Journal of Humanities, Social and Management Sciences (JHSMS)
eISSN: 2788-4791 (online)
https://doi.org/10.47264/idea.jhsms/3.1.28
Vol. 3, No. 1 (January-June 2022), 397-414
https://ideapublishers.org/index.php/jhsms
Research Article

Poverty and deforestation nexus: an economic analysis of cause and effect relationship in Malakand Division, Pakistan

Sami Ullah*[1] | Muhammad Israr[2] | Sanam Wagma Khattak[3]

1. Khyber Pakhtunkhwa Food Safety and Halal Food Authority, Peshawar, Pakistan.
2. Agriculture Department, Government of Khyber Pakhtunkhwa, Peshawar, Pakistan.
3. Department of Economics, University of Peshawar, Peshawar, Pakistan.

*Corresponding Author Email: sami00212@yahoo.com

Received: April 8, 2022 Accepted: June 26, 2022 Published: June 30, 2022

Abstract

Rural poverty is perhaps the main cause of deforestation and vice versa. This two-way relationship appears to exist in a slightly greater form in rural communities worldwide. To analyse the same relationship empirically, a study was conducted in Malakand Division, of Khyber Pakhtunkhwa, Pakistan. The data was collected from one hundred and eighty respondents through a self-administered questionnaire. Data was analysed using a non-recursive two-stage linear regression model and descriptive statistics. The findings revealed a two-way relationship between poverty and deforestation in the area under study. It was established that rural communities have low-income levels and rely heavily on natural resources, particularly the forest sector, for their fundamental survival and subsistence needs. The survey also shows that environmental deterioration in the form of deforestation is severe in the Malakand Division and that the majority of people are unaware of the necessity of environmental conservation. It is recommended that the government through strict regulations and by taking practical steps towards poverty reduction, may stop deforestation in the area under study.

Keywords: poverty, rural poverty, rural communities, environment, degradation, deforestation, environmental deterioration, environmental conservation.

How to Cite:
Ullah, S., Israr, M. & Khattak, S. W. (2022). Poverty and deforestation nexus: an economic analysis of cause and effect relationship in Malakand Division, Pakistan. *Journal of Humanities, Social and Management Sciences (JHSMS), 3*(1), 397-414. https://doi.org/10.47264/idea.jhsms/3.1.28

1. Introduction

Arguments linking poverty and environmental quality have existed since the 18th Century. Malthus (1798) claimed that the poor continue to ruin their surroundings and infrequently think about the future. Numerous researchers from various nations have studied the connection between poverty and the environment. The detrimental consequences of poverty on the environment, especially on the timber industry, have been a major theme. Few studies have looked closely at the connection between poverty and the environment. One of the most crucial problems is whether various forms of poverty improve or harm the environment in various ways (Forsyth *et al.*, 1998). Environmental deterioration and rural poverty are linked in complex ways. Several states have recognized this. For instance, the 2004 National Environmental Conservation Policy of India states that "the relationship between poverty and environmental deterioration is a significant challenge that the country faces" (Kothari, 2004). It emphasizes the dual effects of poverty and environmental degradation, showing how poverty may both contribute to and worsen environmental conditions. The poorest people in the earth reside in areas with the worst environmental conditions (Pearce & Warford, 1993).

The rate at which already-existing communal resources are taken from the environment can vary depending on poverty levels. Scientists and development professionals have tested this in a number of ways, and it has been valid all the time (Dasgupta & Maler, 1994). It's common knowledge that poverty has a significant role in the degradation of the ecosystem and forests. The impoverished have historically been held responsible for numerous social problems and environmental damage. According to the "Vicious Circle" theory, the intensive use of natural resources by the poor degrades the environment, which then fuels further poverty and perpetuates the cycle.

The ability of humans to use natural resources responsibly is impacted by poverty, and environmental stress increases (Brundtland Commission Report, 1987). The impoverished, who must provide for their families basic needs, misuse natural resources by illegally harvesting trees and shrubs for firewood and failing to preserve soil nutrients (World Bank, 1992). The impoverished use up natural resources more quickly because they have less access to various types of created goods. They are compelled to rely on natural resources, especially for food and fuel, as they cannot cover their fundamental necessities through purchases (Duraiappah, 1996). It is also evident that the poor suffered as a result of environmental degradation and the depletion of natural resources. The costs of deforestation, desertification, air and water pollution, and other environmental problems fall disproportionately on the poor (Kadekodi, 1995). The absence of natural resources, notably water and wood, negatively impacts the poor. Due to time-consuming domestic chores like collecting firewood and decreased productivity of natural resources, which are the major source of income for the rural poor, environmental poverty lowers the income of the poor.

They are particularly impacted by ecological diseases, environmental decline and natural disasters. As a result, the main cause of poverty is environmental degradation (Pearce & Warford, 1993). Most impoverished people's health and socio-economic well-being are put in danger when extreme poverty and environmental degradation are coupled. They had a low life expectancy, a high neonatal death rate, starvation, illness, and illiteracy (Ekbon & Bojo, 1999). Malakand, a region abundant in natural resources, is seeing an increase in environmental deterioration, particularly in the agriculture and forestry industries. Rural poverty may play a

significant role in this decline. There hasn't been any empirical research done in this area in the concerned division.

1.1. Poverty in the study area

With 207.68 million citizens and a 2.1 percent population growth rate, Pakistan is the fifth-largest nation in the world. In Pakistan, 62.84 percent of the population lives in rural areas (Pakistan Bureau of Statistics, 2018). According to The News International, the World Bank estimated that Pakistan's poverty rate was 39.3 percent in 2020–21, would stay at 39.2 percent in 2021–22, and might decrease to 37.9 percent by 2022–23 using the lower-middle income poverty rate. In 2015, 24.3% of Pakistan's people were considered to be living in poverty. In Pakistan, 1.3 percent of employed people made less than $1.90 per day in 2019 (World Bank, 2020). With a $150 per capita income, 72% of the rural population of the Malakand Division lived in poverty. 40% of households in Malakand relied on agriculture for income, with poorer households relying on it more so because they had less access to inputs, financing, and extension services. Gender disparities in Malakand's illness, mortality, literacy, and educational levels were made worse by the region's isolation and the strict implementation of female segregation. Rural women's access to services including health care, education, and extension programs was greatly hampered by the lack of female service providers in those areas (Asian Development Bank, 2011).

1.2. Deforestation in the study area

In Pakistan, there are 4.6 million hectares of forests (Pakistan Bureau of Statistics, 2005) which drastically decreased by 24.7% between 1995 to 2015 due to habitat change (Bhatti, 2011). The main factor for this degradation is the excessive use of timber wood for fuel purposes. Pakistan is on 2nd position in terms of deforestation in the world, endangering the lives of rural residents (Bhatti, 2011). One-seventh of the province of Khyber Pakhtunkhwa is covered with forest, however due to excessive tree and forest cutting for various purposes, the forest is rapidly disappearing. Similarly, the timber mafia felled about 0.7 million trees during the recent turmoil in the Malakand Division, which is abundant in forests. Around the Malakand Division, the wood was held in a number of go downs, mainly at Chakdara, Thana and Batkhela (Jamal, 2006). In order to determine the extent of the cause and effect link between poverty and deforestation, as well as the benefits that forests provide to the rural poor, this study was carried out in the Malakand Division of the Khyber Pakhtunkhwa Province.

2. Literature review and theoretical background

The concept of “Investment Poverty” put forth by Reardon and Vosti (1995) gave a new dimension to the poverty environment nexus and tied it to the current metrics for measuring poverty. Poverty and environmental linkages in developing and emerging nations have drawn a lot of attention from economists, environmentalists, decision-makers, and international development organizations (Angelsen, 1997). Numerous studies have revealed how strongly dependent on forest resources the rural poor in developing and undeveloped nations are to survive (Shiva & Verma, 2002; Narain *et al.*, 2008). Most of the poor in rural regions depend on common resources like water, meadows, and woods, which they misuse (Jodha, 2000). The foliage, woodland, and soil are degraded more quickly by sheep and goats than by the cows and buffaloes of the wealthy in rural areas, where they are prized possessions for the poor (Rao,

1994). It is known as the poverty-environment nexus to refer to this reciprocal relationship (Duraiappah, 1998; Dasgupta *et al.*, 2005). How household wealth influences reliance on common natural resources has been sought to measure by Beck and Nesmith (2001) and Vedeld *et al.* (2004). It was found that the dependence on shared resources increases as income does. A different study gathered information from 197 homes in Zimbabwe's various villages. It was found that poor households had far higher rates of reliance on forests and natural resources, with 40% of their income coming directly from these sources (Cavendish, 2000).

The previous conversation shows how closely both rural poverty and environmental decline are related. The poor's deforestation in rural regions affects production costs, agricultural output, and ultimately income in both direct and indirect ways as a result, poverty and environmental degradation spiral out of control. Each becomes the cause and effect of the other. Some causal hypotheses regarding the connection between poverty and the environment were put forth by Duraiappah (1998). Environmental deterioration is caused by a variety of variables, including poverty, wealth, power, and greed as well as market failure and institutional failure. On the other hand, rural poverty and environmental deterioration can be related. The environmental degradation is commonly caused by institutional and market failure, including unclear property rights and poor government policies (Pearce & Warford, 1993; Dasgupta & Maler, 1994). Poverty and environmental degradation are caused by all of these reasons (Khan *et al.*, 2020).

Rural poverty is one of the main causes of forest degradation. To fulfil their basic needs, the underprivileged in rural areas rely significantly on environmental resources, particularly the timber industry. In accordance with a 1992 World Bank report, two-thirds of the world's poor reside in rural areas and are entirely dependent on and make extensive use of environmental resources for a variety of purposes, such as burning bushes for cooking and heating, and engaging in unsustainable agricultural practices. Rural poverty increases due to the degradation of natural resources and vice versa (Lopez, 1992). Due to their extreme poverty, resources are going to degrade at a rate not compatible with long-term sustainability. Examples of such livelihood activities include indiscriminately cutting down trees in the forest for fuel and using insufficient (Holden *et al.*, 2004). The dependent poor's income continues to decrease due to the degradation of these resources, creating a "downward spiral." Speedy population growth coupled with a lack of resources or incentives to boost productivity may lead to over-exploitation of vulnerable areas. Another downward cycle is possible (World Bank, 1992). The link between rural poverty and environmental deterioration has been the subject of extensive research. These studies examined how dependent rural areas are on natural resources, particularly forests.

3. Research methodology

3.1. The study area (Malakand Division)

One of the largest divisions in the province in terms of area is Malakand. It covers the area between 36.070 degrees west and 36.400 degrees east and between 71.430 degrees south and 73.850 degrees north. Its 29,872 Km^2 total area makes up 40.1% of the province's total land area. It is situated in the northwest of the province and has boundaries with the states of Nooristan to the north, Gilgit Baltistan to the east, Districts Mardan and Charsadda to the south, and Districts Kohistan, Battagram, and Afghanistan to the west. According to the 2017 Census,

there are 7.57 million people living in the Malakand Division overall (Pakistan Bureau of Statistics, 2018).

3.2. Data source and data collection

A well-structured closed-ended questionnaire used in Malakand Division over the months of June and July 2021 collected the majority of the primary data used in the study. Secondary data was acquired from published sources such as the Pakistan Economic Survey and the Environmental Protection Agency. Closed-ended, well-structured questionnaires were distributed to randomly chosen people to gather personal information, economic data, information about how dependent people are on forests and other natural resources, and willingness to pay values. The research area's high level of illiteracy precluded the use of alternative interview formats. Thus, face-to-face interaction was used to administer the questionnaires instead.

The willingness of people to pay for deforestation was determined using the Contingent Valuation Method (CVM) survey approach. This strategy assigns a monetary value to a product or service for which there is little or no market value (Swallow, 1994). With the contingent valuation method methodology, various formats are available to give value to environmental goods. The format employed in this study was an open-ended bidding procedure (Clark & Friesen, 2008). This style was chosen to acquire the highest willingness to pay while also allowing for straightforward estimation. The recipients of natural resources in rural communities were asked how much they would be prepared to pay for forest tree chopping. The level of the environmental deterioration caused by land degradation, deforestation, and bushfire can be better understood by closely examining the surrounding environment. Direct observation was used to gain a visual image of both livelihood activities and environmental degradation. Secondary data was gathered from published and unpublished material including thesis, journals, books etc.

3.3. Sampling

The survey was conducted in Malakand Division. Because of its location, 70 to 80 percent of its inhabitants depend directly on natural resources to meet their basic day-to-day needs. All domestic cooking and burning needs are met by the diverse collection of forest trees. The shrubs and grasses are used as cattle feed. Subsistence farming and timber cutting and selling are the main economic activities in the area.

Table-1: District wise population and sample size

SN	District	Population (Million)	No of Respondent
1	District Swat	2.3	45
2	District Lower Dir	1.4	30
3	District Upper Dir	0.95	25
4	District Buner	0.99	25
5	District Malakand	0.72	20
6	District Shangla	0.76	20
7	District Upper & Lower Chitral	0.45	15
	Total	7.57	180

The respondents for the second stage of sampling were chosen from all seven districts in the division. The purpose of choosing all districts was to achieve maximum variety. The majority of the respondents were family heads. A total of 180 people were questioned, representing all seven districts.

3.4. Sample size

A sample of 180 respondents was selected. In each district, all respondents were randomly selected. Sampling was based on population of each district. There are enough commonalities among the population in terms of income, occupation, education and fuel usage.

3.5. Survey instruments

The survey was undertaken by direct interaction with the respondents. Due to the high level of illiteracy in the study area, other types of data gathering procedures did not appear to be suitable. The questionnaire was closed-ended and well-structured where all necessary information were coded to be asked.

4. Data analysis

The relationship between rural poverty and deforestation was investigated in the Malakand Division poverty-environment nexus. The researchers used descriptive statistics as well as regression analysis. The socio-economic features of the selected individuals were explained using frequency tables, pie charts, and bar charts in the descriptive phase. In descriptive data, the negative effects of their livelihood activities on the forest sector were also highlighted. After collecting data from selected participants, the data was edited, necessary modifications were made, and the data was coded into the statistical software SPSS Version 20 for further processing. Regression analysis was utilized as an analytical tool in addition to descriptive statistics.

4.1. Econometric model

The following two models (Non-Recursive & Two-Stage Linear Regression Model) constructed by Alvarez and Glasgow (1999) were used.

$$SF = \beta_0+\beta_1 Inc+\beta_2 Fam+\beta_3 Edu+\beta_4 Pnm+\beta_5 Up+\beta_6 Wtp + \varepsilon \quad \ldots\ldots (1)$$

$$INC = \alpha_0+\alpha_1 SF+\alpha_2 Fam+\alpha_3 Edu+\alpha_4 Pnm+\alpha_5 Up+\alpha_6 Wtp+\varepsilon \quad \ldots\ldots (2)$$

The relationship between income and poverty is inverse. Increases in household income lead to a decrease in poverty. In addition, there is a link between income and deforestation. Higher poverty levels in rural communities make them more reliant on forest resources in places where farming and fuel wood cutting are the primary sources of income, resulting in deforestation and poverty. Beta (β) is predicted to have a negative sign. Also, there is an inverse association between education and deforestation. Higher education necessitates a better environment since educated individuals are well-versed in environmental conservation and the long-term consequences of deforestation. As a result, the beta (estimation coefficient) is projected to be negative. Farmers' harvests are reduced by a highly degraded forest sector, which leads to

increased poverty. It is assumed that the regression coefficient will be positive. In addition, there is an inverse association between education and poverty. Higher education equates to higher income levels, enhancing the ability of household heads to meet the basic necessities of their family members. As a result, the beta's sign is projected to be negative. When maximum members of the household are illiterate and without jobs, the size of the household and poverty have a direct relationship. Also, the stochastic term is denoted, and the parameters to be estimated are denoted.

5. Results and discussion

As per the result of the study, all of the respondents were male. Culture of the area restricted the researcher from data collection from female. Out of 180 people polled, 2.7% were in age group 21 to 30, 28.3% were in age group 31 to 40, 25% were in age group 41 to 50, 28.8% were in age group 51 to 60, and 15% above 60 years. The majority of those who responded were married. Only 5 (2.7%) of the 180 people polled were single. Most of the respondents were illiterate or with minimum level of education (primary). 41.1 percent of respondents have never had formal education, while 35.0 percent have just completed primary school. Only 15.5 percent had completed matriculation, while 8.33 percent had completed their studies. The majority of respondents have a big household size. Out of 180 respondents, 86 (47.7%) have a household size of 11-15 members, while 55 (30.5%) have a family size of 6-10 individuals. Twenty-four households have one to five members, and fifteen families have 16 or more members. The results show that the research area had a higher number of large families. Table-2 shows the results below.

Table-2: Respondent's socio-economic characteristics

Demographic Factor		Sample Size (N)	(%)
Gender	Male	180	100
	Female	0	0
Age of Respondents	21yrs to 30yrs	5	2.7
	31yrs to 40yrs	51	28.3
	41yrs to 50yrs	45	25
	51yrs to 60yrs	52	28.8
	60yrs & above	27	15
Marital Status	Single	5	2.7
	Married	175	97.2
Education	Nil	74	41.1
	Primary	63	35.0
	Metric	28	15.5
	Graduation	15	8.33
	Post-Graduation	0	0
Household size	0-5	24	13.8
	6-10	55	30.5
	11-15	86	47.7
	16-above	15	0.08

Source: Field survey

5.1. Economic livelihood of the respondents

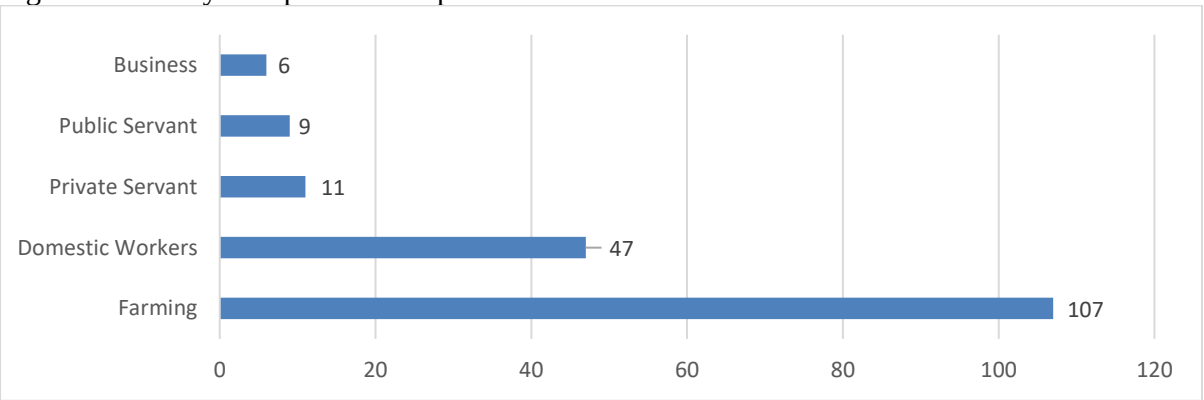
In this section the respondents were characterized according to their primary occupation and

average monthly income. Poverty has been defined as a broad issue with various dimensions that includes low income, restricted or no access to basic requirements, discrimination or social exclusion, and so on (Quijandria *et al.*, 2000).

5.2. Primary occupation of respondent's

Occupation of inhabitants in a given area directly reflects their level of reliance on natural resources. The majority of the population in the area under study are engaged in farming/agriculture. They mainly rely on natural resources as their income source. The results showed farmers (59.4%), domestic workers (26.1%), private servants (6.1%), public servants (5%) and businessmen (3.3%).

Figure 1: Primary occupation of respondents

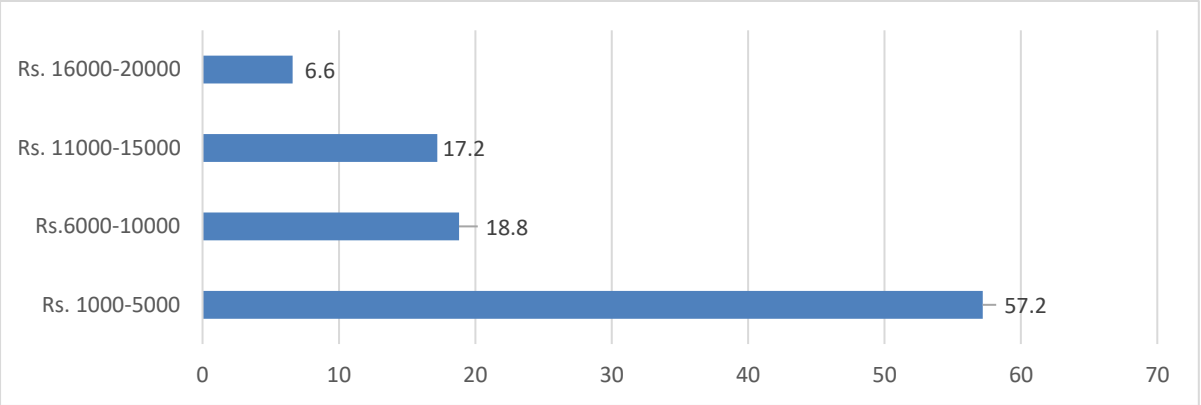


Source: Field survey

5.3. Income of the respondents

Natural resource degradation in rural areas is assumed to be mostly predicted by the average monthly income. The average monthly income of majority of the respondents was less than 5,000 rupees exposed the level of poverty in the study area. 57.2 percent of the respondents had an average monthly income less than or equal to 5,000 rupees. 18.8% of those surveyed earn between 6,000 and 10,000 rupees per month. A monthly income of between 11,000 and 15,000 rupees was earned by 17.2% of respondents, while between 15,000 and 20,000 rupees was earned by 6.6%.

Figure 2: Income level of respondents



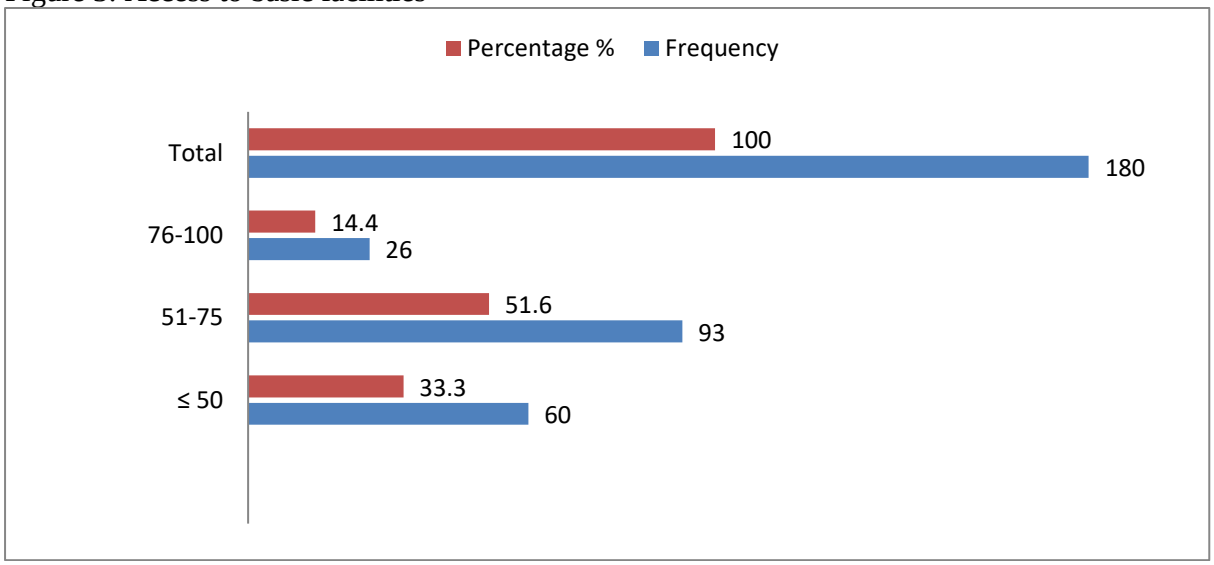
Source: Field survey

5.4. Access to basic family needs

World Bank (1992) reported that rural communities are highly dependent and indiscriminately abusing the common resources around them. They take down a lot of forest trees and plants, and they use soil irresponsibly without considering about its fertility and nutrients. Using household consumption as a proxy for income (Deaton, 2003), the analysis predicts that the gap between income and consumption will be modest, indicating a significant reliance on self-produced and self-collected products. Both self-produced and self-collected goods contributed significantly to family income in the study area. It was crucial to evaluate how the poor provided their families' basic requirements like food, shelter, clothes, health and education. 51.6 percent of individuals surveyed said they could only afford to pay for between 51 and 75 percent of their family's essential needs.

Only 33.3% of those surveyed were able to only partially or not at all provide for their family's basic necessities. The situation was attributed to a decline in the farm output and a lack of reliable employment in the region. Only 14.4% of the individuals surveyed claimed they could fulfil 76–100% of their basic needs for life. Those were the ones who had a stable job or had their own business. As a result, it may be argued that the poor's over-reliance on forest resources causes environmental deterioration, which negatively impacts the poor's livelihood in rural regions.

Figure 3: Access to basic facilities

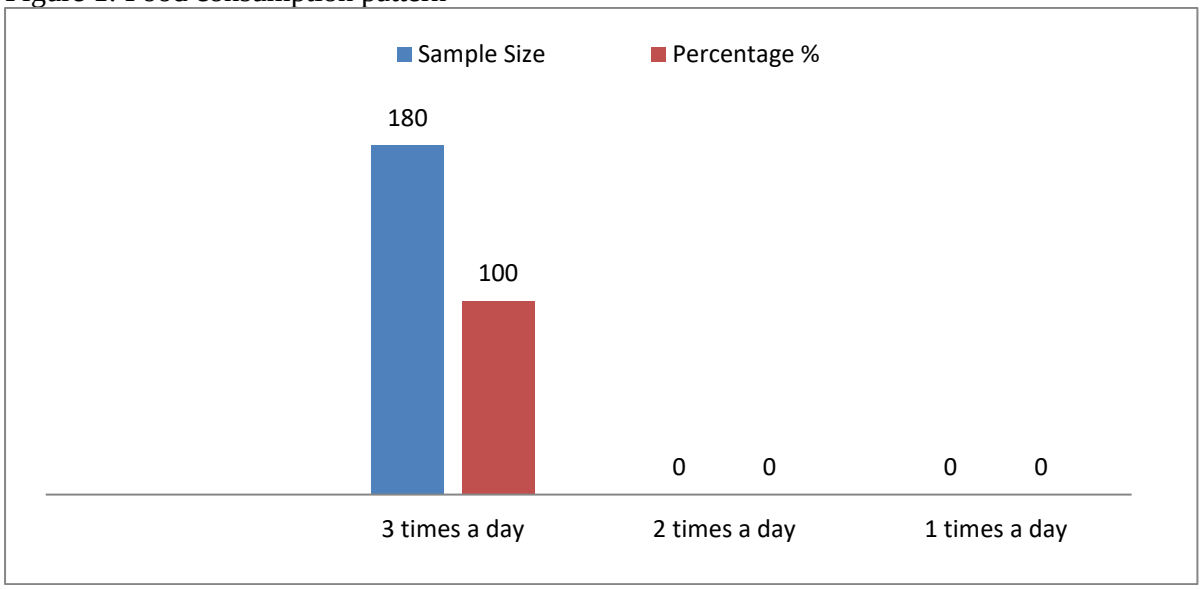


Source: Field survey

5.5. Food consumption pattern

It was found that inhabitants in the research area consumed food three times per day, much like the rest of the nation. The pattern of food consumption showed that the area's poor population mostly depended on natural resources for their subsistence. In rural areas of the study area, saving behaviour was not seen to be practiced. If there are many people cooking, there will be a lot of fuel, which suggests there will be a lot of forest and bush cutting. Rural people typically utilised firewood or charcoal for cooking. In the study area, every single responder eats three meals per day.

Figure 1: Food consumption pattern



Source: Field survey

5.6. State of environment in Malakand Division

Inhabitants in the study area consume food three times a day. It suggests that the poor in the study area use natural resources to an excessive degree. Rural communities do not appear to have a high rate of savings. Cooking in rural areas was traditionally done with firewood or charcoal, thus if there are a lot of people cooking, there will be a lot of fuel, which means a lot of forest and bush cutting. As shown in the graph, 100 percent of the respondents in the research area consume food three times per day.

5.7. Fuel use for cooking, heating and lighting

Poor residents in the rural parts of Malakand Division are known to use forest and natural resources like wood, vegetables, fruits, green grasses etc. to increase income. For cooking, heating and lighting, there is a strong demand for fuel wood. The low cost of fuel wood and the lack of substitutes are the economic reasons for its use in cooking, heating, and lighting. One's income level usually determines the fuel used for cooking, heating and lighting. Because of the inexpensive cost of fuel wood, it is widely used. The fuel sources for cooking, heating, and lighting are summarized in table-3 below. Cooking is done primarily using firewood. For this purpose, 72.2% of households used firewood and 19.4% used LPG gas. In the study area, using other sources like electricity, charcoal and kerosene is uncommon. Only 8.3 percent of the families were reported to utilize charcoal for cooking.

Again, firewood is the primary source of heat in the Malakand Division. 62.2% families were reported to use firewood, 16.6% charcoal and 21.1% LPG gas as a heat source. In the study region, heating cold water and rooms is a regular practice throughout the winter. The primary energy source in the Malakand Division is electricity, and alternative sources were LPG gas and kerosene oil in areas where electricity is not available. Out of 180 households, 65.5% were using electricity for lighting purpose, 18.3% and 16.1% used kerosene and LPG gas respectively.

Table-3: Main source of fuel usage

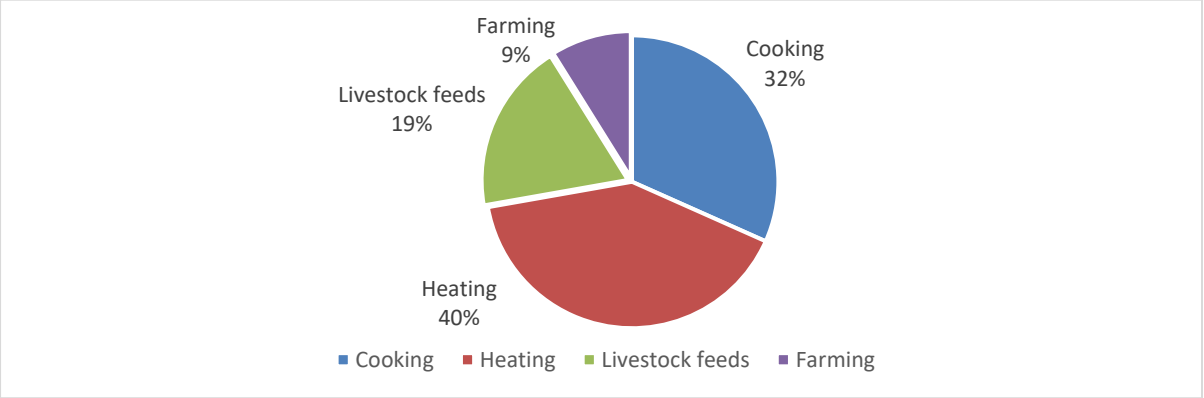
Activity	Fuel (Usage (%))
Cooking	Firewood (72.2%) Charcoal (8.3%) Gas (19.4%) Kerosene (0%) Electricity (0%)
Heating	Firewood (62.2%) Charcoal (16.6%) Gas (21.1%) Kerosene (0%) Electricity (0%)
Lighting	Firewood (0%) Charcoal (0%) Gas (16.1%) Kerosene (18.3%) Electricity (65.5%)

Source: Field survey

5.8. Bush burning

Burning is a seasonal activity in the Malakand Division mountainous areas throughout the winter (November-February). Bush burning is reported to be one of the biggest causes of deforestation in the study area. Bushfires appear to be caused directly by deforestation, biodiversity loss, and soil erosion. Farming, hunting, grazing, charcoal production, and wood harvesting are the main causes of bushfires (Nsiah-Gyabaah, 1994). As shown in figure 5 below, 32% of families burn bushes for cooking purposes, 40% cut it for heating purposes, 19% utilized it as animal feed, and 9% for agriculture purposes.

Figure 2: Bush burning and its causes



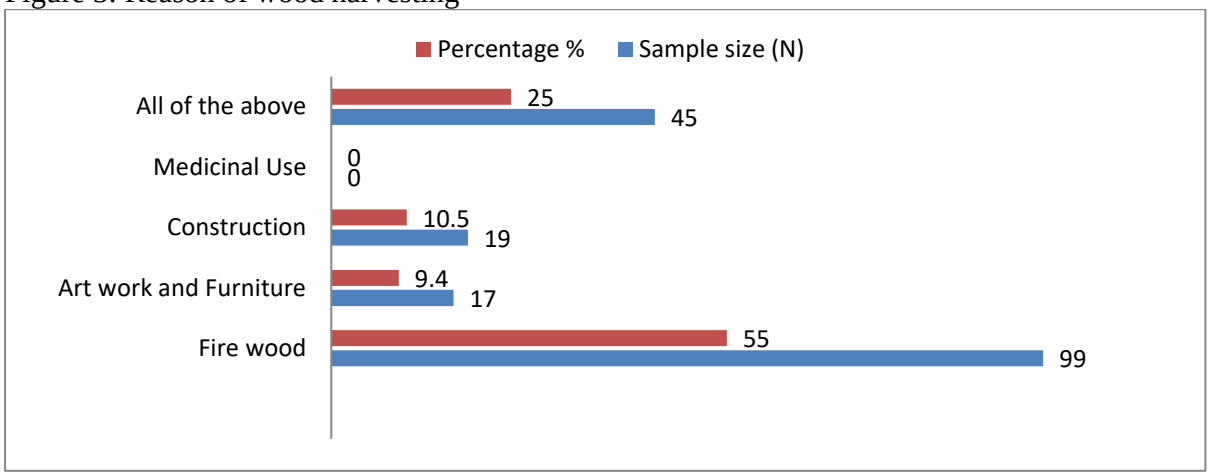
Source: Field survey

5.9. Wood harvesting

Wood cutting is very common in rural areas and it significantly impacts the ecology, forest degradation and the local community's livelihood. Wood harvesting is carried out for various reasons, including fuel, art and furniture, construction and medicinal uses. In rural places, piles of cut wood for various residential purposes can be seen in every house. When asked if they cut down forest trees and for what reasons, respondents said yes. Of surveyed individuals, 55%

said they use forest timer for fuel, 9.4% for furniture and ark work, 10.5% for construction and 25% said they cut it for all purposes. 24.4% of respondents stated that they replant trees after cutting them and 76.6% didn't plant any tree after cutting them for various economic reasons.

Figure 3: Reason of wood harvesting

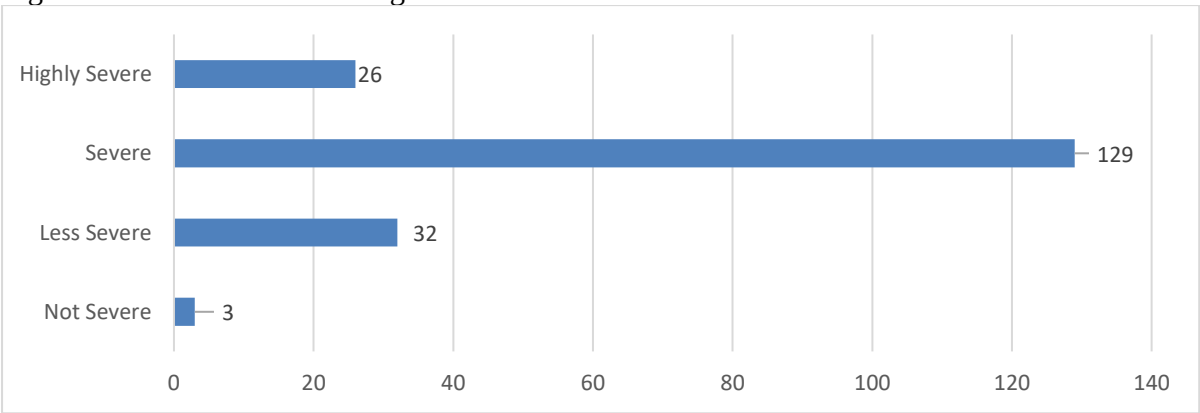


Source: Field survey

5.10. Forest cutting and its extent in the study area

The degree of deforestation in Malakand Division was investigated and whether or not the inhabitants are aware of environmental conservation efforts or not. 129 respondents stated that deforestation in the Malakand Division is severe, 26 stated that it is very severe, 32 stated that it less severe, and 3 respondents stated it is not severe. 134 out of 180 (74.4%) respondents were found unaware of the phenomenon of environmental protection.

Figure 4: Extent of forest cutting

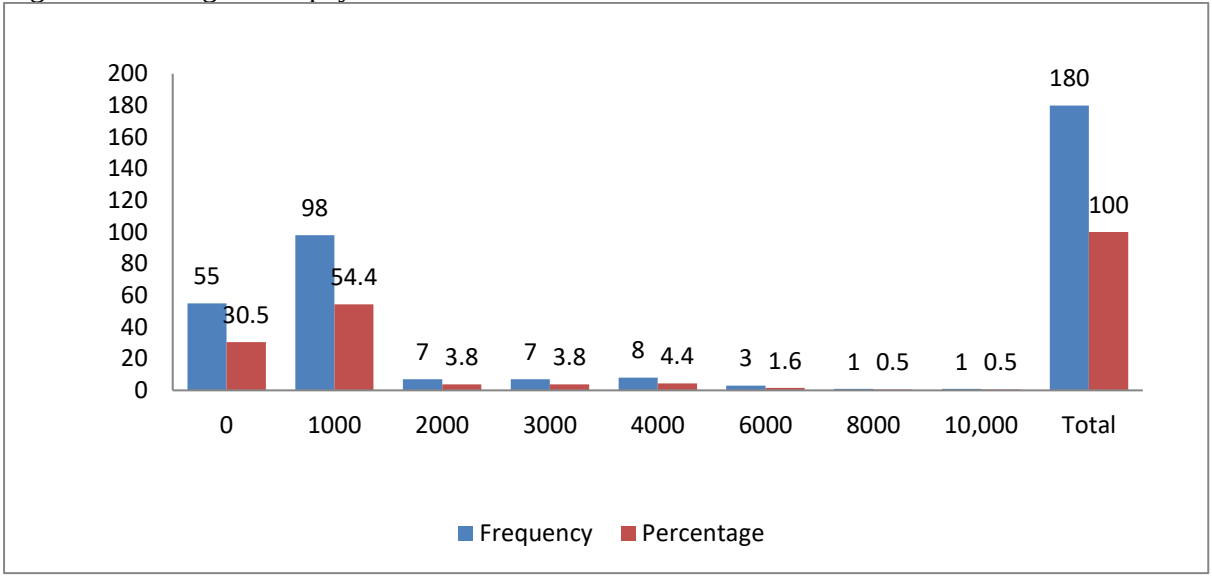


Source: Field survey

5.11. Willingness to pay for wood harvesting

The Contingent Valuation methodology was used in conjunction with the bidding game method to determine the readiness of the public to pay for the removal of forest trees. The inhabitants of the study area were inquired about their willing to pay for a single tree cut down. The majority of respondents, 98 out of 180 (54.4%), were willing to pay only a tiny amount of Rs. 1000, while 30.5 percent were unable to contribute even a single penny.

Figure 5: Willingness to pay



Source: Field survey

6. Regression analysis

6.1. Impact of poverty on deforestation

The impacts of poverty on forest degradation are depicted in the OLS estimations below. The greater correlation coefficient (R^2Adjusted=88.2%) is due to the fact that independent variables account for the majority of the variation in the model. It indicates that forest degradation is largely determined by individual income levels, rural community education, household size, willingness to pay, and fuel wood usage patterns.

Table-4: Poverty impacts on deforestation

Variables	Unstandardized Coefficients (B)
Constants	0.673(0.001)
Household Size of Respondents	0.161(0.012)
Usage Pattern of Fuel Wood	0.355(0.001)
Income Level of Respondents	-0.290(0.001)
Education of Respondents	-0.328(0.001)
Willingness to Pay	0.152(0.001)
Basic Needs Met (%)	-0.006(0.924)

R^2: 0.89
F-Statistics: 223.7
DW Statistics: 1.79
DV: Source of Fuel

The model employed above complies with the validity testing guidelines (R^2). In the model, a minimal R^2 value of 0.15 is met (Mitchell & Carson, 1989). The regression analysis revealed that the relationships between dependent and independent variables. All independent variables are significant at a 5% level of significance except the variable basic needs met. There is an adverse link between respondents' income, education, and fuel source. The negative

relationship between respondents' fuel source and monthly income suggests that as income increases, poverty decreases, leading to little environmental impact and deforestation. As income declines, poverty levels rise, resulting in increased environmental degradation and deforestation. Forest destruction results in low yields and perpetuates poverty in rural communities. As a result of the improved income and reduced poverty, there is a greater likelihood that the community will embrace environmentally friendly behaviours, alleviating the forest resource degradation scenario. The results are in line with those of Jodha (2000) and Cavendish (2000). The explained variable has a positive relationship with the usage pattern of fuel wood (a proxy for deforestation). This is in line with what one would predict based on prior knowledge.

The outcome is also consistent with Duraiappah's (1998) findings. Household size has a favourable correlation with fuel sources. As a result of the lack of alternatives for subsistence, the rural community's reliance on forest resources in the study region grows. The study's findings are in line with those of Duraiappah (1998) and Ekbon and Bojo (2001). There is a positive relationship between willingness to pay and forest degradation. Because most of the respondents are poor and do not care about forest and environmental conservation, they are unwilling to contribute even a single euro or a small amount for forest resource protection and conservation. The outcome is comparable to Cavendish's (2000) research. Given the advice of a minimum value of 0.15, the modified R^2 (88.2%) is reasonable (Row and Chestnut, 1983; Mitchell & Carson, 1989). This demonstrates that the model accounts for the majority of the difference in the dependent variable. Durbin Watson statistics (1.79) indicate that there is little autocorrelation in the data.

6.2. Impact of deforestation on poverty

The results are explained in the table-5 below. Estimates of coefficients that give the best match between data and the supposed theoretical model were evaluated at a significance level of 5%. The model complies with the validity testing standards (Mitchell & Carson, 1989). In Mitchell and Carson's model, a minimum value of R^2=0.15 is met, indicating that it is a good model.

Table-5: Impact of deforestation on poverty

Variables	Parameter Value (Coefficients)
Constants	-0.194(0.002)
Household size	-0.098(0.001)
Usage pattern	-0.114(0.001)
Education of the respondents	0.609(0.001)
Willingness to pay	0.177(0.015)
Percentage of basic needs met	0.163(0.106)
Source of fuel	-0.670(0.001)

R^2= 0.89
F Statistics= 229.57
DW Statistics=1.7
DV=Income of Respondent

The explanatory variables have the expected signs with the explained variable. Except for the percentage of basic needs supplied, all other factors are statistically significant at the 5% level. At a 5% statistical significance level, the most important variables predicting poverty are the

source of fuel, fuel wood usage pattern, household size, respondents' education, and willingness to pay. The relationship between respondents' income and fuel sources is negative, implying that as deforestation rises, income levels decline, poverty levels rise, and vice versa. Degradation of forest resources has a negative impact on farmer yields, resulting in increased poverty in rural communities. As the rural community's income rises, so does its reliance on natural resources. With income increase, the reliance of rural community decrease on forest resources. The study's findings are comparable to those of Jodha (2000) and Cavendish (2000). The respondent's household size negatively affects his or her income. This indicates that when the size of a household grows, poverty becomes more likely, especially if the majority of the members are unemployed, illiterate, reliant on the household head, or engaged in farming. Allen and Barnes (1985), Rudel and Roper (1997).

Education too, has the expected positive outcome. People's income is also influenced by their educational attainment. In comparison to those who are uneducated or have a low level of education, those with a greater level of education have a better income. Educated people are passive in forest cutting and in environmental damage since they are aware of the consequences of deforestation. They used to acquire lumber for construction and fuel wood from the impoverished in the countryside, which was a source of revenue for them. The readiness of the rural community to pay for tree cutting/deforestation has a positive sign, implying that people's willingness to pay increases as their income level rises. Compared to rural poor people, wealthy people are more educated, aware of the implications of deforestation and willing to pay a fair price for forest cutting and environmental destruction. In light of Row and Chestnut's (1983) and Mitchell and Carson's (1983) minimal value of 0.15, the modified R2=88.5 percent is appropriate (1989). This demonstrates that the model explained the major variation in the explained variable. This is a common occurrence in many CVM trials (Desvouges *et al.*, 1987). The 1.70 Durbin Watson statistic indicates that there is no autocorrelation among the variables in the model. According to the regression analysis, forest destruction increases poverty in Malakand Division.

7. Conclusion

The study aimed to look into the empirical relationship between poverty and deforestation. Because they have no other source of income or energy, the poor cannot care for forest resources and must rely on non-sustainable forest resources to meet their fundamental requirements. The study was carried out in the Malakand Division rural areas where deforestation, poverty and excessive use of natural resources have been reported. The study used well-designed questionnaires to gather primary data, which was then extensively used. Regression analysis, bar charts, and frequency tables were a few of the analytical tools. The study’s findings proved the close association of poverty with deforestation in the area concerned. As a result, it was discovered that the research area has a relationship between poverty and environmental quality. The study findings also indicate that in the Malakand Division, poverty levels are less affected by deforestation than deforestation is by poverty. According to the research, the rural residents of the Malakand Division depend largely on natural resources to survive. A significant percentage of their income comes from farming and forests, proving that individuals are more affected by natural resource declines.

According to the study findings, poverty is the major cause and effect of deforestation in the Malakand Division. It is recommended that the government may devise certain policies and

initiate some poverty reduction program in the area. Provision of Sui Gas like facilities in the area may reduce the cutting of forest as firewood up to great extent. The government may also formulate strict regulations on forest cutting and those who are involved should be treated strictly.

References

Allen, J. & Barnes, D.F. (1985). The causes of deforestation in developing countries. *Annals of the Association of American Geographers, 75*(2), 163-184. https://doi.org/10.1111/j.1467 8306.1985.tb00079.x

Alvarez, R. N. & Glasgow, G. (1999). Two stage estimation of non-recursive choice model. *Political Analysis, 8*(2), 147-165. https://doi.org/10.1093/oxfordjournals.pan.a029810

Angelsen, A. (1997). The poverty–environment thesis: was Brundtland wrong? *Forum for Development Studies, 24*(1), 135-154. https://doi.org/10.1080/08039410.1997.9666053

Asian Development Bank. (2011). Pakistan: Malakand Rural Development Project. https://www.adb.org/sites/default/files/evaluation-document/35810/files/in298-11.pdf

Bhatti. S. I. (2011). An overview of forests in Pakistan. *World Environmental day 16th June, 2011*.

Beck, T., & Nesmith, C. (2001). Building on poor people's capacities: The case of common property resources in India and West Africa. *World Development*, *29*(1), 119-133. https://doi.org/10.1016/S0305-750X(00)00089-9

Brundtland Commission Report (1987). Our Common Future, "Process of preparation of the Environmental Perspective to the year 2000 and Beyond." *Oxford University*.

Cavendish, W. (2000). Empirical regularities in the poverty-environment relationship of rural households: Evidence from Zimbabwe. *World Development*, 28(11), 1979-2003. https://doi.org/10.1016/S0305-750X(00)00066-8

Clark, J., & Friesen. L. (2008). The causes of order effects in contingent valuation surveys: An experimental investigation. *Journal of Environmental Economics and Management*, *56*(2), 195-206. https://doi.org/10.1016/j.jeem.2007.12.005

Dasgupta, P. (2003). Reproductive externalities and fertility behavior. *European Economic Review*, 44, (4-6), 619-644.

Dasgupta, P. & Maler, K.G. (1994). Poverty, institutions and the environment- resource base. *World Bank Environment Paper No. 9*.

Dasgupta, S., Diechman, U., Meisner, C. & Wheeler, D. (2005). Where is the poverty–Environment nexus? Evidence from Cambodia, Lao PDR, and Vietnam. *World Development*, 33(4), 617-638. https://doi.org/10.1016/j.worlddev.2004.10.003

Desvouges, W. H., Smith, V. K. & Fisher, A. (1987). Option price estimates for water quality improvements: A contingent valuation study for the Monongahela River, *Journal of Environmental Economics and Management*, *14*(3), 248-267. https://doi.org/10.1016/0095-0696(87)90019-2

Deaton, A. (2003). Household surveys, consumption, and the measurement of poverty. *Economic Systems Research*, *15*(2), 135-159.

Duraiappah, A. K. (1996). Poverty and environmental degradation: A literature review and analysis. IIED, Amsterdam. *CREED Working Paper Series No. 8*.

Duraiappah, A. K. (1998). Poverty and environmental degradation: A review and analysis of the nexus. *World Development, 26*(12), 2169-2179. https://doi.org/10.1016/S0305-750X(98)00100-4

Ekbon, A., & Bojo, J. (1999). Poverty and Environment: Evidence of Link and Integration in the Country Assistance Strategy Process. *Word Bank Africa Region Discussion Paper No. 4*.

Forsyth, T., Leach, M., & Scoones, I. (1998). Poverty and environment: Priorities for research and policy; An overview study. *Prepared for the United Nations Development Programme and European Commission, Institute of Development Studies, UK*. https://personal.lse.ac.uk/FORSYTHT/povenv_forsyth_leach.pdf

Pakistan Bureau of Statistics. (2005). Pakistan Poverty Reduction Strategy Paper (PRSP). *Planning Commission and Economic Affairs Division Government of Pakistan Islamabad*. http://www.finance.gov.pk/poverty/PRSP-II.pdf

Pakistan Bureau of Statistics. (2013-14). Pakistan Economic Survey 2013-14. *Government of Pakistan Finance Division, Economic Adviser's Wing, Islamabad*.

Pakistan Bureau of Statistics. (2018). Census 2017.

Government of Khyber Pakhtunkhwa. (2009). Malakand comprehensive stabilization and socio- economic development strategy.

Holden, S., Shiferaw, B., & Pender, J. (2004). Non-farm income, household welfare, and sustainable land management in a less-favoured area in the Ethiopian highlands. *Food Policy, 29*(4), 369-392. https://doi.org/10.1016/j.foodpol.2004.07.007

Jamal, H. (2006). Does inequality matter for poverty reduction? Evidence from Pakistan's poverty trends. *The Pakistan Development Review*, 45(3), 439-459. https://www.jstor.org/stable/41260772

Jodha, N. S. (2000). Waste Land Management in India: Myths, motives and mechanism. *Economic and Political Weekly*, 5, 466-474. https://www.jstor.org/stable/4408909

Kadekodi, G. K. (1995). Operationalising sustainable development, ecology-economy interactions at a regional level. *Internal Publication, Institute for Environmental Studies (IVM), Netherland*.

Khan, K., Ullah, S., Ullah, A., Khan, S., & Saragih, M. Y. (2020). Impact of Farm forestry on Socio-Economic Condition of Farming Communities in District Mardan, Pakistan. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, *3*(4), 2649-2661. https://bircu-journal.com/index.php/birci/article/view/1276.

Kothari, A. (2004). Draft National Environment Policy 2004: A Critique. *Economic and Political Weekly*, *39*(43), 4723–4727. http://www.jstor.org/stable/4415711

Lopez, R. (1992). Environmental degradation and economic openness in LDCs: The poverty linkage. *American Journal of Agricultural Economics*, *74*(5), 1138-1143. https://doi.org/10.2307/1242771

Malthus, T. (1798). An essay on the principle of population. *Penguin Classics. Reprinted, 1985*.

Mitchell, R.C. & Carson, R.T. (1989). *Using surveys to value public goods: The Contingent Valuation method*. Taylor and Francis Group.

Narain, U., Gupta, S., & Van't Veld, K. (2008). Poverty and resource dependence in rural India. *Ecological Economics*, *66*(1), 161-176. https://doi.org/10.1016/j.ecolecon.2007.08.021

Nsiah-Gyabaah, K. (1994). *Environmental degradation and desertification in Ghana: A study of the upper west region*. Avebury Ashgate Publishing Limited.

Qazi, I. A. (1994). Pakistan: Country and forests. In M. M. Ashraf, & I. Ahmad (eds.), *Handbook of Forestry*. Pakistan Agriculture Research Council, Islamabad, Pakistan.

Quijandria, B., Monares, A. & Montenegro. R. U. P. (2000). Haciauna Region sin probresrurales. *Siantago International fund for Agriculture Development*.

Rao, C. H. (1994). Agricultural growth, rural poverty and environmental degradation in India, Oxford University Press.

Row, R. D., & Chestnut, L. G. (1983). Valuing environmental commodities: Revisited. *Land Economics*, *59*(4), 404-410.

Reardon, T., & Vosti, S. (1995). Links between rural poverty and the environment in developing countries: Asset categories and investment poverty. *World Development,* 23(9), 1495-1506. https://doi.org/10.1016/0305-750X(95)00061-G

Rudel, T. & Roper, J. (1997). The paths to rain forest destruction: cross-national patterns of tropical deforestation, 1975-1990. *World Development.* 25, 53-65. https://doi.org/10.1016/S0305-750X(96)00086-1

Shiva, M. P., & Verma, S. K. (2002). *Approaches to sustainable forest management and biodiversity conservation with pivotal role of non-timber forest products*. Valley Offset Printers and Publishers, India.

Swallow, B. (1994). The role of mobility within the risk management strategies of pastoralists and agro-pastoralists. *Sustainable Agricultural Programme of the International Institute for Environment and Development, London*. https://dlci-hoa.org/assets/upload/key-resilience-and-climate-change/20200803111133653.pdf

Vedeld, P., Angelsen, A., Sjaastad, E. & Berg, G. K. (2004). Counting on the environment: Forest environmental incomes and the rural poor. *World Bank Environment Department*, Paper 98.

World Bank. (1992). *World Development Report 1992: Development and Environment*. Oxford University. https://doi.org/10.1596/0-1952-0876-5

World Bank. (2020). World Development Report 2020. https://www.worldbank.org/en/publication/wdr/wdr-archive