES	YES	YES
Multan	Punjab	NO	NO	NO	NO	YES	YES	YES	YES
Muzaffarabad	AJK	NO	NO	NO	NO	YES	YES	YES	YES
Narowal	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Nasirabad	Balochistan	NO	NO	YES	NO	YES	YES	YES	NO
Neelam	AJK	YES	YES	YES	YES	YES	YES	YES	YES
Nowshera	KP	NO	NO	NO	NO	YES	YES	YES	NO
Okara	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Peshawar	KP	YES	YES	YES	YES	YES	YES	YES	YES
Pishin	Balochistan	NO	NO	NO	NO	YES	YES	YES	NO
Poonch	AJK	YES	YES	YES	YES	YES	YES	YES	YES
Quetta	Balochistan	YES	YES	YES	YES	YES	YES	YES	YES
Rahim Yar Khan	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Rawalakot	AJK	NO	NO	NO	NO	NO	NO	NO	YES
Rawalpindi	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Sahiwal	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Sanghar	Sindh	YES	YES	YES	YES	NO	NO	NO	NO
Sargodha	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Shaheed Benazirabad	Sindh	YES	YES	YES	YES	NO	NO	NO	NO
Sheikhupura	Punjab	YES	YES	YES	YES	YES	YES	YES	NO
Sialkot	Punjab	NO	NO	NO	NO	YES	YES	YES	NO
Sibi	Balochistan	YES	YES	YES	YES	YES	YES	YES	NO
Skardu	GB	YES	YES	YES	YES	YES	YES	YES	YES
Sukkur	Sindh	YES	YES	YES	YES	YES	YES	YES	NO
Swat	KP	YES	YES	YES	YES	YES	YES	YES	YES
Tangir	GB	NO	NO	NO	NO	YES	YES	YES	NO
Tharparkar	Sindh	YES	YES	YES	YES	NO	NO	NO	NO
Thatta	Sindh	YES	YES	YES	YES	NO	NO	NO	NO
Upper Dir	KP	NO	NO	NO	NO	NO	NO	NO	YES
Zhob	Balochistan	YES	YES	YES	YES	YES	YES	YES	NO
Ziarat	Balochistan	NO	NO	NO	NO	NO	NO	NO	YES

Annexure B2: List of Visited Districts where Profiling was Conducted

District	Province	Household Survey	Tandoor/ catering/ hmam survey	Aara/Toll survey	Small industry survey	Timber market survey	Major Industry Survey	Herbal/ NTFP Survey	Tourism Survey
Awaran	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Badin	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Bagh	AJK	NO	NO	NO	NO	NO	NO	NO	NO
Bahawalnagar	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Bajaur	KP	NO	NO	NO	NO	NO	NO	NO	NO
Barkhan	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Batagram	KP	NO	NO	NO	NO	NO	NO	NO	NO
Buner	KP	NO	NO	NO	NO	NO	NO	NO	NO
Chagai	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Chamman	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Charsadda	KP	NO	NO	NO	NO	NO	NO	NO	NO
Darel	GB	NO	NO	NO	NO	NO	NO	NO	NO
Dera Bugti	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Duki	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Ghanche	GB	NO	NO	NO	NO	NO	NO	NO	NO
Gupis yasin	GB	NO	NO	NO	NO	NO	NO	NO	NO
Hafizabad	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Hangu	KP	NO	NO	NO	NO	NO	NO	NO	NO
Harnai	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Hattian	AJK	NO	NO	NO	NO	NO	NO	NO	NO
Haveli	AJK	NO	NO	NO	NO	NO	NO	NO	NO
Hub	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Jacobabad	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Jaffarabad	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Jamshoro	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Jhal Magsi	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Kachhi	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Kalat	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Kamakohlu	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Karak	KP	NO	NO	NO	NO	NO	NO	NO	NO
Kashmore	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Keamari	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Kech	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Khairpur	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Kharan	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Kharmang	GB	NO	NO	NO	NO	NO	NO	NO	NO
Khyber	KP	NO	NO	NO	NO	NO	NO	NO	NO
Killa Abdullah	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Killa Saifullah	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO

Kohistan lower	KP	NO	NO	NO	NO	NO	NO	NO	NO
Kohistan upper	KP	NO	NO	NO	NO	NO	NO	NO	NO
Kohlu	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Kolai Palas	KP	NO	NO	NO	NO	NO	NO	NO	NO
Korangi	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Lakki Marwat	KP	NO	NO	NO	NO	NO	NO	NO	NO
Lakki Marwat	KP	NO	NO	NO	NO	NO	NO	NO	NO
Layyah	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Lodhran	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Lower Dir	KP	NO	NO	NO	NO	NO	NO	NO	NO
Malakand	KP	NO	NO	NO	NO	NO	NO	NO	NO
Malir	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Mandi Bahauddin	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Mastung	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Matiari	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Mianwali	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Mirpur Khas	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Mohmand	KP	NO	NO	NO	NO	NO	NO	NO	NO
Musakhel	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Muzaffargarh	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Nagar	GB	NO	NO	NO	NO	NO	NO	NO	NO
Nankana Sahib	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Naushahro Feroze	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
North Waziristan	KP	NO	NO	NO	NO	NO	NO	NO	NO
Nushki	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Orakzai	KP	NO	NO	NO	NO	NO	NO	NO	NO
Pakpattan	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Panjgur	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Qambar Shahdadkot	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Rajanpur	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Roundu	GB	NO	NO	NO	NO	NO	NO	NO	NO
Shangla	KP	NO	NO	NO	NO	NO	NO	NO	NO
Sheerani	Balochistan	NO	NO	NO	NO	NO	NO	YES	NO
Shigar	GB	NO	NO	NO	NO	NO	NO	NO	NO
Shikarpur	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Sohbatpur	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
South Waziristan	KP	NO	NO	NO	NO	NO	NO	NO	NO
Sujawal	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Surab	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Swabi	KP	NO	NO	NO	NO	NO	NO	NO	NO
Tando Allah Yar	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Tando Muhammad Khan	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Tank	KP	NO	NO	NO	NO	NO	NO	NO	NO
Toba Tek Singh	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Tor Ghar	KP	NO	NO	NO	NO	NO	NO	NO	NO
Umerkot	Sindh	NO	NO	NO	NO	NO	NO	NO	NO
Upper chitral	KP	NO	NO	NO	NO	NO	NO	NO	NO
Vehari	Punjab	NO	NO	NO	NO	NO	NO	NO	NO
Washuk	Balochistan	NO	NO	NO	NO	NO	NO	NO	NO
Diamer	GB	NO	NO	NO	NO	YES	YES	YES	NO

Annexure C: A Technical Note on Water and Social Conservation Analysis

Forests and well-vegetated rangelands/pastures lands play an important role in protecting watersheds and flood plains areas of our river basins by regulating water flows (their timing, quantity, and quality) and protecting landscapes, infrastructure, and soil by preventing, controlling, and minimizing landslides and erosion. Similarly, mangrove forests in the Indus Delta area protect shorelines in the coastal areas from wave action and floods besides protecting valuable agricultural lands from saltwater intrusion.

These are some selected examples of the linkages and interaction of forests and vegetated landscapes with water, soil, landscape, and infrastructure protection (dams, irrigation networks, highways/roads, electric supply and distribution networks, telecommunication networks, hospitals, educational institutions, buildings and construction, industrial and commercial premises, etc.) and the positive role forests have viz-a-viz these resources.

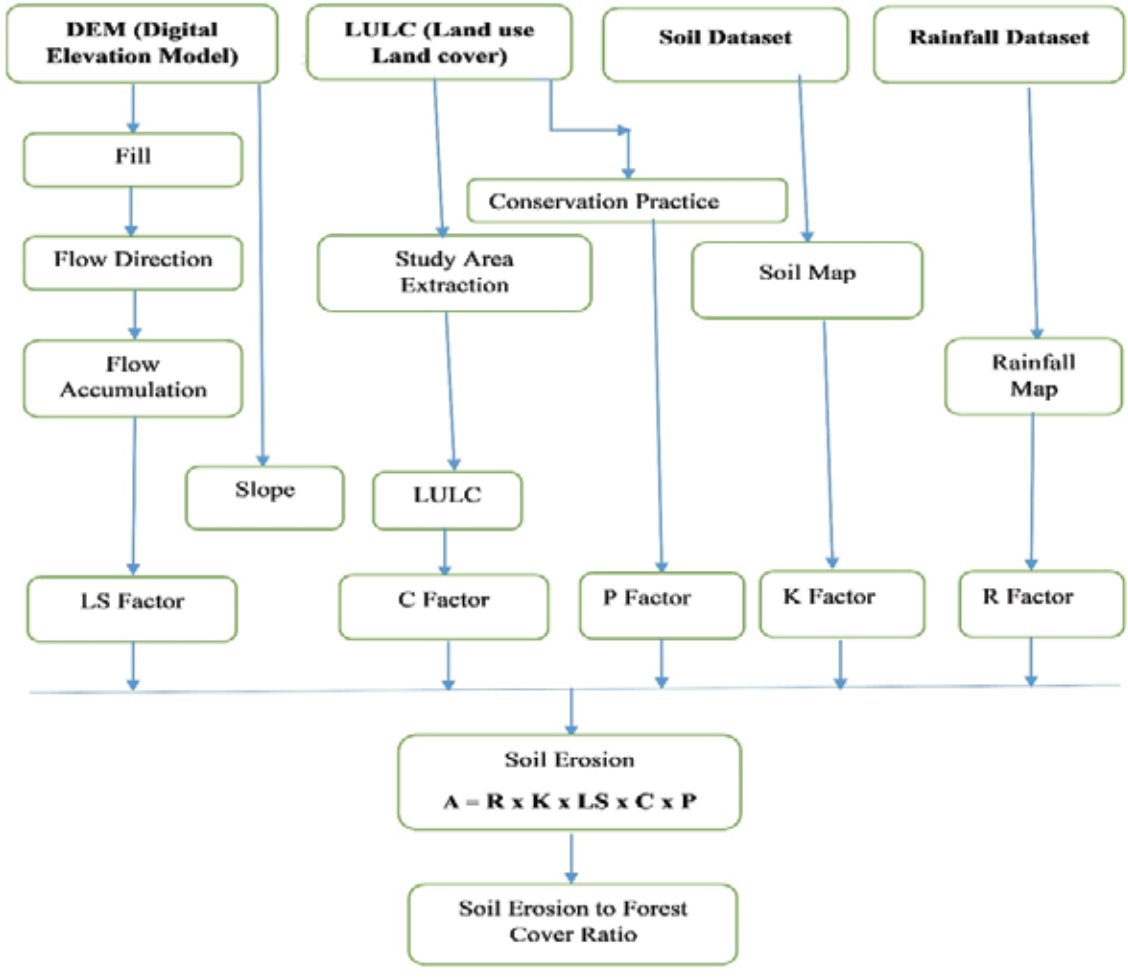
Cognizant of the above role of forests, forest management and planning in Pakistan and its different sub-units need to allow for the consideration of these soil, water, landscapes, and infrastructure-related issues, and to strategically manage forest resources to optimize different watershed services. Examples of these watershed services include surface water flow regulation for ensuring sustained water supply; prevention of flood damages to humans, landscapes, and different infrastructure; prolongation of life dams for hydropower generation; water purification; soil protection; prevention of landslides and their damages, etc.

Remote sensing SRTM 1 Arc-Second Global (30m Resolution) calculated the digital elevation model (DEM) data and drain points of 13 major water reservoirs watersheds. ArcGIS hydrology tool was used to find the aspect ratio, stream networks on lower sides, and then calculate pore points (dam locations); watersheds were calculated on the upper sides of the pore points. ICIMOD data derived the forest and grassland classes in the delineated watershed areas. The below Table shows all the data sets used in the soil and water conservation analyses.

Data Sets used for the Soil and Water Conservation Analyses

No.	Data Type	Description	Source
1	Digital Elevation Model	SRTM 1 Arc-Second Global (30m resolution).	https://earthexplorer.usgs.gov/
2	Land Use Land Cover	ICIMOD Land cover maps for 2019 at the 1:500000 scale.	https://doi.org/10.26066/RDS.1972511
3	Soil Data	World soil map published at 1:5000000 scale.	https://storage.googleapis.com/fao-maps-catalog-data/uuid/446ed430-8383-11db-b9b2-000d939bc5d8/resources/DSMW.zip
4	Rainfall Data	Annual rainfall data processed from daily rainfall data 2011 to 2021.	https://crudata.uea.ac.uk/cru/data/hrg/

Overall Methodology of the Soil & Water Conservation Analysis



The RUSLE (Revised Universal Soil Loss Equation) was used to estimate the soil loss erosion. It estimates the soil loss by water fall from hills its average annual value in (ton $h^{-1} y^{-1}$), as:

$$A = R \times K \times LS \times C \times P$$

Where

A: Average annual soil erosion (tons/ha/year) = R x K x LS x C x P

R: Rainfall erosivity (MJ mm $ha^{-1} y^{-1}$),

K: Soil erodibility (t h MJ^{-1} mm^{-1}),

LS: Slope length-gradient factor,

C: Crop-management factor,

P: Support practice factor for erosion control

Forest classes derived from the ICOMOD database were used to calculate the total forest areas in the watersheds. Values of LS and P factors derived from the STRM DEM, the study assigned the cover factor (C) value to each forest class. We use the World Soils map to find the soil erodibility factor (K) and CRU TS rainfall datasets to calculate the rainfall erosivity factor (R). The estimated erosion loss was classified into four classes very weak (0-2 t ha^{-1} y^{-1}), weak (2-5 t ha^{-1} y^{-1}), moderate (5-15 t ha^{-1} y^{-1}), strong (>15 t ha^{-1} y^{-1}). The evaluation of forest ecosystem services pertaining to soil conservation was calculated by obtaining the percentage areas of soil loss intensity to grasslands/rangeland areas in the watersheds.

Annexure D: Statistical Tables

Table D1: Region-wise sample size and profiling of timber market survey (in numbers)

Region	Sample Size	Total markets
AJK	35	64
Balochistan	35	54
GB	38	58
KP	100	870
Punjab	130	2,115
Sindh	65	1,220
Total	**403**	**4381**

Table D2: Trends of timber supply from ublic Forests across pprovinces (in million cubic metre)

Province	1992-93	2002-03	2020-21
Punjab	0.05	0.07	0.03
KP	0.25	0.11	0.12
Sindh	0.06	0.04	0.00
Balochistan	0.01	0.00	0.02
Gilgit Baltistan	0.00	0.00	0.04
AJK	0.10	0.08	0.08
Total	**0.46**	**0.30**	**0.29**

Table D3: Timber consumption by different industries (in million m³)

Type	Small Industry	Major Industry	Total	%
Furniture Industry	4.864	1.723	6.587	34.45
Country Sawmills		5.443	5.443	28.47
Wood related construction	0.564	1.679	2.244	11.73
Wood Artifacts/Wood Carving Industry	0.954	0.217	1.171	6.12
Chipboard/Hardboard Industry	0.011	0.842	0.854	4.46
Wood based cottage		0.707	0.707	3.70
Crate/Box Making Industry	0.010	0.519	0.528	2.76
Sports Goods		0.402	0.402	2.10
Match Industry		0.344	0.344	1.80
Boat Making Industry boats/launches	0.189	0.026	0.215	1.12
Plywood Industry		0.193	0.193	1.01
Tonga, Horse cart, Handcarts, etc.	0.033	0.130	0.163	0.85
Ship Building Industry		0.126	0.126	0.66
Pulp and Paper Industry		0.019	0.019	0.10
Truck/Bus body/Tractor Trolley		0.017	0.017	0.09
Textile Bobbins		0.007	0.007	0.04
Pencil Industry		0.005	0.005	0.03
Agriculture Implements		0.005	0.005	0.03
Particle Board		0.002	0.002	0.01
Others (specify)		0.091	0.091	0.47
Total	**6.625**	**12.497**	**19.122**	**100**

Table D4: Number of major wood-based industries interviewed (in numbers)

Code of Industry	AJK	Baluchistan	GB	KP	Punjab	Sindh	Overall
Brick Kiln Industry	0	3	0	10	2	0	15
Tobacco Curing Industry	0	0	0	11	0	0	11
Charcoal Kiln Industry	0	0	0	0	1	0	1
Plywood Industry	0	0	0	1	15	0	16
Truck/Bus body/Tractor Trolley	0	8	0	12	0	20	40
Ship Building Industry	0	0	0	0	0	1	1
Boat Making Industry boats/launches	0	19	0	0	0	0	19
Sports Goods Industry	0	0	0	0	7	1	8
Match Industry	0	0	0	7	0	0	7
Wood Artifacts/Wood Carving Industry	1	0	5	29	36	26	97
Furniture Industry	77	129	31	126	238	34	635
Chipboard/Hardboard Industry	0	0	2	4	5	7	18
Crate/Box Making Industry	0	6	0	3	36	0	45
Country Sawmills	0	1	4	18	33	6	62
Pulp and Paper Industry	0	0	0	3	1	0	4
Pencil Industry	0	0	1	0	0	0	1
Agriculture Implements	0	0	0	7	1	0	8
Textile Bobbins	0	0	1	0	0	0	1
Tonga, Rehra, Handcarts, etc.	0	0	0	3	5	3	11
Particle Board	0	0	0	0	0	7	7
Wood based cottage	0	0	0	4	0	0	4
Wood related construction	3	1	1	18	33	0	56
Others (specify)	0	0	0	1	0	0	1
Total	81	167	45	257	413	105	1,068

Table D5: Profiling of major wood-based industries (in numbers)

Industry code	AJK	Balochistan	GB	KP	Punjab	Sindh	Total
Brick Kiln Industry	0	5	0	341	1888	305	2539
Tobacco Curing Industry	0	0	0	10	1	0	11
Charcoal Kiln Industry	20	0	0	0	333	55	408
Plywood Industry	0	0	0	2	146	100	248
Truck/Bus body/Tractor Trolley	0	10	0	17	20	150	197
Ship Building Industry	0	0	0	0	0	50	50
Boat Making Industry boats/launches	0	69	0	0	0	160	229
Sports Goods Industry	0	0	0	0	30	90	120
Match Industry	0	0	0	17	0	0	17
Wood Artifacts/Wood Carving Industry	0	0	7	663	269	930	1869
Furniture Industry	133	331	82	2035	4665	1780	9026
Chipboard/Hardboard Industry	0	0	0	6	27	210	243
Crate/Box Making Industry	0	10	0	21	496	210	737
Country Sawmills	0	0	2	43	2087	90	2222
Pulp and Paper Industry	0	0	0	3	36	20	59
Pencil Industry	0	0	0	0	1	20	21
Agriculture Implements	0	0	0	111	46	40	197
Textile Bobbins	0	0	0	0	14	20	34
Tonga, Rehra, Handcarts, etc.	0	4	0	18	112	290	424
Particle Board	0	2	0	0	0	20	22
Wood based cottage	0	0	0	3	6640	66	6709
Wood related construction]	0	0	0	774	1697	50	2521
Others (specify)	0	0	0	0	234	0	234
Total	**153**	**431**	**91**	**4064**	**18742**	**4656**	**28,137**

Table D6: Surce of purchase of wood (% distribution)

Source	AJK	Baluchistan	GB	KP	Punjab	Sindh	Overall
Directly purchase from government	32.8	0.3	0.0	0.8	0.0	0.4	2.3
Directly purchase from Farmland	20.5	4.7	7.2	2.2	1.8	1.2	3.7
Purchased from market/middleman	46.8	93.2	92.1	94.8	95.9	80.8	90.5
Import	0.0	1.8	0.0	1.3	2.4	15.7	3.1
Self-production	0.0	0.0	0.7	0.2	0.0	0.4	0.1
others	0.0	0.0	0.0	0.8	0.0	1.5	0.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table D7: Registration status of business (% distribution)

Provinces	Registered	Not registered	Don't know	No response	Total
AJK	74.1	24.7	1.2	0.0	100
Baluchistan	7.1	92.9	0.0	0.0	100
GB	76.6	21.3	2.1	0.0	100
KP	68.2	30.0	0.8	1.1	100
Punjab	46.0	34.4	2.6	17.0	100
Sindh	46.7	52.4	1.0	0.0	100
Overall	**48.8**	**42.9**	**1.5**	**6.9**	100

Table D8: Current marketing strategy of your products (% distribution)

Provinces	No marketing	Online/ E-commerce	Dedicated Showroom	Through Dealers/ agents	Newspaper/ magazine	Local cable, radio/TV	Brochure
AJK	85.2	0.0	14.8	0.0	0.0	0.0	0.0
Baluchistan	0.0	0.0	82.9	17.1	0.0	0.0	0.0
GB	40.4	2.1	55.3	2.1	0.0	0.0	0.0
KP	26.6	0.0	38.2	19.5	1.5	0.4	12.4
Punjab	35.4	1.2	31.1	31.1	0.2	0.2	0.7
Sindh	67.6	0.0	14.3	15.2	0.0	0.0	1.9
Total	**34.7**	**0.6**	**39.1**	**21.0**	**0.5**	**0.2**	**3.5**

Table D9: Province-wise sample of Small Industries (in numbers)

Province	Industries visited	Number of industries from PBS Blocks
AJK	53	11,295
Balochistan	15	4,374
GB	103	3,597
KP	202	65,155
Punjab	390	161,536
Sindh	191	47,483
Total	**954**	**293,439**

Table D10: Current marketing strategy of selling products (% distribution)

Province	No marketing	Online/ E-commerce	Dedicated showroom	Through Dealers/agents	Local cable/radio/TV	Others
AJK	98.1	0.0	1.9	0.0	0.0	0.0
Balochistan	90.1	0.0	3.4	6.5	0.0	0.0
GB	81.6	0.0	14.6	1.0	1.0	1.9
KP	39.6	0.0	33.2	7.4	0.0	19.8
Punjab	66.2	0.3	9.0	24.6	0.0	0.0
Sindh	91.1	1.1	6.8	0.0	0.0	1.1
Overall	**69.0**	**0.3**	**14.0**	**11.9**	**0.1**	**4.7**

Table D11: Source of cooking fuel (% distribution)

	Firewood	Gas	LPG	Kerosene oil	Electricity	Dung cake	Crop residue	Charcoal/ coal	Others	Total
National										
Rural	60.4	16.2	6.3	0.0	0.0	4.9	10.8	1.1	0.3	100.0
Urban	11.8	81.2	4.8	0.0	0.0	0.5	1.0	0.4	0.2	100.0
Punjab										
Rural	49.0	19.5	7.6	0.0	0.0	6.4	16.4	0.7	0.3	100.0
Urban	9.8	80.7	7.0	0.0	0.0	0.7	1.3	0.2	0.4	100.0
Sindh										
Rural	70.5	13.8	1.1	0.0	0.0	7.1	6.4	0.9	0.1	100.0
Urban	7.6	90.6	0.9	0.0	0.0	0.3	0.3	0.3	0.0	100.0
Khyber Pakhtunkhwa										
Rural	75.3	14.0	6.9	0.0	0.0	0.7	2.3	0.3	0.4	100.0
Urban	17.9	73.1	8.2	0.0	0.0	0.0	0.6	0.1	0.2	100.0
Balochistan										
Rural	62.9	18.8	3.7	0.0	0.0	1.0	10.6	2.4	0.5	100.0
Urban	28.4	59.0	8.8	0.0	0.0	1.0	1.2	1.3	0.4	100.0
Azad Jamu and Kashmir										
Rural	74.2	5.8	4.5	0.1	0.1	6.7	3.2	5.5	0.0	100.0
Urban	35.4	45.3	10.8	0.1	0.4	1.1	1.2	3.9	2.0	100.0
Gilgit Baltistan										
Rural	86.7	0.0	7.4	0.3	1.0	2.4	1.7	0.5	0.0	100.0
Urban	54.8	0.0	42.6	0.4	0.4	0.4	0.4	1.0	0.0	100.0

Table D12: Sources of fuel for heating by province (% distribution)

Source	National	Punjab	Sindh	KP	Balochistan	AJK	GB
Solar	3.4	4.6	4.0	0.7	0.9	1.3	1.6
Electricity	2.6	1.1	6.0	1.3	4.9	17.9	13.9
LPG	0.8	1.2	0.1	0.6	1.2	3.7	7.7
Gas	27.4	30.1	37.4	12.2	17.2	12.3	6.3
Biogas	0.1	0.1	0.3	0.0	0.0	0	0
Crop residual	8.2	5.9	7.2	10.8	17.3	1.7	1.7
Kerosene oil	0.1	0.0	0.3	0.0	0.2	0	0
Fire-wood and charcoal	21.3	17.9	9.3	36.3	40.1	55.6	57.6
Dung cake	2.8	4.6	1.6	0.8	0.2	0.72	1.2
No facility	13.9	12.7	9.1	26.2	9.1	6.7	7.7
Others	19.3	21.8	24.6	11.1	8.8	0	2.2
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Estimated from PSLM 2019/20
* Estimated from Forestry 2021/22 survey
** Estimated from MICS 2020/21 survey

Table D13: Source of fuel for heating purpose (% distribution)

	Solar	Electricity	LPG	Gas	Biogas	Crop residual	Kerosene oil	Fire-wood and charcoal	Dung cake	No facility	Others	Total
National												
Rural	3.3	2.3	0.9	11.7	0.1	11.4	0.1	28.1	3.9	17.4	20.9	100
Urban	3.6	3.3	0.7	62.0	0.3	1.1	0.2	6.2	0.5	6.2	15.9	100
Punjab												
Rural	4.2	1.0	1.2	14.9	0.1	8.2	0.0	23.3	6.4	15.6	25.2	100
Urban	5.5	1.4	1.2	63.5	0.2	0.9	0.0	6.0	0.7	6.2	14.5	100
Sindh												
Rural	5.8	5.7	0.2	8.3	0.3	13.6	0.0	15.3	3.1	15.8	32.0	100
Urban	2.4	6.2	0.0	65.7	0.4	1.0	0.4	3.6	0.2	2.7	17.4	100
Khyber Pakhtunkhwa												
Rural	0.7	1.3	0.6	7.9	0.0	12.1	0.0	40.2	0.8	26.5	10.0	100
Urban	0.1	1.6	0.9	44.1	0.0	1.4	0.0	8.4	0.3	24.4	18.9	100
Balochistan												
Rural	1.0	5.3	1.2	10.7	0.0	20.5	0.3	43.8	0.2	9.8	7.3	100
Urban	0.4	3.3	1.2	45.9	0.1	3.1	0.1	23.8	0.4	6.3	15.5	100
Azad Jamu and Kashmir												
Rural	1.1	12.6	3.4	4.5	0.0	2.1	0.0	66.0	2.5	7.8	0.0	100
Urban	1.5	23.5	4.5	18.6	0.0	1.2	0.0	45.5	0.4	4.7	0.0	100
Gilgit Baltistan												
Rural	1.4	6.6	4.4	3.5	0.0	2.1	0.0	70.6	2.4	9.0	0.0	100
Urban	1.8	23.5	14.5	7.6	0.0	1.2	0.0	40.5	0.4	5.7	4.8	100

Table D14: Household fuelwood consumption (kg/hh/day)

Province	Rural		Urban		Overall	
	Winter	Summer	Winter	Summer	Winter	Summer
Punjab	18	9	18	9	18	9
Sindh	20	15	20	12	20	12
KP	20	12	20	10	20	10
Balochistan	22	10	22	10	22	10
GB	23	9	23	10	23	10
AJK	21	7	21	9	21	9
Total	**19**	**10**	**19**	**10**	**19**	**10**

Table D15: Livestock dependence on rangelands/grazing lands across provinces

Type of livestock	No. of livestock (in millions)	Livestock dependent on rangeland (in millions)	Per day feed requirement of an animal (in KGs)	No. of days in a year fed or raised through open range grazing in range lands, forest lands, shrub and bush lands, river banks and roadsides vegetation	Annual fodder production from rangeland (million KGs)	value of fodder in billion
Khyber Pakthunkhwa						
Buffalo	2.33	0.19	14	36	93.65	1.28
Cattle	7.22	1.19	9	329	3534.25	48.42
Goat	11.61	7.68	3	336	6966.57	95.44
Sheep	4.07	2.69	2	345	2088.42	28.61
Camels	0.08	0.05	15	345	270.26	3.70
Asses	0.68	0.28	9	292	735.84	10.08
Horses	0.09	0.04	12	292	129.82	1.78
Mules	0.08	0.04	9	292	105.65	1.45
Punjab						
Buffalo	21.47	0.89	14	36	431.25	5.91
Cattle	17.43	1.44	9	329	4267.39	58.46
Goat	23.99	9.92	3	336	8995.34	123.24
Sheep	7.69	3.18	2	345	2468.86	33.82
Camels	0.24	0.10	15	345	522.57	7.16
Asses	0.08	0.00	9	292	8.28	0.11
Horses	0.20	0.03	12	292	111.37	1.53
Mules	2.70	0.67	9	292	1758.92	24.10

Sindh						
Buffalo	13.78	0.57	14	36	276.87	3.79
Cattle	14.33	2.37	9	329	7014.61	96.10
Goat	22.34	12.93	3	336	11728.55	160.68
Sheep	5.73	3.32	2	345	2575.60	35.29
Camels	0.40	0.17	15	345	870.95	11.93
Asses	1.63	0.07	9	292	176.60	2.42
Horses	0.06	0.01	12	292	35.53	0.49
Mules	0.03	0.01	9	292	18.92	0.26
Balochistan						
Buffalo	0.510	0.084	14	18	20.51	0.28
Cattle	4.984	3.708	9	310	10345.32	141.73
Goat	21.369	15.899	3	345	14810.29	202.90
Sheep	18.347	13.651	2	354	10873.18	148.96
Camels	0.546	0.361	15	345	1904.48	26.09
Asses	0.745	0.431	9	292	1133.19	15.52
Horses	0.087	0.036	12	292	122.99	1.68
Mules	0.010	0.004	9	292	10.51	0.14
AJK						
Buffalo	0.899	0.149	14	300	601.83	8.25
Cattle	0.689	0.513	9	300	1385.10	18.98
Goat	2.296	1.708	3	335	1545.07	21.17
Sheep	0.299	0.222	2	335	167.56	2.30
Camels	0.001	0.001	15	365	4.47	0.06
Asses	0.069	0.040	9	365	131.07	1.80
Horses	0.016	0.007	12	365	27.76	0.38
Mules	0.012	0.005	9	365	16.43	0.23
GB						
Buffalo	0.003	0.000	14	300	1.83	0.03
Cattle	0.526	0.391	9	300	1056.76	14.48
Goat	2.288	1.702	3	335	1539.78	21.09
Sheep	1.132	0.842	2	335	634.76	8.70
Camels	0.002	0.001	15	365	8.31	0.11
Asses	0.026	0.015	9	365	48.61	0.67
Horses	0.073	0.030	12	365	128.12	1.76
Mules	0.001	0.001	9	365	1.64	0.02
Yaks	0.020	0.016	9	365	53.59	0.73

Table D16: Projection of rural and urban share of population in Pakistan

Province	Percent	2022	2025	2030	2035	2040
KP	100	39.23	41.51	45.60	50.10	55.05
Rural	83	32.72	34.62	38.03	41.79	45.91
Urban	17	6.51	6.89	7.57	8.32	9.14
Punjab	100	121.54	128.60	141.29	155.23	170.55
Rural	63	76.57	81.02	89.01	97.79	107.44
Urban	37	44.97	47.58	52.28	57.43	63.10
Sindh	100	52.88	55.95	61.47	67.54	74.20
Rural	48	25.38	26.86	29.51	32.42	35.62
Urban	52	27.50	29.09	31.97	35.12	38.59
Balochistan	100	13.63	14.42	15.85	17.41	19.13
Rural	72	9.81	10.38	11.41	12.53	13.77
Urban	28	3.82	4.04	4.44	4.87	5.36
ICT	100	2.21	2.34	2.57	2.83	3.11
Rural	49	1.08	1.15	1.26	1.39	1.52
Urban	51	1.13	1.19	1.31	1.44	1.58
AJK	100	4.39	4.63	5.09	5.59	6.14
Rural	82	3.60	3.80	4.17	4.58	5.03
Urban	18	0.79	0.83	0.92	1.01	1.10
GB	100	1.72	1.84	2.02	2.22	2.44
Rural	83	1.43	1.52	1.68	1.84	2.02
Urban	17	0.29	0.31	0.34	0.38	0.41
Overall	100	235.59	249.29	273.88	300.91	330.61
Rural	63	148.42	157.05	172.55	189.57	208.28
Urban	37	87.17	92.24	101.34	111.34	122.32

Table D17: Average household size and number of households

Province	2022	2025	2030	2035	2040
KP					
Household Size	7.52	7.50	7.47	7.42	7.37
Households (in 000)	5,217	5,330	5,453	5,594	5,739
Punjab					
Household Size	5.78	5.76	5.73	5.69	5.64
Households (in 000)	21,027	21,501	22,024	22,601	23,234
Sindh					
Household Size	6.23	6.21	6.18	6.14	6.09
Households (in 000)	8,488	8,677	8,885	9,112	9,362
Balochistan					
Household Size	8.12	8.10	8.07	8.04	7.99
Households (in 000)	1,679	1,715	1,754	1,794	1,839
ICT					
Household Size	6.24	6.22	6.19	6.15	6.10
Households (in 000)	355	363	371	381	391
AJK					
Household Size	6.24	6.22	6.20	6.18	6.16
Households (in 000)	789	802	818	833	849
GB					
Household Size	7.60	7.58	7.55	7.51	7.46
Households (in 000)	292	301	306	312	318
Pakistan					
Overall Household Size	6.24	6.22	6.20	6.18	6.16
Rural Household Size	6.40	6.38	6.36	6.34	6.32
Urban Household Size	5.97	5.95	5.93	5.91	5.89
Rural Households (in 000)	23,191	23,707	24,233	24,771	25,322
Urban Households (in 000)	14,601	14,929	15,264	15,607	15,957

Table D18: Current and projected household fuelwood demand across provinces (in million m³)

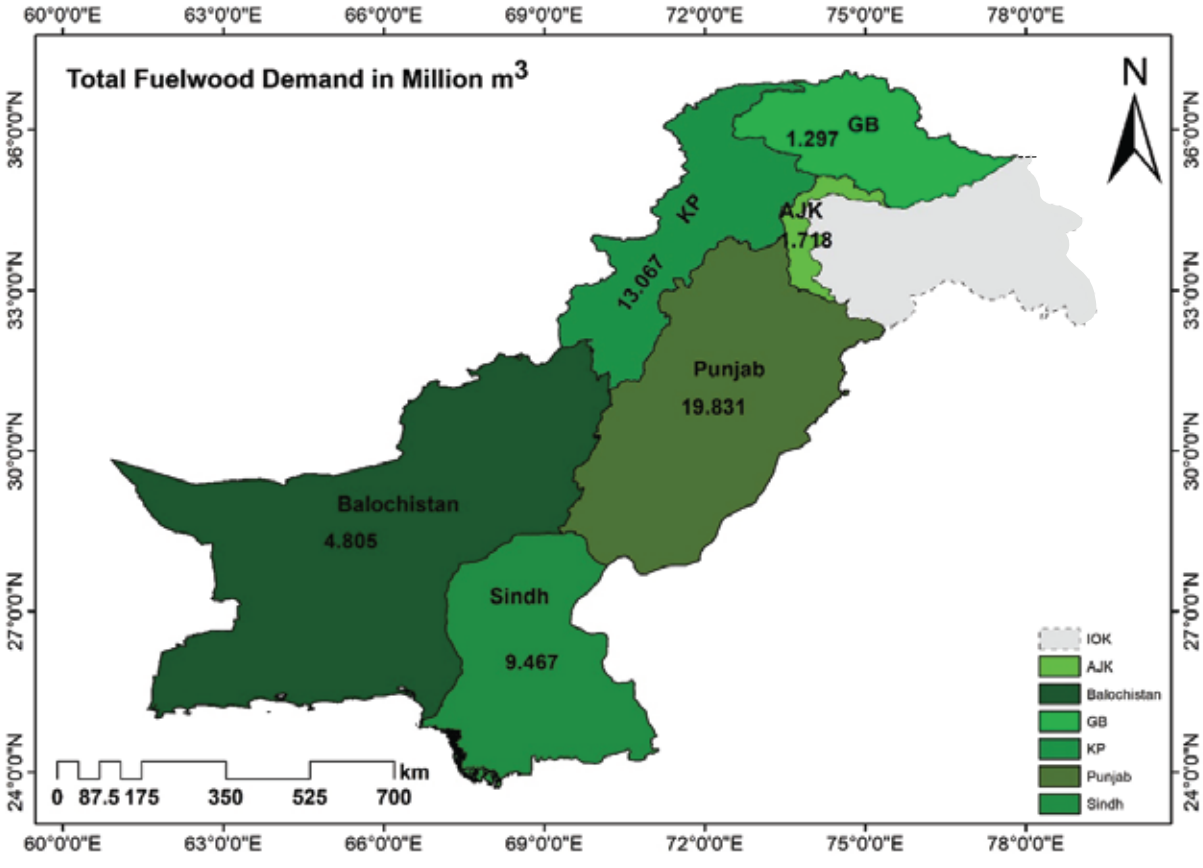
Item	Per capita consumption m^3	2022	2025	2030	2035	2040
		Khyber Pakhtukhwa				
Overall	0.341	13.4	14.2	15.6	17.1	18.8
Rural	0.390	12.8	13.5	11.6	16.3	17.9
Urban	0.087	0.6	0.7	4	0.8	0.9
		Punjab				
Overall	0.157	19.1	20.2	22.2	24.4	26.8
Rural	0.219	12.8	13.5	11.6	16.3	17.9
Urban	0.049	6.3	6.7	10.6	8.1	8.9
		Sindh				
Overall	0.188	9.9	10.5	11.6	12.7	13.9
Rural	0.354	9.0	9.5	10.4	11.5	12.6
Urban	0.035	0.9	1.0	1.2	1.2	1.3
		Balochistan				
Overall	0.380	5.2	5.5	6.0	6.6	7.3
Rural	0.446	4.4	4.6	5.1	5.6	6.1
Urban	0.207	0.8	0.9	0.9	1.0	1.2
		ICT				
Overall	0.218	0.48	0.51	0.56	0.62	0.68
Rural	0.305	0.33	0.35	0.38	0.42	0.46
Urban	0.062	0.15	0.16	0.18	0.20	0.22
		AJK				
Overall	0.378	1.66	1.75	1.92	2.11	2.32
Rural	0.433	1.56	1.64	1.81	1.98	2.18
Urban	0.267	0.10	0.11	0.11	0.13	0.14
		Gilgit Baltistan				
Overall	0.822	1.41	1.51	1.66	1.82	2.00
Rural	0.933	1.33	1.42	1.56	1.72	1.89
Urban	0.601	0.08	0.09	0.10	0.10	0.11

Table D19: Fuelwood demand, supply comparison and gap (in million m³)

Demand/supply	2022	2025	2030	2035	2040
		KP			
Demand	13.067	15.13	16.63	18.23	20.05
Supply	8.43	8.732	10.244	13.016	17.048
Gap	4.637	6.398	6.386	5.214	3.002
		Punjab			
Demand	19.831	23.09	25.4	27.91	30.67
Supply	14.06	14.396	16.076	19.156	23.636
Gap	5.771	8.694	9.324	8.754	7.034
		Sindh			
Demand	9.467	11.76	11.79	13.03	14.28
Supply	7.00	7.225	8.361	10.44	13.464
Gap	2.467	4.535	3.429	2.59	0.816
		Balochistan			
Demand	4.805	5.82	6.36	6.99	7.73
Supply	4.096	4.989	5.136	5.406	5.798
Gap	0.709	0.831	1.224	1.584	1.932
		AJK			
Demand	1.718	1.85	2.04	2.24	2.46
Supply	0.91	1.011	1.515	2.439	3.783
Gap	0.808	0.839	0.525	-0.199	-1.323
		GB			
Demand	1.297	1.57	1.71	1.87	2.05
Supply	1.206	1.625	1.751	1.982	2.318
Gap	0.091	-0.055	-0.041	-0.112	-0.268

Table D20: Timber demand, supply comparison and gap (in million ㎥)

Demand/supply	2021	2025	2030	2035	2040
National					
Demand	19.13	20.94	23.006	25.277	27.771
Supply	14.63	15.967	20.644	28.663	40.024
Gap	4.50	4.973	2.362	-3.386	-12.253
KP					
Demand	3.44	3.487	3.831	4.209	4.624
Supply	2.99	3.386	4.772	7.148	10.514
Gap	0.45	0.101	-0.941	-2.939	-5.89
Punjab					
Demand	13.52	10.999	12.084	13.277	14.587
Supply	7.99	8.43	9.97	12.61	16.35
Gap	5.53	2.569	2.114	0.667	-1.763
Sindh					
Demand	4.442	4.7	5.164	5.673	6.233
Supply	2.13	2.427	3.467	5.249	7.773
Gap	2.312	2.273	1.697	0.424	-1.54
Balochistan					
Demand	1.145	1.211	1.331	1.462	1.607
Supply	0.86	0.899	1.033	1.264	1.592
Gap	0.285	0.312	0.298	0.198	0.015
AJK					
Demand	0.42	0.389	0.427	0.469	0.516
Supply	0.35	0.482	0.944	1.736	2.858
Gap	0.07	-0.093	-0.517	-1.267	-2.342
GB					
Demand	0.50	0.154	0.17	0.186	0.205
Supply	0.31	0.343	0.459	0.657	0.937
Gap	0.19	-0.189	-0.289	-0.471	-0.732


Total Fuelwood Demand in Million m3
N
GB
1.297
AJK
1.718
KP
13.067
Punjab
19.831
Balochistan
4.805
Sindh
9.467
IOK
AJK
Balochistan
GB
KP
Punjab
Sindh
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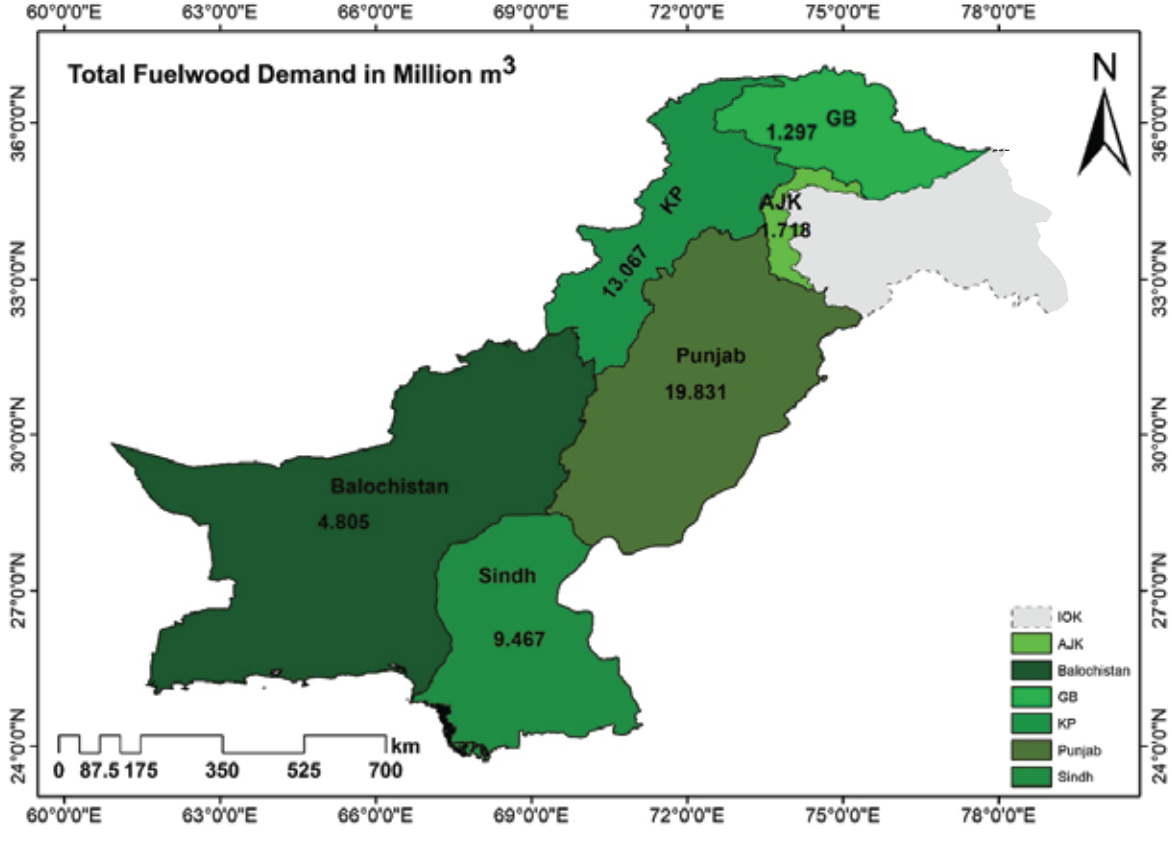
Total Fuelwood Demand in Million m3
N
GB
1.297
AJK
1.718
KP
13.067
Punjab
19.831
Balochistan
4.805
Sindh
9.467
IOK
AJK
Balochistan
GB
KP
Punjab
Sindh
km
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60°0'0"E
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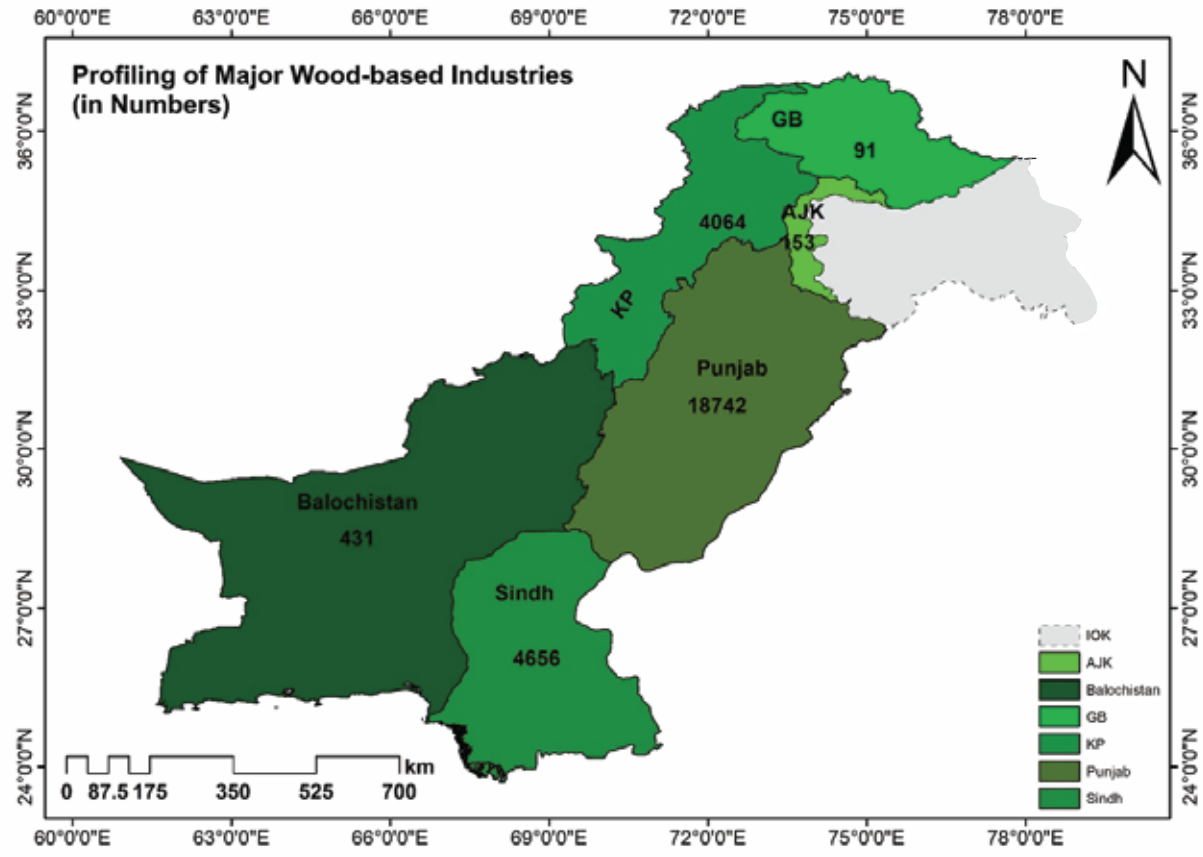

Total fuel wood supply

Annexure E:

Punjab

In Punjab, Bhakkar and Khushab districts were selected for carrying out NTFPs case studies. District Bhakkar, as part of the Thal desert, is chiefly characterized by its sand dunes, and abundant sunshine, with a common drought prevalence. These characteristics make this region a suitable region for the plant named "Tamarix Aphylla" Locals call it Frash or Ghaz or Khaggal or Tamarisk. This plant provides economic and medicinal benefits too. The average cost of its wood is around PKR 150-180 per Kg and an average woody plant can yield wood worth PKR 1300-1500. Commercially, its twigs are sold at PKR 800, and wood is sold at PKR 400-450 per 40 KG. Afterward, the wood goes to district Bhakkar's factories where it is used as an input in the chip-board industry. Around 150,000 to 200,000 kilograms of wood is consumed by each factory daily. Each factory provides jobs to around 50-60 permanent employees and 100-120 daily wagers. Furthermore, its bark, flower, and gals serve medicinal purposes as well. Tamarix Aphylla is also utilized in carpentry, agriculture implements, fuel wood, shelter belts, charcoal, tannin, erosion control, and sand dune stabilization.

Similarly, FGDs were carried out in the district Khushab as well, with a focus on the Eucalyptus. The Khushab's land has salinity, seepage, and waterlogging issues which were further exacerbated by the completion of the Thal grand canal. Consequently, Provincial Forest Officials introduced farm forestry of "Eucalyptus", locally named Sufeda or Lachi, or Red River Gum. Its wood is widely used in plywood, particleboards, furniture, sports goods, crate-box making industries, fencing, shuttering and scaffoldings, turnery, firewood, flooring, construction material, etc. Also, it is used in producing oil, and herbal medicine in the treatment of many diseases, aches, and pains. Pertinently, Eucalyptus sapling cost is minimal i.e., PKR 03 - PKR 05, costing PKR 5000 per hectare with minimal water cost. That means the overall output per hectare is 25000 kg to 30000 kg. The cost of wood from Sufaida varies from 350 - 450 per 40 Kg. On average the revenue from wood is around PKR 400,000 every four years per hectare. When trees are cut, and wood sold, the stems grow back on their own for four years and this cycle continues 4-5 times. Summarily, the total revenue is around PKR 20,00,000 to PKR 25,00,000. This is why almost 250,000 people in Khushab are partially dependent on Eucalyptus. Nearly 10-30% of the wood is used locally and the rest is transported to Lahore, Sargodha, Peshawar, etc. for wood-based industries.

There is also a need for exploring the possibility of operationalizing the eucalyptus wood in chipping wood, paper making, tissue production as well as packaging material.

Sindh

In Sindh, non-timber forest product (NTFP) case studies were carried out in districts Hyderabad and Nagarparkar. Among many, Munj or Reed and Guggul (Commiphora wightii/ Commiphora mukul) are the main NTFPs in the province. Munj, locally called Kana is a large, tufted grass, found in the riverine area alongside riverbeds. Whereas, Guggul is a small shrub or tree which produces a fragrant resin. Guggul bears significant ecological, religious, medicinal, and economic importance for local communities. Specifically, the local Jogis - the minority Hindu artisan community's livelihoods is dependent on Munj, with all men, women, as well as children engaged in making different handicrafts from the plant. Nevertheless, other communities from neighboring provinces are also linked with these NTFPs businesses in different capacities. A range of finished and semi-finished products are made by utilizing different parts of the plants. Namely, the carpets, mats for walls, roofs, doors and windows, chairs, stools, fancy mats, and indoor decoration pieces, medicinal gum (antiseptic for mouth ailments, cholesterol control, skin diseases, weight loss), and ingredient for fragrances manufacturing.

Gugul and Munj, both supply and demand-side measures are needed. These include proper regulation by provincial departments with a focus on balanced, sustainable NTFPs extraction, technological innovation, improving warehouse capacities, awareness campaigns with the involvement of not-for-profit sector, conducting proper resource assessment study, and large-scale saplings production.

Khyber Pakhtunkhwa

Khyber Pakhtunkhwa is blessed with diverse varieties of NTFPS. Based on the rich profile in the context of NTFPs, for this study, focus group discussions (FGDs) were held in South Waziristan, Hangu, Karak, and Madyan (Swat) districts. The focused NTFPs were Chilgoza, Pine, Mazri, honey, among others. The Chilghoza forests situated in South Waziristan, are owned by the indigenous Ahmadzai Wazir tribe, spread over 218000 - acre area with 11 million trees. An estimated 40,000 households depend on these forests for their livelihoods by earning PKR 100,000 to 150,000 annually. The total production of Chilghoza nuts has been estimated at about 65,000 tons per year.

The Hangu's district prominent NTFP, Mazri or Dwraf Palm (Nannorrhops ritchiana), is scattered sporadically at 24,291 hectares. A significant quantity of Mazri is received from the newly merged districts (ex-FATA) as well. The annual estimated production of Mazri, pouring into Hangu market is about 800,000 Kilograms. A majority (60-70%) of poor rural households are involved in a supply chain with significant numbers of elderly women and kids. Both raw and semi-finished Mazri are transported to Peshawar, Nowshehra, Mardan, Attock, etc. An average household earns from Rs.20,000 to Rs.50,000 monthly. The majority of the folks are involved in weaving and making ropes - commonly produced product, followed by hand fans (Babozi in Pashtu), handicrafts, mats, mosque praying mats, baskets, and bread pots (shkor in Pashtu and Changer in Urdu).

District Karak's Takhte Nasrati Tehsil is the most famous site for producing honey due to abundance of favourable host plants for honeybees. Major honeybee types are Apis cerana, Apis mellifera, Apis dorseta, and Apis florae. Annually 400 to 500 tons of honey is collected in Karak and more than 1200 to 1500 rural persons are involved in it. About 2% honey is of Ber, 10 to 15% of Phulai/Acacia, and the rest is others. Currently, the price per 50 Kg of honey ranges from PKR 18,000 to 70,000, depending on the honey's type. In the honey dealing area of Takhte Nasrati, 15% to 25% of local residents are benefitted from the income generated from honey, and a household on average earns Rs. 200,000. Raw extracted honey is processed through stirring and aeration in the district of Peshawar, adding a value of PKR 50,000 per kg to its value.

District Swat's Madyan is a hub of NTFPs business. Prominent NTFPs include morels, wild almonds, walnut, Chalghoza, Hazel Nut, Pine Needles, Mushkebala, Mamekh, Kaniz, Srajarai, Sharshamay, Amlok/Wild Persimmon, Sperkay/Thyme, Maro Rang, Benafsha flower and leaves, berries like raspberry, blackberry, yellow raspberry, Juniper seed, pine resin, deodar oil, Metherjara/Trillium, etc. Local men, women, and children collect these NTFPs. An estimated PKR 30 to 35 crores, PKR 6 to 7 crores, PKR 4 crores, and PKR 3 to 4 crores of earnings is made from Walnut, Morrel, Pine Needles, and Honey, respectively.

In KP, locals pointed out several issues across the supply chain i.e., production, collection, transportation, processing, and marketing of NTFPs. The cumbersome procedures and slow process of acquiring a transport pass (TP) from the provincial Forest Department, and hefty fee collection by the forest, Customs, and Police departments, make the timely delivery of products challenging. Additionally, there is lack of facilities for processing, packaging, and storage of all NTFPs produced in respective districts. Insects attacks, extensive pesticide usage, illegal deforestation, unplanned and hasty interventions by local and international NGOs, over-extraction, heavy government levies, and harmful flora and fauna, are the range of challenges in the supply chain which need to be addressed.

Balochistan

In Balochistan province, district Ziarat. Lasbela, and Sherani were selected for the case studies. Prominent NTFPs are medicinal plants of Juniper ecosystem, Guggle plants, and Chilghoza ecosystem. Balochistan's Juniper Forest Ecosystem is spread throughout districts Ziarat, Quetta/Harnai, Kalat, Loralai, Killa Saifullah, Pishin, and Killa Abdullah. These forest ecosystems include Juniper (locally known as Obusht in Pashto, Hapurse in Brahvi, and Majoo or Sanober in Urdu). These plant species have medicinal uses for various purposes.

In district Lasbela, Guggle (commophora mukkal) with the synonymous name Waghtii, is a prominent NTFP. It is a medium-sized, thorny/spiny flowering shrub, and one of the hardiest species in drought-hit areas. It has a wide range of uses and plays a major role in the traditional herbal medicine of India. Guggle and Gum Guggleu are the names of the yellowish resin extracted from its trunk. This resin is the source of the modern extracts of Guggle. The resin or gum is also used to lower cholesterol and triglyceride levels, and treat arthritis and obesity. According to a study, in 1999, only 18500 kg market of gum was reported. Karachi is the main market where 20 percent of Guggle gum comes from Balochistan while 80 percent comes from Sindh. At present 10 to 11 tons are being marketed while there is a demand for 60 to 70 tons per annum. The top export destination is India (60%) while 20% is exported to Singapore. The present Management of Natural Resources has no plan for the Guggle tree. Neither there has been plantation drive or conservation efforts of Guggle trees a priority. There is a dire need for the delineation of Guggle conservancies either in protected Forests or communal land through involvement of custodian communities.

The Chilghoza forests of the Suleiman Range spread over the Suleiman Mountains (part of District Zhob and Sherani Districts). The Mountains contain the world's largest pure stand of Chilghoza (Pinusgerardiana) forests that are known to be the world's pure stand. The Chilghoza forests of Suleiman Range provide habitat to the endangered straight horned markhor "Capra falconerijerdonii" too. Pine nuts are the main products and most of the population depended on this for their livelihoods support. In the past few years, these nuts have become the most expensive with a price of Rs 7500/ kg in the market. Although Chilghoza nuts are the main NTFP collected from the Sherani forests, the people living in the vicinity of these forests also benefit from the collection of a variety of other NTFPs. Unfortunately, anthropogenic activities like exhaustive cone harvesting for seed collection, logging for timber, harvesting for fuel wood, overgrazing, burning, hunting, and many other factors have brought disturbances in the Chighoza ecosystem.

Azad Jammu and Kashmir

In the State of Azad Jammu and Kashmir (AJK), districts Rawalakot, Poonch, Mirpur, and Bhimber were selected for the FGDs with a focus on Poplar plantations and Eucalyptus. In Poonch, Poplar was selected due to the high dependency of local communities on this plant for their livelihoods over the years. Per family land holding is small, on average less than one acre. Presently, almost 1,000 households are linked to the Poplar plantation business. As a common practice, trees are sold to dealers while in the field in return for cash, while cutting, processing, and transportation expenses are paid by dealers. The average sale price is about 400 rupees per maund, equivalent to 1.75 cubic feet on which 70 rupees is expenditure from farm to market and then the middleman sells the produce at an average price of rupees 600 to 700 per maund and earns a profit of 130 to 230 rupees per maund. From 2011 to 2021, the total volume of wood extracted was 5,130,575 (cft). Presently, Poplar logs are sold in Rawalpindi, Islamabad, Gujranwala, Sialkot, and Lahore. The wood is also used in match, plywood, sports, and construction industries (through wood planks, support props for shuttering, particle board manufacturing, and carets making). Furthermore, in Rawalakot, the wood is sold in raw form.

In Mirpur and Bhimber, FGDs with a focus on Eucalyptus and Poplar were carried out in Kotla Jhangian Datta, Forest Nursery Koohl, and the Divisional Forest Officer office. The state of Azad Jammu and Kashmir (AJK) forest department, through the support of international organizations, has been involved in plantation efforts with the active participation of local communities. Interestingly, the affluent families of the twin districts with the support of foreign settled relatives are doing well with a reasonable return on plantation efforts. The majority of the plantation owners and farmers sell their plants to the middlemen (usually from Pakistan's other districts). The middleman, organized in unions, holds the monopoly in maintaining the price offered to the farmers and earns a handsome profit (almost 100% as reported by FGD participants). To challenge the monopoly of the middleman, some foreign returned plantation owners got involved in forwarding value addition across the supply chain by establishing a sawmill, producing semi-finished and finished wood products and establishing of the fish farm. It has led to the job creation of local populace, craftsmen, and artisans. At present about 50 such persons are engaged in such activities in about every village of 5,000 to 6,000 population.

Gilgit Baltistan

Gilgit Baltistan, home to numerous endangered plant species, is famous for housing the largest amounts and types of NTFPs in Pakistan. For GB, case studies were carried out in districts Astore, Ghizer, and Diamer owing to their rich NTFPs' resources and historical dependence on native rural communities. Some of the prominent medicinal plants of district Astore include Black Cumin and Kuth, while aromatic plants include Sausuria, Artemisia, Berberis, Thymus, Wild Mint, and Rheum. District Diamer's most common NTFP product is Chilghoza (the nuts of Pinus gerardiana) popularly grown in Goharabad, Huddur, Gaiys, and Khinar. Provincial medicinal and aromatic plants (MAPs) have medicinal, aromatic, and economic value. More than 90% of the local communities and households living in high altitude areas harvest, store, and sell these NTFPs in local and national markets. Moreover, 30% of the local urban households benefit from these plants' collection and processing. The NTFPs activity leads to annual earning of PKR 50,000 to 200,000 in district Astore and PKR 100,000 to 500,000 in district Diamer. A significant number of local harvesters and contractors participate in the twin districts' NTFPs supply chain, including women.