



## Research Article

# Socioeconomic Impacts of Agroforestry Practices in District, Charsadda

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**Abstract** | A survey was carried out in Tehsil Charsadda of Charsadda District to ascertain the socio-economic profile of the farmers resulting from Agroforestry and to evaluate the impacts of Agroforestry practices in the study area. Using two-stage random sampling, data was collected from eighty respondents through a structured questionnaire. The primary motivations for planting trees were income (67.5%) and timber (31.25%), with firewood being a minor reason (1.25%). A significant majority (78.75%) of respondents grow trees on their farmland to sell them and support their families, while 21.25% use the trees for personal purposes. Most respondents (61.25%) use LPG for cooking and heating due to its availability, while 32.5% also use firewood, and 6.25% use crop residues along with firewood. Of the 80 respondents, 63.75% use fuelwood from their farmland, and 36.25% purchase it from the market. Regarding agricultural production, 35% of respondents indicated that crop trees increase production, while 58% believed that the prevalence of poplars in the area decreases agricultural production due to shade and water absorption, and 8% reported no impact. The findings reveal a significant annual income from selling farm trees, ranging between Rs 1 and 2,000,000. According to the data, 61.25% of respondents reported that agroforestry increases milk sales, while 38.75% stated it reduces milk sales due to competition between poplars and agricultural crops for water, resulting in less fodder and reduced livestock sales. To improve the situation, better coordination between forest authorities and local farmers is necessary. Forest authorities should address misconceptions about agroforestry, educate farmers on the benefits of various tree species, including environmental benefits, fruits, and fodder, and provide tree saplings. Additionally, new plantations should be established to combat climate change.

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**Keywords** | Socioeconomic impact, Agroforestry, *Populus deltoides*, Income, Production



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## Introduction

A technique of land management in which trees are combined with other crops or livestock

to enhance highly beneficial relationships with other organisms (bacteria, fungi, insects, birds, and mammals), thereby promoting the ecological health of the system (Cemansky, 2015). It has been predicted

that agroforestry will have various environmental and socio-economic benefits, benefiting both society as a whole and its users (Gao *et al.*, 2014). Agroforestry has enormous potential to sustainably improve food production and farmers' economic conditions through its positive impact on household income (Neupane *et al.*, 2001). It is recognized that agroforestry offers numerous environmental and economic benefits (Simelton *et al.*, 2017).

Agroforestry, or the cultivation of plants and trees together on the same piece of land, with or without the presence of animals, is an important land-use strategy in developing countries (Jawad *et al.*, 2013). Agroforestry requires interactions between woody and non-woody elements on an economic and ecological scale (Glover *et al.*, 2013; Nair, 2006). Implementing such tree-based agriculture makes economic sense and can improve economic resilience through product diversity. This is because multifunctional trees can perform a variety of tasks, such as providing extra money, fodder, or food (e.g. edible plants). For example, rural communities can help an agroforestry operation become more profitable in difficult times. Agroforestry can provide new employment opportunities in rural areas for non-agricultural activities such as timber harvesting, furniture making and grain drying (Glover *et al.*, 2013).

The main benefits of agroforestry for sustainable development programs are environmental protection (watershed), biodiversity conservation, and climate change mitigation and adaptation. Because agroforestry also helps create traditional jobs, it has the potential to provide a range of benefits (e.g. providing money to disadvantaged farmers, stabilizing the environment and ecosystems, and reducing desertification and deforestation) (Richard *et al.*, 2009). Agroforestry is vital to maintaining biodiversity and also contributes to human well-being by producing a variety of commodities including food, income and fuel wood, building materials, fodder, herbs and medicinal plants (Legesse and Nagesh, 2021). The agroforestry system improves overall farm productivity, enriches soil through litter fall, and maintains environmental services including carbon sequestration to mitigate climate change, protect watersheds, and preserve biodiversity (Toppo and Raj, 2018). Agroforestry is very good at providing various ecosystem services, including long-term soil quality and production, pest and disease control, water regulation and quality, and

associated biodiversity (Beillouin *et al.*, 2021).

A developing country like Pakistan regards agriculture as the backbone of its economy. 63.6% of Pakistanis living in rural areas work directly or indirectly in agriculture. 42.3 percent of all workers are employed in agriculture, which generates 24 percent of GDP. However, various environmental issues such as water scarcity, climate change and soil degradation have significant negative impacts on the agricultural sector (Clark *et al.*, 2003). Economic benefits of AF include providing firewood, solid wood, pulp, or biofuel for personal use, sale, or farming (Dev *et al.*, 2018). Farmers often have good evaluations of the impacts of AF practices, according to research conducted in many economies (García de Jalón *et al.*, 2018; Ullah *et al.*, 2022). Farmers in Khyber Pakhtunkhwa Charsadda district planted various trees. The fact that farmers in Charsadda are planting trees in addition to crops shows their awareness of the importance of trees and underscores the district's enormous potential for agroforestry (Khan, 1997). This study aims to determine the socio-economic profile of the respondents due to agroforestry and to identify the impacts of agroforestry practices in the study area.

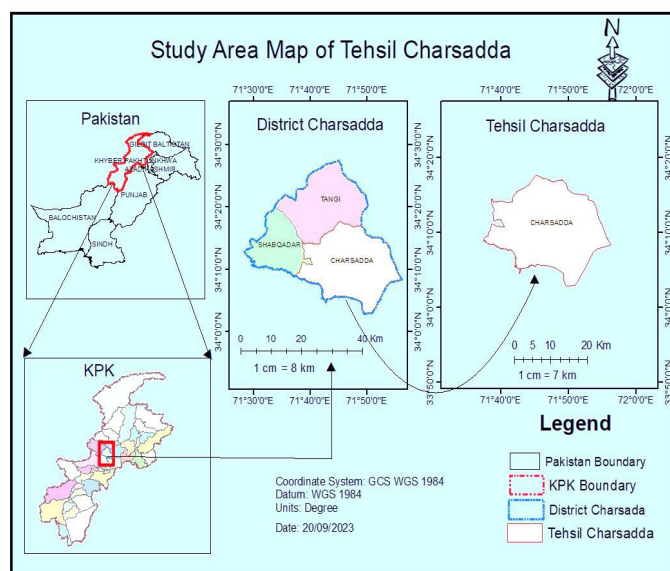
## Materials and Methods

### *Study area*

Charsadda district is between 34-03' and 34-38' north latitudes and 71-28' and 71-53' east longitudes. Located in the west of the Khyber Pakhtunkhwa, Charsadda is bordered by Malakand District to the north, Mardan District to the east, Nowshera and Peshawar Districts to the south, and the Mohmand Agency of the Federally Administered Tribal Areas to the west. The district has a total area of 243753 acres or 996 square kilometers. The average temperature here is 22.5 °C (pmd.gov.pk). The average annual rainfall is 460 mm (pmd.gov.pk).

### *Data collection and sampling strategy*

A two-stage random sampling was carried out for the survey of respondents. First, 10 villages were randomly selected from the list of 80 villages in Tehsils Charsadda. In the second stage, 10 farmers were randomly selected from each selected village (Ahmad *et al.*, 2021). Therefore, a total of 80 farmers were interviewed to gather the information requested for the purpose of the study. The details of the villages and the number of respondents are given in the table.



**Figure 1:** Study area Map.

#### List of villages sample.

S.No	Name of village	No of respondents
1	Ambadher	8
2	Dheri Sikandar Khan	8
3	Daulatpura	8
4	Agra	8
5	Sheikh Killi	8
6	Nawan Killi	8
7	Sheikho	8
8	Sardheri	8
9	Tarnab	8
10	Dheri zardad	8

Two different strategies were used to access the samples. In the first phase, which consisted of village selection, the sampling intensity was kept at 12.5% from 80 villages and 10 villages were randomly selected. 10 respondents were then selected from each village, assuming there were 1600 households in each village and using a 0.5% sampling intensity (Ahmad *et al.*, 2021).

#### Data analysis and compilation

In order to compile the data and present it in tabular form, it was necessary to transfer all the recorded information to a tally sheet. The analysis and discussion of the data, the derivation of insights and the elaboration of relevant recommendations and suggestions were carried out using simple statistical methods such as averages and percentages.

## Results and Discussion

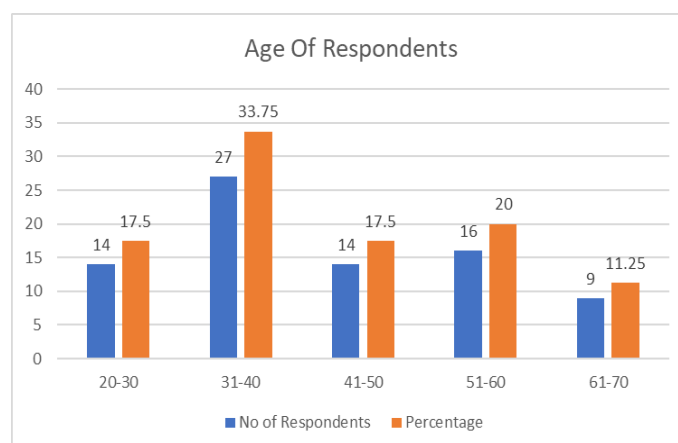
A sample of 80 respondents was selected per sampling design of the study to collect data by using structured and pre-tested questionnaire to assess socio economic impact of agroforestry practices.

### Age

The person in charge of the household takes decisions regarding all family matters, including property. The interview taken from respondents are (17.5%) of 21-30 years age, (33.75%) respondents of 31-40 years age, (17.5%) respondents of 41-50 years age, (20%) respondents are of 51-60 years of age and (11.25%) respondents are age of 61-70.

**Table 1:** Age of respondents.

Age	Percentage
21-30	17.5
31-40	33.75
41-50	17.5
51-60	20
61-70	11.25



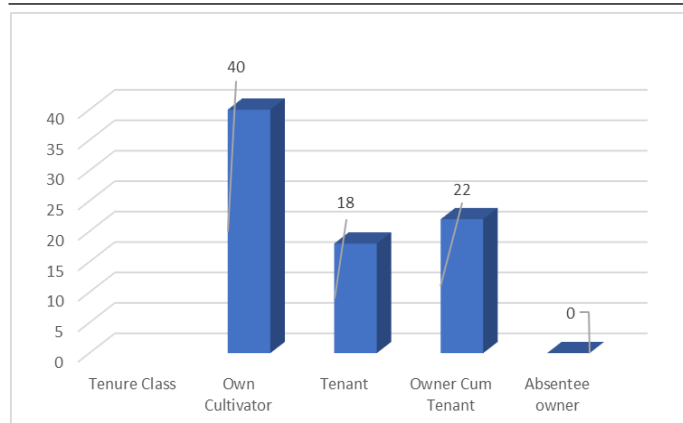
**Figure 2:** Age of respondents.

### Tenure status

The results of the study show that most of the respondents (50%) are own cultivator, (22.5%) the tenant and (27.5%) of the respondents are owner cum tenant.

**Table 2:** Tenure status of respondents.

Tenure status	Percentage
Own cultivator	50
Tenant	22.5
Owner cum tenant	27.5
Absentee owner	0



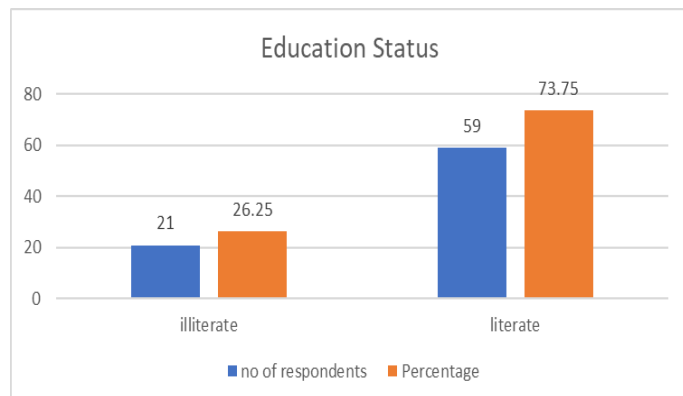
**Figure 3:** Tenure statuses of respondents.

#### Education status of respondents

Total of 80 respondents were interviewed and data was collected from them, out of which 21 respondents (26.25%) were illiterate and 59 respondents (73.75%) were literate and literate respondents include those which have done matric and above graduation while illiterate include below matric respondents.

**Table 3:** Education status of respondents.

Education status	Percentage
Illiterate	26.25
Literate	73.75



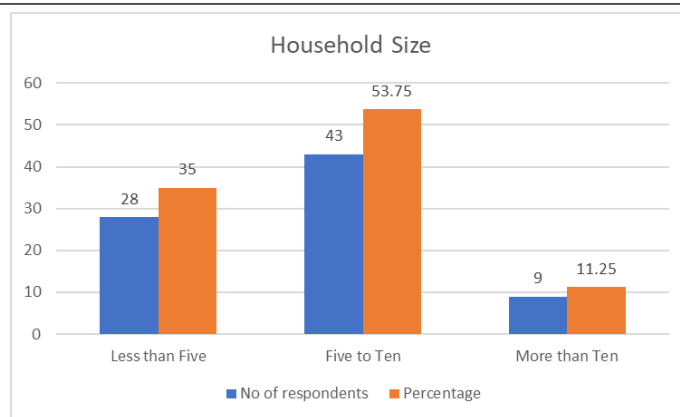
**Figure 4:** Education status of respondents.

#### Household size

Data were collected from 80 households, with 35% of respondents having household size of less than five, 53.75% of five to ten members, and 11.25% having family members of more than ten.

**Table 4:** Household size.

Household size	Percentage
Less than five	35
Five to ten	53.75
More than ten	11.25



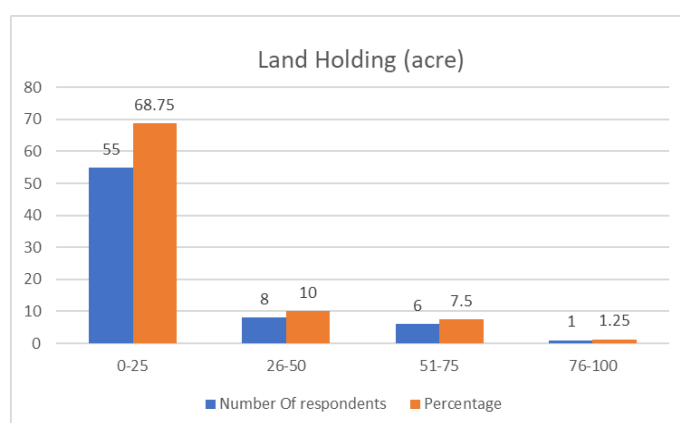
**Figure 5:** Household size of the respondents.

#### Land holding

Respondents land holdings were divided into four classes according to the size of the land. The study shows that the majority (68.75%) of respondents have land ranging in size from 0-25 acres. (10%) of respondents own properties ranging from 26 to 50 acres. (7.5%) of respondents own land holdings of 51-75 acres, followed by (1.25%) of respondents whose land holdings are 75-100 acres.

**Table 5:** Land holding.

Land holding (acre)	Percentage
0 to 25	68.75
26 to 50	10
51 to 75	7.5
75 to 100	1.25



**Figure 6:** Land holding (acre).

#### Fodder consumption

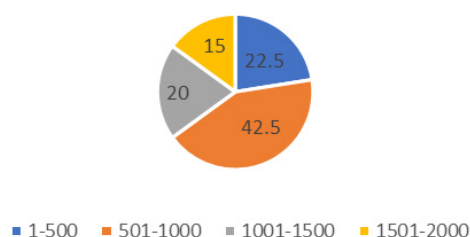
The respondent's animals annual fodder consumption is divided into four classes, with values ranging from 1 to 2000 Mann. Almost (22.5%) of the respondents told that their animals consume about 1-500 Mann fodder, (42.5%) of respondents animals consumes between 501-1000 Mann, (20%) respondents animals

consumption ranging between 1001-1500 Mann and (15%) respondent's animals consume about 1501-2000 Mann fodder annually.

**Table 6:** *Fodder consumption.*

Fodder consumption class	Percentage
1-500	22.5
501-1000	42.5
1001-1500	20
1501-2000	15

Fodder Consumption



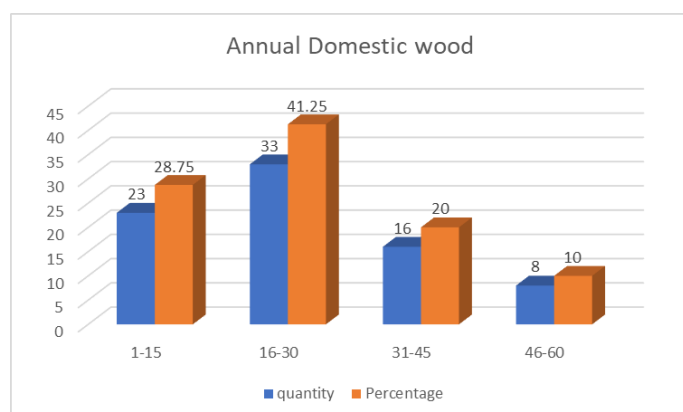
**Figure 7:** *Fodder consumption.*

#### Annual domestic wood

From the data it is concluded that (28.75%) of the respondents use between 1 and 15 Mann annually for firewood. (41.25%) have an annual consumption of between 16 and 30 Mann, (20%) of respondents have an annual consumption of 31 to 45 Mann, followed by (10%) of respondents with an annual consumption of 46 to 60 Mann.

**Table 7:** *Annual domestic wood.*

Annual domestic wood class	Percentage
1-15	28.75
16-30	41.25
31-45	20
46-60	10



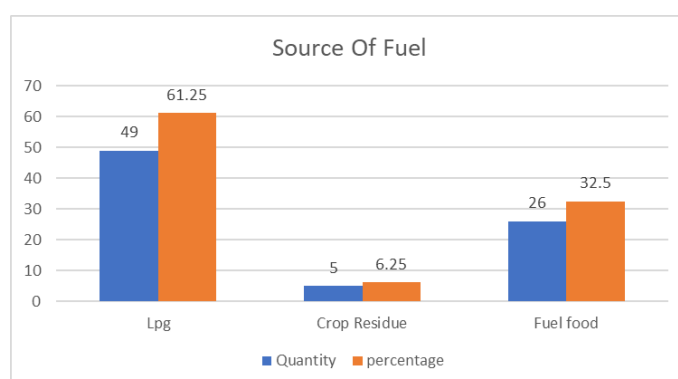
**Figure 8:** *Annual domestic wood.*

#### Source of fuel

In our study area, the majority of respondents (61.25%) use LPG as a fuel for cooking, heating, etc. in their homes due to availability. Most respondents (32.5%) also use firewood and the remainder (6.25%) also use crop residues with firewood.

**Table 8:** *Source of fuel.*

Source of fuel	Percentage
LPG	61.25
Crop Residue	6.25
Fuel Wood	32.5



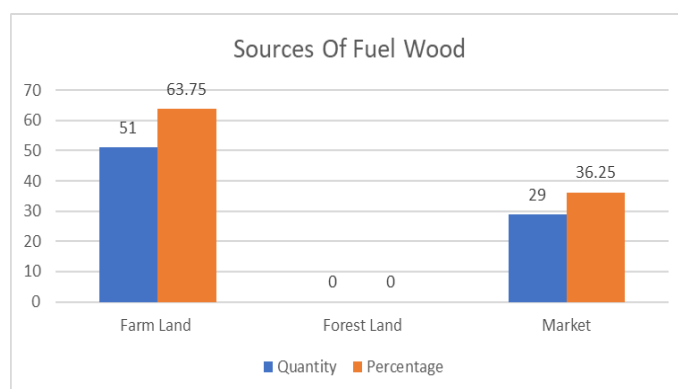
**Figure 9:** *Source of fuel.*

#### Source of fuelwood

Different respondents have different source of fuelwood use. According to the data collection out of 80 respondents 51 respondents (63.75%) were using fuel wood from their farm land, 29 respondents (36.25%) buying fuel wood from the market.

**Table 9:** *Source of fuelwood.*

Source of fuelwood	Percentage
Farmland	63.75
Forest land	0
Market	36.25



**Figure 10:** *Source of fuelwood.*



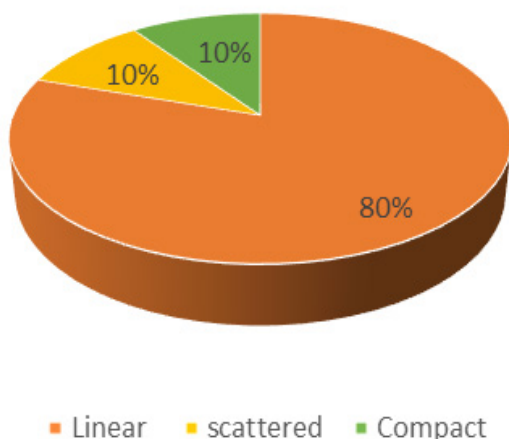
### Pattern of tree planting

The analysis shows that the most common and accepted pattern for planting trees on agricultural land by (80%) of respondents is linear planting along field and canal boundaries, as they believe this planting takes up less space and second, they provide the plant protection. In contrast, (10%) of respondents favored planting scattered on farmland and (10%) planting compact trees.

**Table 10:** Pattern of tree planting.

Pattern of tree planting	Percentage
Linear(line)	80
Scattered in agriculture crop	10
Compact i.e. in patches	10

### Pattern of Planting



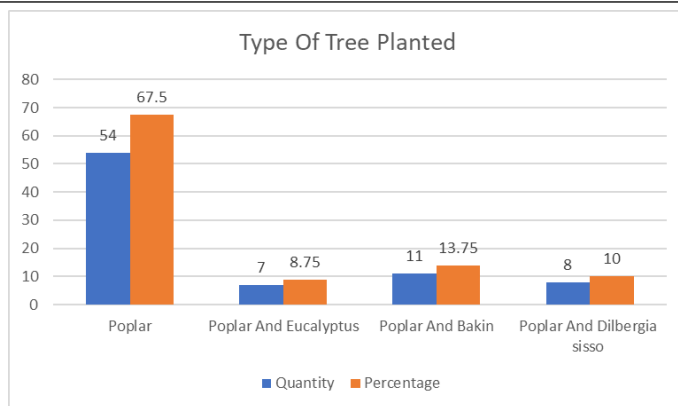
**Figure 11:** Pattern of tree planting.

### Type of tree planted

Different people have different opinion regarding species selection for agroforestry in study area but most of the people prefer poplar specie which is (67.5%) and some people prefer poplar and bakain specie which is (13.75%). Similarly, some prefer Poplar and eucalyptus which is (8.75%) and followed by Poplar and *Dilbergia sisso* which is (10%).

**Table 11:** Types of tree planted.

Specie	Percentage
Poplar	67.5
Poplar and eucalyptus	8.75
Poplar and bakain	13.75
Poplar and <i>Dilbergia sisso</i>	10



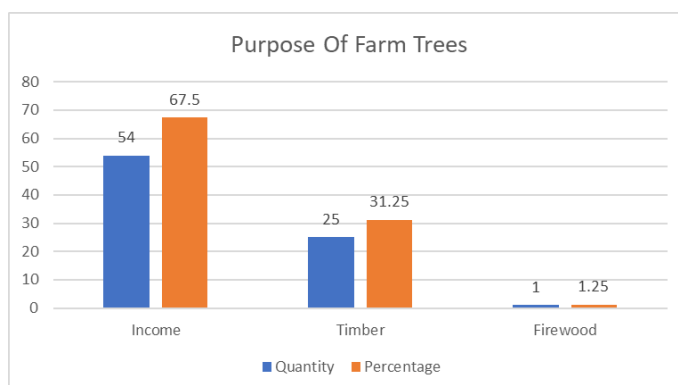
**Figure 12:** Types of tree planted.

### Purpose of farm trees

The purpose of farm tree is mainly income which is (67.5%) and timber which is (31.25%) followed by (1.25%) which is firewood.

**Table12:** Purpose of farm trees.

Purpose of farm tree	Percentage
Income	67.5
Timber	31.25
Firewood	1.25



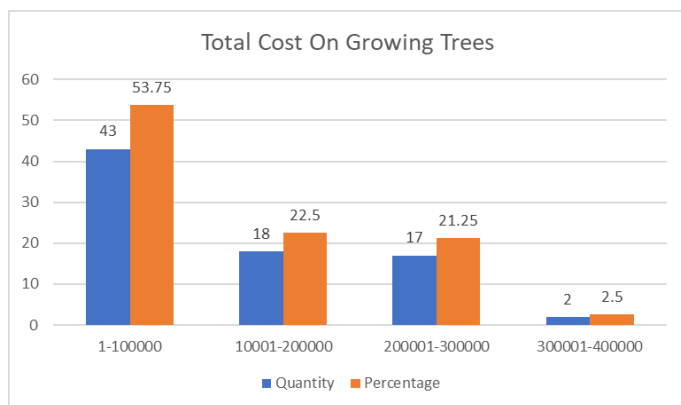
**Figure 13:** Purpose of farm trees.

### Total cost on growing trees

The cost on growing of these trees ranges from 1 to 400000 Rs. According to data (53.75%) of respondents have cost on growing trees from 1-100000 Rs, while (22.5%) ranges from 100001-200000 Rs. Similarly (21.25%) of respondents have total cost of 200001-300000 Rs and (2.5%) of respondents have cost of 300001-400000 Rs.

**Table 13:** Total cost on growing trees.

Total cost on growing trees	Percentage
1-100000	53.75
100001-200000	22.5
200001-300000	21.25
300001-400000	2.5



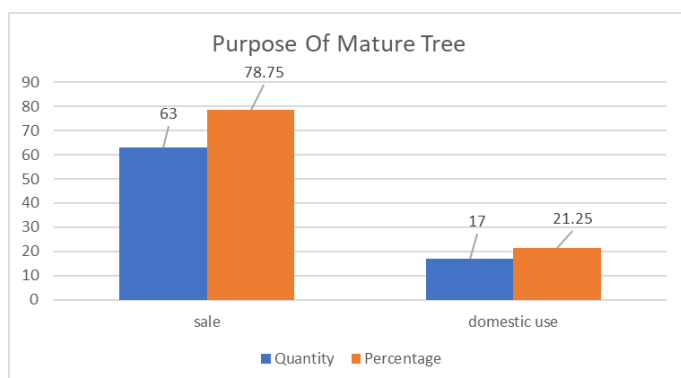
**Figure 14:** Total Cost on Growing Trees.

#### Purpose of mature trees

The study shows that (78.75%) of the respondents grow trees on their farmland to sell them to make money to support their families. Also, a good percentage of respondents (21.25%) use it for home use.

**Table 14:** Purpose of mature trees.

Purpose of mature trees	Percentage
Sale	78.75
Domestic Use	21.25



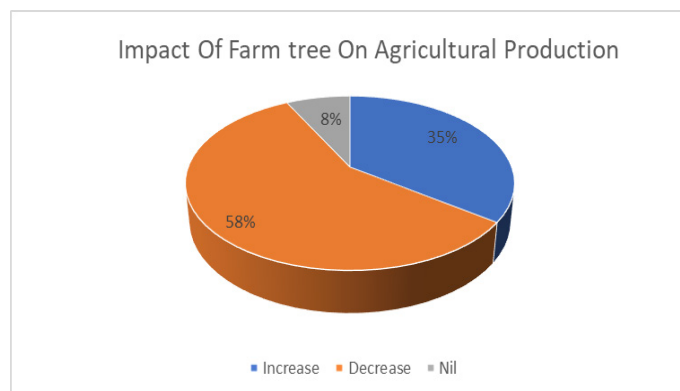
**Figure 15:** Purpose of mature tree.

#### Impact of farm trees on agricultural production

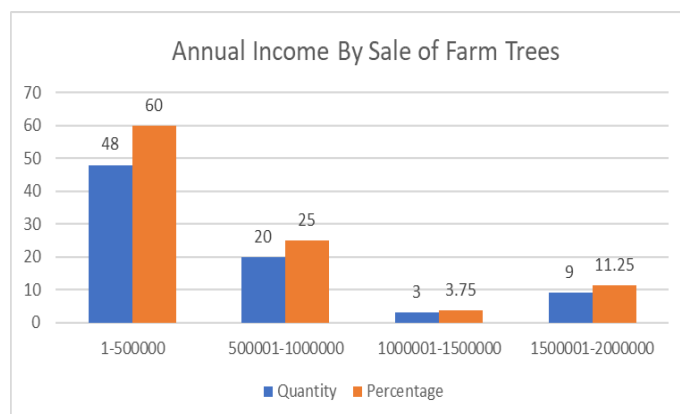
According to data (35 %) respondents told that farm trees increase agriculture production, while (58%) told that majority was popular in study area it decreases agriculture production due to shade and absorbing water from them, and (8%) told that have no effect on agricultural production.

**Table 15:** Impact of farm trees on agricultural production.

Impact of farm tree on agriculture production	Percentage
Increase	35
Decrease	58
Nil	8



**Figure 16:** Impact of farm trees on agricultural production.



**Figure 17:** Annual income by sale of farm trees.

#### Annual income by sale of farm trees

The results are very impressive, the annual income from selling farm trees ranges from Rs 1 to 2,000,000. According to the data (60%) of the respondents sell their trees between Rs 1-500,000 annually. Thereafter (25%) sell trees for 500,001 to 1,000,000 rupees. And the remaining respondents (3.75%) sell trees for between 1000001 and 1500000 rupees annually, while (11.25%) sell them for between 1500001 and 2000000 rupees annually.

**Table 16:** Annual income by sale of farm trees.

Annual income by sale of farm trees	Percentage
1-500000	60
500001-1000000	25
1000001-1500000	3.75
1500001-2000000	11.25

#### To whom farm trees are sold

According to the survey, (23%) of respondents sell their trees to local consumers, (44%) sell them in a pay-on-demand market and (34%) sell them to middle man.

**Table 17:** *To whom farm trees are sold.*

To whom farm trees are sold	Percentage
Local consumer	23
Middle Man	34
Market	44

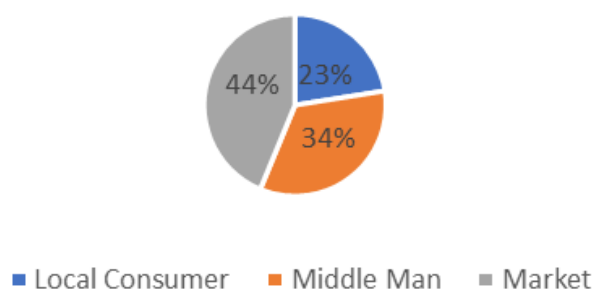
#### *How you came to know about agroforestry*

The analysis shows that (36%) of people learn about agroforestry through the Forest department. Also, a sufficient percentage (34%) of respondents who initiated agroforestry themselves. (11%) are inherited, while (11%) were started due to market demand and (8%) due to media.

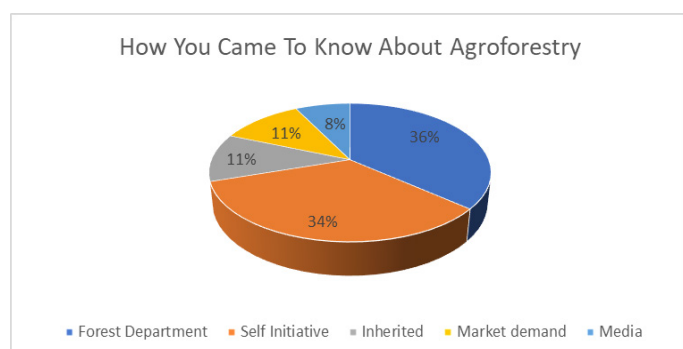
**Table 18:** *How you came to know about agroforestry.*

How you came to know about agroforestry	Percentage
Forest department	36
Self initiative	34
Inherited	11
Market demand	11
Media	8

#### To Whom Farm Trees Are Sold



**Figure 18:** *To whom farm trees are sold.*



**Figure 19:** *How you came to know about agroforestry.*

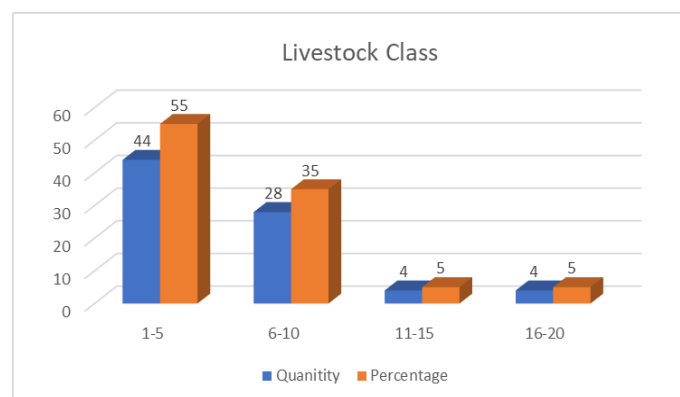
#### *Livestock class*

Four livestock classes between 1 and 20. (55%) of the respondents have a livestock between 1 and 5, followed

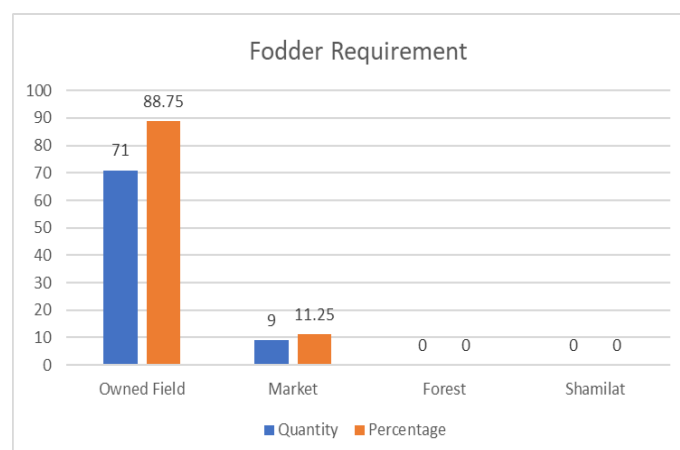
by (35%) with a livestock between 6 and 10 animals. (5%) have livestock between 11 and 15 animals. And the remaining (5%) have 16-20 animals.

**Table 19:** *Livestock class.*

Livestock class	Percentage
1-5	55
6-10	35
11-15	5
16-20	5



**Figure 20:** *Livestock class.*



**Figure 21:** *Fodder requirement.*

#### *Fodder requirement*

Majority of the respondents are fulfilling their fodder requirement from their own field that is (88.75%). And almost (11.25%) of the respondent population are purchasing the fodder from market.

**Table 20:** *Fodder requirement.*

Fodder Requirement	Percentage
Own field	88.75
Market	11.25
Forest	0
Shamlat	0

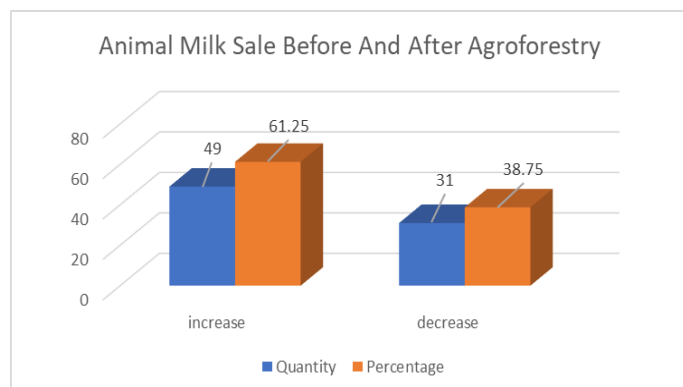


### Animal milk sale before and after agroforestry

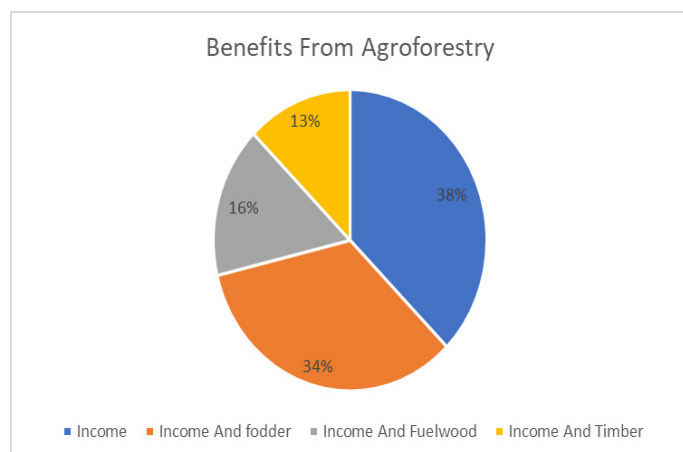
According to data (61.25%) respondents told agroforestry increases milk sale, while (38.75%) told that that agroforestry decreases milk sale.

**Table 21:** *Animal milk sale before and after agroforestry.*

Animal milk sale before and after agroforestry	Percentage
Increase	61.25
Decrease	38.75



**Figure 22:** *Animal milk sale before and after agroforestry.*



**Figure 23:** *Benefits from agroforestry.*

### Benefits from agroforestry

According to data (38%) respondents told that we get income benefits from agroforestry while (34%) told that income and fodder. similarly (16%) told that income and fuelwood and (13%) told of income and timber.

**Table 22:** *Benefits from agroforestry.*

Benefits from agroforestry	Percentage
Income	38
Income and fodder	34
Income and fuelwood	16
Income and timber	13

[Luqman et al. \(2018\)](#) conducted a study regarding the impact of agroforestry on the food security of rural households, wood, a good fuel source, is at the top with the highest mean value (2.95). One of the key limitations with the highest mean (2.62) is the small amount of agricultural land owned. According to the majority of respondents, the main benefit of agroforestry was reducing soil loss. The results of the chi-square test data showed a highly significant relationship between the respondents' perception of poverty and their level of education, source of income and the size of their land holdings. Our results also concluded that 73.75% of the respondents were literate and 26.25% of the respondents were illiterate. The average landholding size of farmers is 0 to 25 acres. The consumption (28.75%) of the respondents is between 1 and 15 Mann of firewood per year, (41.25%) is between 16 and 30 Mann per year and (20%) of the respondents are consuming between 31 and 45 Mann per year. followed by (10%) respondents with an annual consumption of 46-60 Mann. LPG is mainly used as fuel, so that less firewood is used. Due to availability, majority of the respondents i.e. 61.25% use LPG as fuel for cooking, heating etc. in their homes. 32.5 percent of those surveyed also use fuelwood. The major source of fuelwood is from farmland due to agroforestry practice which is (63.75%). Different farmers have different species selection and according to data (67.5%) of people prefer poplar specie.

[Rayyan et al. \(2021\)](#) stated that agroforestry is the simultaneous cultivation of different elements on one site in order to improve both the socio-economic position of farmers and the environmental situation. Our results show that 15% of respondents planted for protection while 72.5% of respondents planted for economic reasons. Additionally, 12.5% of farmers planted trees to stabilize their land. In addition, 10% of households benefit from firewood and 57.5% receive cash benefits from agroforestry. The survey also found that 32.5% of farmers rely on both farmland and market sources for fuelwood, while 45% of farmers benefit directly from the production of fuelwood on their land. The study concluded that socioeconomic status criteria such as family size, land ownership, subsidies received, livestock ownership, energy consumption and total income had a significant impact on tree planting on agricultural land. It is crucial to take measures that improve forestry and agricultural extension services, agricultural training

and national agroforestry. Also, our primary reason for planting is economic purpose which is (67.5%). 60% of the respondents sell their trees between Rs 1 and 500,000 annually. Followed by (25%) sales between Rs 500,001 and Rs 1,000,000. And other remaining (3.75%) respondents sell trees for 1,000,001 to Rs 1,500,000 per annum while (11.25%) sell for Rs 1,500,001 to Rs 2,000,000 per annum. The (78.75%) respondents grow trees on their farmland for the purpose of selling to earn money to support his family. Also, a good percentage of respondents (21.25%) use it for home use.

Saha *et al.* (2018) found that 82.14% of respondents considered agroforestry to be a practice that could increase agricultural production. In addition, 73.8% of respondents identified agroforestry as a technique that increases household income and 30.95% identified it as a way to ensure food security. Nevertheless, 34.52% of respondents believed that the methods would reduce the yield of cash crops, and some of them (17.85%) believed that the implementation of the scientific approach would be difficult. As a result, not all farmers in the study area used agroforestry techniques. In conclusion, it can be concluded that for the successful implementation of agroforestry to increase agricultural productivity and overall income, greater public awareness of the benefits of agroforestry, provision of adequate technical support and ensuring effective use of available farmland are required by landowners of the respondents in the study area. While (35%) respondents told that farm trees increase agriculture production, while (58%) told that majority was poplar in study area it decreases agriculture production due to shade and absorbing water from them. The (55%) of the respondents have a livestock population between 1 and 5, followed by (35%) with a livestock population between 6 and 9 animals. The majority of the respondents are fulfilling their fodder requirement from their own field that is (88.75%). According to data (61.25%) of respondents told agroforestry increases milk sale, while (38.75%) told that agroforestry decreases milk sales due to a decrease in agricultural production. (38%) of respondents told that we get income benefits from agroforestry while (34%) told that income and fodder both.

## Conclusions and Recommendations

The purpose of agroforestry is mainly to generate

income (67.5%) and timber (31.25%), followed by (1.25%) fuelwood. From the data it can be concluded that (78.75%) of the respondents grow trees on their farmland to sell them to earn money to support their family. Additionally, a good percentage of respondents (21.25%) use it for home use. They said we wouldn't go to the market to buy wood. According to the data, (35%) of respondents said crop trees increase agricultural production, while (58%) said the majority of poplars in the area decrease agricultural production due to the shade and water absorption from them, and (8%) said there was no impact on agricultural production. The results are very impressive, the annual income from selling farm trees is between Rs 1 and 2,000,000. According to the data, (61.25%) of the respondents said that agroforestry increases milk sales while (38.75%) said that agroforestry reduces milk sales. They believe that the poplar competes with agricultural crops, which absorb water from the crops, leaving less fodder available and causing them to sell their livestock. The data shows that (38%) of the respondents said that we get income benefits through agroforestry, while (34%) said that we get income and fodder. (16%) said income and fuelwood, and (13%) said income and timber.

## Novelty Statement

Exploring the socio economic impacts of agroforestry on in one of the District at Khyber Pakhtunkhwa ,Pakistan to unveil a transformative approach to sustainable agriculture, combining ecological benefits with enhanced socio economic resilience, and offering a blueprint for addressing the countries pressing environmental and resource challenges.

## Author's Contribution

Kashif Haleem: Data Collection.  
 Basheer Ahmad: Literature Review.  
 Muhammad Rayyan: Formatting.  
 Nowsherwan Zarif: Topic Selection.  
 Saif Ullah Khan: Data Analysis.  
 Salman Ahmad: Composing.  
 Anwar Ali: Final Review.

## Conflict of interest

The authors have declared no conflict of interest.

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