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MY BELOVED PARENTS

DECLARATION

I am Kamona Mondal, 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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ABSTRACT

Agroforestry is a land use system that integrates trees with agriculture crops, and/ or animals simultaneously or sequentially to get higher productivity, more economic returns and better social and ecological benefits on a sustainable yield basis. Different types of agroforestry are practiced in Fakirhat upazila of Bagerhat district of Bangladesh. Among which, respondents mainly practice aquasilviculture, homegarden and mixed crop with boundary planting. Agroforestry types of land use have contributed to the diversity of products and services for better livelihood. It has contributed to the increased family income (cash and non-cash). In conventional study, cash income is generally recorded and assessed. But the contribution of non-cash value to the total household income is usually underestimated in commercial evaluation. This research tries to assess the contribution of agroforestry to the household income from both cash and non-cash income. The study was conducted on sixty agroforestry practioner through a semi-structured questionnaire interview. Respondents practice homegarden and aquasilviculture predominantly. Agroforestry contributes to about 60% of the total family income. Out of total agroforestry related income, cash income (68%) are generated mainly from aquasilviculture and mixed crop with boundary planting. In total agroforestry related income, non-cash income contributes about one third of the household income, which is usually unseen. Paddy, fodder, fuel wood are important sources of non-cash income. Non -cash value of agroforestry significantly contribute to the family income of the study area. It is seen that, the bigger the land area, higher the income. The household respondents get huge amount of fuelwood from agroforestry which is about 80% of their energy. So, Agroforestry practice increases the household income and improves their living condition.

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AF	Agroforestry
et.al	With other
Sp.	Species
&	And
%	Percentage

CHAPTER I: INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Bangladesh, being a subtropical country, enjoys a wide range of diversity of plants in agroforestry. Land is the basic resources of human society. 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, conversion into non-forest land for settlement, farming, recreation and industries (Banglapedia 2014). So, it might be difficult to fulfill the requirements of the people's demand for fuel, fodder, timber and other necessities with the existing forest resources in Bangladesh. On the other hand, the demand of food crops has been increasing rapidly due to ever increasing population in Bangladesh. However, the country has only 7.63 million hectares (ha) of arable land and per person arable land is 0.05 hectares (WB 2011). Due to over growing population, per capita land area is decreasing at an alarming rate of 0.005 ha/capita/year since 1989. This put heavy pressure on land for human habitation and crop production (Hossain, *et.al.* 1996).

In such circumstances, traditional land use pattern should be converted into sustainable land use, which will permit maintenance of productivity combined with conservation of the resources. AF might be the best land-use system for sustainable livelihood in Bangladesh to cope with the present situation. It is a land based production system that is directly related to food security, employment, income opportunities and environmental issues. 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 Bangladesh is an over populated and land hungry country having about 14.4 million hectares of land with population of 152.52 millions (BBS, 2011). Because of the rapid growth of population and indiscriminate destruction of forest cover, it is difficult to meet the country's huge demand for timber, fuel, food and fodder and maintaining ecological balance. In such a situation Agroforestry represents a land use system involving deliberate management of multipurpose trees and shrubs in close association with seasonal vegetables (Fernandes, *et.al*,1986).

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The benefits created by agroforestry practices are both economic and environmental. Agroforestry can increase farm profitability in several ways:

(1) The total output per unit area of tree/ crop/livestock combinations is greater than any single component alone,

(2) Crops and livestock protected from the damaging effects of wind are more productive, and

(3) New products add to the financial diversity and flexibility of the farming enterprise. Agroforestry helps to conserve and protect natural resources by, for example, mitigating non-point source pollution, controlling soil erosion, and creating wildlife habitat. The benefits of agroforestry add up to a substantial improvement of the economic and resource sustainability of agriculture (Garrett, *et al.*, 1994).

The best product having commercial value from alley cropping trees might be poles and pulpwood as these trees are mostly short-rotation species. Trees in homegarden work as insurance in case of sudden crop failure or to support crops against environmental hazards and also to provide extra income from trees. Moreover, if there is a failure in one crop, the other crops would supplement the deficit. So, AF is largely evolved with sustainability concerns - resiliency, diversity, and avoiding negative side effects in mind (Brooks, K. N. *et.al*, 1995).

At present, people are practicing various AF practices all over the country (Aktar, M.S., et.al.1992). It is also intensively practiced in Bagerhat district. People of Fakirhat upazila are now practing different types of Agroforestry practices. They produce a lot of products. It helps their livelihood income. It is important to note that cash and non-cash uses of forests are often so intertwined at the household and community levels that their contributions cannot be easily separated. The cash value of AF products (NWFPs, such as mushrooms, fruits, medicinal products, honey, nuts and oil) is highly variable by "tradable" value and rarity of the product, by location and by market access. The material/cash benefits of forests generally tend to be better recognized, while the non-cash contributions of forests, including NWFPs, ecosystem services, tourism, and cultural benefits are largely "invisible."

1.2 RATIONALE OF THE STUDY

Agroforestry (AF) is a traditional land use system in Bangladesh where tree species like date palm (Phoenix sylvestris), palmyra palm (Borassus flabellifer), babla (Acacia nilotica), mango (Mangifera indica), khoer (A. catechu), mahogany (Swietenia mahogany), jackfruit (Artocarpus heterophyllus), eucalyptus and sissoo (Dalbergia sissoo) grow naturally or planted on agricultural lands and are purposely retained and maintained by the farmers for different household utilities, products and also for cash income (Abedin, M.Z. and Quddus, M.A. 1991). Various patterns of agroforestry systems are practiced in different agro-ecological regions of Bangladesh which reflects biophysical and social variations (Shams, R. 2013). Trees are planted on the borders or within the field, systemically or at irregular intervals, usually with crops such as rice, wheat, pulse, jute, oilseed, sugarcane, vegetables and others, and farmers also grow shade-tolerant crops such as turmeric, ginger and aroid when trees have high canopy coverage (e.g. jackfruit, mahagony) (Miah, M. G.,e.at 2002). AF system provides enough food, timber, fodder, fruit, fuel wood, construction materials, raw materials and other products for forest-based small-scale enterprises and other cottage industries (Rahman, S. A. 2011).

It is observed that on an average about 2 percent family income come from the homgarden AF (FAO, 2004). In a study of intercropping agroforestry in Bangladesh it is found that about 46 percent of 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, et.al., 1993). Besides fuel wood supplying for household cooking, AF 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.

Non-cash income from forests come from forest products which households collect but consume/use in the home, or trade as barter for other goods and services rather than selling. These may be fuelwood, timber, forest foods, medicines, fodder or fibre. Country- and region specific studies indicate that where such data are reliably available, the non-cash economic contributions of forests to household and national economies range between three and five times the formally recognized, cash contributions (Agrawal, 2013).

Although several studies have been conducted on AF practice from various perspectives, but no study is so far carried out specifically to ascertain the socio-economic impact of AF on farmers' livelihood in the Fakirhat upazila, at Bagerhat district. This study would provide information about the contribution of agroforestry in household economy of rural community. The rural people's livelihood is heavily dependent on non- cash income that is usually underestimated 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. In order to encourage adoption of agroforesty type of landuse it is important to study the contribution of agroforesty and convince farmer about the scopes and opportunities for their sustainable livelihood. Therefore, this study is conducted in Fakirhat upazila to know the socio-economic impact of AF on farmers' livelihood. So there is an urgent need for better data on the non-cash contributions of forests to inform governments and policymakers on the true value of forest resources.

1.3 SPECIFIC OBJECTIVES

- ❖ To assess the contribution of Agroforestry to the household income.
- ❖ To identify the Cash and Non-Cash income in Agroforestry.

CHAPTER II: LITERATURE REVIEW

2. LITERATURE REVIEW

Forests are among the most diverse and widespread ecosystems on earth and millions of people living in most tropical countries derive a significant part of their livelihoods from various forest products for centuries. These products also play a vital role to the livelihoods of people living in or adjacent to forests. According to the World Bank (2002), more than 1.6 billion people throughout the world relying heavily on forests for their livelihoods and some 350 million people depends only on forest both for their subsistence and income. Agroforestry is one of the age-old practices based on combinations involving trees, crops and livestock on the same land unit, and the recognition of their inherent advantages (Nair, 2007).

2.1 AGROFORESTRY

Agroforestry has been defined as 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 population (King and Chandler 1978). Agroforestry is based on the premise that land use systems that are structurally and functionally more complex than either crop or tree monocultures result in greater efficiency of resource capture and utilization (nutrients, light, and water), and greater structural diversity that entails a tighter coupling of nutrient cycles (Nair, 2007).

ICRAF (1982) defined agroforestry system as a land use system that integrates trees with agriculture crops, and/ or animals simultaneously or sequentially to get higher productivity, more economic returns and better social and ecological benefits on a sustainable yield basis than are obtainable from mono-culture on the same unit of land, especially under conditions of low levels of technological inputs on marginal sites.

Agroforestry is practiced by millions of farmers, and has been a feature of agriculture for millennia. It encompasses a wide range of working trees that are grown on farms and in rural landscapes, and includes the generation of science-based tree enterprise opportunities that can be important in the future. Among these are: fertilizer trees for land regeneration, soil health and

food security; fruit trees for nutrition and income; fodder trees that improve smallholder livestock production; timber and fuelwood trees for shelter and energy; medicinal trees to combat disease, particularly where there is no pharmacy; and trees that produce gums, resins or latex products (Garrity, 2004). Many of these trees have multiple uses, each providing a range of benefits.

An estimated 1.2 billion rural people currently practise agroforestry on their farms and in their communities, and depend upon its products (World Bank, 2004). Their tree-based enterprises help ensure food and nutritional security, increase their income and assets, and help solve their land management problems. Trees play a particularly pivotal role wherever people depend on fragile ecosystems for survival and sustenance.

Agroforestry is the most diverse and widespread ecosystems on earth and millions of people living in most tropical countries derive a significant part of their livelihoods from various agroforestry products for centuries.

In simple word, agroforestry is a science that combines trees and agriculture crops (food, fruit, vegetables, fodder and forage etc) together in the same land at the same time.

Agroforestry is form of land use that successfully satisfies the needs of the crop farmers, foresters and or stock farmers. It produces a lot of products. We can categories into two types like goods and services. And from there we generate two types of household income; cash and non-cash income.

2.2 CASH INCOME

Cash income may be defined as immediate payment, in full or part, for goods or services. A huge amount of cash income derived from agroforestry products like fuelwood, timber, forest foods, vegetables etc.

2.3 NON-CASH INCOME

Non-cash income is defined as the products which households collect but consume/use in the home rather than selling. These may be fuelwood, timber, forest foods and medicines, fodder, fibre, organic fertilizer etc. This non-cash income is a fraction of the income drawn from

agroforests by those who live in or near them and rely on them in part for their overall annual income from all sources – agriculture, livestock, off farm employment or trade, and forest.

2.4 HOME GARDENS

Homegardens may have originated in prehistoric times when hunters and gatherers deliberately or accidentally dispersed seeds of highly valued fruit trees in the vicinity of their camp sites (Hutterer, 1984).Home gardens are established near home for their food, vegetables, fruit and fodder production, for aesthetic and ornamental values and for religious purposes. It is multistory types in which fodder or timber trees, fruit trees, and vegetables are grown together.

A prominent structural characteristic of the homegarden is the great diversity of species with many life forms varying from those creeping on the ground, such as the sweet potato, to tall trees often metres and more, e.g., the coconut palm, and vines climbing on bamboo poles and trees. These create the forest-like multistorey canopy structure of many homegardens. (Ahmad et al., 1980).

Tallest trees (Sissoo, Mahogany , coconut and nut trees included in Naldha Moubhag Union) of this system are strong light demander and middle storey trees are moderately shade tolerant fruit trees. At the ground level vegetables and other herbaceous shade tolerant crops like ginger, turmeric, chilly, pine apple, coffee, cardamom etc) are grown under tree shade. For these reasons homegardens are being promoted in many countries, e.g., in Lima, Peru (Ninez, 1985), Ghana (Asare et al, 1985), the Pacific Islands (Falanruw, 1985; Sommers, 1985; Thaman, 1984), Sri Lanka (Jacob and Alles, 1987) Indonesia and Bangladesh.

Table 1: Local and scientific name of trees and fruit species (Practice in homegarden)

Local name	Scientific name
Narikel	*Cocos nucifera*
Am	*Mangifera indica*
Kanthal	*Artocarpus heterophyllus*

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Supari	*Areca catechu*
Peyara	*Psidium guava*
Bel	*Agele marmelos*
Papaya	*Carica papaya*
Jam	*Syzygium* spp.
Litchi	*Litchi chinensis*
Tentul	*Tamarindus indica*
Tal	*Borassus flabellifer*
Khejur	*Phoenix sylvestris*
Rain tree	*Samanea saman*
Mehogony	*Swietenia mehogoni*
Lebu	*Citrus limon*
Amra	*Spondias dulcis*
Boroi	*Ziziphus mauritiana*
Sissoo	*Dalbergia sissoo*

Home garden with fodder (Ficus spp) and fuel wood (sissoo etc) species is common in those areas where natural forests has been destroyed or exhausted long time ago. The main advantages of home gardens village people got, are as follows:

❖ Produce diversify products such as vegetables/ food/fruit, spices, fodder and timber and increase cash income directly.

❖ Nutritive value of farmer's diet is increased.

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❖ Farmer can generate income from the sale of surplus vegetables.

❖ Agroforestry products can be obtained throughout the year.

❖ Favorable environment can be created for the farmers through provision of shade, wind breaks and privacy.

There are many examples of introduction of higher inputs and improved technology in homegardens, both spontaneously carried out by the people or stimulated by the government. In conclusion we can say that homegardens do have a promising future. It is relatively easy to increase yields and income.

2.5 Mixed crop with boundary planting

Mixed crop with boundary planting is the growing of two or more crops alongs with boundary tree species simultaneously on the same field such that the period of overlap is long enough to include the vegetative stage (Gomez and Gomez, 1983). It provides year-round ground cover, or at least for a longer period than monocultures, in order to protect the soil from desiccation and erosion. By growing more than one crop at a time in the same field, farmers maximize water use efficiency, maintain soil fertility, and minimize soil erosion.

Advantages of Mixed crop with boundary planting:

❖ It gives additional yield income/unit area than sole cropping.

❖ Mixed crop with boundary planting with cash crops is higher profitable.

❖ Reduction in soil runoff and controls weeds.

❖ Intercrops provide shade and support to the other crop.

❖ It maintain the soil fertility as the nutrient uptake is made from both layers of soil.

❖ Mixed crop with boundary planting system utilizes resources efficiently and their productivity is increased.

❖ It helps to avoid inter-crop competition and thus a higher number of crop plants are grown per unit area.

❖ It acts as an insurance against failure of crops in abnormal year.

Disadvantages of Mixed crop with boundary planting:

❖ Harvesting is difficult.

❖ Yield decreases as the crops differ in their competitive abilities.

❖ Management of Intercropping having different cultural practices seems to be difficult task.

❖ Improved implements cannot be used efficiently.

❖ Higher amount of fertilizer or irrigation water cannot be utilized properly as the component crops vary in their response of these resources.

As a general conclusion, through Mixed crop with boundary planting, farmers can achieve the full production of the main crop and also an additional yield (bonus) associated with an increased plant population of the second component. Hence, it can increase incomes obtained by smallholder farmers in areas where labor is not shortage. The farmers could better use the appropriate population of component crops in Mixed crop with boundary planting systems in order to maximize yield of both crops as well as total productivity (Ninez, 1985).

2.6 AQUASILVICULTURE

Aquasilviculture (from the Greek word "aqua," meaning water, and "silvos," meaning tree), involves the growing of fish and other aquatic organisms within a mangrove area without cutting down a single tree.

Aquasilviculture is a management strategy that combines and harmonizes fish production and mangrove development. Aquasilviculture mainly practice in Naldha Moubhag Union, Fakirhat upazila. It is a multipurpose and integrated management system. Aquasilviculture locally called as Ghar practice. It is an environment-friendly approach producting different types of fish, vegetables and trees.

Table: 2 Scientific name of different Tree and crops spp. (Practice in aquasilviculture)

Local name	Scientific name
Guava	*Psidium guava*

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Lemon	*Citrus* spp
Papaya	*Carica papaya*
Narikel	*Cocos nucifera*
Vegetables	
Bean	*Lablab niger*

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

Local name	Scientific name
Rui	*Labeo rohita*
Catla	*Catla catla*
Mrigal	*Cirrhinus mrigala*
Silver carp	*Hypophthalmicthys molitrix*
Punti	*Puntius chola*
Galda	*Macrobrachium rosenbergii*
Tilapia	*Puntius ticto*
Shoal	*Channa striatus*

The strategy has become a favorable livelihood opportunity to sustainably augment fishers income and, at the same time, reforest the mangrove.

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Advantages

- ❖ Improve productivity of fisheries and aquaculture within ecological limits

- ❖ Produce multiple products such as fish, fruits, fodder, fuel wood and timber.

- ❖ Improve and sustain the fish and fruit productivity

- ❖ Extra income can also be generated from trees, fruits ducks and pigs.

- ❖ Improve the farm site ecology by reducing soil erosion and nutrient loss.

- ❖ Improve the local micro-climate creating cool environment to fish during summer season.

- ❖ This practices helps for the beautification of the surrounding areas.

- ❖ Leaves, flowers, and fruits fallen into the fish pond can provide food to fish.

- ❖ Low investment cost and use of locally available materials.

Disadvantages

- ❖ Pond and dike always changes because of erosion.
- ❖ Labor intensive.
- ❖ Difficult to manage.
- ❖ Lack of trained man power.

2.7 WOODLOT

A woodlot is a parcel of a woodland or forest capable of small-scale production of forest products (such as wood fuel, sap for maple syrup, sawlogs, and pulpwood) as well as recreational uses like bird watching, bushwalking, and wildflower appreciation. The term woodlot is chiefly North American; in Britain, a woodlot would be called a wood, woodland, or coppice.

One distinguishing characteristic of a woodlot is that the parcel size or quality of wood on the parcel does not generally justify full-scale commercial harvesting, leaving many woodlots as private investments by individuals.

On the other hand, good forest management practices, even on a small scale, may create a sustainable source of products, which can significantly contribute to the aggregate inventory available to forest-product consumers.

Diversity of tree species, management practices of woodlot and its contribution to the socio-economic condition of rural household has been studied in different part of Bangladesh.

Well-managed woodlots or plantations can provide revenue or other economic value from timber or nut sales, fuelwood, or control of runoff. They can also provide enjoyment of wildlife and natural beauty (Nair, 2007).

CHAPTER III: METHODOLOGY

3.1 Study Area Profile

3.1.1 Geography of the study area

Fakirhat Upazila (bagerhat district) area 160.68 sq km, located in between 22°39' and 22°49' north latitudes and in between 89°34' and 89°47' east longitudes. It is bounded by rupsa and mollahat upazilas on the north, rampal upazila on the south, bagerhat sadar and chitalmari upazilas on the east, batiaghata and Rupsa upazilas on the west.

3.1.2 Demographics

As of the 1991 Bangladesh census, Fakirhat has a population of 123956. It has 24,286 households. Males constitute 51.12% of the population, and females 48.88%. This Upazila's eighteen up population is 67565. Fakirhat has an average literacy rate of 43% (7+ years), compared to the national average of 32.4%. The literacy rate is 49% among males and 36.7% among females. The population is 123,956, of whom 51.12% are male and 48.87% are female. 71.55% of the population are Muslim, 28.43% Hindu and 0.02% follow other religions (Parthadev Shaha, 2012).

(Source: Google Earth)

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3.1.3 Main occupations

38.15% of the population are engaged in agriculture and 16.94% as agricultural labourers, 2.81% in fishing, 6.07% as wage labourers, 14.86% in commerce, 3.01% in transport, 8.3% in services and 9.86% in other occupations.

3.1.4 Land use

There are 10,072.03 hectares of arable land and 5,804.53 hectares of fallow land; single crop 64%, double crop 30% and treble land 6% land control. Among the peasants 33% are marginal, 35% small, 25% intermediary and 7% rich.

3.1.5 Crops

The main crops are Paddy, potatoes, betel leaf and vegetables. The extinct crops and crops nearing extinction are mustard seed, sweet potato and pulses.

3.1.6 Main fruits

The main fruits are coconuts, boroi, areca nuts and bananas (Parthadev Shaha, 2012).

3.2 METHODOLOGY

The relevant primary data were collected from study area through household survey by using purposive and snowball sampling methods. At first I selected three unions (Naldha Moubhag, Bahirdia, Fakirhat) and ten villages from the selected unions by following purposive sampling method. I selected respondents from the villages by following snowball sampling method. For this task, I prepared a semi-structured questionnaire including the necessary questions to collect relevant information from local respondents. I surveyed around 60 respondents in total from the study area. 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). Sampling process are given below-
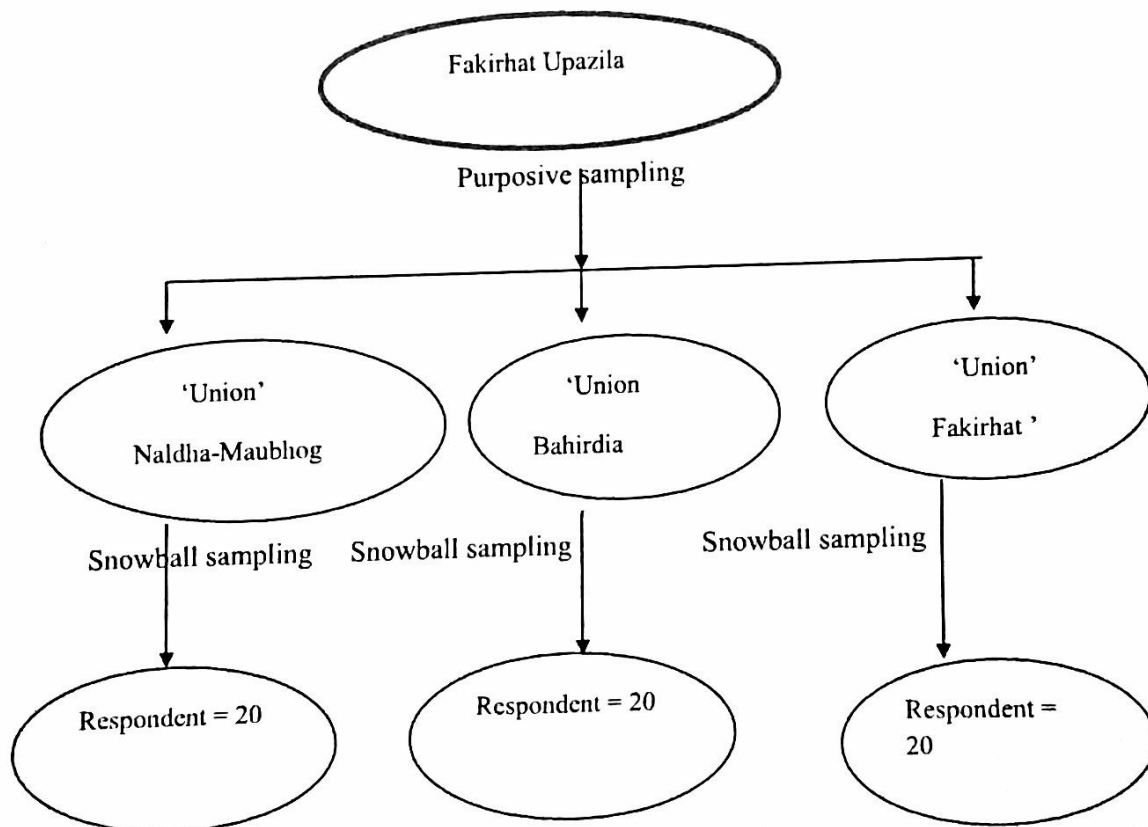
Flow-chart of local sample respondents in Study area

I selected 9 villages from the three unions. On the other hand secondary information such as statistical data, reports, and maps were collected from various Government, Non-government

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organizations, literature and internet. The collected data were processed by using Microsoft Excel in order to calculate necessary indices.

Table 4: Surveyed villages in Fakirhat Upazila

Study area		
Union	Villages	Sample size
Naldha Moubhag	Dahar Moubhag	6
	Uper Moubhag	8
	Naldha	6
Bahirdia	Mansa	7
	Mansa-Attaka	7
	Attaki,	8
Fakirhat Union'	Pagla Samnager	6
	Kathaltala	8
	Pagla Dayapara	6
Total 3	6	60

Figure 1: Some pictures of field survey in the study area.

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Household age classes of respondents

Table 5: Respondents age

Age groups	Percentage of respondents
25-32	21
32-39	33
39-46	28
46-53	10

The above table shows the family age of sample households.

Figure 2: Age classes of Respondents

There are about 33% households respondents aged between 32-39 age group. 28%, 21%, 10% households respondents aged between39-46, 25-32, 46-53 respectively. It was observed that respondents age do not have any effect on their Agroforestry practice because people of all age practice Agroforestry.

4.2 Family size of respondents

Table 6: Family size of respondents

Family Size	Percentage of respondents
1.00-3.00	20
4.00-6.00	71
7.00-9.00	8

The above table shows the family size of sample households.
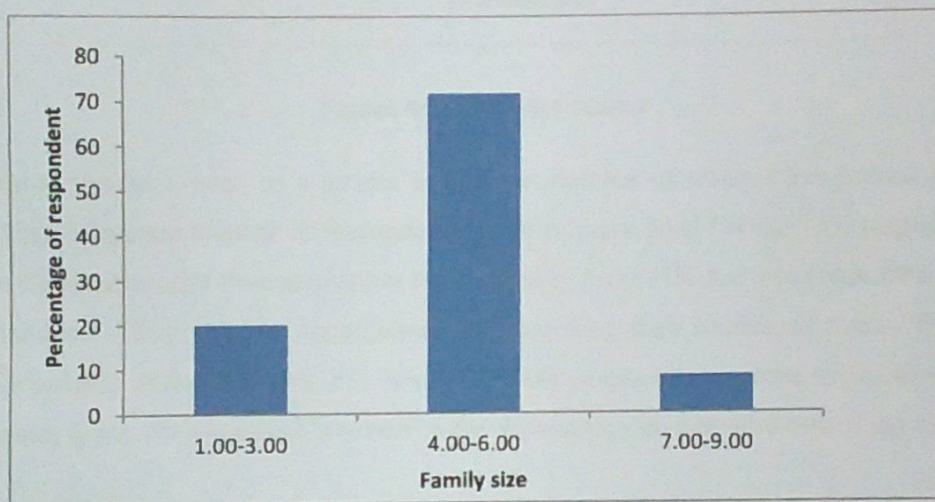
Figure 3: Family size of the respondent

There are about 71% households living 4-6 members, so most of the family is medium in size in term of family members. Only a few are in joint family that is about 8%. It was observed that family sizes do not have any effect on their livelihood because most of the people are dependent on AF related income for their livelihood whether the number of family members is small or large.

4.3 Literacy level
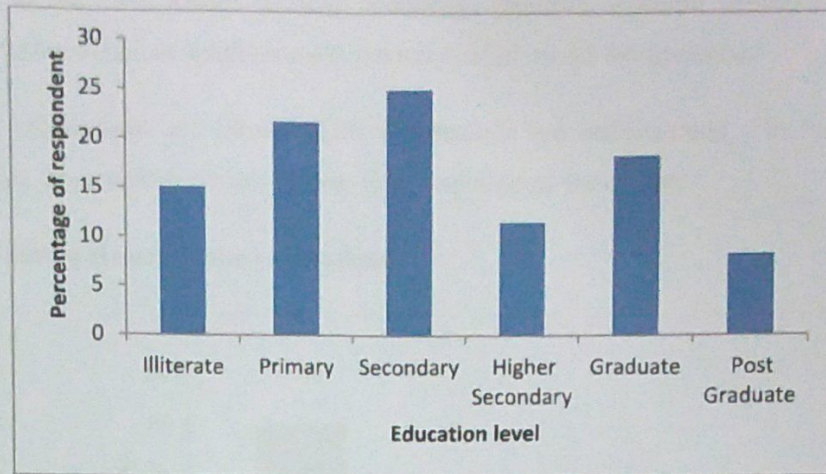
Figure 4: Education status

Education is the back bone of a nation. Significant number of respondents passed secondary level (25%). Moderate number of respondent passed primary level (21%). 15% respondents are illiterate. Graduation and Post-graduation level are very low (11% and 8% respectively) among the respondents. 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. So it is possible to reduce the dependency on natural forest of our country.

4.4 Occupation

Figure 5: Occupation of the sample respondents

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Occupation is an important factor that reflects one's socio-economic position. I observed 60 respondents of the three unions (Naldha Moubhag, Bahirdia, Fakirhat Union) in the Fakirhat upazila. I found several occupations some are not related to AF occupations.

About 57% respondents are farmer, 32% respondents are businessman, 7% respondents are service holder, 2% respondents are labour. Few respondents are drivers.

4.5 Land Holding classes of the respondents
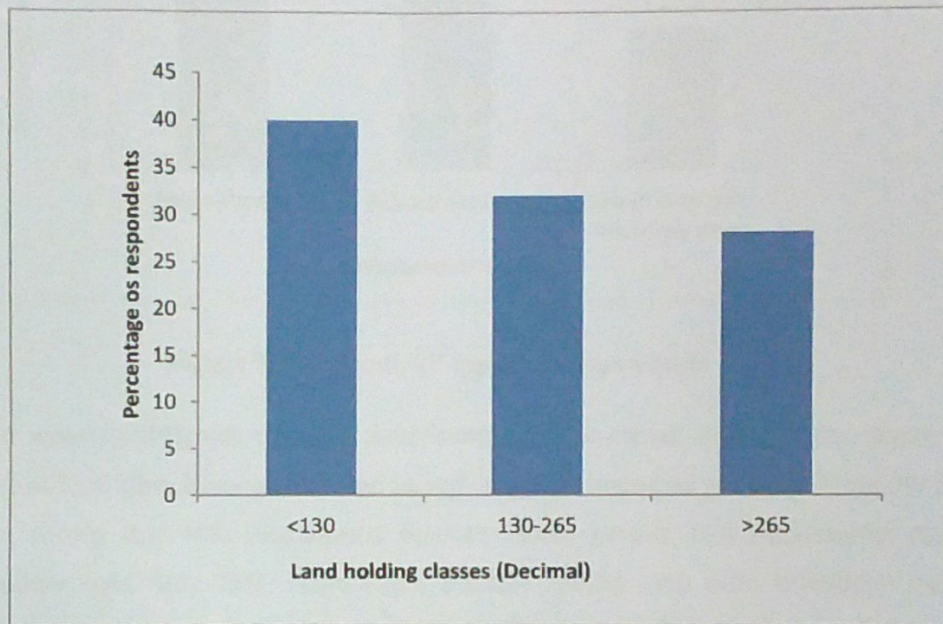
Figure 6: Land holding classes of the respondents

Land is an indicator of the socio-economic condition of the local people. In the study areas, Most of the people do not have enough land. There are 40% people have only 130 decimal land. 32% respondents belong to 130-265 decimal land. Most of the people practiced aquasilviculture here. And only 28% respondents holdings 265 and above decimal land.

4.6 Percentage of respondents having different types of Agroforestry Practices
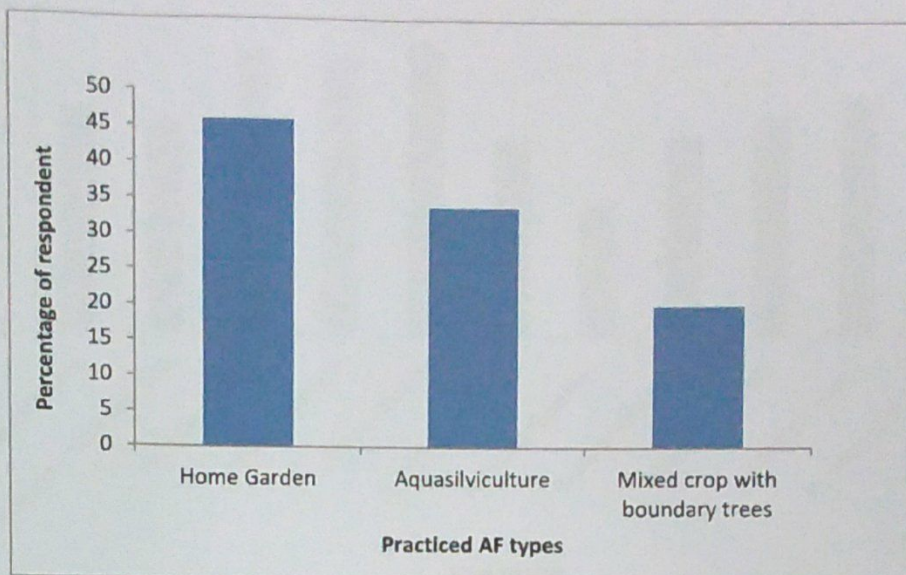
Figure 7: Practiced AF types by respondents

In Fakirhat upazilla, different types of Agroforestry are practiced. Most of the respondents practice Aquasilviculture, Homegarden and mixed crop with boundary planting. From the figure it has been shown that 46% respondents practice Home garden 34% respondents practice Aquasilviculture, and only 20% respondents practice mixed crop with boundary planting simultaneously. So, Homegarden and aquasilviculture contribute household income more in Fakirhat upazilla.

Table7: Percentage of respondents having different types of Agroforestry Practices

Agroforestry types	Percentage of respondents
Homegarden	46
Aquasilviculture	34
Mixed crop with boundary planting	20

4.7 Most common tree species in Agroforestry practices
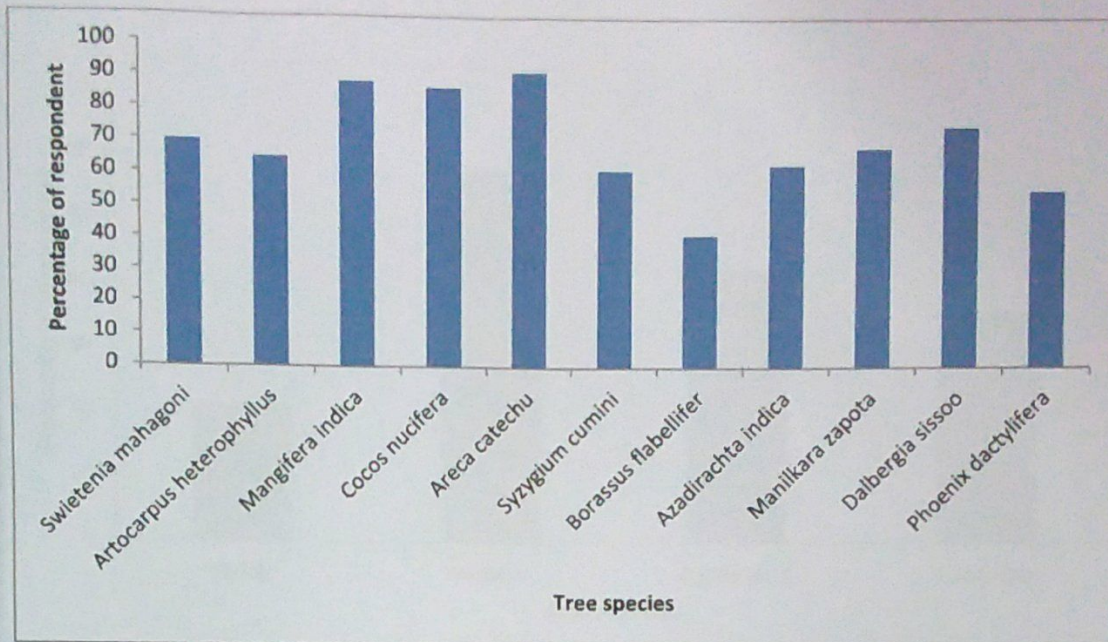
Figure 8: Practiced Trees Species

Most of the respondents in Fakirhat Upazilla mainly practice homegarden and aquasilviculture. The respondents who practice homegarden , practice various types of tree species as Mahogony, Kathal, Mango, Coconut, supari, sissoo etc. From this graph it has been shown that 91% respondents preferred Supari, 86% respondents preferred narikel, 75% Sissoo, 70% respondents preferred Mahogony, 68% Sabada, 65% Kathal, 63% Neem, 61% Jam, 55% Khajur, and 41% respondents preferred Tal respectively. It has been cleared that most predominant fruit species are Supari and narikel 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 crop species in Agroforestry practices
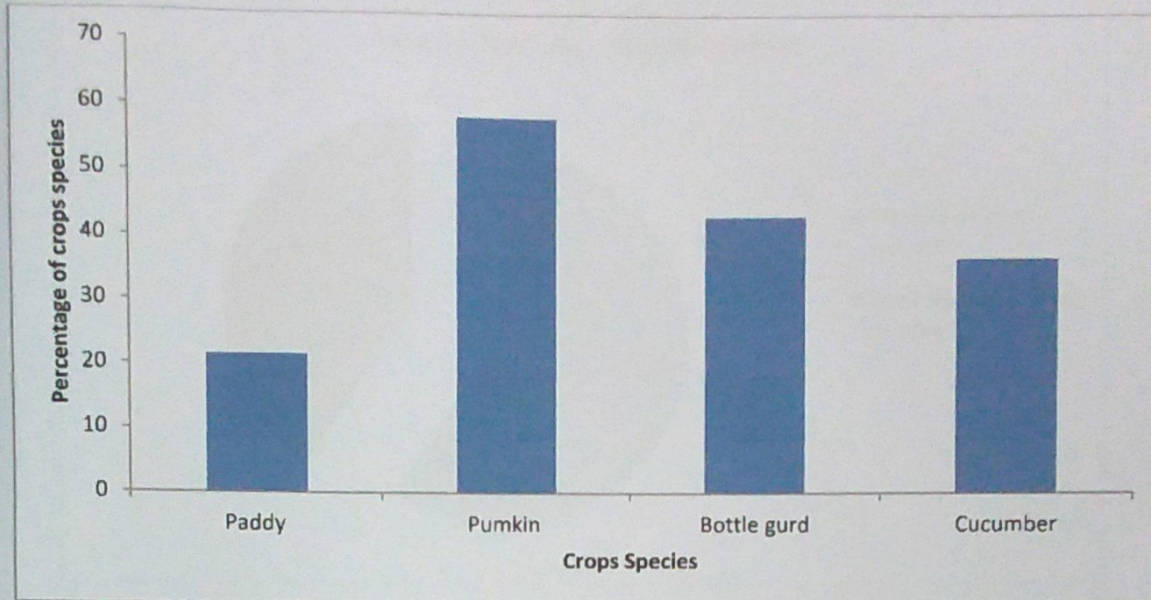
Figure 9: Practiced Crops Species

The respondents who practice homegarden and intercropping , practice various types of crops as cucumber, bottlegard, pumpkin, paddy etc. From this graph it has been shown that 58% respondents cultivate pumpkin, 43% cultivate bottlegurd. The respondents who practice intercropping and aquasilviculture mostly produces paddy, cucumber. 36% respondents cultivate cucumber and 21% respondents cultivate paddy respectively. This crop species has large contribution in household cash and non-cash income.

4.9 Proportion of income related to Agroforestry and Non- Agroforestry
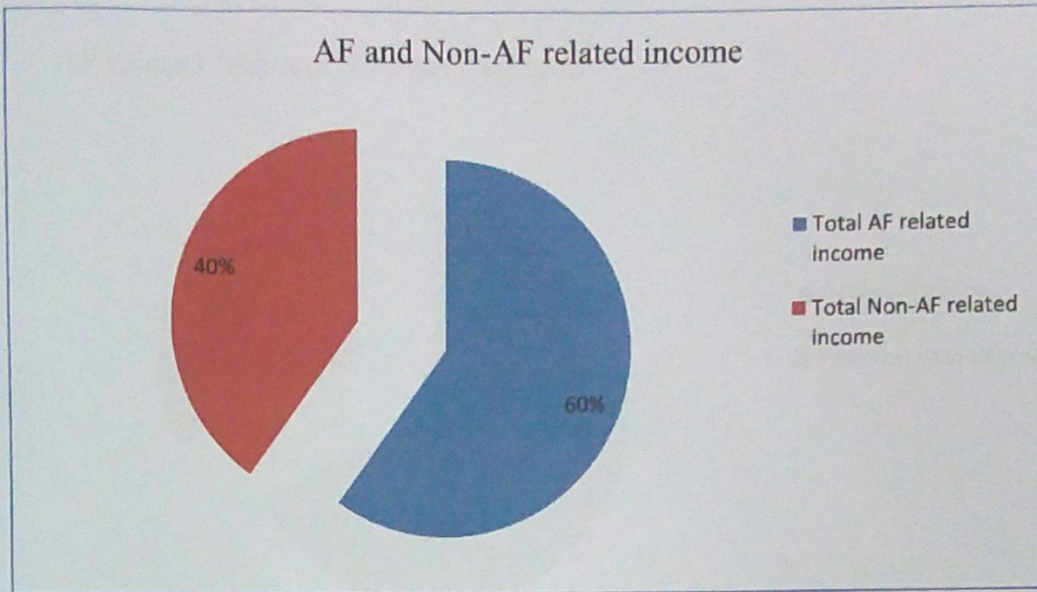
Figure 10: AF related and Non-AF related cash income

The average monthly income distribution of the respondents has been divided into two income groups. It is clear from this graph that the average AF related monthly cash income is more than non-AF related monthly cash income of the respondent households. About 60% cash income comes from AF related practiced and about 40% cash income comes from non -AF related practiced.

4.10 Proportion of Agroforestry related cash and non-cash income

AF related cash and Non-cash income

- Total cash income
- Total Non cash income

32%

68%
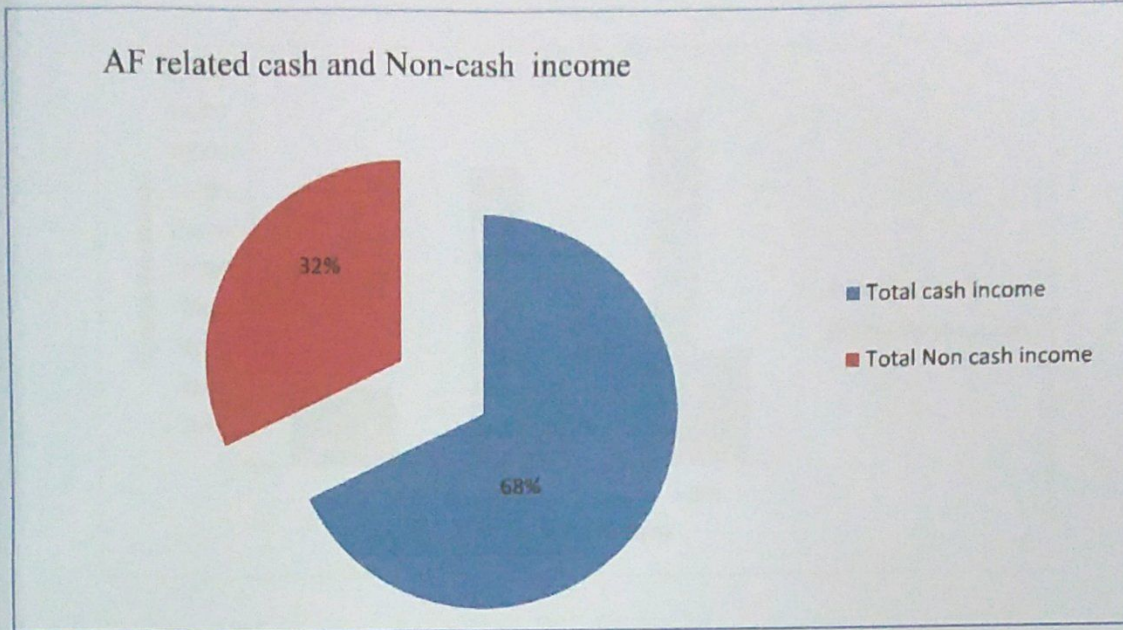
Figure 11: AF related cash and Non-cash income

In Fakirhat upazila, it is found that about 68 percent of respondents generated cash income from selling AF 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 AF come from AF products which households collect but consume/use in the home, or trade as barter for other goods and services rather than selling. These may be fuelwood, timber, forest foods, medicines, fodder or fibre. From the above graph it is found about 32 percent of the non-cash income comes from AF products. It plays a significant role to improve livelihood condition of the surveyed area.

4.11 Relationship between Land holding and Agroforestry related cash and non-cash income

Figure12: Relationship between land holding and AF related income

Land is an indicator of the socio-economic condition of the local people. It plays an important role to household income. Agroforestry related household income varies with their land holding. In the figure it has been shown that household who holding more land, gets more Agroforestry related income because he has more area to practice different types of Agroforestry .Respondents belongs to below 130 decimal land get on an average 3500tk cash and 4000tk non-cash income per month from different types of AF practices. Here non-cash value contributes significantly in their daily life. 130-265 decimal get on an average 1500tk cash and 4000tk non-cash income per month and 265 and above decimal land get on an average 18000tk cash and 6000tk non-cash income per month from different types of AF practices respectively.

4.12 Income sources from Agroforestry products separated in cash and non-cash income.
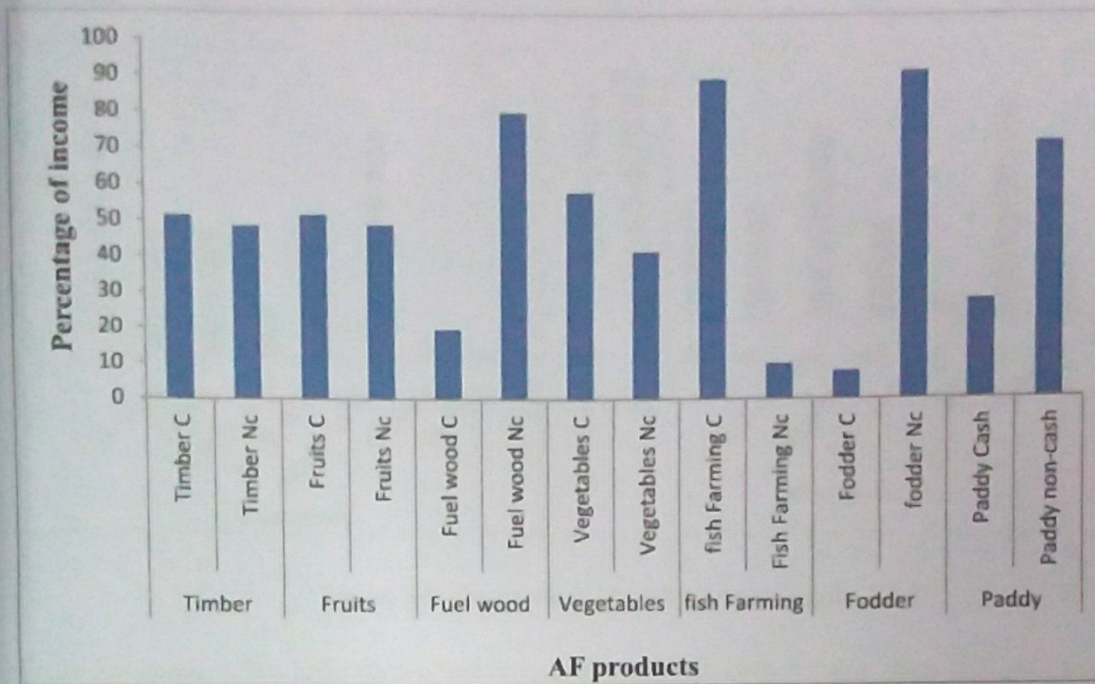
Figure 13: Income sources from Agroforestry products

Different types of cash and non-cash income generate from AF practice. Huge amount of cash income come from Fish framing by respondents. Considerable amount of non-cash income generate from different types of AF products. 92% from fodder, 72% from Paddy, 49% from timber- non-cash income are produced from different types of AF practices.

4.13 Proportion of cash and non-cash income from different sources of Agroforestry products
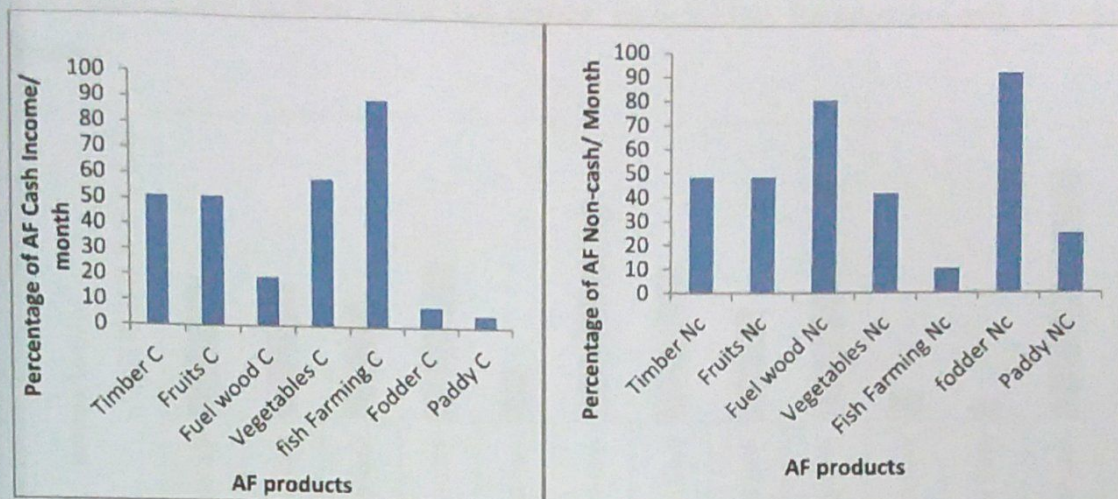
Figure 14: Proportion of cash and non-cash

From the graph, it has been shown individual cash and non-cash income from total AF income. Out of total AF related income, significant amount (55%) of cash income generate from fish farming. significant amount of non-cash income generate from fodder (33%), Paddy (25%) respectively.

Table8: Different items of non-cash income sources of each category

Timber	Fruits	Fuel wood	Vegetables	Fishes	Fodder
Fence	Family consumption	Leaves and Branches	Family consumption	Family consumption	Cattle consumption
Home Construction	Distribution to friends and Family	Agriculture Residue	Distribution to friends and Family	Distribution to friends and Family	
Furniture		Prunning Materials			
Agricultural instrument					

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4.14 Relationship between below 130 decimal land holding Respondents and AF related income
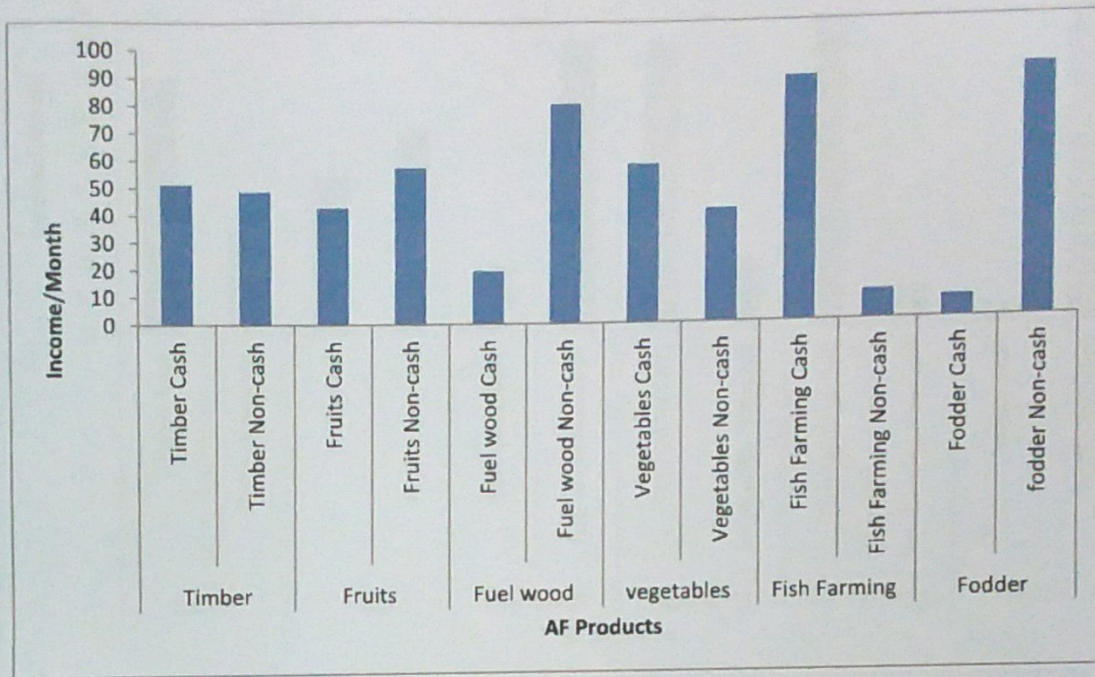
Figure15: Below 130 decimal land holding Respondents and AF related income
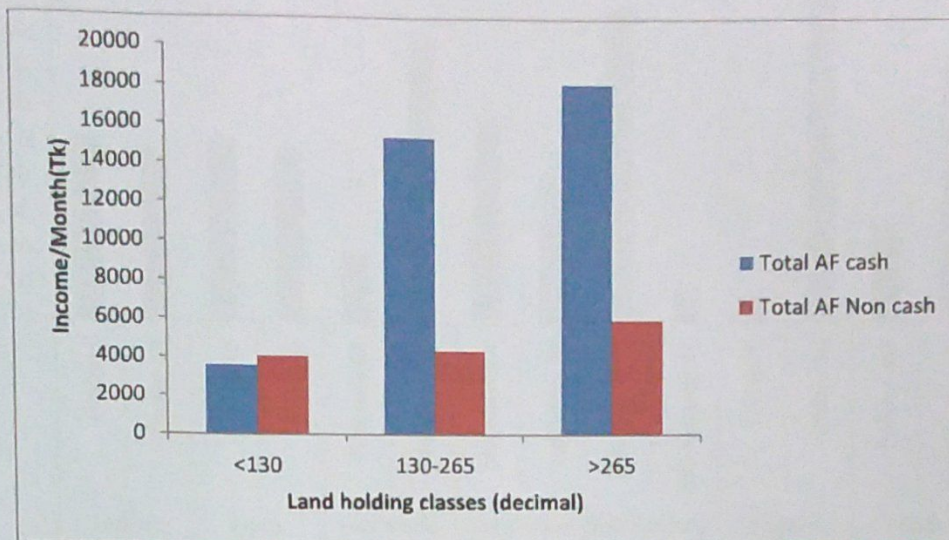
Land is an indicator of the socio-economic condition of the local people. It plays an important contribution to household income. Agroforestry related household income varies with their land holding. In the figure it has been shown that household who holding more land , gets more Agroforestry related income because he has more area to practice different types of Agroforestry. Respondent belongs to below 130 decimal land get Timber cash 51%, Timber non-cash 49%; Fruits cash 43%, Fruits non-cash57%; Fuelwood cash 20%, Fuelwood non- cash 80%; Vegetables Cash58%, Vegetables non- Cash 41%; Fish Farming cash 90%, Fish Farming non-cash10%; Fodder cash 8%, Fodder non-cash 92%. Most of the people here practice home garden.

4.15 Relationship between 130-265 decimal land holding Respondents and AF related income
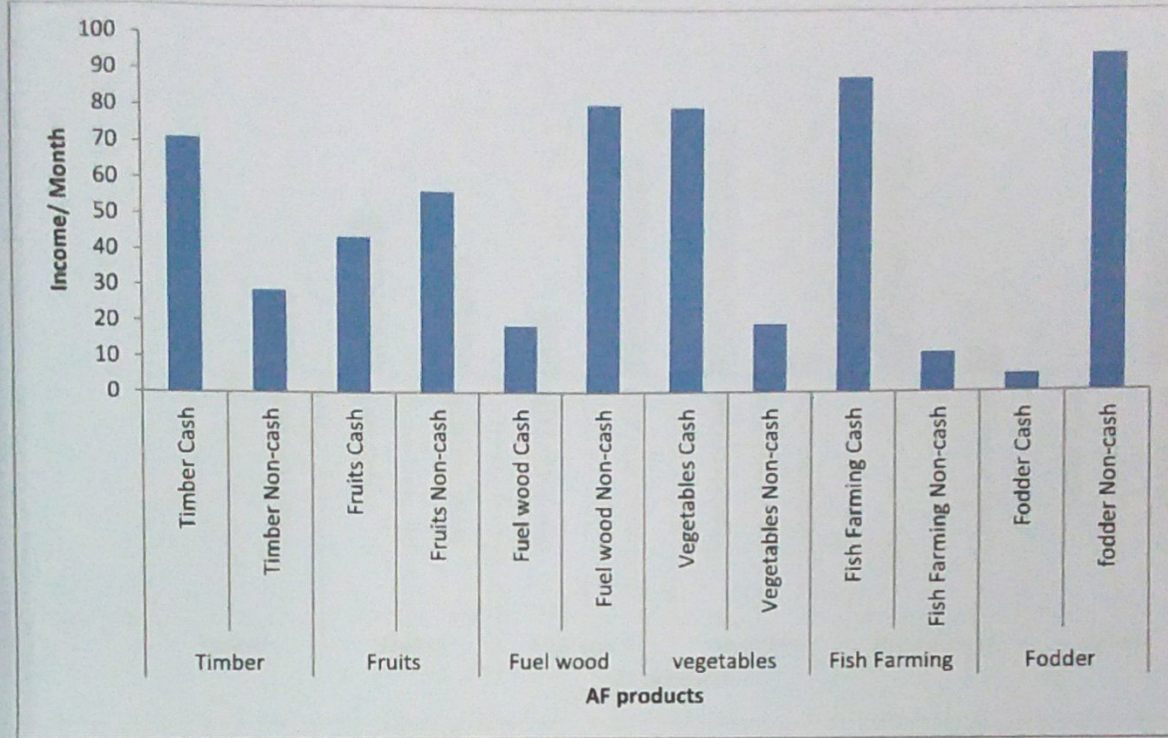
Figure16: 130-265 decimal land holding Respondents and AF related income

Respondent belongs to 130-265 decimal land land get Timber cash 71%, Timber non-cash 29%; Fruits cash 43%, Fruits non-cash57%; Fuelwood cash 20%, Fuelwood non- cash 80%; Vegetables Cash 80%, Vegetables non- Cash 20%; Fish Farming cash 90%, Fish Farming non-cash10%; Fodder cash 6%, Fodder non-cash 94%. Most of the people here practice Intercropping and Aquasilviculture.

4.16 Relationship between 265 and above decimal land holding Respondents and AF related income
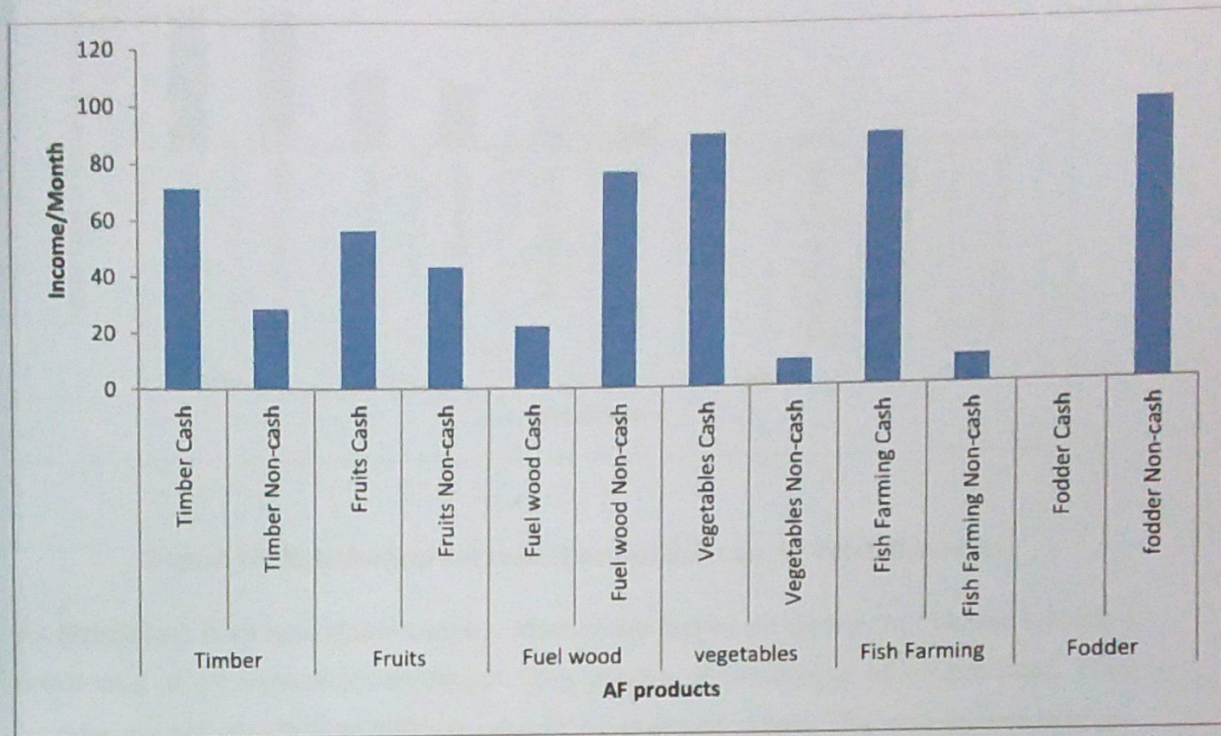
Figure17: 265 and above decimal land holding Respondents and AF related income

Respondent belongs to 265 and above decimal land get Timber cash 71%, Timber non-cash 29%; Fruits cash 56%, Fruits non-cash 44%; Fuelwood cash 23%, Fuelwood non- cash 77%; Vegetables Cash 90%, Vegetables non- Cash 10%; Fish Farming cash 90%, Fish Farming non-cash10%; Fodder non-cash 100%. Most of the people here practice Intercropping and Aquasilviculture

4.17 Relationship between of occupation and AF related income
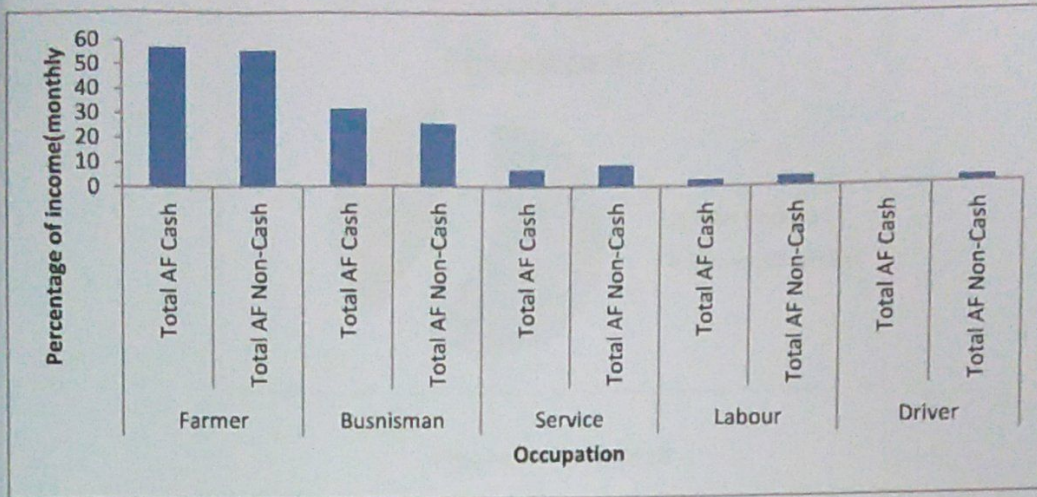
Figure 18: Relationship between of occupation and AF related income

As Bangladesh is an agricultural country. Most of the people are farmer. In Fakirhat Upazila I found most of the respondents are farmer. They practice different types of AF practiced. They get huge amount of cash from different types of AF practiced. About 57% cash income they got from different types of AF practiced. They consume huge amount of AF products, that they could not consider. About 56% non-cash valued they consume. Small Businessmen get about 32% cash and 26% non-cash income, service holders get about 7% cash and 9% non-cash income, Labours get about 3% cash and 4% non-cash income and Drivers get minor amount about 28% cash and 3% non-cash income respectively.

4.18 Livestock and their types
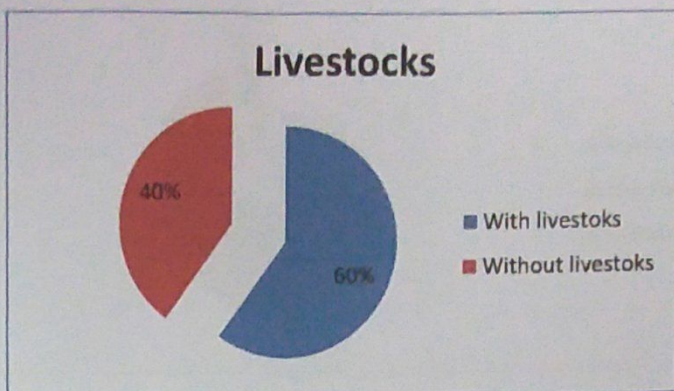
Figure19: Livestock

About 60% people have livestock and rest of the 40 % people have no livestock. There are a few problems of rearing livestock in this area but most of the people rear livestock.
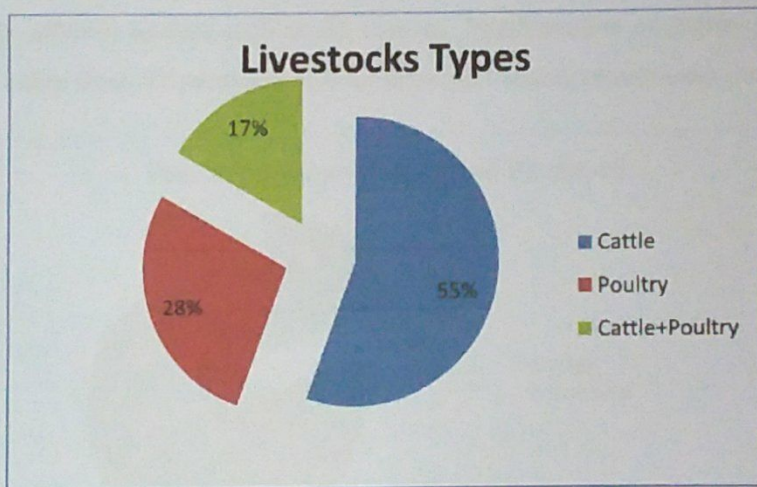
Figure 20: Different types of livestock

From the graph it has been shown that only 55% respondents rear cattle , 28% poultry and17% both of this. Selling livestock, people of this upazilla earn handsome amount of money. So, livestock contribute household income.

4.19 Types of Energy and energy sources
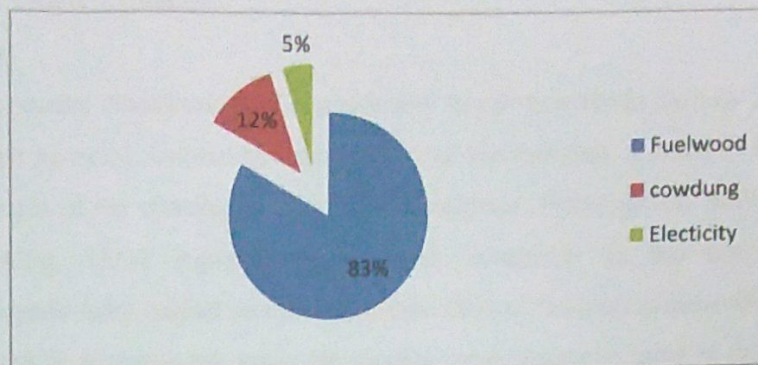
Figure21: Types of Energy and energy sources

People are using different types of energy such as fuel wood, cow dung, electricity, gas etc. to fulfill their fuel energy demand. Maximum people are using fuel wood and cow dung, as their major energy sources because other sources are not available for this area. People collect their fuel wood from different sources such as AF sources. Small portion of energy is purchased too. 83% fuelwood come from AF practices. It is an important source of non-cash income.
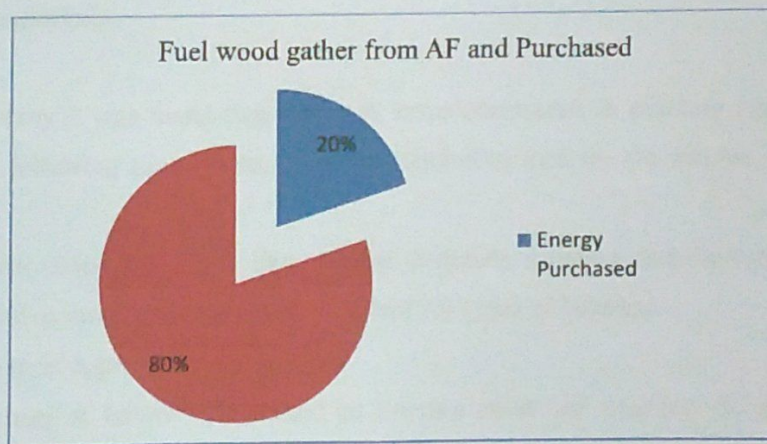
Figure 22: Combination of energy gathers from AF and Purchased

Huge amount of energy for cooking they get mainly from homegarden. Considerate amount money is spent for fuel wood purchased. But Fakirhat Upzila, most of the people have not paid for this. About 80% of energy they gather from Agroforestry and 20% purchased. It improves their economic condition.

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CHAPTER V: CONCLUSION

5.1 Conclusion

This research presents contribution of Agroforestry to the household income and to assess the cash income and non-cash income of Agroforestry of the Fakirhat upazila at Bagerhat district. Most of the people of the upazila practice Aquasilviculture, Homegarden and mixed crop with boundary planting. These Agroforestry practices contribute to the household economy significantly. Agroforestry related income contribute 60% of the total income of this upazila. Out of income related to Agroforestry, non-cash income contributes one third of the total household income that is usually underestimated in commercial evaluation. Cash income contributes 68% of the total Agroforestry related income. Non-cash income contributes much of the economy of the people, but people ignore the non-cash value of Agroforestry. Cash income from Agroforestry improves household's livelihood condition and non–cash income from Agroforestry fulfills their daily nutrition and diet. By practicing various Agroforestry types, people become economically stable as well as it enhances environment biodiversity.

5.2 Recommendations

During the survey it was found that there are some constraints in practing agroforestry types. However, the following suggestions are recommended to increase the income of people of the area.

- ❖ Different extension works like training program, seedling distribution etc. should be provided to motivate more people to adopt AF types of land use.
- ❖ Selection of appropriate tree species.
- ❖ Proper use of fallow land should be brought under AF practice. So that it meets the demand for timber, fuel wood, fruit, fodder and raw materials. This will increase the income and opportunity of the household owners.
- ❖ The respondents did not follow any cropping pattern. They planted trees, wherever, the space was available. So training would be beneficial to overcome this situation.
- ❖ More intangible benefits of Agroforestry practices on soil fertility, improved and sustained productivity and socio-economic aspect should be carried out at larger scale.

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APPENDIX

Questionnaire for contribution of Agroforestry to the household income of the Fakirhat Upazila

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		
Aquaisilviculture		
Woodlot		
Intercropping		
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

Source of income	AF related						
	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 busness	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								