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**Title:** Contribution of Agroforestry to the household income in Bagerhat Sadar Upazila of Bagerhat District

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**Contribution of Agroforestry to the household Income in  
Bagerhat Sadar Upazilla of Bagerhat District**



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**Forestry and Wood Technology Discipline  
Khulna University  
Khulna-9208  
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2017**

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Contribution of Agroforestry to the household Income in Bagerhat  
Sadar Upazilla of Bagerhat District

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**DEDICATED TO  
MY BELOVED PARENTS**

## DECLARATION

I am Nasrin Sultana, declare that this thesis is the results of my own works and it has not been submitted or accepted for acceptance degree in any other university.

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Date 19.02.2018

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**Nasrin Sultana**

## ABSTRACT

Agroforestry practice is becoming popular in Bagerhat sadar upazila of Bagerhat district. Income from agroforestry is perceived from two dimensions, cash and non-cash. In conventional study key focus is mostly on cash income and that are usually assessed. But non-cash income can be very significant in the total livelihood earnings of rural community. The purpose of the study was to identify the cash and non-cash income in order to determine the contribution of agroforestry to the household income. A questionnaire survey was carried out to collect information related to cash and non-cash from agroforestry. Different types of agroforestry practices observed in the study area but commonly practiced agroforestry types are homegarden and aquasilviculture. Agroforestry related non-cash income contributes about one third of the total family income which is usually not recognized but has very important contribution to the livelihood. Important sources of non-cash income are fuelwood, paddy and fodder.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

Agroforestry is an intensive land management system that optimizes the benefits from the biological interactions created when trees and or shrubs are deliberately combined with crops and/ or livestock.

Agroforestry is a sustainable land management system, which increases the overall yield of the land, combines the production of crops(including tree crops) and forest plants and or animals simultaneously or sequentially, on the same unit of land, and applies management practices that are compatible with the cultural practices of the local people (King, 1979).

Agroforestry is a collective name for land use systems involving trees combined with crops and/ or animals on the same unit of land.

#### **It has the following benefit:**

- ❖ Improvement in rural living standard from sustained employment and higher incomes.
- ❖ Improvement in nutrition and health due to increased quality and diversity of food outputs.
- ❖ Increment in maintenance of outputs of food, fodder, fuelwood, timber.
- ❖ Better protection of ecological system.
- ❖ To maximize land productivity.

Agroforestry is an age-old land use system that has been practiced for thousands of years by farmers the world over. Although in recent years, it has also been developed as a science that promises to help farmers increase the productivity, profitability, and sustainability of production on their land, the science of agroforestry lags far behind the art of existing agroforestry practices.

It is observed that on an average about 2 percent family income come from the homgarden agroforestry (FAO, 2004). Farmers generated cash income from selling trees and met expenses for purchase of land, bullocks and inputs for crops, supplemented expenses of marriage,

household expenditure, and loan repayment (Chowdhury, M.K. and Mahat, T.B.S. 1993). Besides fuel wood supplying for household cooking, agroforestry also provides environmental, economic and social benefits to the community (Chundawat, B.S. and Gautam, S.K. 1993) which ultimately boasts the sustainable livelihood strategies of the local people.

Agroforestry also plays a vital role in rural socio-economic development as well as poverty reduction. Likewise, AF practice increases yield and services of per unit agro-forest area. At present, people are practicing various AF practices all over the country (Aktar, M.S., *et al.* 1992).

Income from agroforestry is perceived from two dimensions, cash and non-cash. Cash income is defined as the income (agroforestry products) received from cash during a specified period, especially that of rural and farming households. Cash income include selling fruits, medicinal Products, honey, nuts etc.

Non-cash income is defined as the agroforestry products and services which households consume or use directly or indirectly rather than selling. These may be fuel wood, timber, foods and medicines, fodder (Agrawal, A. *et al.* 2013).

It is important to note that cash and non-cash uses of agroforestry are often so intertwined at the household and community levels that their contributions cannot be easily separated.

## **1.2. Justification of the Study:**

Bangladesh is one of the most densely populated country of the world having about 164.4 million (UNFPA, 2016) people in its area of 148560 sq. km with more than 1138 persons per sq.km. There are 9.2 million hectares of cultivable land and about 8461 sq. miles of forest in Bangladesh. Agriculture is the foundation of the country, which contributes about 37 percent to the gross domestic product (ADB 2016). About 80 percent people lives in rural areas in 15.4 million households spreading over 87000 villages (BBS, 2016). Bangladesh has about 17 percent of forestland (BBS 2010). But the actual tree covered area is only 6 to 7 percent at present (Islam, K.K. and Sato, N. 2010). Which is decreasing at an alarming rate due to overpopulation.

Moreover, forests in Bangladesh have declined by 2.1 percent annually over the last three decades due to deforestation, illegal logging and harvesting, slash-and-burn agriculture, construction of roads, industries and other infrastructure (Banglapedia 2014).

The land is limited. So there is no scope to increase the forest land and agricultural land. In these circumstances, traditional land use pattern should be converted into sustainable land use, which will permit maintenance of productivity combined with conservation of the resources on which, that production depends. Agroforestry is a sustainable land use and management system for land that increases total production; combine agricultural crops, tree crops, forest plants, animals are thereby increase total production thus can ensure maximum land use with traditional agroforestry system. Therefore, this study is conducted in Bagerhat sadar upazila to identify the cash and non-cash income in order to assess the contribution of agroforestry for sustainable livelihood and greater family income. Non-cash income can be very significant in the total livelihood earnings of rural community that is usually underestimated in commercial evaluation. So Bagerhat sadar upazilla of Bagerhat district was selected purposively for this study.

### **1.3.Objectives:**

- ✓ To assess the Contribution of Agroforestry to the household income.
- ✓ To identify cash and non-cash income in Agroforestry.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2. LITERATURE REVIEW

##### 2.1. Definition and concepts of Agroforestry

Agroforestry is a sustainable management system for land that increases total production, combines agricultural crops, tree crops and forest plants and or animals simultaneously and applies management practices that are compatible with the cultural patterns of the local people.

Nair (1979) defined agroforestry as a landuse system that imerged tree crops and animal in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to farmers.

Anon (1990) defined agroforestry is any form of permanent land use by which tree crops are cultivated in combination with agricultural crops and possibly also in combination with animal husbandry.

King and Chander defined agroforestry as sustainable land management system which increase the overall yield of land combines the production of crops and forest land and animal simultaneously.

Agroforestry is an age-old practice in Bangladesh as an indispensable part of rural lives and livelihoods. In most of the agro-ecological regions of the country, the farmers in the rural communities have been practicing agroforestry for centuries, where growing different tree species in their homestead compounds and in their crop fields is a common phenomenon with its virtue of short time benefits from agricultural crops and long –term benefits from trees (Lal 1991; Alam; 1993; Chowdury 1993; Mallick 2000). In homestead agroforestry (also known as homegarden), crops, trees, livestock and fish ponds in and around the homesteads are integrated into the homestead production system; while in crop fields, especially in rain-fed agricultural upland areas, farmers grows grow trees intentionally or retain the naturally occurring plants

along field boundaries or within fields in association with the main crop (Ali & Ahmed 1991; Alam 1993). Cropland and homestead agroforestry are practiced on the private land of the landowner. In addition, Shifting cultivation and taungya system, the oldest traditional agroforestry systems, are practiced by the tribal communities in the hills which are the center of their livelihood activities (Miah *et al.* 2002). These are the traditional systems in the country that have been developed and practiced by the farmers through trial error over centuries based on their needs and knowledge. Depending on the topography and climatic variations, there are several major agro-ecosystems in Bangladesh, such as floodplain, hill and terrace ecosystems (Miah *et al.* 2002). Homestead agroforestry, the most dominant system in the country, is found all over the country. Cropland or farmland agroforestry practiced predominantly in floodplain and terrace ecosystem areas, whereas shifting cultivation and taungya system are found in hill ecosystems.

## **2.2. Types of agroforestry**

There are various types of agroforestry system they are given below

### **2.2.1. Boundary plantation with mixed crops**

In this system, trees are grown mixed or separately along boundaries with crops for various purposes such as wood, fodder, soil conservation.

#### **Advantages**

1. Reduces the insect/mite pest populations because of the diversity of the crops grown. When other crops are present in the field, the insect/mite pests are confused and they need more time to look for their favorite plants.
2. Reduces the plant diseases. The distance between plants of the same species is increased because other crops (belonging to a different family group) are planted in between.
3. Utilizes the farm area more efficiently.
4. Results in potential increase for total production and farm profitability than when the same crops are grown separately.



### **2.2.2. Woodlots**

According to Nshubemki (1998), the term woodlots means a near replica of wood vegetation assortments in smallholdings.

Woodlots is a tract of land of any size and shape that contain naturally occurring or planted trees (Ramadhani *et al.*,2002). Therefore, woodlot is the mature stand of trees with no further intercropping; conserved for multiple benefits like wood fuel, poles, fodder, timber and honey while also restoring the soil fertility. The major tree species which are planted such as Mehogany, Raintree, Sisso, Ipil-ipil, Eucalyptus, Akashmoni etc. Therefore, from the woodlots, farmers can obtain benefits for domestic uses and income generation, all of which contribute to improvement of livelihood.

### **2.2.3. Homegarden**

Homestead is composed of home and adjacent land occupied by a household. With the increased scarcity of arable land, agroforestry in homesteads is considered as the potential area of intercropping in the context of rural Bangladesh which is usually managed by household members, particularly women (Khan 2007; Miah and Hossain 2010).

Camaco, 1987 stated homegarden as land, ponds, house, plants and animals housing having continuous interaction with the farmer and his family, fulfilling some of the daily homestead needs. It is usually contains living house, cultivated land and bare space.

The cultivated space is usually located around the houses, as front yard and back yard.

In a homegarden, the upper story is often of tree and species that production timber, fuel wood , fruit and fodder. The middle story may produce coffee, banana, papaya and the understory produce pulses and beans, medicinal or ornamental plants. It provides opportunities for income generation with substantial benefits to resource poor farmers and female farmers (Miah & Hossain 2010; Alam & Sarkar 2011). It offers them a spectrum of products, such as food (fruits, vegetables and spices), tree products (timber, firewood), non-timber products (medicinal and aromatic plants, bamboos and others). The benefits of homestead agroforestry can be understood

more clearly by some numeric representations. For instance, this system contributes nearly 50% of the cash flow to the rural poor, and also contributes about 70% of the fruit, 40% of the vegetables, 70% of the timber, and 90% of the firewood and bamboo requirement of Bangladesh (Miah & Hossain 2010).

**The main advantages of home gardens village people got, are as follows**

- ✓ Homegarden act as a reserve bank of food and cash for farmers.
- ✓ Play a vital role in providing firewood, fodder, fruit, medicine, timber.
- ✓ To increase farmers income level and improve living standard.
- ✓ Source of fodder for livestock.
- ✓ Maintenance of biodiversity.
- ✓ Employment opportunities.
- ✓ Enhances aesthetic value.

**Table 1 Local and scientific name of tree and fruit species (Practice in homegarden)**

Local name	Scientific name
Narikel	<i>Cocos nucifera</i>
Am	<i>Mangifera indica</i>
Kanthal	<i>Artocarpus heterophyllus</i>
Supari	<i>Areca catechu</i>
Peyara	<i>Psidium guava</i>
Bel	<i>Agele marmelos</i>
Papaya	<i>Carica papaya</i>
Jam	<i>Syzygium spp.</i>
Litchi	<i>Litchi chinensis</i>

Tentul	<i>Tamarindus indica</i>
Tal	<i>Borassus flabellifer</i>
Khejur	<i>Phoenix sylvestris</i>
Rain tree	<i>Samanea saman</i>
Mehogany	<i>Swietenia mehogoni</i>
Lebu	<i>Citrus limon</i>
Amra	<i>Spondias dulcis</i>
Boroi	<i>Ziziphus mauritiana</i>
Sissoo	<i>Dalbergia sissoo</i>

(Source: Field survey, 2010)

### 2.2.3. Aquasilviculture

An aquasilviculture system that integrates fisheries and trees into a production system (<http://books.nap.edu/openbook.php?>)

It has following characteristics:1. Aquasilviculture is a multipurpose production system.2. Integrated management system.3. Combination of fish and trees.

The respondents who practice aquasilviculture, practice various types of tree species as Mehogany, Sissoo, Koroi, Neem etc. Different types of fruit trees were also practiced such as guava, mango, lemon, papaya. Various types of vegetables such as bean, cucumber, brinjal, pumpkin etc.

**Table 2 Scientific name of different tree, fruit species and vegetables (Practice in aquasilviculture)**

<b>Tree species</b>	
<b>Local name</b>	<b>Scientific name</b>
Mehogany	<i>Swietenia mahagony</i>
Sissoo	<i>Dalbergia sissoo</i>
Koroi	<i>Albizia lebeck</i>
Nim	<i>Azadirachta indica</i>
<b>Fruit species</b>	
<b>Local name</b>	<b>Scientific name</b>
Guava	<i>Psidium guava</i>
Lemon	<i>Citrus spp</i>
Papaya	<i>Carica papaya</i>
Narikel	<i>Cocos nucifera</i>
<b>Vegetables</b>	
<b>Local name</b>	<b>Scientific name</b>
Cucumber	<i>Cucumis sativus</i>
Bean	<i>Lablab niger</i>

Nim	<i>Azadirachta indica</i>
-----	---------------------------

The respondents who practice aquasilviculture, culture various types of fishes as Catla, rui, mrigal, common carp, tilapias etc. which are called sada fish locally. They also practice prawns. The respondent who earn a lot of money, practice bagda only taking huge amount of land.

**Table 3 Scientific name of different fishes (Practice in aquasilviculture)**

Local name	Scientific name
Rui	<i>Labeo rohita</i>
Catla	<i>Catla catla</i>
Mrigal	<i>Cirrhinus mrigala</i>
Silver carp	<i>Hypophthalmichthys molitrix</i>
Punti	<i>Puntius chola</i>
Galda	<i>Macrobrachium rosenbergii</i>
Tilapia	<i>Puntius ticto</i>
Shoal	<i>Channa striatus</i>

### 2.3. Cash income

Cash income is defined as the income (agroforestry products) received from cash during a specified period, especially that of rural and farming households. Cash income include fruits, medicinal products, honey, nuts etc.

#### 2.3.1. Non-cash income

Non-cash income is defined as the agroforestry products and services which households consume or use directly or indirectly rather than selling. These include fuel wood, timber, fruits and medicines, fodder (Agrawal, A. *et al.* 2013).

### **2.3.2. Contribution of Agroforestry to the household income (Mainly cash and non-cash income)**

At present, people are practicing various AF practices all over the country. Agroforestry is a land based production system that is directly related to food security, employment, income opportunities and environmental issues. In Bangladesh, most of the native fruits, vegetables, fuel wood, timber come from homestead (Haque, 1993). Homestead trees provide eighty percent of all wood consumed in Bangladesh (Ali and Ahmed, 1993). Village forests supply to the extent of about seventy percent and fuel wood to the extent of about eighty five percent of the supply (Pasha, 1995). Trees in homegarden play an important role in the livelihood of rural poor and the rural economy and act as a buffer against rural poverty (Chowdury and Mahat, 1993). Practice of aquasilviculture produce multiple products such as fish, fruits, fuel wood, timber. Extra income can generated from trees, fruits, ducks and pigs AF also plays a vital role in rural socio-economic development as well as poverty reduction. Likewise, AF practice increases yield and services of per unit agro-forest area.

It is important to note that cash and non-cash uses of agroforestry are often so intertwined at the household and community levels that their contributions cannot be easily separated.

A considerable amount of cash income derived from agroforestry products like fuelwood, timber, fruits etc. Non-cash income from different types of agroforestry products which households consume or use directly rather than selling. The rural people's livelihood is heavily dependent on non-cash income that is usually not recognized in commercial evaluation. In rural Bangladesh majority of agroforestry is of subsistence nature where non cash income is more important than that of cash income.

## CHAPTER THREE

### MATERIALS AND METHODOLOGY

#### 3. General description of the study area:

##### 3.1. Geography:

Bagerhat sadar is an Upazila of Bagerhat District in the Division of Khulna. It is bounded by fakirhat and chitalmari upazilas on the north, rampal and morrelganj upazilas on the south, kachua upazila on the east, Fakirhat and Rampal upazilas on the west. It is located in between 22°35' and 22°50' north latitudes and in between 89°38' and 89°53' east longitudes .The upazilla occupies an area of 316.97 square kilometer. The main rivers in the area are the Bhairab, Chitra, Daudkhali, Pollahar and Putimari. This upazilla has 45,527 households. There are 10 unions, namely as Baruipara, Bemarta, Bishnupur, Dema, Jatrapur, Karapara, Khanpur, Rakhalgachhi, Shat gambuj union.

##### 3.2. Population

Total population 266,389 ; Male 51.22%, Female 48.78%; Muslim 77.45%, Hindu 22.06%, Christian 0.42%, others 0.07%.

##### 3.3. Literacy rate

Average literacy 49.9%, Male 55.3%, Female 44.2%.

### **3.4. Main Occupations**

Agriculture 29.64%, fishing 2.34%, agricultural laborer 14.04%, labourer 8.02%, service 10.67%, others 13.73%.

### **3.4. Land Use**

Cultivable land 20553 hectares, fallow land 200 hectares; single crop 56%, double crop 38%, treble crop 6%; land under irrigation 2.20%.

### **3.5. Main Crops**

Paddy, wheat, jute, potato, banana and papaya, garlic, onion.

### **3.6. Main Fruits**

Safeda, mango, jackfruit, banana, papaya, ata, jamrul.





Figure 3.1: Location of the study area (source: LGED, Bagerhat sadar upazila, Home)

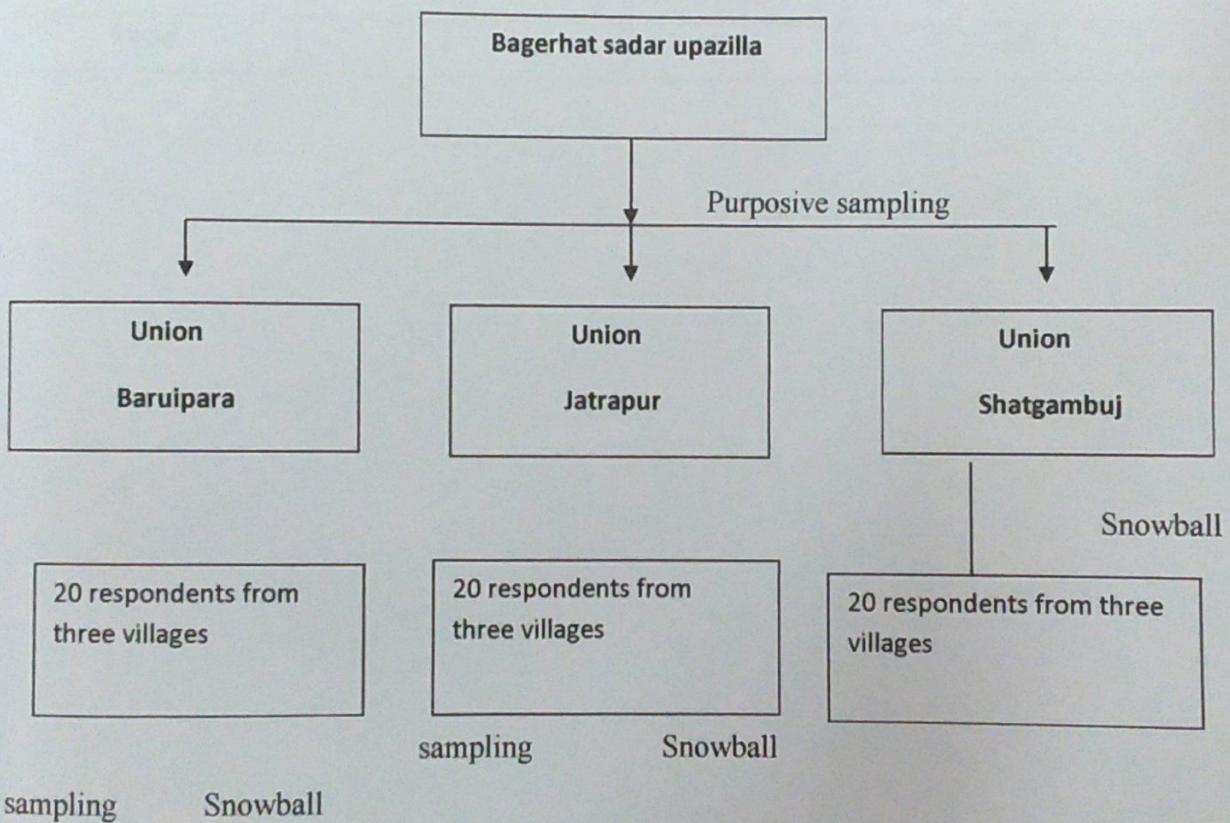
### 3.1.1. METHODOLOGY

The Primary data were collected from Bagerhat sadar upazilla through household survey by using purposive and snowball sampling method. Three unions (Jatrapur, Baraipara, Shatgumbuj) and three villages from the each union were selected purposively. Primary field data were



collected with a semi-structured questionnaire from 60 respondents following a snowball sampling method. I surveyed 20 respondents from each union and total 60 respondents were conducted for data collection. According to Yen, 60 to 120 samples are handsome enough for evaluating a fact in a social survey; a higher numbers has been selected because of diversification in population (Yen, 1984). On the other hand secondary information such as statistical data, reports, and maps were collected from various Government, Non-government organizations, literature and internet. Then collected data was analyzed in percentages for easy explanation with graphs. MS Excel was used to process and analyze the collected data.

**3.1.2. Sampling process are given below-**



**Flow diagram of sampling method**

**Table 4. Surveyed villages in Bagerhat sadar Upazila**

<b>Upazila</b>	<b>Unions</b>	<b>Villages</b>	<b>Sample size</b>
<b>Bagerhat sadar</b>	<b>Baruipara</b>	Karthikdia	7
		Laopala	7
		Arpara	6
	<b>Jatrapur</b>	Jatrapur	7
		Mosidpur	7
		Chapatala	6
	<b>Shatgambuj</b>	Sundarghona	7
		Barakpur	7
		Ronbijoypur	6
<b>Total</b>	<b>3</b>	<b>9</b>	<b>60</b>



## CHAPTER IV: RESULTS & DISCUSSIONS

### 4.1. Age classes

Table 5: Age classes

Age classes	Percentage of respondents
25-30	12
31-36	16
37-42	23
43-48	34
49-54	15

The above table shows the age classes of sample households. There are about 12% respondents age classes within 25-30, there are about 16% respondents age classes within 31-36, 23% respondents age classes within 37-42 range, 34% respondents age classes within 43-48 range, 15% respondents age classes within 49-54 range respectively. It was observed that households age do not have any effect on their Agroforestry practice because people of all ages practice Agroforestry.



Figure 1: Age classes of the respondent

## 4.2: Family size of the respondents

Table 6: Family size

Family size	Percentage of respondents
2-3	22
4-5	46
6-7	32

The above table shows the family size of sample household. There are about 22% household members family size range within 2-3, 46% respondents having family size 4-5, 32% respondents having family size 6-7. So most of the family size is medium in size only few are in the joint family.

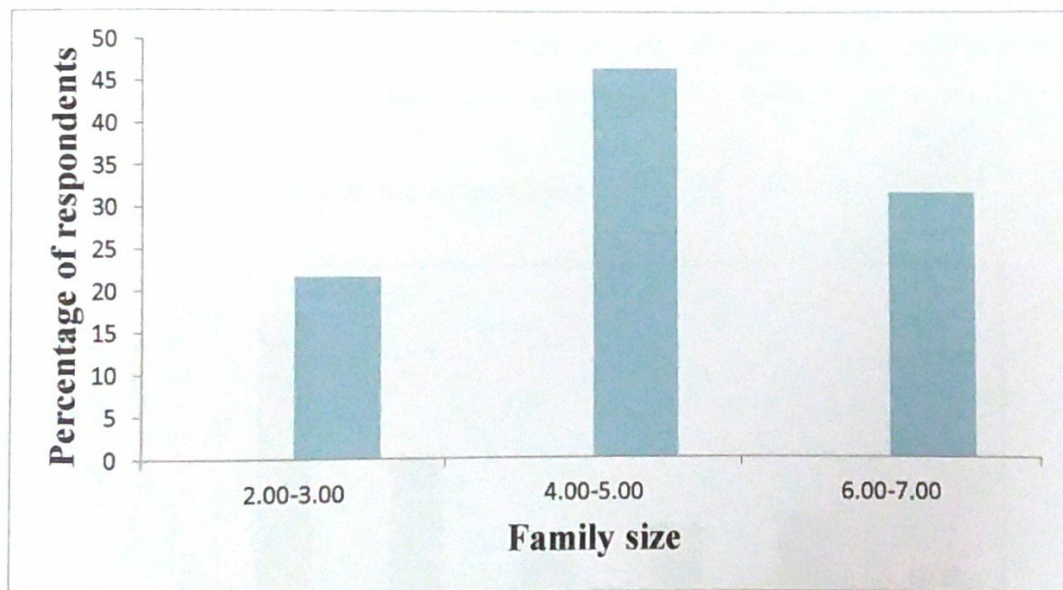


Figure 2: Family size of respondents



### 4.3. Literacy level

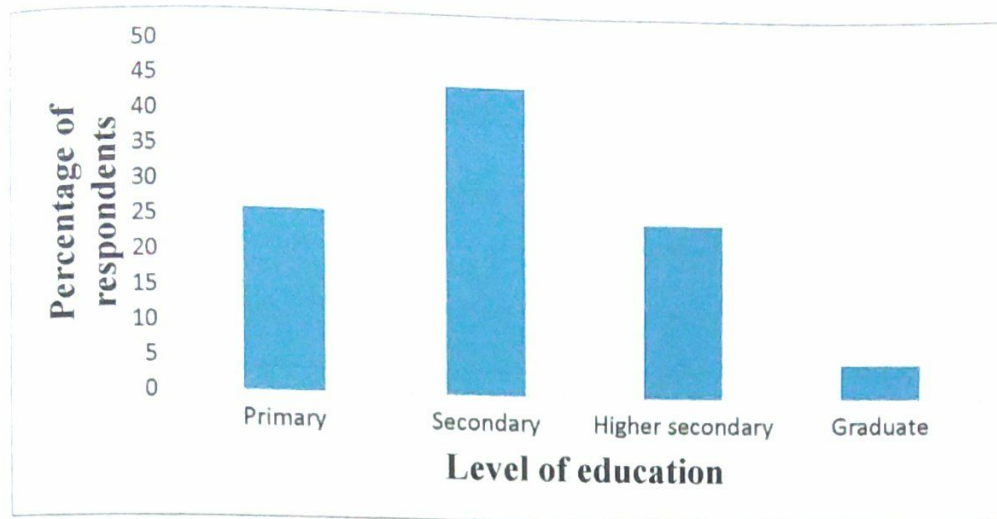


Figure 3: Educational Status

Education is the back bone of a nation. Significant percentages of the family members are Primary and secondary level among the households. They practice Agroforestry for improving their livelihood status. They know about the benefits of Agroforestry. For this most of the people have a prone to practice different Agroforestry types.

### 4.4. Primary occupation of the respondents

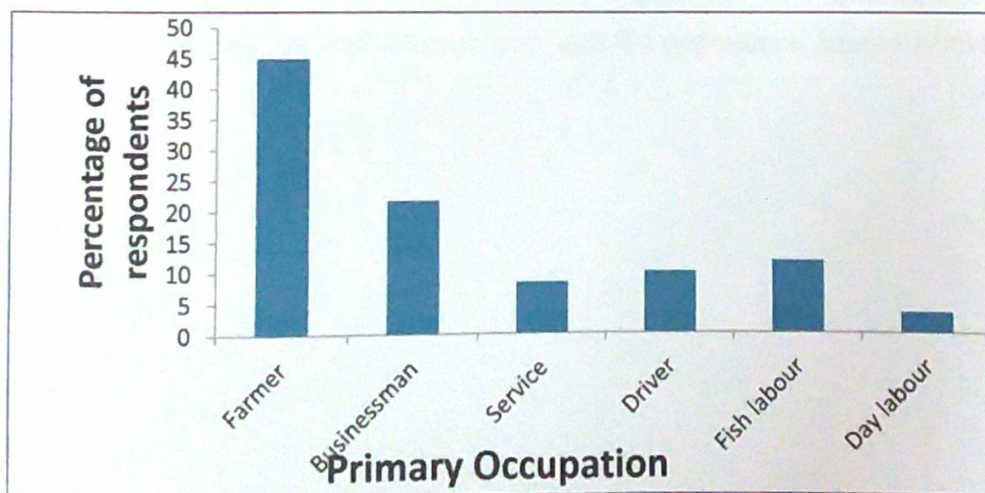
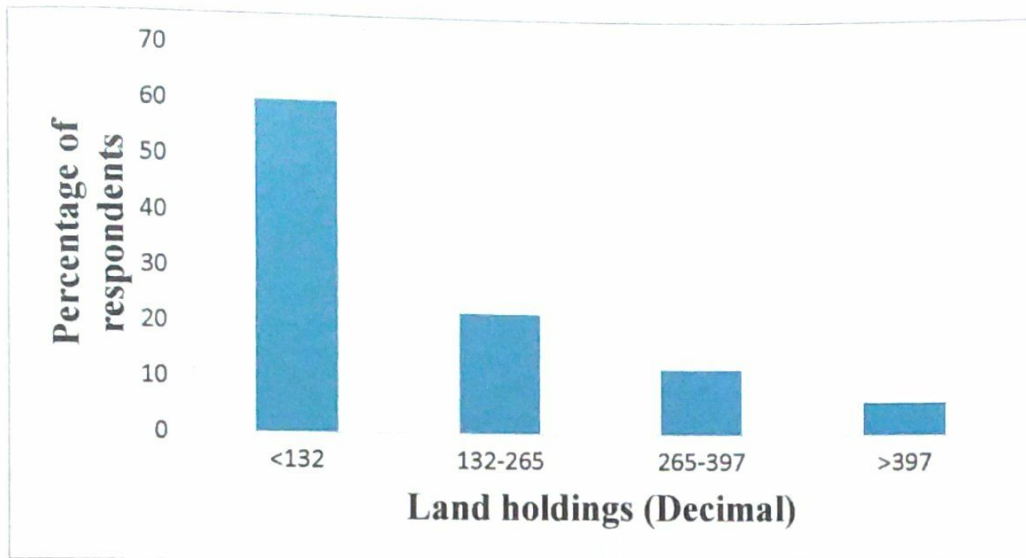


Figure 4: Primary occupation of the respondents

Occupation is an important factor that reflects one's socio-economic position. From the figure it has been observed that 45% respondents were farmer, 22% respondents are businessman, 8% respondents were fish labour, 10% respondents were drivers, 12% respondents were service holder and 3% of the respondents were day labour respectively.

#### 4.5. Land holdings classes of the respondents

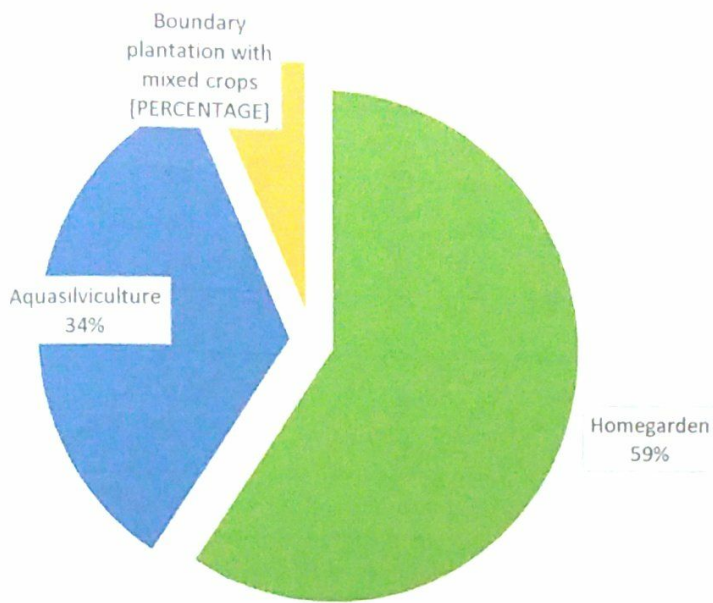


**Figure 5 : Land holding classes in decimal**

Land is an indicator of the socio-economic condition of the respondents. From the figure, 62% respondents having <132 decimal land, 20% respondents having 132-265 decimal land 10% respondents having 265-397 decimal land and 8% respondents having Above 397 decimal land respectively.



#### 4.6. Percentage of respondents having different types of AF practices



**Figure 6 : Percentage of respondents having different types of AF practices**

In the study area, different types of agroforestry are observed. Most of the respondents practice Homegarden, aquasilviculture and boundary plantation with mixed crops. From the figure it has been shown that 59% respondent Practice homegarden, 34% respondents practice aquasilviculture, 7% respondents practice mixed with boundary planting, In the study area the higher number of household income comes from homegarden and aquasilviculture.



#### 4.7. Most common tree species in AF practices

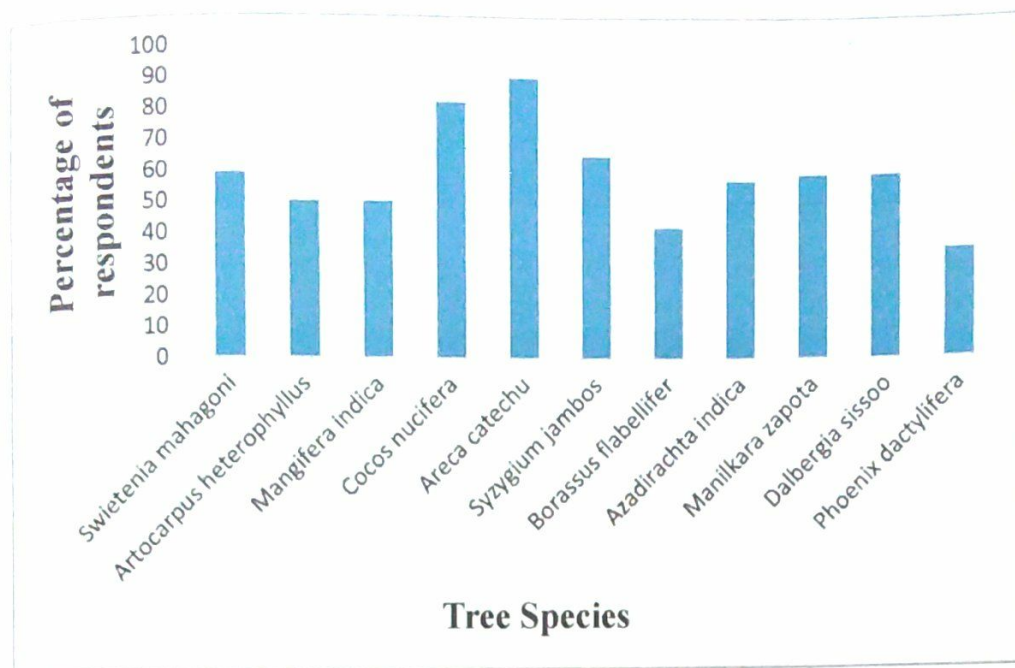
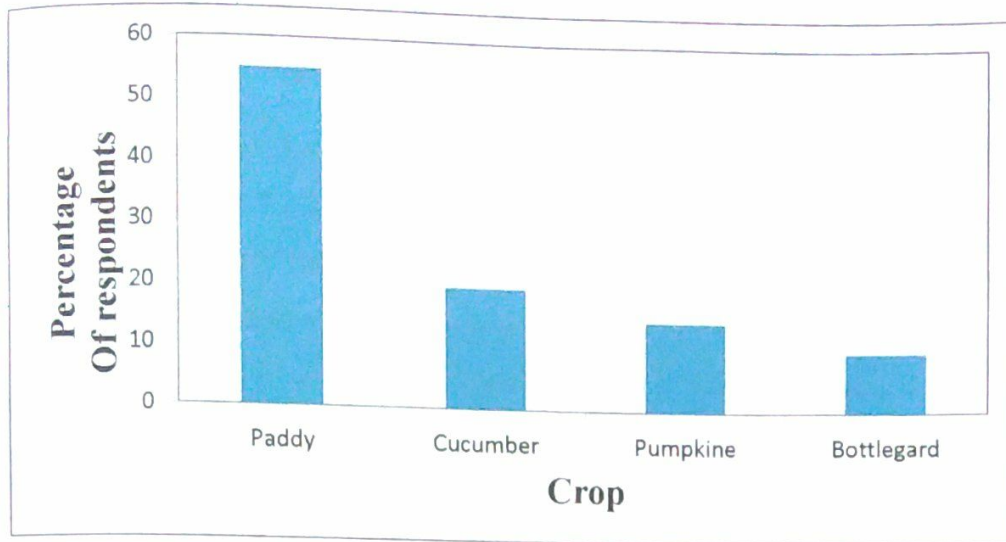


Figure 7: Most common tree species in AF practices

Most of the respondents in Bagerhat Sadar Upazilla mainly practice homegarden and aquasilviculture. The respondents who practice homegarden and aquasilviculture, practice various types of tree species as Mahogany, Kathal, Am, narikel, supari, sissoo etc. From this graph it has been shown that 90% respondents preferred Supari, 80% respondents preferred narikel, 59% respondents preferred jamrul, 60% respondents preferred Mahogany, 50% respondents preferred Kathal, 30% respondents preferred khejur respectively. It has been cleared that most predominant fruit species were Supari and fuelwood species were Mahogany in the study area. This tree species are good source of fruit, timber, fuelwood, fodder species and those species fulfill our nutrition and increased household income.

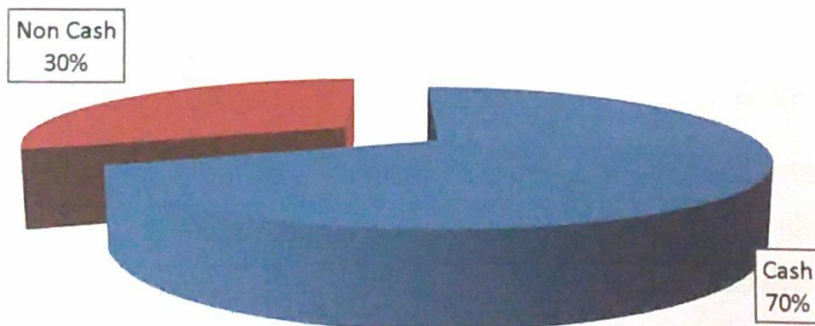
#### 4.8. Most common seasonal crops in AF practices



**Figure 9 : Most common seasonal crops in AF practices**

The respondents who practice homegarden and aquasilviculture, practice various types of crops as cucumber, bottlegard, pumpkin, paddy etc. From this Piechart it has been shown that 55% respondents cultivate paddy, 20% respondents cultivate cucumber, 15% respondents cultivate pumpkin and 10% cultivate bottlegard respectively. This crop species has large contribution in household cash and non-cash income.

#### 4.9. Proportion of AF related cash and non-cash income



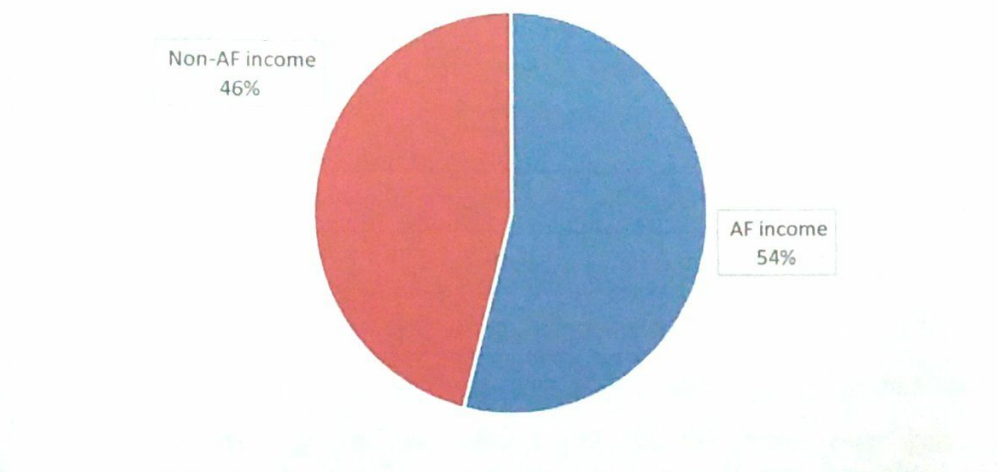
**Figure 10: Proportion of AF related cash and non-cash income**



In the study area, it is found that about 70% respondents generated cash income from selling agroforestry related products and met expenses for purchase of land, bullocks and inputs for crops, supplemented expenses of marriage, household expenditure, and loan repayment.

Non-cash income from agroforestry come from agroforestry products which households collect but consume/use in the home, or trade as barter for other goods and services rather than selling. These income include fuelwood, timber, forest foods, medicines, fodder or fibre. From the above graph it is found about 30% percent of the non-cash income comes from AF products. It plays a important role to improve livelihood condition of the surveyed area.

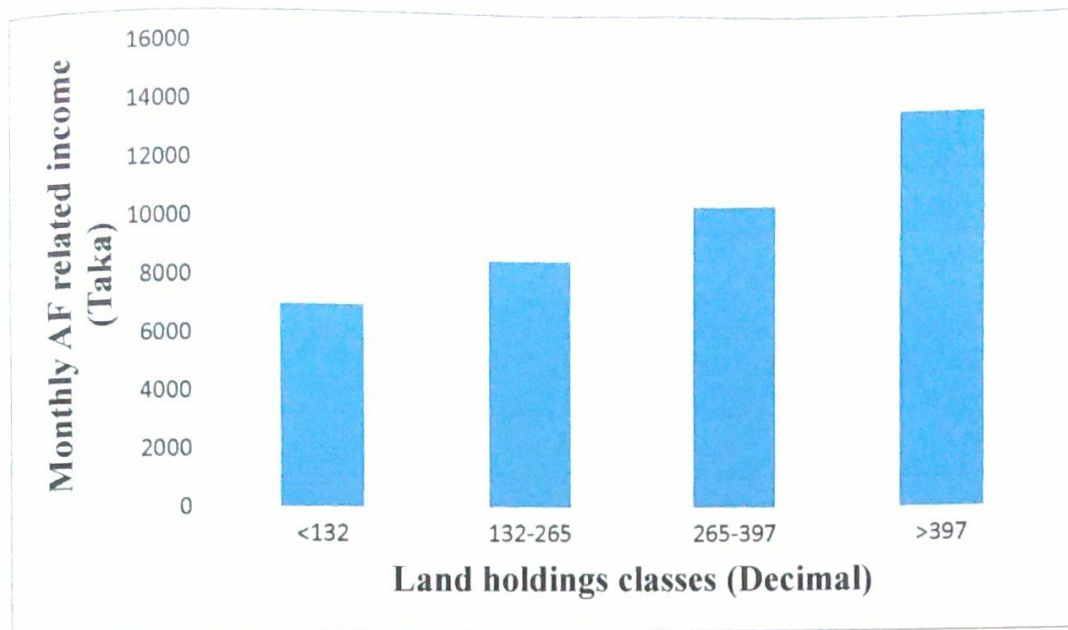
#### 4.10. Proportion of income related to AF and non AF



**Figure 11: Proportion of income related to AF and non AF**

From this bar chart it has been found that agroforestry related income contributes 54% for sustainable livelihood and greater family income and non- agroforestry related income contributes 46% household income. From the result it is concluded that Agroforestry is one of the major sectors in income pattern of the respondents.

#### 4.11. Relationship between land holding classes and AF related income monthly



**Figure 12 : Relationship between land holdings and AF related income**

Land holding plays an important contribution to household income. In the above chart land holding basis income is presented. In the figure it has been shown that household who holding more land he gets more Agroforestry related income because he has more area to practice different types of Agroforestry. Above 397 decimal land owner gets 13700 taka/month. Agroforestry related household income varies with their land holdings.



#### 4.12. Income sources from AF products separated from cash and non-cash

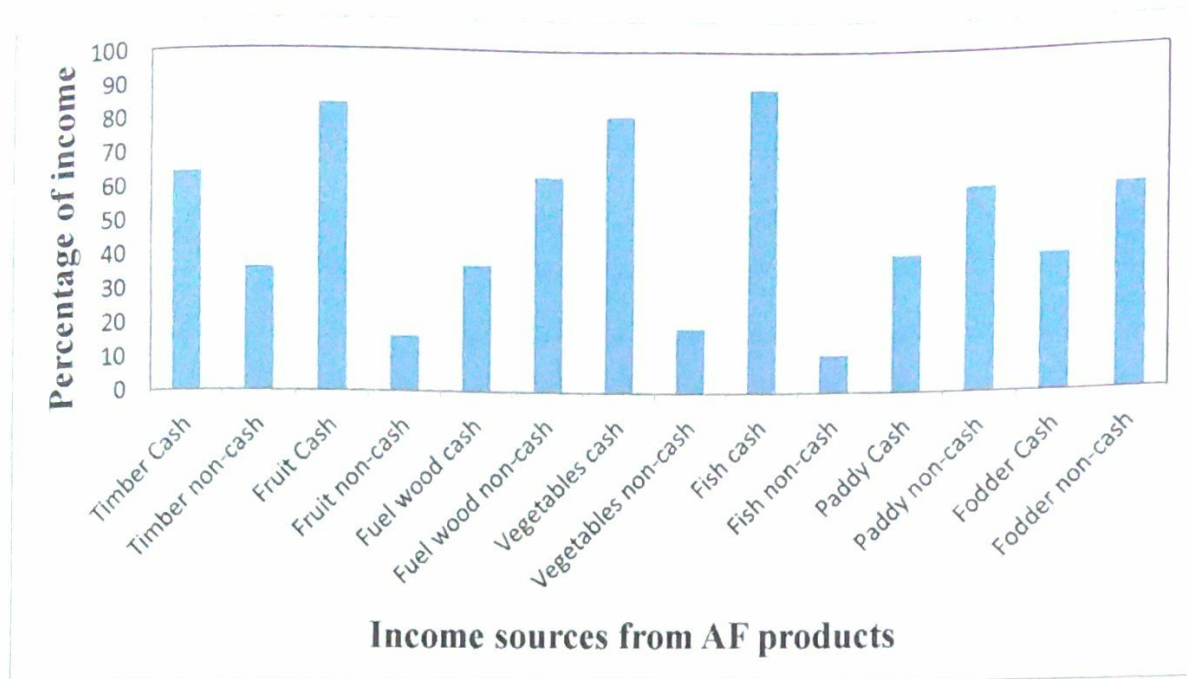
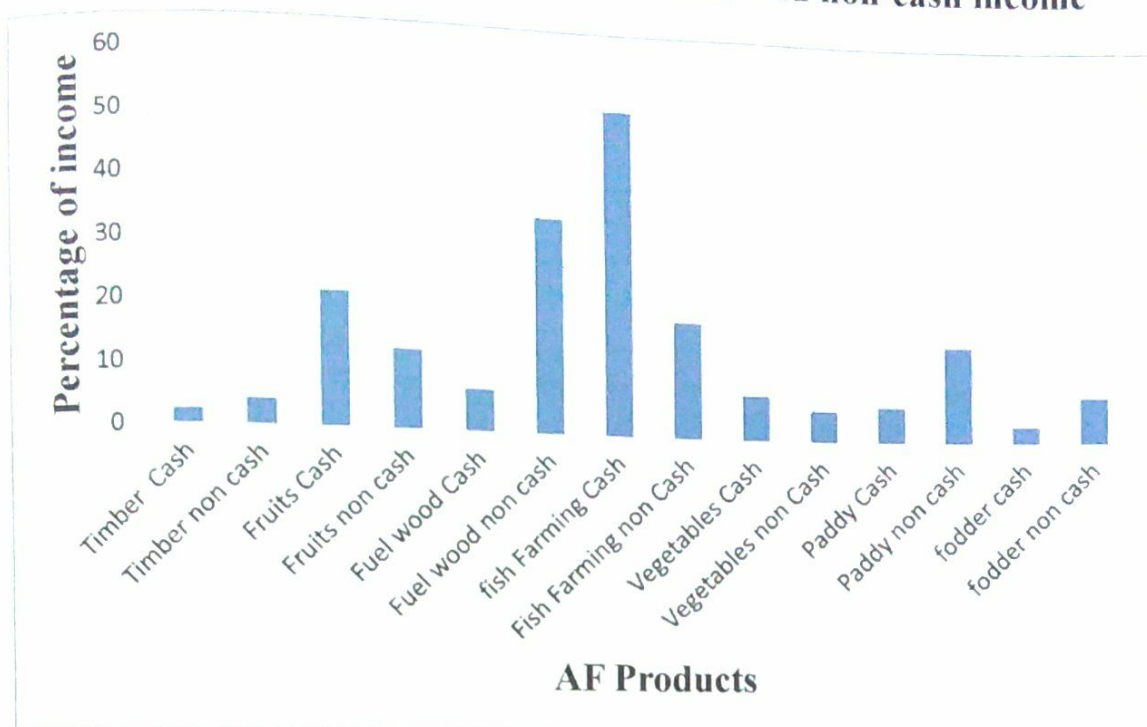


Figure 13: Income sources from AF products separated from cash and non-cash

The second objective of this research was to see the cash and non-cash income of the respondents from agroforestry. The cash and non-cash income divided into seven categories of agroforestry products. Different types of cash and non-cash income generates from agroforestry practice. Considerable amount of cash income generated from fish farming by respondents. From different types of agroforestry products non-cash income generates 36% from timber, 63% from fuelwood, 60% from fodder respectively.

#### 4.13. Proportion of different sources of cash and non-cash income



**Figure 14: Proportion of different sources of cash and non-cash income**

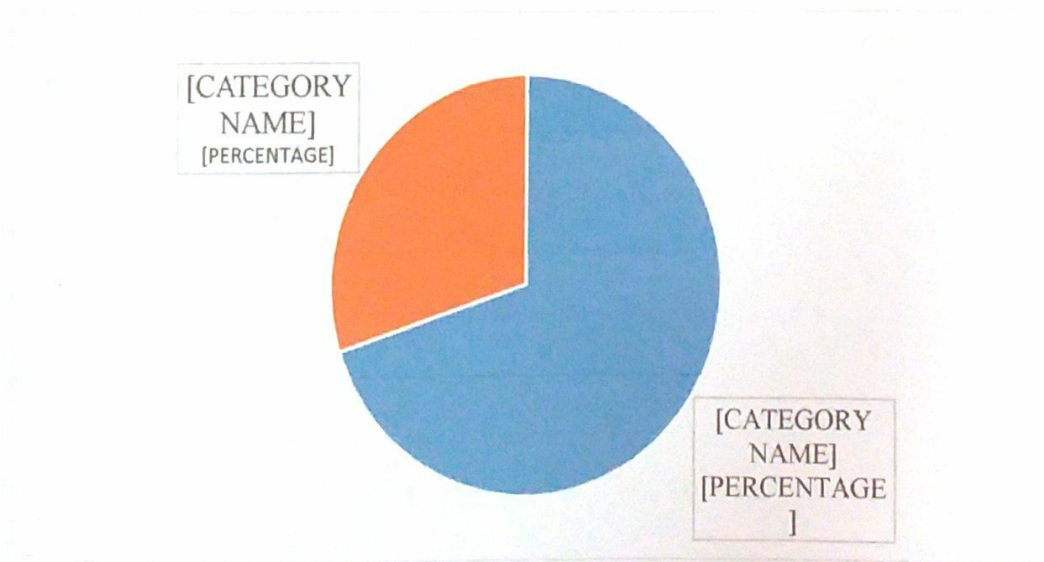
This graph represents the total cash and non-cash income of the respondents from different sources of agroforestry practices. The income is presented as a proportion to income sources. Here we see the cash income total is 100% as well as non-cash income. From this graph it has been cleared that Out of the total AF related income fish farming cash income contribute 52% income of the respondents and fuelwood non-cash income contribute 34% income of the respondents.

**Table 7: Different items of non-cash income sources of each category**

Timber	Fruit	Fuel wood	Vegetables	Fish	Paddy	Fodder
-Fence -Agricultural implements -House construction	-Family consumption -distribution to friends and family	-Leaves and branches -Pruning materials	--Family consumption -distribution to friends and family	-Family consumption -distribution to friends and family	-Family consumption	-Cattle consumption

This table represents the non-cash use of agroforestry products. This research found fuel wood as the major income sources that means fuel wood should have major use among the respondents.

**4.14. Livestock status**

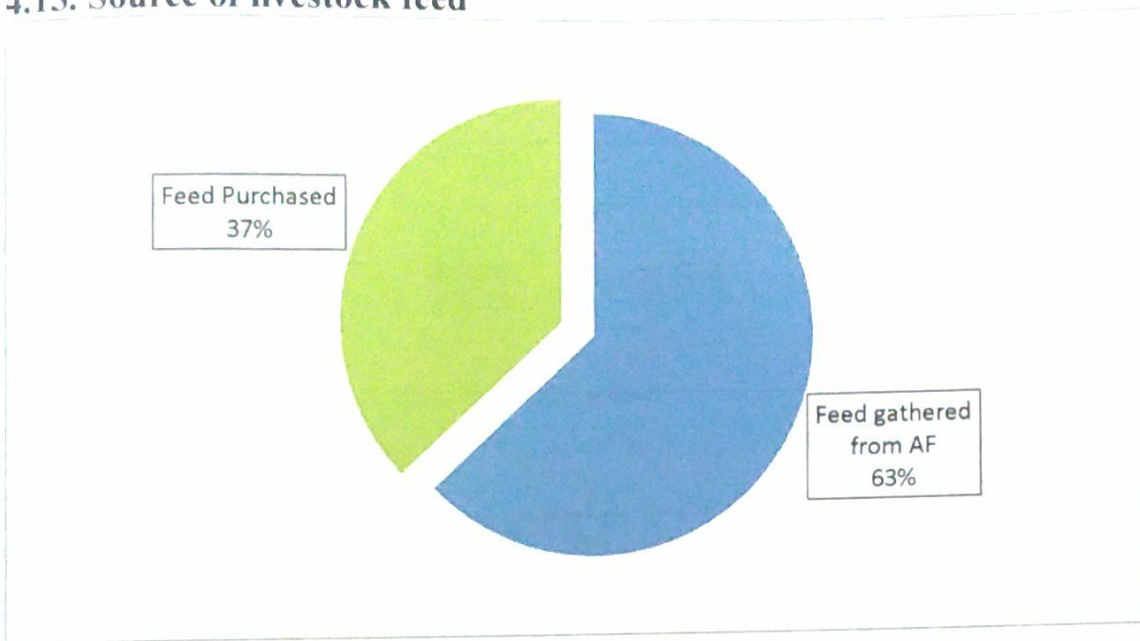


**Figure 15: Livestock status**



About 70% people have livestock and rest of the 30 % people have no livestock. Fodder supply from agroforestry that is an important non-cash source of income. Livestock contribute household income.

#### 4.15. Source of livestock feed

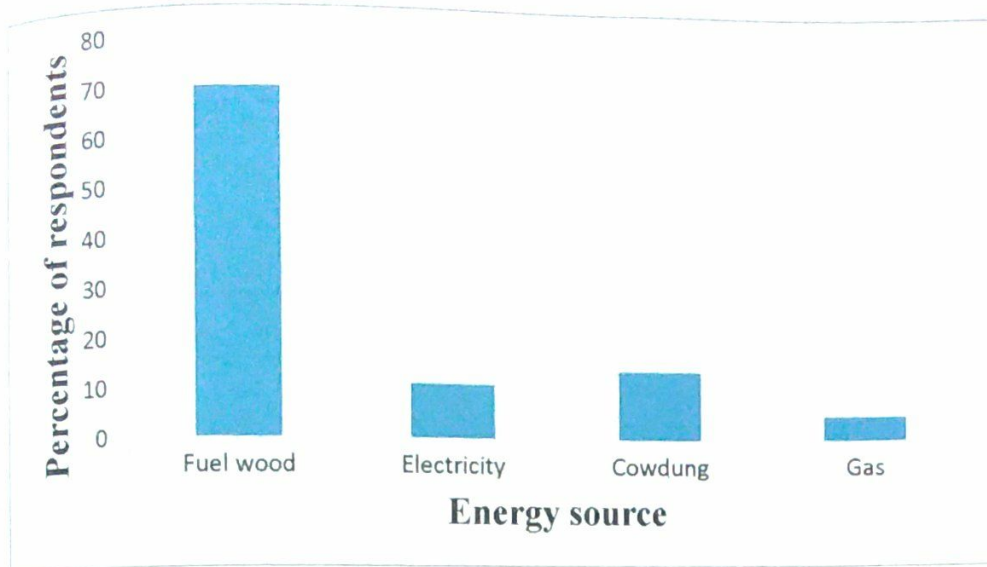


**Figure 16: Source of livestock feed**

Source of livestock feed gathered from agroforestry. 63% feed gathered from agroforestry and 37% purchased by the respondents. These encourage respondents to rear livestock because they need not paid extra money to rear livestock.



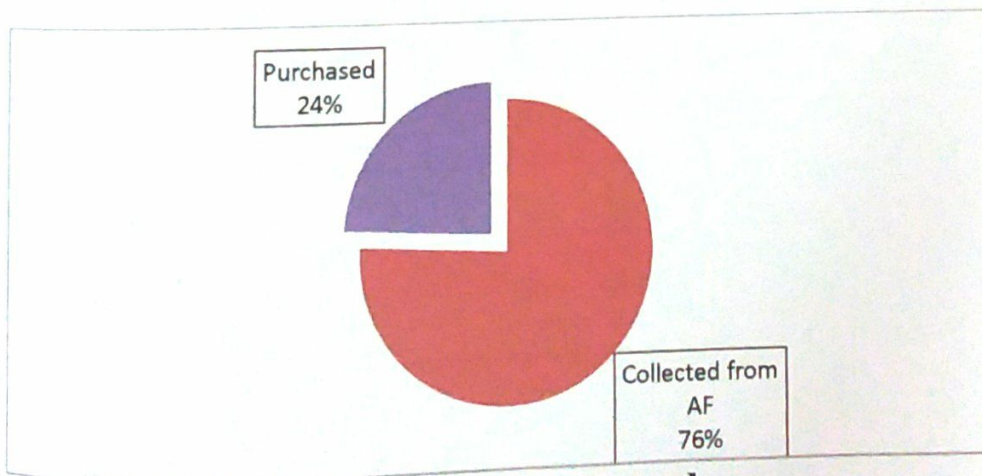
#### 4.16. Sources of cooking energy



**Figure 15: Sources of cooking energy**

Respondents are using different types of energy for cooking as fuelwood, cowdung, electricity, gas. It is seen that most of the respondents use fuelwood as energy source which is a direct contribution of non-cash from agroforestry product. Maximum people are using fuel wood and cow dung, as their major energy sources because other sources are not available for this area. They use 70% fuelwood, 14% cowdung, 11% electricity and 5% gas.

#### 4.1.17. Source of fuel wood



**Figure 15: Source of fuel wood**

People collect their fuel wood from different sources such as Homegarden, aquasilviculture small proportion is purchased too. From, this graph 76% of energy they collected from Agroforestry and 24% purchased.



Figure 17: Some pictures of field survey in the study area







## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATIONS

#### **5.1. Conclusion and recommendations**

Farmers have been practicing agroforestry from time immemorial. In the study area different types of agroforestry practices observed but commonly practiced types of agroforestry are homegarden and aquasilviculture. These agroforestry practices contribute most of the household income considerably. 70% of the family cash income generates from agroforestry practices. In the conventional study only cash income are usually recorded and assessed. On the other hand agroforestry related non-cash income contributes 30% of the total income. Non-cash income of agroforestry has considerable contribution to the household livelihood that would not have been generated from monoculture. Extension work to motivate more people to adopt agroforestry types of landuse. A well planned and designed homestead agroforestry model should be developed where species diversity is high and usually 3-4 vertical canopy strata which indicate the intimacy of plant associations. Tree species along with fishes should be selected wisely and allowing gher dikes more wider to support more trees.



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## APPENDIX

### Questionnaire for contribution of Agroforestry to the household income of the Bagerhat sadar upazilla at Bagerhat district

Date: ...../...../.....

Respondents' Name..... Age.....

Village..... Union.....

#### 1. Household information

Family size: ..... and family information:

Age group	Sex		Education	Occupation
	M	F		
10-20				
20-30				
30-40				
40-50				
>50				
Total				

#### 2. Land Holdings (decimal):

Size (decimal)	Tenure	
	Own	Leased



### 3. Types of Agro forestry usually practiced

Types of AF	Tick mark	Species/Agroforestry Components
Homegarden		
Alley cropping		
Aquasilviculture		
Woodlot		
Mixed plantation with Boundary planting		
Others		

### 4. Agroforestry Tree and crop Species

Species	Tick mark
Mahogany	
Kathal (Jackfruit)	
Amm (Mango)	
Narikel (Coconut)	
Supari ( Batel nut)	
Payeare (Guava)	
Jam (Blackberry)	
Khajur (Date Plam)	
Lebu ( Lemon)	
Sissoo	
Sabada	
Bel	
Jamrul	
Tal	
Litchi	
Neem	
Others	
Pumpkin	
Ginger	
Paddy	
Turmeric	
Corn	
Bottle gourd	
Others	

### Source of income

AF related							
Source of income	Timber	Fruits	Fuel wood	Fodder	Vegetables	manure	others
Amount in TK/month							
Total income/month							

### Non-AF related

Source of income	Tailor	Village doctor	Fish labour	Small business	Driver	Day labour	Service	others
Amount in TK/month								

**5. Do you have livestock?**    Yes / No

If yes, income from livestock-

Name of livestock	Income
Cattle	
Poultry	
Others	

6. Source of energy/ energy consumption ( For cooking)

Types of energy used	Amount/day /week/month	Gathered from AF	Purchased
Fuel wood			
Coal			
Electricity			
Cow dung			
Gas			
Others			

Differentiate between cash income and non- cash income

Source of income	Timber	Fruits	Fuelwood	Fodder	vegetables	Manure	Crop	Others
Cash income								
Non – cash income								