

## Article

# Socio-Economic Impacts of Livelihood from Fuelwood and Timber Consumption on the Sustainability of Forest Environment: Evidence from Basho Valley, Baltistan, Pakistan

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**Abstract:** Forests across the world are considered to be a huge socio-economic and environmental benefit to host and adjacent communities. This study focuses on assessing the impacts of fuelwood and timber consumption on the livelihood of households in the Baltistan region in Pakistan. Primary and secondary sources of data were employed for the study. The primary sources involved the use of questionnaire survey and interview while the secondary sources involved the use of documented information in textbooks and internet materials. The study revealed that 82% of the people within the region were involved in agricultural activities, 71% depended on the extraction of forest resources for their livelihood, while 18% depended on off-farm activities for their livelihood. The study also observed that among the number that depended on forest resources for their livelihood, 59% were involved in the extraction of non-timber forest products while 41% were involved in the extraction of timber forest resources. The study further revealed that there was no significant difference in the level of benefits from the forest across the seven districts under investigation with a chi square value. The volume of forest products extraction was found to be high closest to the forest and to be low with increasing distance from the communities. The major benefits from the forest range were due to employment that increases the individual and family income. Forest also helps to control erosion and enhances aesthetic beautification and temperature regulation. The research suggests that the policy makers must provide a sustainable solution to reduce the overexploitation of the forest resources by providing better alternative earning resources to the resident communities.

**Keywords:** fuelwood; timber environment; deforestation; socio-economic; livelihood; Gilgit Baltistan; Pakistan

## 1. Introduction

The increasing utilization of timber and fuelwood for energy production has been largely influenced by many socio-economic factors that affect the livelihood of most households across the world. The development of timber and fuelwood extraction, processing and utilization for energy production creates huge business opportunities and a reliable source of income that decreases the challenges of unemployment [1,2].

Poverty is one of the biggest problems facing the entire world with six percent of the world's population being perceived to be poor based on the one dollar per day income. The quest to alleviate poverty has forced the majority of people across the world to depend on the extraction, sales and utilization of forest resources as a major source of livelihood. World development initiatives to reduce the poverty level by more than half through the

implementation of “Millennium Development Goals” (MDG) exist [3]. Consequently, over 90% of the 1.2 billion people living in poverty worldwide now rely on forest products extraction. Forest products and resources provide a wide range of social, economic, medicinal, environmental, cultural and traditional benefits [4].

In Pakistan, the utilization of timber to generate wood fuels takes up to 51% while the extraction of timber for construction, furniture and export is 49% [4]. The importance of wood fuels as a source of energy across the world cannot be denied and is considered to be the main component of social development [5].

In Pakistan, the majority of the produced and utilized energy is from wood fuels [6]. The ease of access to wood increases the use of charcoal for the purpose of energy generation that is causing rapid deforestation in vulnerable forested areas in Pakistan [6–11]. The growing rate of deforestation in Pakistan is increasing due to increasing domestic, commercial and industrial energy demand; there is dire need to examine the degree of timber extraction for energy and level of deforestation and its impact on socio-economic and environmental benefits for the Pakistani community. This study aims to analyze the impacts of the extraction of timber for energy production on rural people’s livelihood in the Baltistan region of Pakistan. The study shall seek to answer the following questions:

1. Does the extraction of timber and fuelwood have an economic impact on the people?
2. What are the socio-economic factors that influence timber extraction in Pakistan?
3. What is the socio-economic potential of fuelwood consumption for the people of the study area?

### *1.1. The Role of Timber and Fuelwood Forest Products in the Livelihood of Rural People*

Timber forest products have been touted to have huge economic impacts on the rural population across the world [10–14]. Moreover, timber and fuelwood harvesting increases the rural economy with a huge contribution towards increasing self-economic reliance, family income and employment opportunities [15]. Timber harvesters and non-timber forest products in Pakistan have helped to engage teeming rural dwellers, providing them with up to 50 percent of their total income [16]. The survey recorded the sources of fuelwood, which included both private and public forests. The total amount of timber, weighed in tons, was translated to cubic meters. In 2001, calculations revealed that a total of 3044 m<sup>3</sup> of wood was harvested from natural forests, with 635 m<sup>3</sup> coming from farm woodlots [1].

In addition to the environmental subsistence and economic importance of timber and non-timber forest products, they also provide food security to the majority of rural residents in most developing countries [17,18]. These factors make up the reason why the utilization of fuelwood has a site- and situation-specific energy option. The choice for many users depends on its availability and affordability over other sources of energy [19]. In the past, most Asian countries used wood and non-wood timber forest products mainly for domestic consumption while dry branches and trunks of trees and shrubs were also utilized to produce domestic energy [20]. The problem of fuelwood consumption in Pakistan has been used to produce fuelwood for the purpose of generating energy for commercial purposes [21]. Consequently, the challenges of fuelwood utilization in Pakistan are gradually becoming unbearable over time, as there has been an observed rapid increase in deforestation activities which has made most forest products scarce and has caused extinction [20]. Notably, charcoal, which is a forest product and a major source of household energy production, has slowly become an important commodity for the majority of middle- and low-income earners [22]. It is also very relevant to note that fuelwood contributes significantly to national energy balances and is an important source of income for households and a potential source of renewable energy capable of boosting significant economic growth while at the same time reducing the dependence of poor developing countries on expensive energy imports [6,10]. The term “fuelwood” comprises firewood, charcoal and other wood-derived fuels and accounts for between 70 to 75 percent of total energy usage and 80 percent of household energy utilization across Asian countries [22].

In Pakistan, fuelwood is largely collected either free from the natural forest (municipal forest, forest reserves and some private forests) or by charging small fees (royalties) to the land owners [21].

Forests are known for their natural and numerous resource banks. They have helped in numerous ways to sustain development and human needs the world over for centuries and most people have utilized and harvested fuelwood and timber, wild animals (for meat) and grazed their livestock in forests [23–25].

Forest products are major natural resources capable of satisfying human wants, which range from material needs such as wood (for construction and fabrication); paper; environmental needs such as soil erosion protection and climate change mitigation; and socio-economic needs such as providing employment, business opportunities, creation of wealth, recreational needs and sources of individual or family income [26]. Several studies [27–29], have illustrated that the majority of rural and urban dwellers across the world have benefitted one way or the other (either directly or indirectly) from forest products and most people have high dependence on forest resources for sustenance and growth [30]. Forest and forest products contribute to the well-being of people and their climate, and at times the very survival of millions of rural people in Pakistan has been identified to depend solely on the proceeds from forest resources. Emphatically, the following selection of woody plant products used by rural communities in Pakistan includes: fuelwood, charcoal, livestock forage, mulch/compost and building timber. Forestry and allied businesses such as logging, village carpentry and the fabrication of timber components for the building sector employ almost 500,000 people. The forestry industry provides 0.3% of the GDP.

Between 1996 and 2000, state forests and farmlands generated an average of 31.66 million m<sup>3</sup> of roundwood and 2.35 million m<sup>3</sup> of industrial roundwood each year. To fulfill national demand, another 532,000 m<sup>3</sup> of industrial roundwood was imported each year.

In the form of fuelwood, forests provide 32 percent of Pakistan's overall energy demands. Fuelwood, along with other kinds of biomass, is used as the major energy source by 90% of rural families and 60% of urban households.

For one-third of Pakistan's 86 million cattle, forests offer pasture. Leather, timber and other animal products account for about \$400 million in export revenue, or 9% of overall revenues. Forest degradation is being caused by rising numbers of cattle trampling and browsing, and uncontrolled grazing is a key barrier to sustainable forest management.

Forests are critical for preserving reservoir catchment regions utilized for power generation and irrigation. In Pakistan, agriculture, which accounts for 26% of the GDP, is heavily reliant on irrigation, with yearly losses of PKR 2.3 billion owing to floods, soil erosion in upland watersheds and siltation in reservoirs and irrigation works (source, national forest products statistics, Pakistan) (house ponds, kraals and fences).

Forest products play a major role in the success of industrialization worldwide, as they provide the primary raw materials required for downstream activities such as pulp milling, paper manufacturing, saw milling and furniture manufacturing, and as such, could be considered the core of the value chain of the forestry, timber, pulp and paper industries in the world in general and Pakistan in particular. There are many forest products-based industries in Pakistan such as construction, furniture manufacture, match production, mining applications, particle board and fiberboard manufacture, construction of trains, trucks, buses and boats, production of sports goods, brick manufacture and tobacco curing [31]. Forest resources also offer numerous benefits to the well-being and growth of adjacent communities and society at large in Pakistan. These benefits can be observed to include provision of firewood for charcoal production, medicinal advantages through leaves, herbs and roots, aesthetic advantages by adding unquantifiable natural beauty to surroundings, employment and business opportunities and environmental infrastructure, such as carbon sequestration and water supply [32]. The forest plays a major role in enhancing economic growth as it provides a numerous range of employment and business opportunities which includes full-time, part-time and casual employment in firms or industries which rely on the forests as their raw material base for production. Obviously, major types of full-time

and direct employment could be said to include employment in the forestry unit as forest guides, security and various types of contracting businesses or employment opportunities. Nonetheless, a significant number of contractors tend to be employed full-time, including several workers, nursery jobs, spraying contractors, earth moving contractors, contractors for security and fencing and contractors for harvesting [33,34]. From the socio-economic point of view, the forest provides a large volume of timber and non-timber products. It produces revenue and foreign exchange for the national governments at low prices to meet the demand of pulp and building companies or industries. The government provides local people with employment and business opportunities and provides the residues and byproducts left behind after harvesting for fuelwood or energy production [35,36]. The five highly ranked benefits that households enjoy from the forest are fuelwood, medicinal plant, animal fodder, construction timber and craft materials [37–39]. Forest products, in particular timber products, provide rural people with various categories of jobs and business opportunities, apart from direct employment opportunities for employees engaged in the management of forest units. It also provides indirect jobs for timber traders involved in the bulk purchasing of timber and the production and selling of poles [40]. It was also observed that the forestry sector provides a range of benefits other than industry and job opportunities for local residents and communities [40,41]. Forest resources are also an important part of the rural environment, in which a combination of forest products, community settlements and other agricultural activities form a mosaic of land use and occupational functions [41]. In communities that have large forests, big companies are attracted to such areas or regions and they in turn provide schools, health facilities, markets, basic and social amenities, employment opportunities where they have cited and have a large number or a concentration of employees [42]. The majority of forest areas in Pakistan are in rural areas and play an important role in the establishment and maintenance of socio-economic activities in those areas [43]. Within these areas, however, high levels of poverty are found despite the presence of forest resources and industries [44]. While it can be argued that people living in forest areas are not any wealthier than those living in non-forest areas, the fact remains that without such a forest, they might have been far worse off [44].

### *1.2. Timber and Non-Timber Forest Exploitation and Livelihood Enhancement*

Livelihood can be defined as the means, activities, entitlements, assets through which people make a living through natural or biological factors (land, water, common property resources, flora, fauna) or social factors (community cooperation, family unity, social qualities, participation, empowerment) for the well-being of humans (knowledge, ability, skills) and is therefore considered a necessity when considering sustainable development [45–47].

Exploration and exploitation of timber and non-wood timber forest products are major and supplementary bases of livelihood for farmers and rural households, respectively, in Pakistan [7]. Tobacco curing, fuelwood use per ton of green tobacco was 1.26 m<sup>3</sup> in 1987. Pakistan's yearly tobacco production fluctuated from 64,700 to 89,200 tons between 1978 and 1984. As a result, total fuelwood uses in 1984 would have been 112,400 m<sup>3</sup>.

Brick manufacture, brick kilns produced a total of 11,118 million bricks and 1227 million tiles. One million bricks require an average of 4.3 m<sup>3</sup> of fuelwood and 271 tons of coal to cure. FSMP assessed 1990 fuelwood usage for brick and tile manufacture as 83,370 m<sup>3</sup>. Source: (national forest products statistics, Pakistan) [10–48]. It is posited that livelihood comprises capabilities and present and potential properties, while not undervaluing the natural resource base [45,48,49]. It is further noted that timber and non-wood timber forest products can open up new livelihood opportunities for most rural or forest area dwellers, as the harvesting of timber forest products can be adopted and utilized to enhance personal/individual/family income and brings about business and employment opportunities that could in the long run improve the people's welfare and living standard. However, where there is potential for increased income by forest products sales, the quality and volume of the products will determine the level of income to be obtained by individuals or

groups. Proceeds can accrue as income for individuals, heads of households or the community as a whole, enabling them to invest in public basic and social facilities or amenities such as water systems, nurseries and schools. Considering all of these factors may reduce or decide household level dependency on forest resources and also reduce the threatening level of poverty while at the same time improving opportunities for generating income and correspondingly improving standard of living. This will also reduce the pending risk of land and soil depletion or degradation caused by careless or irresponsible utilization and harvesting of forest products which also leads to the distribution of the watershed [50]. The creation of alternative sources of income, new municipal institutions, access to new services and a new social relations system has important implications for the forest or rural dweller's livelihood and the sustainability of the forest environment. Consequently, three major factors were realized to influence the household livelihood of rural dwellers, namely: (1) the location of specific forest users (2) the ethnic caste background of specific users and (3) the homogeneity or erogeneity of individuals.

In most developing countries, forests are significant in the livelihoods of local people. Local people rely on the forests for various consumables and commercial goods such as fuelwood, construction materials, medicinal products and food.

Globally, between 1295 billion and 1945 billion people are expected to rely on varying degrees of forest products for their survival and around 200 million members of indigenous communities rely solely on the forests [51]. Moreover, 350 million people live adjacent to dense forests and rely on them for their livelihood and income [52]. Estimates are also provided that 25–30% of rural dwellers' source of income depends on environmental resources which include the forests in developing countries [28] and consequently, forests also serve as a safety net during times of crisis or seasonal food shortages [53]. Deforestation and degradation of the ecosystem in Pakistan is rapidly on the increase; without any corresponding precautionary measures to rectify the situation, the forests have continued to suffer overexploitation. There is serious need to adopt conservative measures to ensure the safety and sustainability of the forests and its resources in Pakistan [54]. Consequently, forest co-management approaches have been observed as one major way of improving the livelihoods and welfare of rural communities. Livelihood could also be described as the means for adding value to life. It involves activities that provide food or generate income that could be used in purchasing other goods and services which are essential for human survival.

Forest depletion is one of Pakistan's most pressing environmental concerns. Forests are disappearing at a rate of 39 thousand hectares each year, according to estimates. Between 1990 and 2000, the yearly rate of deforestation in Pakistan was 1.5 percent (FAO, 2005). Fuelwood is an important part of Pakistan's household economy, as it covers about 53% of the total annual household energy needs generated [55]. It has also been estimated that 65–75% of Pakistani households use fuelwood to meet domestic and commercial energy requirements [56,57]. The reliance on fuelwood in Pakistan is expected to remain high considering the huge relevance of the product to the energy availability and utilization in the country and with the non-availability of a credible alternative, no one can predict a shift from the harvesting and utilization of the timber-induced fuelwood in Pakistan [58]. The high demand for domestic fuelwood is thought to be responsible for the rapid depletion of forest areas in Pakistan [59–62]. The country's deforestation rate is estimated to be the second highest in the world [63–67]. The world conservation union (IUCN) has predicted that, with current population growth, wood consumption in Pakistan will increase by 3 percent annually. Therefore, IUCN assumes that if the current rate of deforestation continues, the forests of Pakistan may disappear within 10–15 years.

Across Asia, the Himalayan region's forests are considered to be among the most degraded due to human inducement and influences [68–70]. Deforestation is also frequently due to a growing human population in the Himalayan region which has put a lot of pressure on natural resources due to the corresponding increasing poverty level [71–75]. This theory was considered "too simplistic" and dubbed the "Himalayan theory of en-

vironmental degradation." It is argued that the degradation of environmental resources has been over-dramatized and treated as mere linkages between resources control and politics while other factors have been represented as causal activities of less influence to environmental sustainability. Therefore, conservationists have diverted the discussion from the main problems and the actual causes of deforestation into a situation of competition for advantages or tussles for control.

Despite the importance of fuelwood collection for the national economy, reliable data for Pakistan on fuelwood collection and its impact on natural forests are not available. This is especially true for the Western Himalayan region in the Northern Areas (NAs), where few if any empirical studies of fuelwood consumption have been conducted so far. The present study has been undertaken to respond to this lack of reliable data and to gain an understanding of how fuelwood collection by the local communities impacts on forests in the NAs of Pakistan. While other factors such as livestock grazing and conversion of forest to agricultural land may in some cases also be reported to contribute to deforestation, firewood consumption by local people is often mentioned in the literature as the main cause of deforestation in this region. This study provides local data on fuelwood consumption from Basho Valley, and investigates whether general perceptions that forest depletion is caused by local fuelwood collection can be supported by this case study. In addition, the local extraction of timber was also estimated in order to be able to present a more complete picture of the causes of deforestation in the area. Indeed, overuse and mismanagement have been reported to have seriously impacted natural forests in Basho Valley [76]. The problem of fuelwood consumption in Pakistan is gradually becoming unbearable as charcoal is not only the major source of household energy for the majority of middle- and low-income earners but it is very important to note that it is also a significant contributor to national energy balances and an important source of household income.

In conclusion, it has been observed from available literature that forest resources play a vital role in improving and maintaining the living standards of rural communities adjacent to or near forest areas. Forests are also a major contributor to the economy or national GDP. Forests are mostly in rural areas and are therefore well positioned to support rural host communities' quest for livelihood. Forest products play a critical role in reducing rural communities' levels of poverty and deprivation, while forest resources bring numerous benefits to adjacent communities across Pakistan. Based on the above, this study hereby seeks to investigate and examine if the forest in Baltistan region of Pakistan has socio-economic benefits for the rural dwellers and adjacent communities.

## 2. Conceptual Frameworks Model

### 2.1. Livelihood System Model

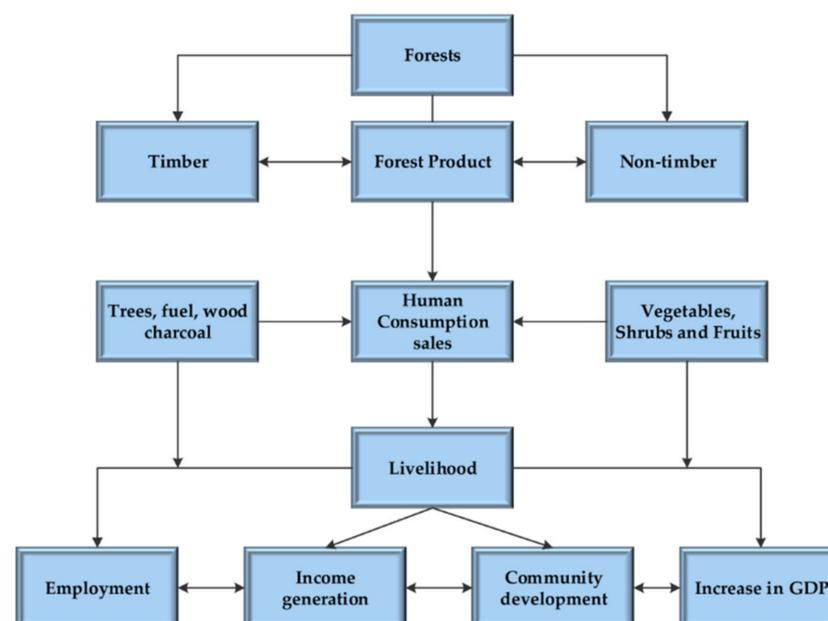
Forest ownership: in Pakistan, forests are classified based on their legal status, function, plant composition and ownership. The sections that follow detail the different forms of state and privately held forests.

State-owned forests account for 85 percent of Pakistan's total forest area, which totals 87.98 million hectares. On the basis of legal classification and protection, they are further classified into four classes:

- Reserved Forests. Forests managed by the Forest Service and designated as "Reserved Forests" under the 1927 Forest Act. Local residents do not have rights or privileges unless they have been officially granted by government notification.
- Protected Forests. Forests designated as "Protected Forests" under the Forest Act of 1927. For grazing, grass cutting, dry wood collecting and other activities, local people enjoy certain rights and concessions.
- Unclassed Forests. The Forest Department manages public forestlands that are neither Reserved Forests nor Protected Forests.
- Resumed Lands. Lands relinquished by bigger landowners after the Land Reforms Act of 1959 set a limit on the amount of land that may be owned. Concerned landowners kept farmed fields but gave up forest properties that exceeded the ceiling. The Forest

Service is in charge of these reclaimed areas. Source: (national forest products statistics, Pakistan). This model, which is basically on livelihood systems, emerged to present livelihood processes and functions. In most forest regions of the world, the household's livelihood is augmented through entitlements and royalties from available capital assets such as the harvesting and sale of timber and non-timber resources. Different households have varying rates of household assets within the same locality. The poorest would need to rely on their resources and their common property entitlements to survive. For most rural dwellers, agricultural activities could be said to be their main occupation and source of livelihood but most of them perceive the harvesting of forest products and resources as a great opportunity to augment their income base and this has served as a conspicuous means of economic enhancement towards the support of rural livelihoods with a clear socio-economic benefit to forest-based communities [14].

The harvesting of forest products can be an important support operation for individuals and families in forest regions, as non-agricultural livelihoods are especially vulnerable to seasonal demand fluctuations. Changes in entitlements/terms of access can have a critical impact on the livelihood of rural dwellers, as it is difficult to have a situation where there is an equitable sharing pattern which will ensure that everyone gets a fair share of the common assets. The model of livelihood systems has shown that forestry helps to improve and enhance the well-being of forest communities in various and numerous ways (consumption and sales of the forest products such as the trees, fuelwood, charcoal, vegetables, shrubs and fruits). The fundamental aspect of this model is that it provides a template to help scholars and planners understand issues of livelihood. The model highlights that livelihood opportunities provide employment opportunities, income generation, community development and increase in GDP (Figure 1).

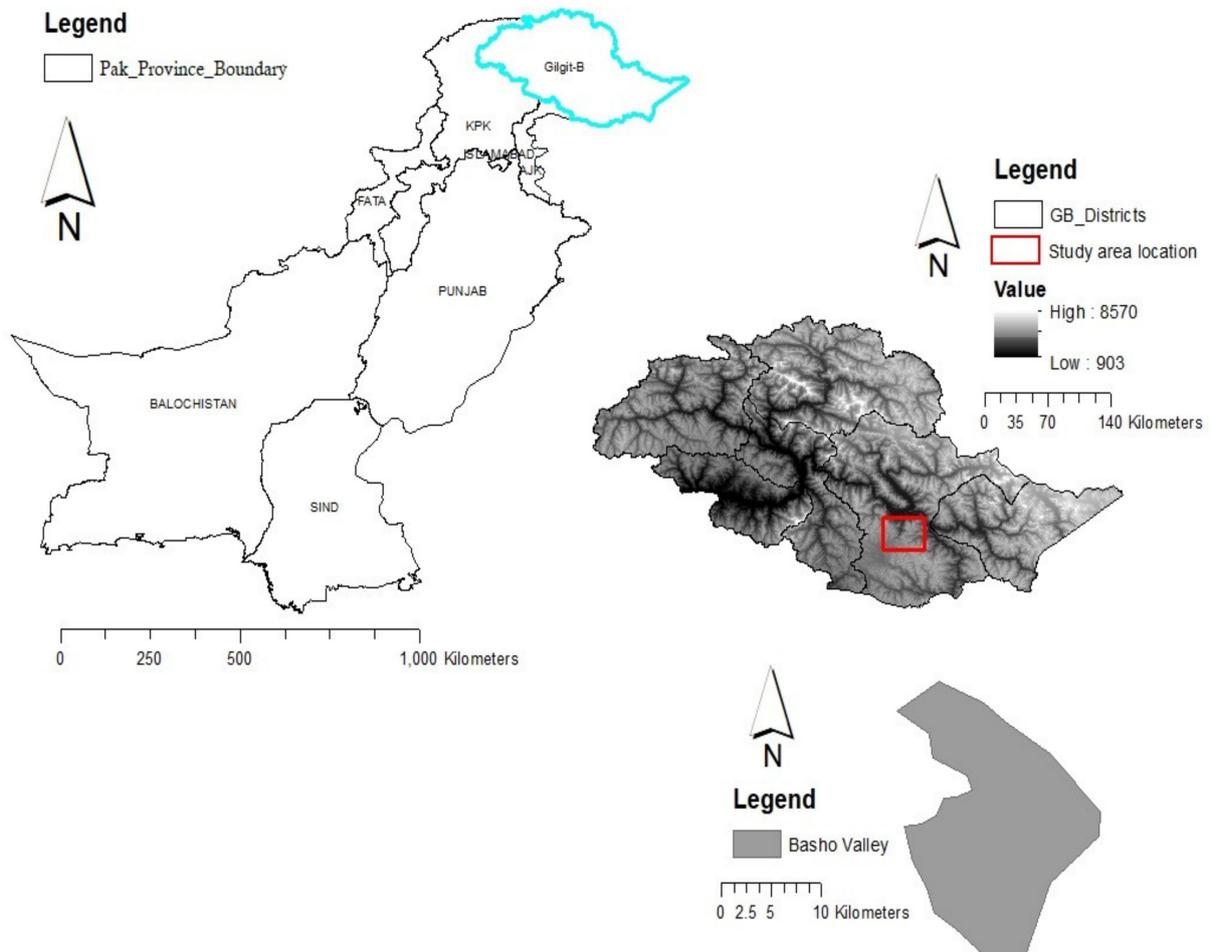


**Figure 1.** Version of livelihood system model.

## 2.2. Study Area

The Basho Valley is situated at 75°15' E, 35°25' N (Figure 2) in the province of Baltistan which is located in northern Pakistan. The valley ascends from the southern side of the Indus River to the top of Banak La (5520 m), at an altitude of around 2150 m above sea level. Located in the Himalayan Range's westernmost arm, Basho lies within a semi-arid, rugged mountain landscape. It lies inside the Himalayan rain shadow. The average rainfall at the bottom of the valley is estimated to be between 100 and 200 mm, but increases with elevation, creating a moister environment in the extensive high-altitude areas. The area has

a marked seasonal climate comparable to the temperate zone, due to the altitude. During summer, the mean maximum temperature is around 30–35 °C, while in winter the mercury may drop to −25 °C.



### Study Area Map (Basho Valley)

**Figure 2.** Map of Baltistan region in the northern areas of Pakistan.

People in Basho live in seven villages distributed along the KharNalla stream in the zone of permanent dwelling: Sultanabad (the highest village), Nazimabad, Meito, Guntho, Khar, Bathang and Matillo (the lowest). During the fieldwork for this report, the total number of households in Basho Valley was counted at 286 and the total population was estimated at 1950. Gilgit Baltistan area has 72,971 km<sup>2</sup> of cover. Gilgit Baltistan has a distinctive terrain, with majestic mountains, world-famous peaks, amazing glaciers, quiet and picturesque valleys, distinctive and attractive forests, rich green meadows, flowing rivers, lovely lakes and captivating fauna, attracting both international and local tourists. According to JFM, joint forest management system, in Gilgit Baltistan most land is owned by the local community. The aboriginal occupations of the people of the area are agriculture and livestock production. Crop cultivation in the area is geared towards irrigation methodology (construction of irrigation channels). Basho Valley falls within three types of vegetation [77]. In other words, the lower northeastern part of the Indus River is defined as subtropical semi-desert to about 2500 m. The region further up is known as Steppe Artemisia, inhabited by scrubs such as the maritime *Artemisia* and *Eurotia ceratoides*. The vegetation in the uppermost part of Basho varies widely from the drier southeast-facing slopes to the wet northwest slopes. The natural blue pine forest covers

the moraine slopes to the northeast. Gulches and glacio-fluvial gravel fans characterize the forested moraine slopes, with sparse vegetation consisting of blue pine, willow and other shrubs.

### 3. Materials and Methods

The study adopted cross-sectional and causal survey methods to investigate and examine the socio-economic impacts of harvesting and forest product utilization by people adjacent to Pakistan's forest regions (Table 1).

**Table 1.** Statistic characteristics of the members.

Demographic Characteristics	Value	Number	Percentage
Where you live	Rural	143	65.0
	Urban	77	35.0
	Total	100	100.0
Age	0–20	58	21.8
	21–30	152	51.0
	31–40	42	14.6
	41–50	34	12.6
	Total	220	100.0
Gender	Woman	75	34.1
	Man	145	65.9
Education	Primary school	127	48.6
	Secondary school	29	8.6
	College	34	10.9
	University	79	26.8
	No formal education	21	5.1
	Single	143	65.0
	married	77	35.0
Profession group	Officer	31	9.5
	Worker	35	11.4
	Housewife	34	10.9
	Student	89	31.4
	Not working	63	24.1
	Other	34	12.7

Primary and secondary information sources were used to collect data for research. The primary sources included the use of questionnaires and interview sessions while the secondary sources included the use of textbooks, recorded forestry registry information and internet materials [78]. The study population consisted of heads of household in the seven villages within Basho Valley, namely: Sultanabad, Meito, Guntho, Khar, Bathang, Nazimabad and Matillo. A total of 286 households are found in Basho Valley and the study used all the household heads with a special interest in examining the volume of forest products extracted from the forest, how many of the household heads were involved in the extraction of forest products, the importance of the forest products to the people, how much was made from forest product extractions compared to other economic activities in the area. We analyzed the data with descriptive statistics (percentage, mean, standard deviation) and inferential statistics (analysis of variance and student's *t*-test) [78,79].

#### Data Collection

Household data were collected from respondents within two separate times/durations (i.e., January and September–December 2019). The socio-economic data collected from each household included income sources, resource endowment (land size, livestock and other assets), literacy rates, family size, years of residence, ethnicity and forest distance. All

the households adjacent to Basho Valley forest totaled 286 households from seven villages (Table 2). All the 286 available households were used for the study. Socio-demographic information was collected using structured and semi-structured questionnaires. To improve the confidence of the respondents and quality of data, locally trained local language research officials were involved in conducting interviews with the respondents in the presence of local leaders. In most instances, the household head was otherwise examined in the absence of the wife or the eldest son. Land usage data included forest product consumption trends (including its origins, average quantity per month and monthly household consumption), collection and type of forest products and other related details. The information collected from the respondents was triangulated using key informants and market-level discussions with local people to capture prices of various forest products exchanged on local markets and prices used to measure consumption of household forest products and calculated monetary contribution of forest products to total household income.

**Table 2.** Respondent random sampling.

Village	Random Sampling	Village	Random Sampling
Sultanabad	50	Guntho	47
Nazimabad	40	Khar	50
Meito	45	Bathang	30
Matillo	24	Total	286

The household incomes were calculated without accounting for local labor costs because of substantial variation in costs for each activity and the possibility of multiple tasks by households. The household incomes were computed using the Formulas (1) to (4) as shown below:

Annual income of Householder = (forest income + farm income + capital return + wage income)

$$Y_{\text{tinc}} = \sum_{i=1}^n [Si] \quad (1)$$

where  $Y_{\text{tinc}}$  is total household income and  $Si$  is income source 1

Income of Forest = (fuelwood annual income + wild forest income + poles income + thatching gross income and forest grazing, etc.). High-altitude pastures and those on the outskirts of forests are generally owned by communities rather than individuals. The majority of the pastures in the Northern Areas are owned by the public. Members of villages without pastures are permitted to graze their animals on the pastures of other communities after paying a fee. An outsider who grazes animals in a communal pasture without paying compensation is fined. There are no set punishments; rather, they are determined by the offender's financial situation. The punishment is always a monetary or in-kind fine, never detention or incarceration (©2003 International Union for Conservation of Nature and Natural Resources).

$$Y_f = \sum_{i=1}^n [FiPi - (Ki)] \quad (2)$$

where  $Y_f$  is the total forest income,  $Fi$  is quantity of product collected 1,  $Pi$  is local market price of forest I and  $Ki$  is production costs of forest product ip.

The value of forest grazing was estimated by substitute approach. Crop income: this was summation of value of yield from various crops grown by a household less all costs of production. Total crop income was calculated as:

$$Y_c = \sum_{i=1}^n [CiPi - (Ki)] \quad (3)$$

where  $Y_c$  is the total crop income,  $C_i$  is yield of crop 1,  $P_i$  is the market price of crop 1 and  $K_i$  is production costs of crop  $i$ .

Livestock income = (cattle sale income + goats' income + sheep income + donkeys' income + chicken income) + income from livestock product that is food crops, fodder, fruit crops, floriculture, cash crops, seed production, livestock

$$Y_i = \sum_{i=1}^n [N_i P_i - (K_i)] + \sum_{i=1}^n [Q_i P_i - (K_i)] \quad (4)$$

where  $Y_i$  is total livestock income,  $N_i$  is number of livestock in category 1,  $Q_i$  is quantity of product from livestock 1.

$P_1$  is the market price of livestock  $_1$  and  $K_i$  is cash costs of keeping the livestock  $i$ , such as pay for herder costs of medicines and feeds. Income from off-farm income/employment: this was the total value of earnings through living while laboring on other households' lands for agricultural or any other economic activity.

The relative forest revenue was used to determine the level of forest dependency. RFI was calculated as a proportion of net forest income to total household income generated from the use and sale of forest environmental resources. This was derived as  $RFI = TFI/TI$ , where  $TI$  is the total household income and  $TFI$  is total forest environmental income [80].

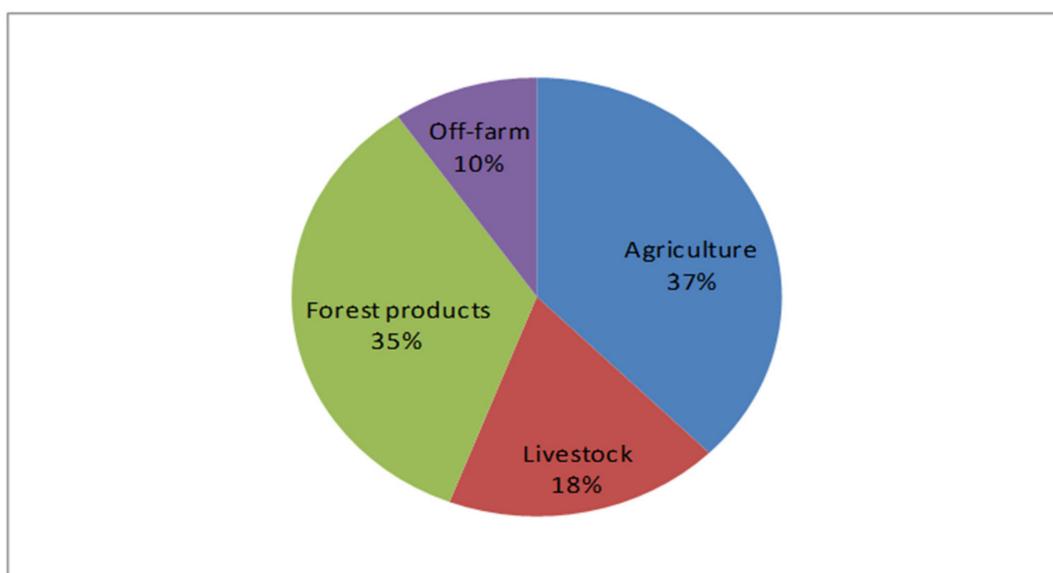
#### 4. Results

The study examined the involvement of the local people in socio-economic activities within the seven villages in Basha Valley. Information in Table 3 revealed that 227 people were involved in agricultural activities, 209 people were involved in extraction of forest products and 110 people were involved in livestock farming while 58 people were involved in off-farm economic activities in the area. Figure 3 further revealed that 37% of the entire study respondents were involved in agricultural activities, 35% of them were also involved in the extraction of forest products and 18% of them were involved in livestock farming, while 10% were involved in socio-economic activities of another nature. It was also deduced from the interview sessions that the people of the area usually participated in multiple economic activities so as to make life very meaningful. The information shows that more people are involved in agricultural activities in the area followed by involvement in extraction in forest products which ultimately is used to augment products from agricultural and off-farm activities in the area.

**Table 3.** Socio-economic survey in the region (2019).

Village	Agriculture	Livestock	Forest Products	Off-Farm	Total
Sultanabad	40 (18) *	22 (20)	40 (19)	4 (7)	106 (18)
Nazimabad	30 (13)	16 (15)	30 (14)	6 (10)	82 (14)
Meito	39 (17)	19 (17)	30 (14)	9 (16)	97 (16)
Guntho	43 (19)	29 (26)	41 (20)	10 (17)	123 (20)
Khar	40 (18)	11 (10)	38 (18)	9 (16)	98 (16)
Bathang	20 (9)	8 (7)	18 (9)	10 (17)	56 (9)
Matillo	15 (7)	5 (5)	12 (6)	10 (17)	42 (7)
Total	227 (100)	110 (100)	209 (100)	58 (100)	604 (100)

Source: author's field survey, 2019; \* () = percentages.



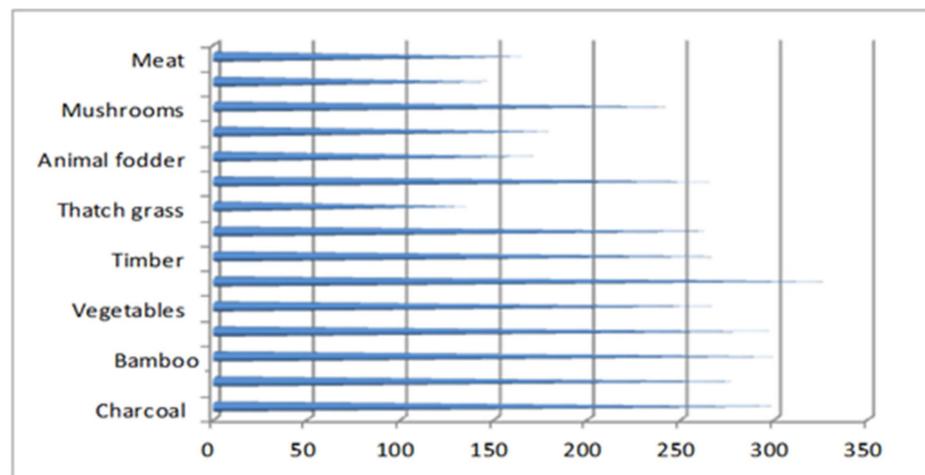
**Figure 3.** Percentages of occupational structure in the region (2019). Source: author's field survey.

The study also examined the sources of forest-based products used by the local people. Information on Table 4 revealed that 57% of the forest products utilized by the households within the area were obtained directly from the forest while the remaining 43% were purchased from people who sold them in the market. This is a clear indication that the forest in the area helps to regulate the economy of the region, as many people were involved in extracting the forest products for sales in the market while others were involved in the extraction of forest products for direct household consumption. The study also revealed that the forest product that was most utilized was as follows: the people who extracted charcoal with 9% of the total extraction from forest, followed by people who extracted firewood with 8.4% and bamboo with 8.3% of the total extracted products. Meanwhile, the least extracted forest product was thatch grass with 3.7% extraction followed by fiber with 4.1% level of extraction. Figures 4 and 5 also reveal that non-timber products were more utilized or extracted from the forest than timber products with a ratio of 51:49%.

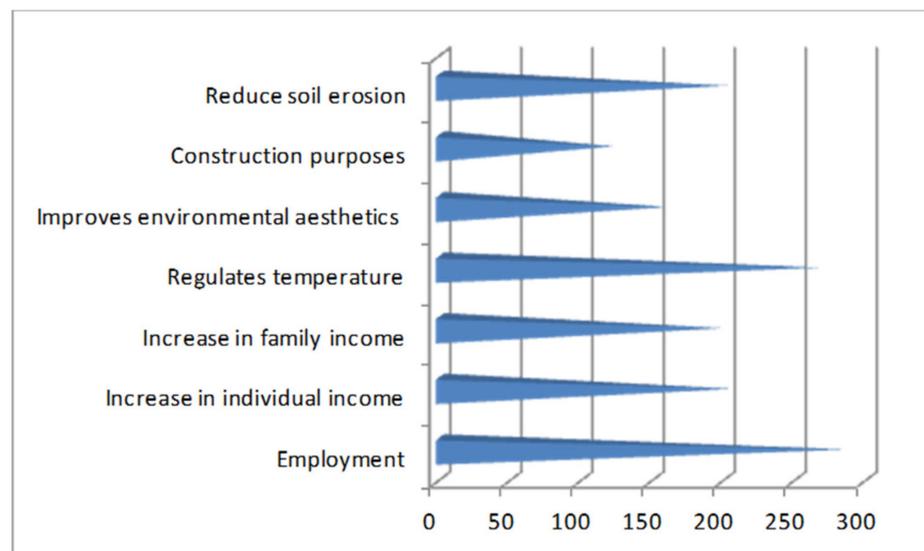
**Table 4.** Types of forest products by the local people (2019).

Types	Forest	Market	Total
Firewood	252 (82)	55 (18)	307 (8.4)
Poles	262 (91)	24 (9)	286 (7.8)
Bamboo	168 (55)	138 (45)	306 (8.3)
Medicine	99 (33)	200 (67)	299 (8.1)
Vegetables	102 (38)	166 (62)	268 (7.3)
Charcoal	189 (57)	142 (43)	331 (9.0)
Wood	59 (21)	216 (79)	275 (7.5)
Honey	189 (70)	82 (30)	271 (7.4)
Thatch grass	81 (59)	56 (41)	137 (3.7)
Fruits	119 (45)	148 (55)	267 (7.3)
Animal fodder	103 (60)	68 (40)	171 (4.6)
Stones	145 (79)	38 (21)	183 (5.0)
Mushrooms	180 (72)	69 (28)	249 (6.0)
Fiber	76 (51)	74 (49)	150 (4.1)
Meat	80 (48)	88 (52)	168 (4.6)
Total	2104 (57)	1564 (43)	3668 (100)

Source: author's field survey, 2019; parenthesis () = percentages.



**Figure 4.** Pattern of forest resource consumption in the area (2019). Source: author's field survey, 2019.



**Figure 5.** Pattern of benefits from forestry in the region (2019). Source: author's field survey, 2019.

Pattern of utilization of forest products in the area is as follows: timber production 59% and non-timber production 41%. Source: author's field survey, (2019).

The study also examined the quantity of forest products extracted and sold by households in the area with a corresponding monetary value of the products. Information in Table 5 reveals that charcoal was most extracted with 10,505.61 kg and provided the highest monthly average income of PKR 393,600, followed by firewood with 8502 kg which provided a monthly average income of PKR 393,101. Meanwhile, the least average income was derived from thatch grass with 294.12 kg extracted which provided a monthly average income of PKR 41,201 followed by fruits with 392.24 kg which provided a monthly income of PKR 49,261.

The study also examined the contributions of the forest to the local people and the adjoining community at large. Information in Table 6 reveals that the highest benefits from the forest in the area are that it has provided employment to the local people, it helps to regulate temperature and it helps to increase individual income. It was also revealed that the least important benefits were that it helped in construction purposes and that it improves environmental aesthetics.

**Table 5.** Quantities and monetary value of forest products extracted by households monthly (2019).

Product	Unit	Quantity	Value (PKR)
Firewood	kg	8502	393,101
Herbal medicine	kg	142.12	114,221
Poles	Number	1301.11	96,102
Honey	kg	202.41	64,209
Meat	kg	926.24	192,073
Fruits	kg	392.24	49,261
Timber	kg	593	362,002
Fiber	kg	471.11	60,121
Mushroom	kg	257.21	30,821
Charcoal	kg	10,505.61	393,600
Thatch grass	kg	294.12	41,201
Building stones	kg	131.45	206,293

Source: author's field survey, 2019.

**Table 6.** Contributions of the forest to the host community.

Benefits	1	2	3	4	5	6	7	Total	Rating
Employment	61	31	35	32	34	50	43	286	1
Increase in individual income	53	26	25	16	21	32	33	206	3
Increase in family income	52	24	22	16	20	33	32	199	5
Regulates temperature	54	30	33	31	33	48	39	268	2
Improves environmental aesthetics	37	22	21	18	15	22	25	160	6
Construction purposes	20	18	11	16	20	21	16	122	7
Reduces soil erosion	26	24	26	22	27	41	36	202	4
Total	303	175	173	151	170	247	224	1443	-
Mean	3.39	3.77	3.68	3.81	3.84	3.76	3.71	-	-
Std. dev.	1.86	2.03	2.04	2.07	2.09	2.08	2.05	-	-

Source: author's field survey, 2019; 1: Sa; 2: Na; 3: Me; 4: Gu; 5: Kh; 6: Be; 7: Ma.

From the test statistics shown in Table 7, it can be seen that chi square value is not significant  $X^2$  (df = 2) = 2.50,  $p > 0.05$ . The observed distribution of benefits from the forest does not differ from what the researcher expected.

**Table 7.** Chi square value is not significant: test statistics.

Test	Benefits
Chi-Square	2.496
df	2
Asymp. Sig.	0.287

There was a strong association between educational attainment and ethnicity ( $X^2 = 2.496$ ,  $df = 2$ ,  $p < 0.05$ ). The study also observed that the forest products provided diverse benefits to the local people and communities adjacent to the forest. Information in Figure 6 shows that the forest provides employment opportunities, it also regulates the temperature, reduces soil erosion, increases family and individual income to the local people, meanwhile the least important benefits are that it provides raw materials for construction. Plate 1 shows the picture of a tree pulled down for construction purposes. In comparison to indigenous homes, the household heads had more tertiary education. There were fewer schools in the Basho Valley neighborhood. The research area's livestock size yielded substantial findings, indicating that owning big herds is connected with access to alternate land. Households with alternative land also had larger cattle and the least amount of forest grazing. Forest grazing is reliant on the supply of fodder on farms during specific seasons, and therefore is an alternative resource. The inference is that the additional livestock units are accounted for through alternate land ownership.



**Figure 6.** Trees extracted from the forest to make poles for construction (2019).

## 5. Discussion

The study examined the socio-economic characteristics of the people of the study area. The study observed that the majority of the local people were predominantly farmers and were involved in agricultural activities. However, most of them were involved in activities that depended on the extraction and utilization of forest products (timber and non-timber products) while some others were involved in off-farm economic activities. The study highlighted that most of the local people and members of the households in the area were involved in multiple economic activities in order to make life more meaningful. This is in line with the findings of [16,20,50] which posited that local people usually get more involved in more than one economic activity in order to improve their welfare and standard of living.

The study also confirmed that non-timber products were more extracted and utilized in the area, with the non-timber products having 59% of utility while the timber products were utilized by 41% of the people. The study also confirmed that from these extracted forest products, more charcoal was extracted and utilized in the area, followed by firewood and bamboo. Further investigation revealed that the people depended more on using forest products for heating and production of heat to keep their surroundings warm. This is in line with the findings of Hall et al., 2015 [10,15,31].

In terms of generated revenue from the forest resources, the study observed that more income was derived from the extraction of charcoal, with a monthly average income of PKR 393,600 followed by income from firewood with PKR 393,101 and from timber with PKR 362,102. This clearly shows that forest products that could be used in heating or production of heat were more utilized as the people had more demand and need for them. This is in line with the findings by Goetz et al., 2017 [7,12] who also stated that local people had high need for products that helped to heat up the surroundings and regulate the cold temperature.

The study also observed that the people and the adjoining communities to the forest enjoyed some benefits from the forest ranging from employment to the increase in both individual and family income but the fundamental aspect of the benefits was that the study found that there was rapid extraction of the forest products and that the forest stands a risk of going extinct if the current rate of extraction of its resources is not controlled and this would make the region at risk of losing the natural/environmental benefits of the forest such as regulation of the temperature and control of erosion which could lead to or expose the area to huge environmental crisis. Consequently, it was observed that the chi square value was not significant  $X^2$  (df = 2) = 2.50,  $p > 0.05$ . The result clearly revealed that the observed distribution of benefits from the forest does not differ from what the researcher expected.

It is very pertinent to note here that from the study, like previous studies, forest products (timber and non-timber resources) have very significant economic impacts on improving individual and family income in adjacent communities to forests. It was also revealed that the more the proximity to the forest, the more the volume of extraction from the forest, which also meant a corresponding effect on generated level of income for the rural dwellers. This also means that distances away from the forest meant less volume of extraction of forest resources.

## 6. Conclusions

The study, which centered on the socio-economic influence of the forest in Pakistan's Basha Valley, found that the forest provided significant socio-economic benefits to the people and communities surrounding the forest. The study observed that the benefits could be classified as both economic and environmental. The economic benefits involved the provision of employment opportunities to the people, increase in both the individual and family income, provision of investment opportunities, while the environmental benefits comprised the regulation of the temperature, reduction or control of erosion and beautification of the surroundings. Forest resources play a significant role in household

income, according to the study. Forest income shares are greater for disadvantaged households, according to research. In absolute terms, however, the wealthier households benefit. Despite the fact that most gathering and use of forest resources is prohibited, poor families exhibited a great reliance on them. The study observed that the more the people enjoyed economic benefits from the forest, the more the environmental risk the area was being exposed to. This means that if the rate of exploitation and extraction of forest products is not controlled, this might result in serious environmental crisis such as drought and soil erosion. As a result of political and administrative changes in the late 1960s and early 1970s, demand for timber from Basho and other forested valleys in the Northern Areas (NAs) increased. The NAs, for example, were split into two Political Agencies in 1971, three districts in 1972 and four districts in 1974. As a result, there was a tremendous demand for timber to build new buildings in the newly formed districts. Basho provided the majority of the timber used in the construction of Skardu, as well as many other buildings and bridges in Baltistan. After the development of a jeep road specially designed to access the forest to satisfy growing timber needs in Baltistan, deforestation in Basho began in the early 1970s. As a result, deforestation in Basho is a new occurrence. Internal influences such as grazing and the transfer of forest land to cultivation are likely to have affected the forest cover to some extent, but these factors pale in contrast to the effects of large-scale commercial harvesting. The study observed that more non-timber forest products were extracted from the forest than timber products at the ratio of 59:41. The report also found that there was no statistically meaningful variation in the amount of forest benefits among the seven districts studied, with a chi square value of  $X^2 (df = 2) = 2.50, p > 0.05$ . The forest provided jobs, increased personal and family income, erosion protection, aesthetic beautification and temperature regulation, among other things. Based on the findings, the study hereby recommends that the management of the forest should install more security in the area and that the government should provide alternative means of livelihood such as organizing training workshops/seminar and granting soft loans to the people to help regulate and control the rate of extraction of the forest products in the area to avoid the risk of extinction of some forest resources or environmental crisis.

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