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Farmer's Attitude Towards Agroforestry in Kushtia District

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DECLARATION

This is to certify that, the project work entitled has been carried out by Asnia Arfin Jui, in the Forestry and Wood Technology, Khulna University, Khulna, Bangladesh. I, declare that, this thesis is the result of my own work and that has not been submitted or accepted for a degree in any other University/ Institutions. I, hereby, give consent for my thesis, if accepted, to be available for inter- library loans, and for further research.

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Name of the candidate : Asnia Arfin Jui

DEDICATED

TO

MY BELOVED MOTHER

Acknowledgement

Abstract

The systematic agroforestry practice is being popular day by day in Kushtia district of Bangladesh. Agroforestry, now considered as a sustainable agricultural system, is being widely promoted all over the world especially in Bangladesh. This paper investigates the adaption of practicing of agriculture and forest specially planting tree species, agricultural crops, fish, and pasture. Concept of agroforestry envisages the practice of forestry on cultivated lands for achieving numerous objectives for the benefits of rural and urban communities. The main objective of this study was to investigate and analyze the farmer's attitude toward's agroforestry, the reason for adoption of agroforestry by farmers and the problems being faced by them in district Kushtia. A sample of 84 respondents selected randomly was interviewed through a semi-structured interview schedule individually. Farmers are interested in Agroforestry practice than traditional practice. The famers (30%, they taken lease from other people) who have no own land; they are not interested in Agroforestry. Most of the respondents (83.2%) have taken positively agroforestry practice but they have not enough skill. The government and different NGOs should also provide technical guidance to the farmers and should create more facility, encouraging program for Agroforestry practice. Finally it has been found that most of the farmers (90%) have positive attitudes towards Agroforestry.

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Chapter 1: Introduction

1.1 Background of the Study:

The area of Bangladesh is very small in comparable to population. Its population growth rate is very high. So, increasing people create new pressure on the various limited resources like forest and land resources. The pressure on the land is increasing day by day. So we have to find new technology to produce more crops and forest products to fulfill our demand in this limited land. Agroforestry is the most suitable form of practice in this case. Agroforestry is the art and science of growing woody and non-woody plants together on the same unit of land for range of benefits (BBS, 2013).

Agroforestry systems are most extensive in developing countries where approximately 1.2 billion poor people depend directly on a variety of agroforestry products and services (IPCC, 2000). In the five sub-Sahara African case studies in Franzel and Scherr (2002), agroforestry is shown to have potential to increase farm incomes and solve difficult environmental problems. It is financially more profitable to local farmers in comparison with traditional cultivation, beside its other economic and social benefits. Thus, it can be a potential alternative cultivation practice that helps to enhance poverty reduction and transition to permanent cultivation (Mai, 1999).

Agroforestry has long been recognized sustainable development models throughout the world due to benefits they brings not only to the economy, society but also to the ecosystem. (Thanh, 2005)

Agroforestry is a sustainable management system for land that increases total production; combine agricultural crops, tree crops, forests plants and   animals. AF system provides notable contribution to sustainable agricultural production because of their potentiality to meet economic, social, ecological and institutional conditions for sustainable livelihoods (Nair, P.K.R. 2006).

Agroforestry is becoming an important land use in Bangladesh. Gradually here the farmers are adopting agroforestry widely. It has potential to complement the products and services of desired form forests. There are wide spread practice of Agroforestry in Kushtia district. Farmers have adopted agroforestry in large scale because of high income, suitable use of land and space, erosion control and protection, crop diversification and risk reduction.

1.2 Justification of the Study:

The area of Bangladesh is very small in comparable to population. Its population growth rate is high. Increasing people create new pressure on the various limited resources like forest and land resources. Pressure on land increasing day by day. People build houses, roads, industry, and other infrastructures by converting the agricultural and forest lands. Land is the most valuable and scarce resource in the country. The per capita land holding is very merge. Hence, scientific and proper utilization of every inches of land is very much essential for national interest. Agroforestry is a sustainable management system for land that increases total production; combine agricultural crops, tree crops, forests plants and animals. AF system provides notable contribution to sustainable agricultural production because of their potentiality to meet economic, social, ecological and institutional conditions for sustainable livelihoods (Nair, P.K.R. 2006).

As the land limitation 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 uses, which will permit maintenance of productivity combined with conservation of the resource. So multilayer use of land and the use of same land for many purposes at the same time should be developed, for example Agroforestry is one of the farming system. Agroforestry is a sustainable management system for land increasing total production.

Agroforestry may be the best tool to poverty alleviation as well as minimize the pressure on natural forest & may be best potential land use system for sustainable livelihoods in Bangladesh (IPCC, 2000).

Kushtia is one of the high lands in Bangladesh. The estimate terrain elevation above sea level is 8 metres. Besides there is satisfactory amount of precipitation every year. So it is so vulnerable for the agroforestry system and a big amount people of this area are directly or indirectly attached with agricultural. But what is their perception over agroforestry is not clear and it is much important to find out this for the further development of agriculture as well as forestry. Besides, earlier there was no such study happened over this concept. As for this; the area is much suitable to study and analyze the perception, attitude and thinking of the farmers towards agroforestry.

1.3 Objectives of the study:

- ➢ To know the farmers' attitude and perception about agroforestry practice.
- ➢ To identify the major Agroforestry practices in kushtia district.
- ➢ To identify the problems and opportunities of agroforestry in the study area.

Chapter2: Literature Review

2.1. Agroforestry:

The word agroforestry is derived from the combination of two words that is agro, meaning "agriculture crops," and forestry, meaning "forest trees". It is a farming method that allows trees and shrubs to grow along with agriculture crops and/or livestock that means blending agriculture and forestry in the same production system.

Agroforestry can be defined as sustainable way of land management which integrates both agricultural and forestry practices on the same land management base.

Agroforestry system practices have been defined by different authors (Nair 1993) as practices which involve "the deliberate integration of trees with agricultural crops and/or livestock either simultaneously or sequentially on the same unit of land".

According to Bene et al., (1977), agroforestry is a sustainable management system for land that increases total production, combines agricultural crops, tree crops and forest plants and animals simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of the local population.

Agroforestry is a land use that involves the deliberate retention, introduction or mixture of trees or other woody perennials in crop/animal production fields to benefit from the resultant ecological and economical interactions (Nair, 1984).

A dynamic, ecologically based natural resource management practice that, through the integration of trees and other tall woody plants with agricultural plants on farms and in agricultural landscape, diversifies production for increased social, economic, and environmental benefits. -- World Agroforestry Center (2003)

Agroforestry has long been recognized sustainable development models throughout the world due to benefits they brings not only to the economy, society but also to the ecosystem.

2.2. Characteristics of agroforestry:

➢ Plant components, at least one of which must be a woody perennial. Components of the system, either ecological and / or economical.

> A high level of interaction (economic and biophysical) between the woody and non-woody components.
> Usually multiple products, often of different categories (e.g. food, fodder, fuel wood).
> The cycle of an agroforestry system is always more than one year.
> The most simple agroforestry system is more complex, ecological and economically than a mono-cropping system. (Hasanuzzaman, 2009).

2.3. Component of agroforestry:

> Tree or woody perennials
> Crops
> Animals
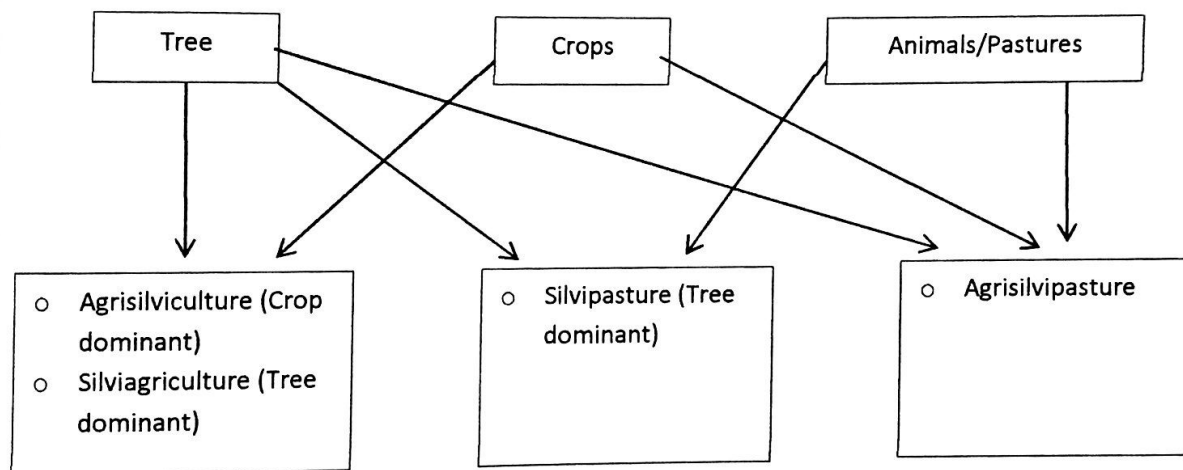
Fig:-2.1: Components of Agroforestry. (Hassanuzzaman, 2009)

2.4. Attributes of agroforestry:

There are three attributes which all agroforestry systems possess. These are: (Hasanuzzaman, 2009)

1. **Productivity**:
Most, if not all, agroforestry systems aim to maintain or increase production (of preferred commodities) as well as productivity of the land. Agroforestry can improve productivity in many different ways. These include: increased output of tree products, improved yields of associated crops, reduction of cropping system inputs, and increased labor efficiency.

2. Sustainability:

By conserving the production potential of the resource base, mainly through the beneficial effects of woody perennials on soils agroforestry can achieve and indefinitely maintain conservation and fertility goals.

3. Adoptability:

The word "adopt" here means "accept," and it may be distinguished from another commonly-used word adapt, which implies modify" or "change." The fact that agroforestry is a relatively new word for an old set of practices means that, in some cases, agroforestry has already been accepted by the farming community. However, the implication here is that improved or new agroforestry technologies that are introduced into new areas should also conform to local farming practices.

2.5. Benefits of agroforestry: Different types of benefit of agroforestry are disused below:

2.5.1. Environmental benefits:

a) Reduction of pressure on natural forests
b) More efficient recycling of nutrients by deep rooted trees on the site
c) Better protection of ecological systems
d) Reduction of surface run-off, nutrient leaching and soil erosion through impeding effect of tree roots and stems on these processes
e) Improvement of microclimate, such as lowering of soil surface temperature and reduction of evaporation of soil moisture through a combination of mulching and shading
f) Increment in soil nutrients through addition and decomposition of litter fall
g) Improvement of soil structure through the constant addition of organic matter from decomposed litter

2.5.2. Economic benefits:

Diversifies the range outputs a given area

a) Increase the value of outputs from a given area of land.
b) Reduces in incidence of total crop failure, common to single or mono cropping systems.

c) Spread the needs for labor inputs more evenly through the year.
d) Provides productive use of underutilized land, labor and capital.
e) Increases in levels of farm incomes due to improved and sustained productivity

2.5.3. Social benefits:

a) Improvement in rural living standards from sustained employment and higher income
b) Improvement in nutrition and health due to increased quality and diversity of food outputs
c) Stabilization and improvement of communities through elimination of the need to shift sites of farm activities.

2.5.4. Biological benefits:

a) Increase crop productivity.
b) Sustain crop productivity.
c) Produce diversified foods.
d) Increase forest productivity.
e) Increase fruit supply.
f) Decrease weed infection

2.6. Disadvantages of agroforestry:

Possible competition of trees with food crops for space, sunlight, moisture and nutrients which may reduce food crop yields;

a) Damage to food crops during tree harvest operation;

b) Potential trees to serve as hosts of insect pests that are harmful to food crops; and

c) Rapid regeneration by prolific trees, which may displace food crops and take over entire fields

d) Requirement of more labour inputs, which may cause scarcity at times in other farm activities;

e) Competition between tree and food crops, which could cause aggregate yields to be lower than those of a single crop;

f) Longer period required for trees to grow to maturity and acquire an economic value;

g) Agroforestry is more complex

2.7. Basis of the Classification:

Nair (1987) used four bases for classification of different agroforestry systems. These are

a) the structure of the system (composition and arrangement of components)
b) function of the system (role and output of components)
c) the socio-economic scale and level of management
d) ecological spread (ecological zones where the system exists)

Later on Dwivedi (1992) reorganizes this basis into seven as follows:

1. Structural
2. Physiognomic
3. Functional
4. Floristic
5. Socio-economic
6. History
7. Ecological

For Bangladesh conditions, the working scientists include "land utilization" as another basis for classification of agroforestry.

2.8. Classification of agroforestry:

2.8.1. Structural classification:

a. Based on the nature of the composition:

The classification of the agroforestry systems on the basis of the nature of composition is (Hassanuzzaman, 2009)

i. **Agrosilvicultural system**: Agrosilvicultural system refers to the use of land for the production of agricultural and forest crops, either simulenously or alternately, e.g., Intercropping of a forest plantation with agricultural crops, growing agricultural tree crops with forest trees.

ii. **Silvopastoral system**: Silvopastoral system refers to a land management system in which forests are managed for the production of wood, as well as, for rearing of domestic animals, e.g. Forests with grasses.

iii. **Agrosilvopastoral system**: Agrocilvopastoral system is the combination of Agrosilvicultural and Silvopastoral system, e.g. Forest with agricultural crops and grazing lands.

iv. **Others (multipurpose tree plantation system)**: This group refers to the management of forest to yield fuel wood, timber, fodder, fruits, medicine etc. there are different types of trees to yield different products

b. Classification based on dominance of components: On the basis of dominance of components, the system is further classified into the following categories: (Hassanuzzaman, 2009)

i. **Silvoagricultural**: Here silviculture is the primary aim of land use. Trees constitute the major component while agricultural crops are integrated with them, e.g., shifting cultivation, taungya cultivation.

ii. **Agrosilviculture**: Agriculture is the primary (major) components and the trees are secondary, e.g., multipurpose trees on farm land, hedgerow or alley cropping, intercropping of trees, home gardens.

iii. **Silvopasture**: Trees constitute the primary (major) component of land use with pastures as secondary, e.g., most grazing land in forests.

iv. **Pastoral silviculture**: pasture is a primary component while the tree is secondary, e.g., grazing lands.

v. **Agrosilvopasture**: It is a combination of crops trees and pastures. Both crops land trees are dominant over pasture.

vi. **Silvoagropasture**: It is a combination of trees, crops and pastures; trees are dominant over other components.

2.8.2. Functional classification

1. Productive Agroforestry system:

This system refers to the production of essential commodities, required to meet the basic needs of the society. It includes intercropping of trees, home gardens, plantation of trees in

and around the crop field, production of animals and fishes in association with trees. Productive functions are as follows:

- Food
- Other woods
- Fodder
- Other products
- Fuel wood

2. Protective Agroforestry system:

This system refers to protect the land, to improve climate, reduce wind and water erosion, improve soil fertility, provide shelter, and other benefits, e.g., windbreaks. Protective functions are as follows:

- Windbreak
- Shelterbelt
- Soil conservation
- Moisture conservation
- Soil improvement
- Shade (for crop, animal and man)

3. Multipurpose agroforestry system:

It ensures multipurpose production through optimizing both productive and protective functions, e.g., hedgerow intercropping, Home garden etc.

2.8.3. Socioeconomic classification:

On the basis of socio-economic considerations, the Agroforestry systems are classified as:

a) **Subsistence Agroforestry system**: It aims at meeting the basis needs of small family having less holding and very little capacity for an investment. There may be some marginal surplus production for sale, e.g., shifting cultivation, scattered trees in the farms, homestead Agroforestry.

b) **Commercial Agroforestry system**: It refers to large-scale production on commercial basis. The main consideration is to sale the products, e.g., tea/coffee under shade tree.

c) **Intermediate Agroforestry system:** It is an intermediate between commercial and subsistence systems. It is practiced on small medium sized farms. The system aims at the production of items, which are not only enough to meet the needs of the family, but to earn money the surplus can be sold.

2.8.4. Ecological classification:

Ecological basis refers to the environmental condition and ecological suitability of systems based on the assumption that certain ecological conditions; i.e., there can be separate sets of agroforestry systems for arid and semi-arid lands, tropical highlands, lowlands humid tropics etc

a) **Tropical:** vegetation in extreme climate, such as, high temperature, low humidity, and scarcity of water etc., e.g., Tropical silvopasture.

b) **Sub-tropical**: vegetation in suitable climatic condition, e.g., Agroforestry practices in the sub-tropical regions including Bangladesh.

c) **Temperate:** vegetation in low temperature, e.g., silvopasture or pastoral silviculture in temperate regions.

d) **Sub-alpine**: vegetation in low and medium mountainous regions, e.g., natural or artificial forest vegetation in low or medium mountains.

e) **Alpine:** vegetation in high mountainous regions, e.g., natural forest vegetation.

2.9. Types of Agroforestry Systems:

I) Agrisilvicultural Systems

In this system, agricultural crops are intercropped with tree crops in the interspace between the trees. Under this system agricultural crops can be grown up to two years under protective irrigated condition and under rained farming up to four years. The crops can be grown profitably up to the above said period beyond which it is uneconomical to grow grain crops. However fodder crops, shade loving crops and shallow rooted crops can be grown economically. Wider spacing is adopted without sacrificing tree population for easy cultural operation and to get more sunlight to the intercrop. Performance of the tree crops is better in this system when compared to monoculture (Anon, 2008).

II) Silvopastoral Systems:

The production of woody plants combined with pasture is referred to Silvipasture system. The trees and shrubs may be used primarily to produce fodder for livestock or they may be grown for timber, fuel wood, and fruit or to improve the soil. (Anon, 2008)

This system is classified in to three categorized (Anon, 2008)

a) Protein bank

b) Live fence of fodder trees and hedges

c) Trees and shrubs on pasture

III) Agrosilvopastoral Systems

The production of woody perennials combined with annuals and pastures is referred Agrisilvopastural system. (Anon, 2008)

This system is grouped into two categories. (Anon, 2008)

a) Home gardens

b) Woody hedgerows for browse, mulch, green manure and soil conservation

2.10. Possible impacts of Agroforestry:

- Controlling poverty through increase income by higher production of agroforestry products for home consumption and market.

- Food security by restoring farm soil fertility for food crops and production of fruits, vegetables, nuts and edible oils.

- Empowerment to women farmers and other less-advantaged rural residents whose rights to land are insecure through better negotiations.

- Reducing deforestation and pressure on forest by providing fuel wood grown on farms.

- Improving soil health of the farm through ameliorated micro-climate and nutrition level. (Anon, 2011)

2.11. History of agroforestry in Bangladesh:

Betagi-Pomora Community Forestry Project (1979): This was the first Agroforestry program started by the Forest Department under the umbrella of social forestry program. Betagi and Pomora are the two village of Rangunia Thana of Chittagong. These were two

denuded (devoid of trees) hill were the Govt. rehabilitate families who encroached forest land with a view to plant trees along with the provision of cultivation of agricultural crops in the allotted land for each family. Initially the program was started in participation of 70 families of Betagi village in 1979, then it was extended in Pomora village on Khas and protected forest land. To start with 70 families so far total 235 families (83 in Betagi and 152 in Pomora) has been rehabilitated in two village.

In the mid-80s on farm Research Division (OFRD) in BARI was established where Agroforestry as a land use systems were evaluated and its potential and necessity in our farming system has been judged.

In 1987, Bangladesh Forest Research Institute (BFRI) conducted Agroforestry research works in Ichamoti of Rangunia. Fashiakhali of Dulahazra and Salna of Gazipir with a view to maximize the productivity of the Govt. forest land.

In 1988, the Institute of Forestry of the University of Chittagong introduced the course of Agroforestry in its curricula for the degree of B.Sc. (hons) in Forestry.

In 1988, Village and farm Forestry Program (VFFP) was initiated under the guidance of Prof. Abdul Haque (the then Professor of Crop Botany) with financial assistance of Swiss Agency for Development and Cooperation (SDC). This program dealt with the exploration of feasibility of implementing Agroforestry works in different areas to the country. This program actually helped in establishing Agroforestry Department in the Bangladesh Agricultural University.

In the 1990, the giant NGOs like BRAC, Proshika, SDC and others started Agroforestry works in the country.

In the 1990, Department of Agroforestry and Environment was established in IPSA, now Banghabandhu Sheikh Mujibar Rahman Agricultural University (BSMRAU) to often MS in Agroforestry.

In 1996, Department of Agroforestry was established by the indefatigable works of Prof. Abdul Haque. With the incorporation of courses of Agroforestry for the undergraduate student of the Faculty of Agriculture, the Agroforestry movement gained momentum. In the newly established department, he (the Prof. Haque) was the founder head.

In 1997, National Agroforestry working Group (NAWG) was formed by the active initiation of the personnel engaged in the Forestry Division of Bangladesh Agricultural Research Council (BARC).

In 1998, First National Agroforestry Workshop was held at BARC organized by NAWG during 21-25 June.

In 2000, The Swiss Agency for Development and Cooperation (SDC) initiated its Sustainable Land Use Programme in the late 1980's and in 2000 handed over the programme to HELVETAS Swiss Interco-operation for implementation.

In 2004, the programme, active in the North and South-Western parts of Bangladesh, developed a successful nursery model in order to reduce poverty by promoting agroforestry.

In 2005, the programme expanded to the whole country under the new name of AFIP: Agroforestry Improvement Partnership. In order to ensure quality planting material (QPM) of timber, fruit and medicinal plant species, the AFIP project collaborated with national level research and extension organizations.

The history of agroforestry intimately associated with the practice of shifting cultivation and taungua system. (Hassanuzzaman, 2009)

2.12. Agroforestry system practice in Bangladesh:

An agroforestry system practice is becoming popular in Bangladesh. An Agroforestry Practice denotes a distinctive arrangement of components in space and time (Nair, 1993).Examples of Agroforestry practices are Tree home gardens, woodlot, Boundary planting, live fences, alley Cropping, Planting crop combinations, etc.

2.12.1. Homestead agroforestry

Homegardens consist of an assemblage of plants, which may include trees, shrubs, vines, and herbaceous plants, growing in or adjacent to a homestead or home compound. These gardens are planted and maintained by members of the household and their products are intended primarily for household consumption; the gardens also have considerable ornamental value, and they provide shade to people and animals. The word homegarden has been used rather loosely to describe diverse practices, from growing vegetables behind houses to complex

multistoried systems. It is used here to refer to intimate association of multipurpose trees and shrubs with annual and perennial crops and, invariably livestock within the compounds of individual houses, with the whole crop-tree-animal unit being managed by family labor (Fernandes and Nair, 1986)

Homestead agroforestry exemplify all the agroforestry characteristics of:

> an intimate mix of diversified agricultural crops and multipurpose trees fulfills most of the basic needs of the local population;

> the multi-storied configuration and high species diversity help reduce the environmental deterioration commonly associated with monoculture production systems;

> Producing sustained yields in a resource-efficient way.

2.12.2. Cropland agroforestry:

Cropland agroforestry combines the production of agricultural crops and trees in the cropland through intercropping. Cropland Agroforestry (CAF) is a traditional land use system in Bangladesh where tree species 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. Planting timber species on agricultural cropland at the same time is called cropland agroforestry. Agrisilvilviculture system denotes the concept of cropland Agroforestry. Agrisilviculture means, the use of land for the concurrent production of agricultural crops and forest crops. Agrisilviculture covers all systems in which land is used to produce both forest trees and agricultural crops, either simultaneously or alternately. (FAO, 1978).

Types of cropland agroforestry

> Boundary plantation

> Alley cropping

> Woodlot

> Live fencing

> Plantation crop combination

2.12.2.1. Adoption Factors of Cropland agroforestry in Bangladesh:

The following factors influence the adaptation of cropland agroforestry in Bangladesh

(Haque, 1993).

> The most forest cover of the country is being depleted at the rate of about 10-15 thousands hectares per year.

> The scope of allocating more government land for forest is extremely limited.

> Per capita land in the country is very small and this is being reduced with the growth of population.

> More and more land is diverted to non-forestry activities.

> Cropland Agroforestry is very effective method of involving landless people and the encroachers of the forest land and illegal exploiters of forest resources in the protection and management of the forest.

> Cropland agroforestry can stop further degradation of the foresters by maximizing the production and income.

> It can meet the multidimensional needs of the rural people for food, fuel, timber, construction materials, agricultural equipment's, etc.

> It can improve the economic condition and the social status of the rural people.

> It can help the rural poor into self- sustained life style.

2.13. Factors influencing farmer's adoption of Agroforestry:

Following Rogers (1983), agroforestry adoption can be described as a mental process, commonly known as the innovation-decision process, farmers go through a stage of being aware or knowledgeable of a new agroforestry technology, to forming positive or negative attitude towards agroforestry, and ultimately to deciding whether to adopt the technology or not. This process can be influenced by a wide variety of factors, including household factors (socioeconomic, resource-base, and outside contacts), community factors (access to extension, education, market, infrastructure, indigenous knowledge and ecological factors), and institutional factors (extension services, training and material support, through government and national/local NGOs). (Ramji, 2001)
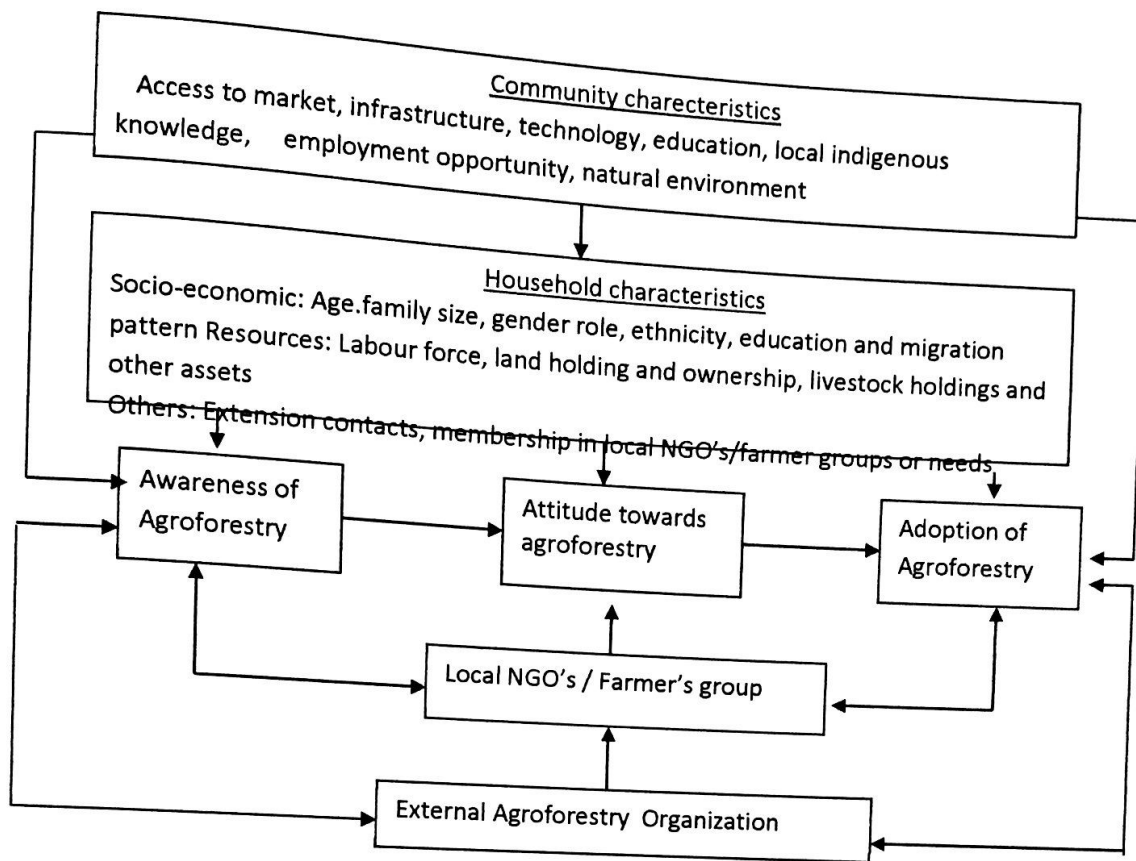
Fig: 2.2. Agroforestry adoption framework (Ramji , 2001)

2.14. Limitations of agroforestry

> **Environmental aspect**

- Loss of organic matter, nutrients and damage of crops during tree harvesting: when the trees are harvested a huge loss of organic matter, nutrients and damage of crops occurred.

- Nutrient competition between trees and crops: trees and crops may compete with each other for nutrient and mineral.

- Moisture competition between trees and crops: In the semiarid and dry zones, this is possibly the most serious problem encountered in agroforestry.

- Production of substances which inhibit germination or growth: Some Eucalyptus species produce toxins which can inhibit the germination or growth of some annual herbs (Poore and Fries, 1985). It has also been suggested that the production of allelopathic substances by tree roots could present a problem in agroforestry, but there is little evidence of this.

- Host of insect and other pests: trees planted in the crops may attract the insect and birds which sometimes harmful for crops. They may be the hosts of different pests.

> **Socio-economic aspect:**

- Agroforestry is more complex practice.
- Required more labor inputs.
- Longer period required to get maturity of trees.
- Competition between trees and crops may reduce the production and thus income.

2.15. Prospect of agroforestry in Bangladesh:

Bangladesh is one of the most densely populated agriculture-based countries in the world. Its population growth rate is very high and thus the area of Bangladesh is very small in comparison to its population. Agroforestry has long been recognized as sustainable development models throughout the world due to the benefits it brings not only to the economy and society but also to the ecosystem.

In Bangladesh, gradually the farmers are adopting agroforestry widely. It has potential to complement the desired products and services from forests.

Agroforestry is a sustainable land use system that increases total production and combines agricultural crops, tree crops, forests plants and/or animals. In Bangladesh the land use systems include annual crop production, horticulture and agroforestry. The agroforestry practices include homestead agroforestry, cropland agroforestry and woodlot. The annual crops cultivated in the homestead agroforestry are various types of vegetables with multipurpose tree species are practiced in different types of Cropland agroforestry along with the annual crops.

The popularity of agroforestry system practice is increasing at present time in Bangladesh

2.16. Likert Scale:

A Likert scale is a psychometric scale commonly involved in research that employs questionnaires. It is the most widely used approach to scaling responses in survey research, such that the term is often used interchangeably with rating scale, or more accurately the Likert-type scale, even though the two are not synonymous. The scale is named after its

inventor, psychologist Rensis Likert. Likert distinguished between a scale proper, which emerges from collective responses to a set of items (usually eight or more), and the format in which responses are scored along a range. Technically speaking, a Likert scale refers only to the former. The difference between these two concepts has to do with the distinction Likert made between the underlying phenomenon being investigated and the means of capturing variation that point to the underlying phenomenon. When responding to a Likert questionnaire item, respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements. Thus, the range captures the intensity of their feelings for a given item. A scale can be created as the simple sum of questionnaire responses over the full range of the scale. In so doing, Likert scaling assumes that distances on each item are equal. Importantly, "All items are assumed to be replications of each other or in other words items are considered to be parallel instruments." (Wuensch, Karl L. (2005)

2.16.1 Likert Item:

A Likert item is simply a statement which the respondent is asked to evaluate according to any kind of subjective or objective criteria; generally the level of agreement or disagreement is measured. It is considered symmetric or "balanced" because there are equal numbers of positive and negative positions. Often five ordered response levels are used, although many psychometricians advocate using seven or nine levels; a recent empirical study found that a items with five or seven levels may produce slightly higher mean scores relative to the highest possible attainable score, compared to those produced from the use of 10 levels, and this difference was statistically significant (http://en.wikipedia.org/wiki/Likert_scale).

The format of a typical five-level Likert item, for example, could be:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree or neutral
4. Agree
5. Strongly agree

A sample of Likert Scale is given below-

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

Fig: 2.3. Likert Scale

2.16.2 Reporting on Likert Scale:

The traditional way to report on a Likert scale is to sum the values of each selected option and create a score for each respondent. This score is then used to represent a particular trait (particularly when used for sociological or psychological research).

This is also quite useful for evaluating a respondent's opinion of important purchasing, product, or satisfaction features. The scores can be used to create a chart of the distribution of opinion across the population. For further analysis, you can cross tabulate the score mean with contributing factors. (http://en.wikipedia.org/wiki/Likert_scale)

2.16.3 When to Use Likert Scales:

This is a very useful question type when you want to get an overall measurement of a particular topic, opinion, or experience and also collect specific data on contributing factors. Measuring the satisfaction (the trait) of a recent shopping experience is a common use.

We should not use this form of question (or at least we should not call it a Likert scale) when the items in the question are unrelated to each other, or when the options are not in the form of a scale. (http://en.wikipedia.org/wiki/Likert_scale)

2.16.4 Level of measurement:

The five response categories are often believed to represent an Interval level of measurement. But this can only be the case if the intervals between the scale points correspond to empirical observations in a metric sense. Reips and Funke (2008) show that this criterion is much better met by a visual analogue scale. In fact, there may also appear phenomena which even question the ordinal scale level in Likert scales. For example, in a set of items A, B, C rated with a Likert scale circular relations like A>B, B>C and C>A can appear. This violates the axiom of transitivity for the ordinal scale.

Even with rather large distortions of perceived distances between scale points, Likert-type items perform closely to scales that are perceived as equal intervals. So these items and other equal-appearing scales in questionnaires are robust to violations of the equal distance assumption many researchers believe are required for parametric statistical procedures and tests. (http://en.wikipedia.org/wiki/Likert_scale)

Chapter 3: Description of the Study Area

3.1. Location and Area:

Kushtia is a district of Khulna Division and is situated on the western part of Bangladesh. Kushtia is bounded on the north by Rajshahi, Natore and Pabna districts, on the east by Pabna and Rajbari Districts, on the south by Jhenaidah, Chuadanga and Meherpur Districts and on the west by Chuadanga and Meherpur Districts and India. It lies between 23°42′ and 24°12′ north latitude and between 88°42′ and 89°22′ east longitudes. The total area of the district is 1621.15 sq.km (625.93 sq.miles)(Source-BBS 2011)

Fig: 3.1- Map of KushtiaDistrict (Banglapedia, 2013)

Table3.1: Broad classification of the area

Upazila	Total area	Land area	Reserve forest	Riverine area
Kushtia Sadar	318.22	306.09	0	12.15
Bheramara	153.71	135.43	0	18.29
Daulatpur	468.76	408.7	0	60
Khoksa	104.85	87.28	0	17.72
Kumarkhali	258.18	233	0	25
Mirpur	305.06	262.45	0	34
Total	1608.80	1432.95	0	167.16

(Source- BBS 2011)

3.2. Administration:

The area of Kushtia is 1621.15 Sq Km. It is under Khulna Division. There are 05 Municipalities in Kushtia named Kumarkhali, Mirpur, Bheramara, Kushtia, and Khoksha. Kushtia District consists of 6 upazilas, 61 unions, 711 mauzas and 978 villages. It is also comprised of 4 paurashavas, 39 paura wards and 77 mahallas.The upazilas are Kushtia Sadar, Kumarkhali, Daulatpur, Mirpur, Bheramara and Khoksa. (Source-BBS2011)

Table 3.2: Number of municipality, union, mauza, mahalla and village

Upazila	Municipality	Ward (PSA)	Mahalla	Union	Mauza	Village
Kushtia Sadar	1	12	36	14	122	176
Bheramara	1	9	15	6	43	78
Daulatpur	0	0	0	14	154	218
Khoksa	1	9	18	9	82	103
Kumarkhali	1	9	17	11	187	201
Mirpur	1	9	9	13	116	192
Total	5	48	95	67	704	968

(Source- BBS 2011)

3.3. Population:

The total population of Kushtia district is 19, 46,838 (Male- 973,518 and Female- 973,320), Sex ratio 100:100, Population Density 1210/Sq Km and annual growth rate is 1.11%.

Table 3.3: Upazila wise Population of Kushtia District

Name	Status	Population census 2011-03-15
Kushtia Sadar	District (Zila)	502599
Bheramara	Subdistrict (Upazila)	208030
Daulatpur	Subdistrict (Upazila)	456313
Khoksa	Subdistrict (Upazila)	134647
Kumarkhali	Subdistrict (Upazila)	45250
Mirpur	Subdistrict (Upazila)	330067
Total		1676906

(Source- BBS 2011)

3.4. Literacy:

The Literacy Rate of Kushtia district is 46.30% (Male- 47.90% and Female- 44.80%), School attendance rate is 54.90% for 5 to 24 years age group.

Table 3.4: Literacy Rate (%) of the area

Upazila	Literacy Rate (%)
Kushtia Sadar	53.9
Bheramara	48.7
Daulatpur	41.3
Khoksa	44.7
Kumarkhali	45.3
Mirpur	41.9
Average	46.3

(Source- BBS 2011)

3.5. Annual Average Temperature and Rainfall:

The annual average temperature of this district varies from Maximum 37.8°C to minimum 11.2°C and annual average rainfall is 1467 mm.(Source-BBS2011)

3.6 Main Crops: Paddy, tobacco, jute, sugarcane, pulses oil seed etc.are main crops of this district. (Source-BBS2011)

3.7 Main Fruits: Mango, banana, jackfruit, lichi etc.are main fruits of this district. (Source-BBS2011)

Chapter 4 - Materials and Methods

4.1. Materials and Methods:

The study was conducted at kushtia district of Bangladesh during June 2017. An exploratory survey was conducted in Kushtia district to explore information regarding the demographic profile of respondents, annual income of respondents, and cultivation practice, attitude, perception and thinking towards agroforestry practice.

4.1.1. Selection of the study area:

During the study a multistage random sampling technique was adopted. Kushtia district was selected purposively as the study area. Three upazilas are namely- 1. Bheramara, 2. Daulatpur, 3. Mirpur, were selected randomly. These are first sampling unit. Then again from each upazila two unions were selected randomly as second sampling unit. On such way, two villages from each union were selected as third sampling unit randomly. From each village more or less five to seven (in accordance with availability) respondents were selected. A total of 84 respondents participated in the face-to-face interview. All the sampling units are shown in the Table 4.1.

Table 4.1: All sampling units in kushtia District

Name of the District	Name of the Upazila (First sampling unit)	Name of the Unions (Second sampling unit)	Name of the Villages (Third sampling unit)
Kushtia	Bheramara	Bahadurpur	Kuchiamora
			Raita
		Juniadaha	Horipur
			Juniadaha
	Daulatpur	Daulatpur	Taragunia
			Borogangdia
		Mathurapur	Mathurapur
			Chandipur
	Mirpur	Poradaha	Chandpur
			Kazipara
		Bahalbaria	Bahalbaria
			Baniakhamar

4.1.2. Selection of the respondents:

In total about 84 respondents (each respondent was selected randomly) were selected for the survey. A detailed socio-economic survey was conducted to assess educational status, land status, livelihood, and interest in agroforestry, necessity, occupation and income. Respondents are selected randomly from villages.

4.1.3 Data collection Process:

The main focus and target was on collecting data of farmer's perception, attitude, interest and thinking over agroforestry in Kushtia district. Primary data were collected from the field survey questionnaire. There was direct face to face formal and informal conversation and interrogation with the existing farmers.

4.1.3.1. Questionnaire survey:

In order to obtain relevant information, the interview schedule was carefully designed keeping in mind the objective of the study. The formal survey of each union was carried out by using the semi structured questionnaire by the author. The questions were written in English; although they were asked in Bengali language.

The questionnaire was covered on:

- o Demographic profile of respondents,
- o Present Agroforestry status.
- o Farmer's attitude towards agroforestry.
- o Problems about agroforestry practice.
- o Their demand for agroforestry practice.

4.1.4. Procedure of data collection:

In order to fulfill the objectives set out for this study; a relevant information and literature were collected from the two following two sources:

4.1.4.1 Primary data collection:

The primary data were collected by conducting a survey work with a well prepared structured questionnaire. For these reason, the interviewers were selected randomly. It is also done by physical visit to the villages and then interviewing the respondents. In it informal discussions with the villagers of the target areas also included

4.1.4.2. Secondary data collection:

The secondary sources of data including books, journals, various publications of Government, institutions and other organizations, articles of local and other research papers on same or similar issues have been used for data collection. In addition to this, internet has also been used as secondary source of data collection. Besides from the following places data was collected-

- Khulna University Library.
- Seminar Library; Forestry and Wood Technology, Khulna University.
- Upazila Krishi Offices or relevant Upazila.
- Uddipon NGO Office, Kushtia
- Internet.

4.1.5. Data processing and Analysis: The surveyed data were converted into frequencies and percentages forms. After collecting information from primary and secondary sources, data are processed and analyzed by following steps:

i.   Reviewed of collected data and information
ii. Discarded of unnecessary parts of the information and data
iii. Sorted of revised data and information
iv. Analyzed for easy explanation

4.1.6. Report writing: After successful completion of primary data analysis and arrangement of all primary and secondary information, then a draft final report was prepared and it was finalized after some necessary correction

4.2. Likert Scale:

A Likert scale is a psychometric scale commonly involved in research that employs questionnaires. The scale is named after its inventor, psychologist Rensis_Likert. Likert distinguished between a scale proper, which emerges from collective responses to a set of items (usually eight or more), and the format in which responses are scored along a range.

The format of a typical five-level Likert item, for example, could be:

1. Strongly disagree

2. Disagree

3. Neither agree nor disagree or neutral

4. Agree

5. Strongly agree

A sample of Likert Scale is given below-

Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

The traditional way to report on a Likert scale is to sum the values of each selected option and create a score for each respondent. This score is then used to represent a particular trait (particularly when used for sociological or psychological research). (Wuensch, Karl L. (2005).

4.3. Limitation of the study:

o Extensive survey is costly and time consuming.

o The number of the respondents was rather small in the study, so only simple statistical tools could be applied for the analysis of data.

4.4. Flow chart of Methodology: Flow chart of the study that has been followed in this study is the following;
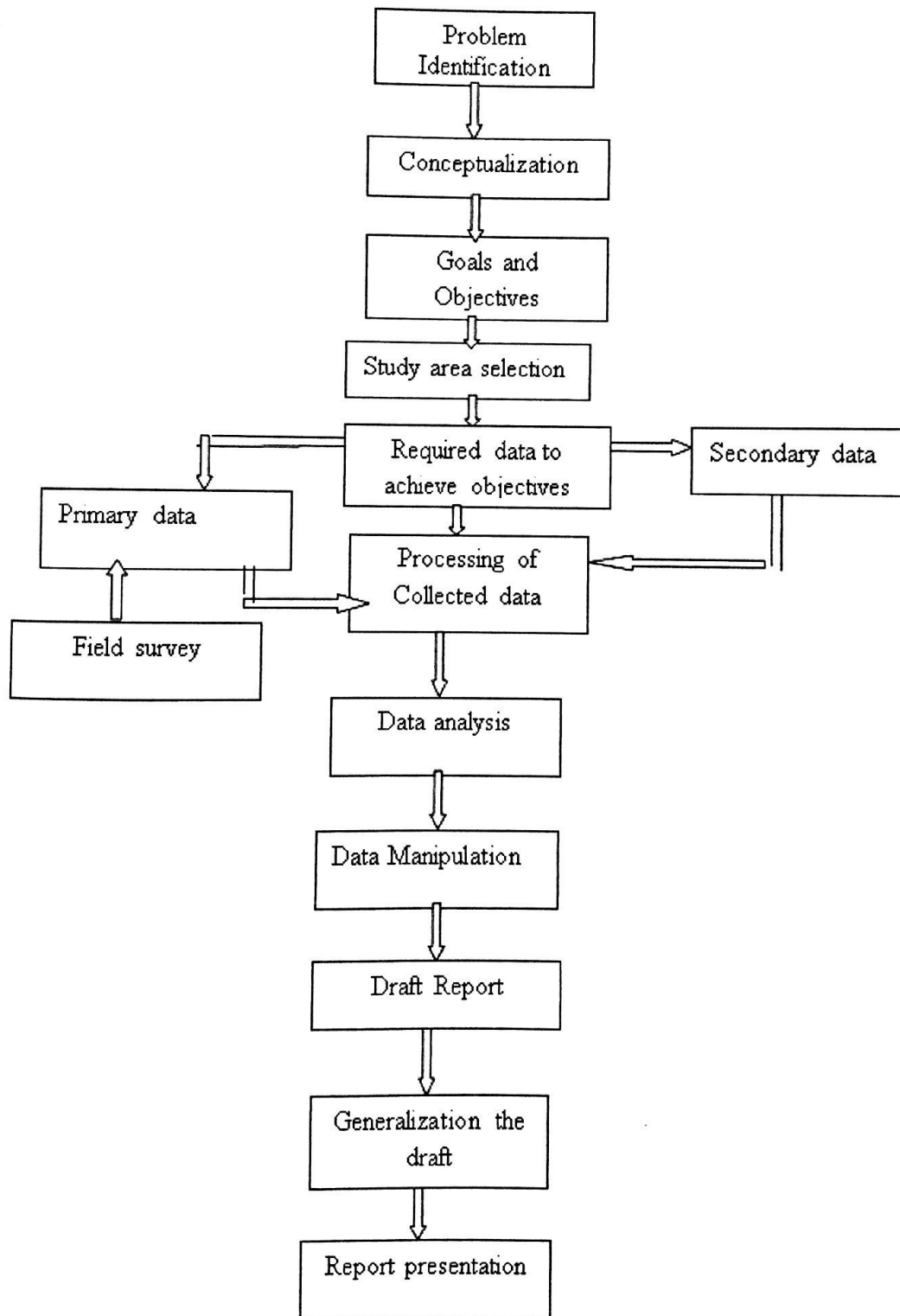
Fig-4.1. Flow chart of Methodology

Chapter 5: Result and Discussion

5.1 Socio-economic characteristics of the respondents:

Most of the respondents (86.3%) is male and only 13.8% is female. The average household size of the study area was about 5. About 43.8% family belonged four (<=4) members, 40% belonged 5-6 members and there was also a few (3.8%) family having more than 8 members. About 42.5% respondents' age group was 26-35 years and 40% was above fifty years.

Table 5.1: Socio-economic characteristics of the respondents

Parameter		Percentage (%)
Sex	Male	86.3
	Female	13.8
Age	18- 25	6.3
	26-35	42.5
	36-50	11.3
	Above 50	40.0
Family Size	<=4	43.8
	5-6	40.0
	7-8	12.5
	8+	3.8

(Source: Author calculation from field survey, 2017)

5.1.1. Level of Education:

Agroforestry demands high literacy because it is a modern method of cultivation. Educational knowledge is very important for providing technical knowledge about cultivation. So, high literacy rate would increase the practice of agroforestry. But, literacy rate of the study area is 68% which is comparatively low in terms of better practice of agroforestry.
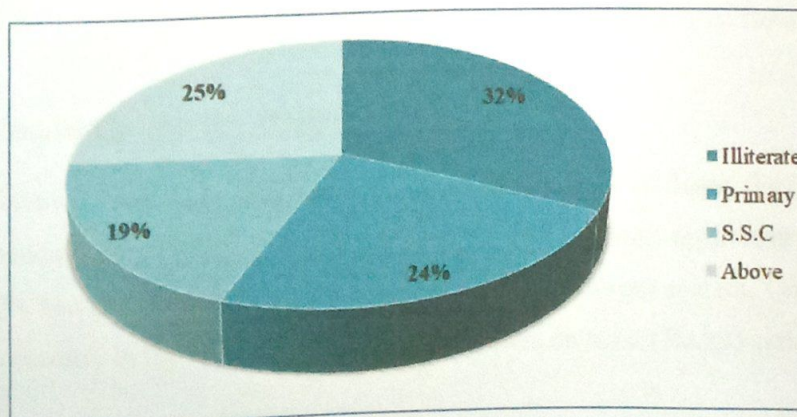
Figure 5.1: Percentage of Level of Education
(Source: Author calculation from field survey, 2017)

Figure 5.1 shows that about 32 % respondents are illiterate and 25% studied above S.S.C level. About 24% respondents have only primary level education and 19 % studied up to secondary school level.

5.1.2. Household income and expenditure (yearly):

Average annual income of the respondents is 96000 Tk. Most of the respondent's (55%) income level is 60000-120000 Tk. per year and about 30% respondents earned 120000-180000 Tk./year. About 12.5% respondents live below the poverty line whose yearly income is less than 60000 Tk. and only 2.5% earned higher than 180000 Tk. per year. At the same time household expenditure of the respondents is almost equal even some time higher than their household income. So, household saving rate is very low.
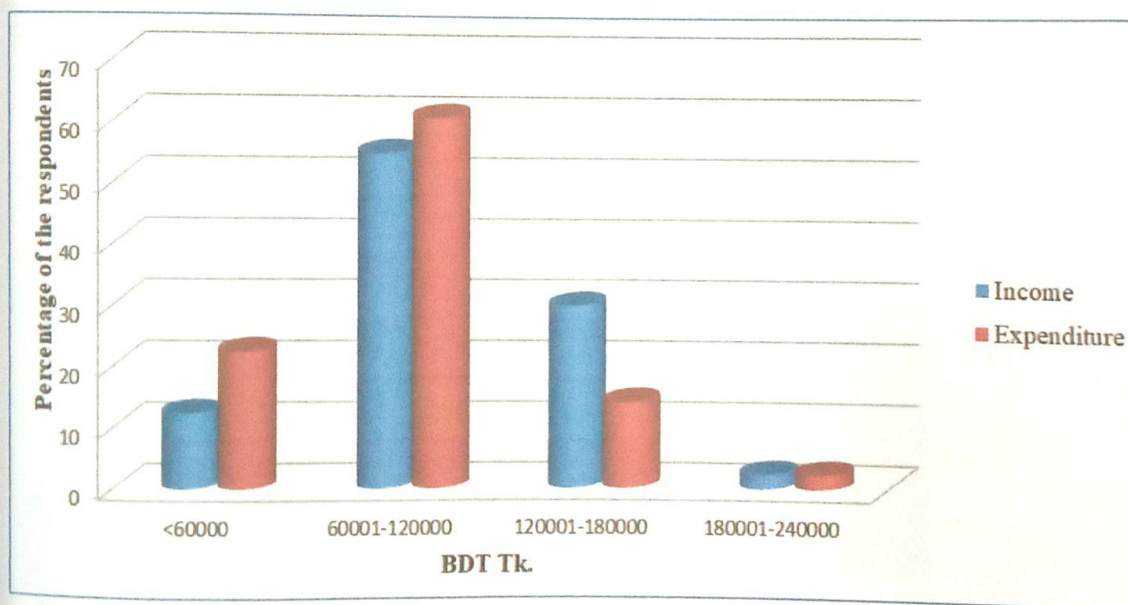
Figure 5.2: Household income and expenditure (yearly)

(Source: Author calculation from field survey, 2017)

5.2. Land Tenureship and Size of land holding:

People prefer own land more than the area taken from others on lease (Borga) system in terms of practicing agroforestry. Most of the people (61%) practice agroforestry in their own land and 30% use the land that they gave others on lease (Borga) system. Only 9% people practice agroforestry in the land that are taken from others on lease (Borga) system.
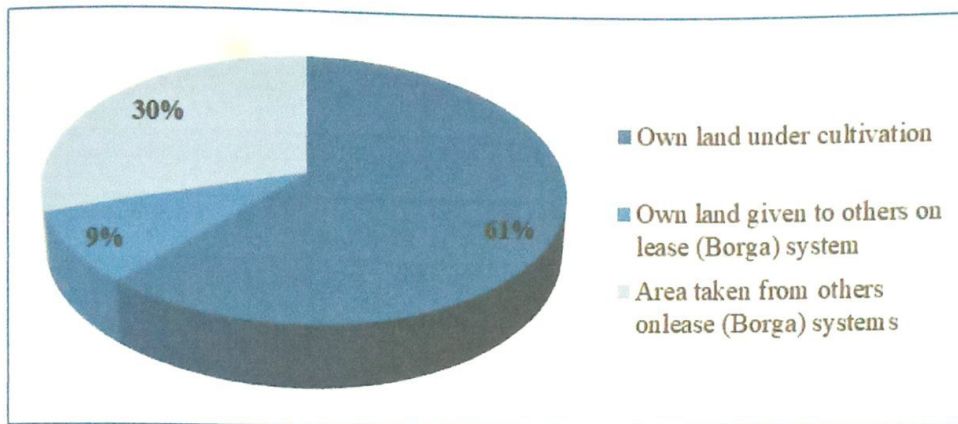
Figure 5.3: Land Tenureship of land holding

(Source: Author calculation from field survey, 2017)

On the other hand, the size of the land is comparatively small. Most of the land (about 70%) is less than 1 acre and 25% land size is more than two acre.
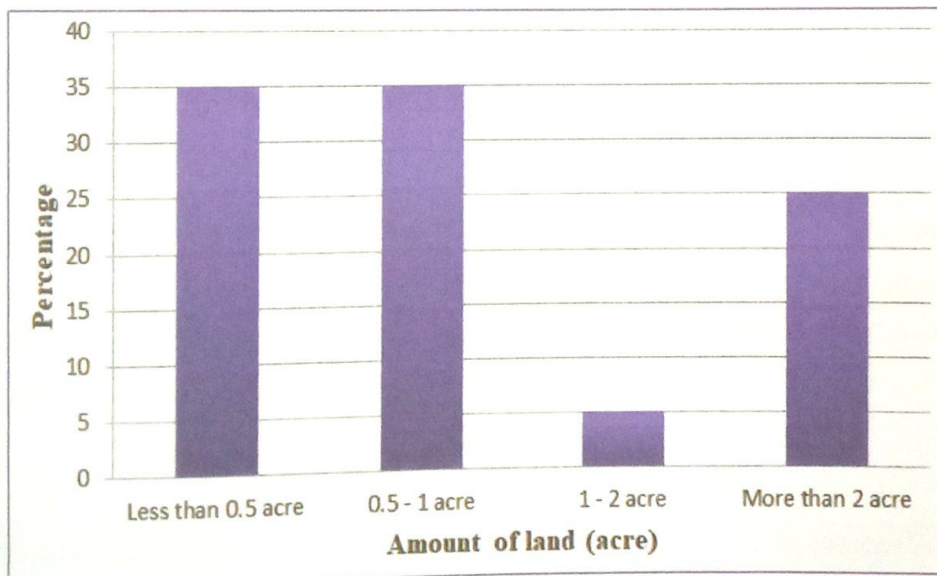
Figure 5.4: Size of land of land holding

(Source: Author calculation from field survey, 2017)

5.3. Present Scenarios of Agroforestry Practice in the study area:

5.3.1. Interest growing for Agroforestry:

Most of the people (60%) got interested from their neighbor of practicing agroforestry. Benefits earning of one inspired others. Some people about 30% got interested from different others source like television program, radio, from people of other areas etc. But there is very

little number of NGOs that work in regard of agroforestry practice and almost no tanning facilities for the common people.
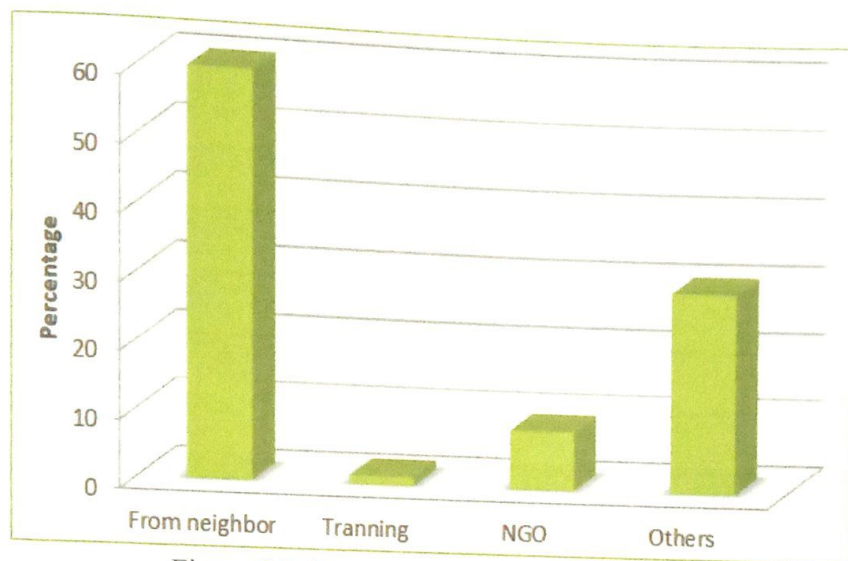
Figure 5.5: Interest growing for Agroforestry

(Source: Author calculation from field survey, 2017)

5.3.2. Benefit from Agroforestry:

People enjoyed different types of benefit by practicing agroforestry in both homestead and cropland. Agroforestry practice provide fuel wood, wood for furniture, different types of fruits, fodder for livestock etc. for house hold consumption as well as selling to market. So, household earned a handsome amount of money every year.

Table 5.2: Yearly Benefit from Agroforestry

Yearly benefit (Tk.)	Frequency	Percentage (%)
<10000	22	27.5
10001-20000	15	18.8
20001-30000	20	25.0
30001-500000	23	28.8

(Source: Author calculation from field survey, 2017)

5.3.3. Economic condition after practicing Agroforestry:

Agroforestry improved the economic condition of the most of the people who practiced it. About 75% respondents accepted that their yearly income increased after practicing

agroforestry and 25% said that income level was almost same or very little change. No one claimed to decrease of income.
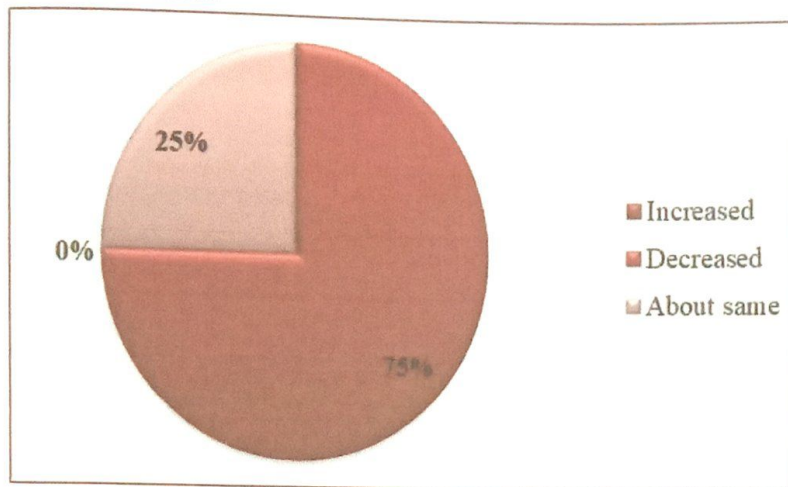
Figure 5.6: Economic condition after practicing agroforestry

(Source: Author calculation from field survey, 2017)

5.3.4. Financial Backup for Agroforestry:

For financial backup of practicing agroforestry, people were largely depended on various kinds of informal source like borrowing from their friends or relatives, local money landers, different micro credit organization etc. About 70% people borrowed money from informal sources and 25% people took loan from formal bank. Only 5% people used their personal savings because saving rate of the household was very low.
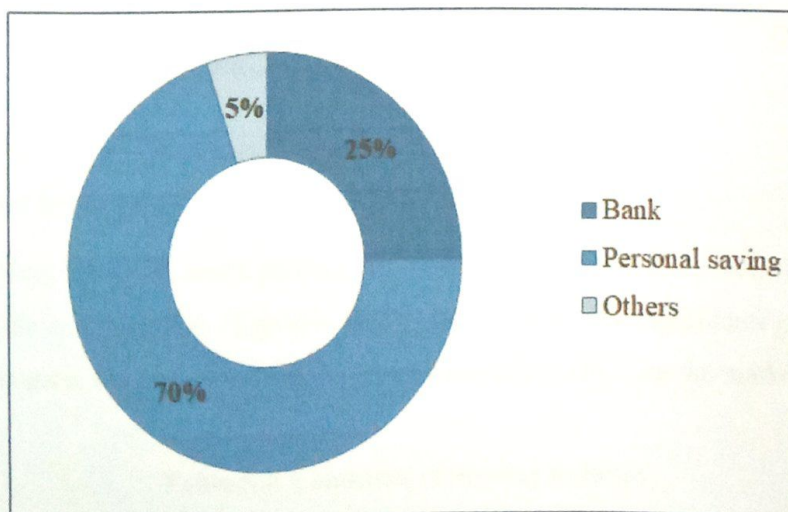
Figure 5.7: Financial Backup for AGF

(Source: Author calculation from field survey, 2017)

5.3.5 Most favorable types of trees:

People prefer different types of trees for homestead and cropland. Homestead agroforestry mainly prefer wood, fodder and fruit trees and fuel, fast-growing, MPTS are favorable for cropland agroforestry.
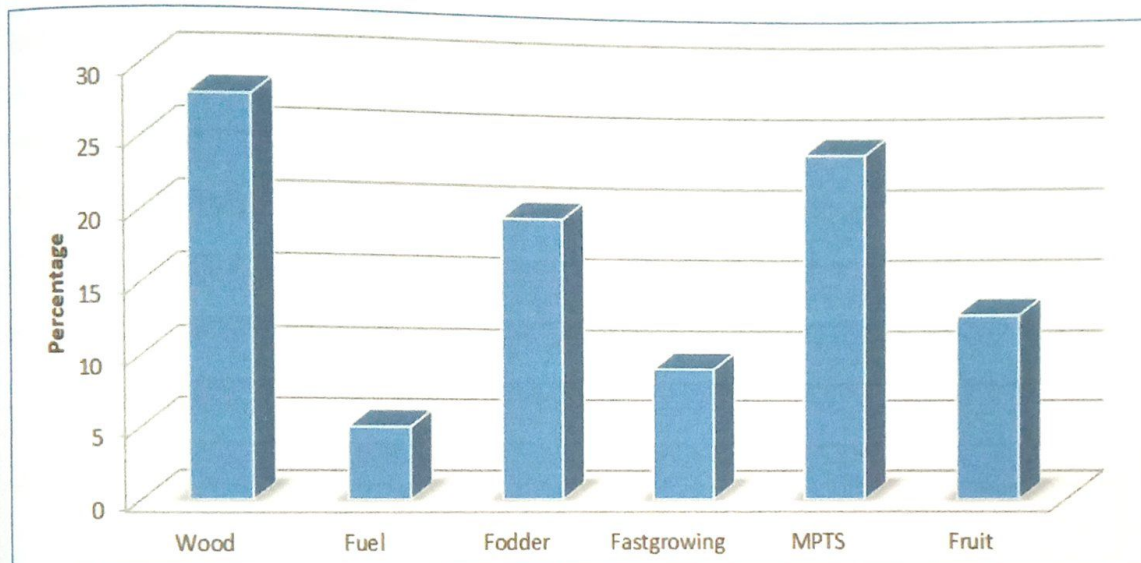
Figure 5.8: Most favorable types of trees

(Source: Author calculation from field survey, 2017)

Figure 5 shows that 28% respondents prefer wood trees, 24.5% prefer MPTS, 19.5% prefer fodder, 13.2 % prefer fruit, 9.3% prefer fast-growing and 5.1% prefer fuel wood trees for practicing agroforestry. Branches and dry leafs of the trees were used in fuel purpose that might reduce the percentage of fuel wood trees.

5.3.6. Market facilities:

Market facilities for agroforestry products were in favorable condition. About 48.8% people agreed that the condition was in good category as well as 32.5% respondents permitted it to excellent category. On the other hand, 18.8% respondents claimed on the market facilities as poor.

Table 5.3: Condition of Market facilities

Parameter	Excellent	Good category	Poor
Percentage (%)	32.5	48.8	18.8

(Source: Author calculation from field survey, 2017)

5.4. Land use system and Type of crops Cultivated in the study area:

The land use systems in the study area include crop production and Horticulture. Agroforestry practices undertaken by farmers in the study area include boundary plantation, mixed cropping etc. (Table-5.4). The annual crops cultivated in the land use system included papaya, banana, Mango, jackfruit, coconut, paddy, jute, sugarcane, wheat, mustard oil seed, potato, supari, maize, betel leaf, masur dal, mug dal, til, brinjal, lal shak, bean, cucumber, onion, corolla, etc. The trees in the land use system included mango, jackfruit, date, coconut tree, mehagani, kul, rain tree, kadam, gamar, sisso, nim, bamboo, etc.

Table 5.4: Types of crops grown in the study area

Type of crops	Percentage of farmers
Annual crops	42.20
Annual crop + Tree	26.50
Annual crop + Pasture	18.25
Annual Crop + Tree + Pasture	12.75

(Source: Author calculation from field survey, 2017)

Table-5.4 presents that about half of the farmers (42.20%) largely depends on annual crop production. In consideration of agroforestry system significant number (26.50%) of user is involved in agri-silvicultural system. Other system is practiced in a limited portion. Most farmers had desire and generally depend on to grow annual crops in order to provide annual household consumption. They also wanted to increase income by incorporating trees. By this study we found that, people are interested in pasture culture (18.25%) with annual crop because immediate high cash return.

Table 5.5: Types of annual crop used in agroforestry practice

Local Name	Scientific Name
Potato	*Solanum tuberosum*
Paddy	*Oryza sativa*
Wheat	*Triticum aestivum*
Masur	*Lens esculenta*
Mustard	*Brassica spp*
Bean	*Lablab purpureus*
Brinjal	*Solanum melongena*
Sugarcane	*Saccharum officinarum*
Jute	*Corchorus olitorius*

5.5. Agroforestry Practice in the study area:

Through the study we found that most of the people learned agroforestry inherently. That is they found the way to practice agroforestry from their superiors. The people of the study area have a tradition of practicing Agroforestry practice; recently their practices have been reinforced by the need for socio-economic and environmental sustainability. Three common Agroforestry types were found in the study area.

A. Homestead Agroforestry practice

B. Cropland Agroforestry Practice

    a. Boundary Plantation

    b. Mixed Cropping

    c. Woodlot

5.5.1. Homestead Agroforestry: The most and widely practiced system of agroforestry in this area is homestead agroforestry. About every home there is home garden. Home gardens, mixed plantings of annual, tree crops and pasture around dwelling area, are a common type of multistory agroforestry system.

Pic- 5.1: Homestead Agroforestry in Kushtia District (Field survey 2017)

Multistory means that there are at least two layers of plants growing to different heights in the system. In home gardens, the lowest level often consists of vegetables or root crops; the second level includes fast-growing trees or crops such as bananas, spices, and cacao; a third higher level may consist of large trees that provide fruit, timber and shade. Home gardens also provide a pleasant shaded living area. Many farmers already grow multipurpose trees in their home gardens for flowers, fruits, and seeds, trees, fish, agricultural crops, cattle, etc. In the study area almost 100% farmers practice home garden traditionally.

5.5.2. Cropland Agroforestry: Cropland Agroforestry combines the production of agricultural crops and trees in the cropland through intercropping. Three cropland Agroforestry types were found in the study area that is described below.

5.5.2.1. Boundary Plantation: Boundary plantations combine perennial, preferably leguminous trees or shrubs grown around an arable crop. Boundary plantations as windbreaks also protect crops. Timber trees planted along boundaries spaced at 6m x 6m or 5m x 5m to reduce excessive shading of annual crops, while for fruits trees 4m x 4m is ideal and trees for fuel wood can be planted at 3m x 3m.

Pic-5.2: Boundary plantation in Kushtia District (Field survey 2017)

Commonly used trees for boundary plantation are Babla, Supari, Date, Coconut, Rain tree, Mahagoni, Palm are grown along field boundaries or bunds of paddy, wheat fields. Babla and Mahagani also have high commercial values. Boundary plantations are so popular in the study area for their benefits.

5.5.2.2. Mixed Cropping: Mixed Cropping constitutes one of the main agricultural land use practice in the study area. Most of the farmers (70%) contain various annual crops, which is commonly referred to as Mixed Cropping system. These farms grow various annual crops, which are simultaneously grown on the same unit plot. In the study area legumes, vegetables along with sugarcane and paddy are the common practice in mixed cropping system.
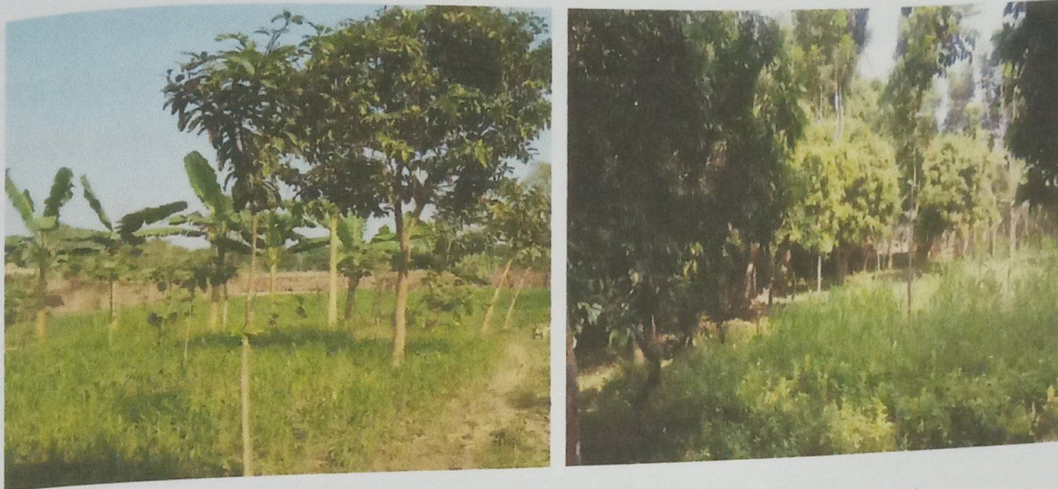
Pic-5.3: Mixed Croping in kushtia district (Field survey 2017)

These farmers have a multi – cropping system and provide farm stability, and he efficiency in the use of land and labor, as well as ensure annual security. Another thing is to be noted that betel-leaf is so much practiced cultivation in Kushtia. Here with it different types of vegetables are cultivated.

5.5.2.3. Woodlot: Woodlot plantation is another most common agroforestry practice in Kushtia district. Woodlot plantation is nothing but the segmentary plantation of commercial trees in the crop land or along with cropland. A wood lot is an Agroforestry practice where multipurpose woody perennials are planted and managed over time to produce fuel wood, poles, and stakes for climbing crops; food and animal components may be integrated into woodlots, especially during the initial establishment phase (Nair, 1993).
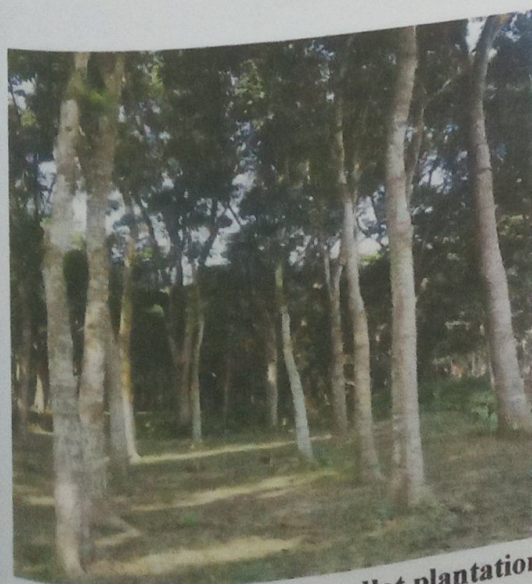
Pic-5.4: Woodlot plantation in Kushtia District (Field survey 2017)

Mainly the MPT's species are preferable in this system. The major woodlot species in Kushtia district are like Mehagani, Rain tree, Babla, Ipilipil, Akashmoni etc. About 41% respondent earlier or are now practicing Woodlot plantation because of its rapid large amount cash return.

Table 5.6: Type of Crops Grown in the study area

Agroforestry Practice	Types of trees	Types of crops	Pasture
Boundary plantation	Khejur, Coconut Akasmoni, Mahagoni, Neem, Rain tree	Paddy, Jute, Wheat, Banana, Halud.	X
Mixed Cropping	Supari, Coconut, Mahagoni, Sajina, Khejur, Jam, Mango,Kamrang, Neem, Jackfruit, etc.	Rice, Maize, Kachu, Halud, Banana, Ginger, Tomatoes, Cabbage and Marich etc.	Cow, Goat, Buffelo, Swan.
Monoculture	X	Aman Paddy, Boro Paddy.	X
Homegarden	Supari, Coconut, Mahagoni, Sajina, Khejur, Mango,Jam, Kamrang, Neem, Jackfruit etc.	Different vegetables.	Cow, Goat, Buffalos, Swan, Duck, Hen, Hogg, Pigeon, Ram etc.
Woodlot	Mahagani, Akashmoni, Sisso, Raintree, etc.	X	X

(Source: Field survey, 2017)

5.6. Farmer's Attitude towards agroforestry:

The results revealed that majority of the farmers had 'favorable' attitude towards agroforestry. The farmers of Kushtia in general had favorable to more favorable attitude towards agroforestry. But they showed slight different attitude in term of homestead and cropland. This attitude is expressed in Likert Scale following.

5.6.1. Homestead: Homestead agroforestry is traditionally practiced system and it has been practicing science a long time ago the farmers are eagerly positive on this. Besides they get different extra benefits from this system like protein, food from cattle, fuel, fodder, vegetables and also cash from these.

Table 5.7: Farmer's Attitude on Agroforestry in Likert Scale (Homestead)

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(Source: Author calculation from field survey, 2017)

For the homestead the farmers of Kushtia district showed so much positive thinking and attitude. About 90% of the farmers strongly agreed with homestead agroforestry.
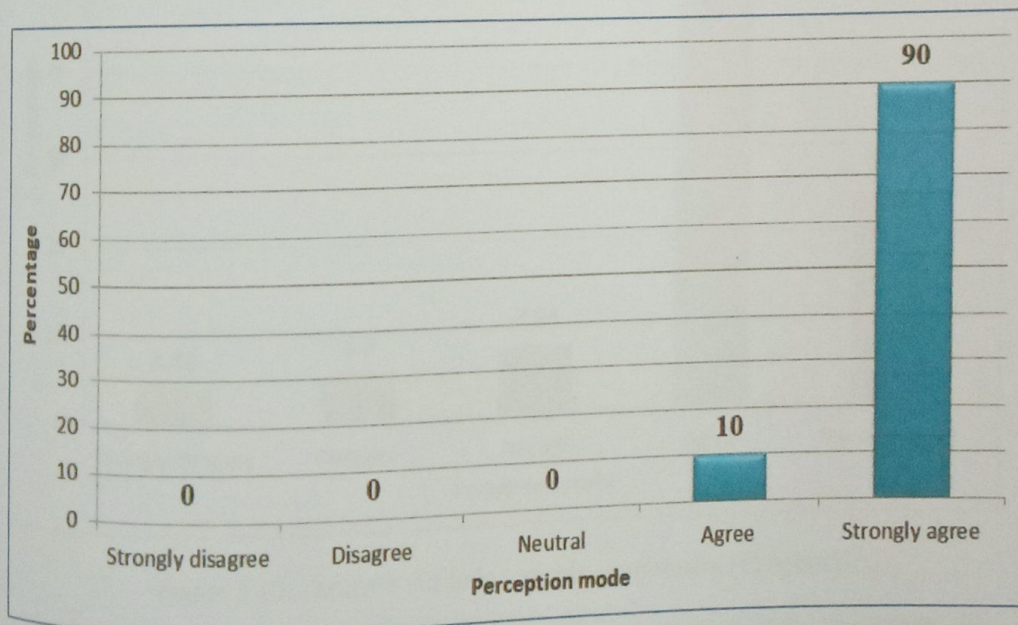
Figure 5.9: Farmer's Attitude towards agroforestry (Homestead)

(Source: Author calculation from field survey, 2017)

5.6.2. Cropland: In our country generally croplands are being used for more likely only for crop cultivation. Trees in cropland are kind of new here. So there might take some more time to acquaint with this type of system.

Table 5.8: Farmer's Attitude on Agroforestry in Likert Scale (Cropland)

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(Source: Author calculation from field survey, 2017)

So For the cropland agroforestry the farmers of Kushtia district showed a little less interest than the homestead. Most of them are quite positive in this regard. They are agreed with this.
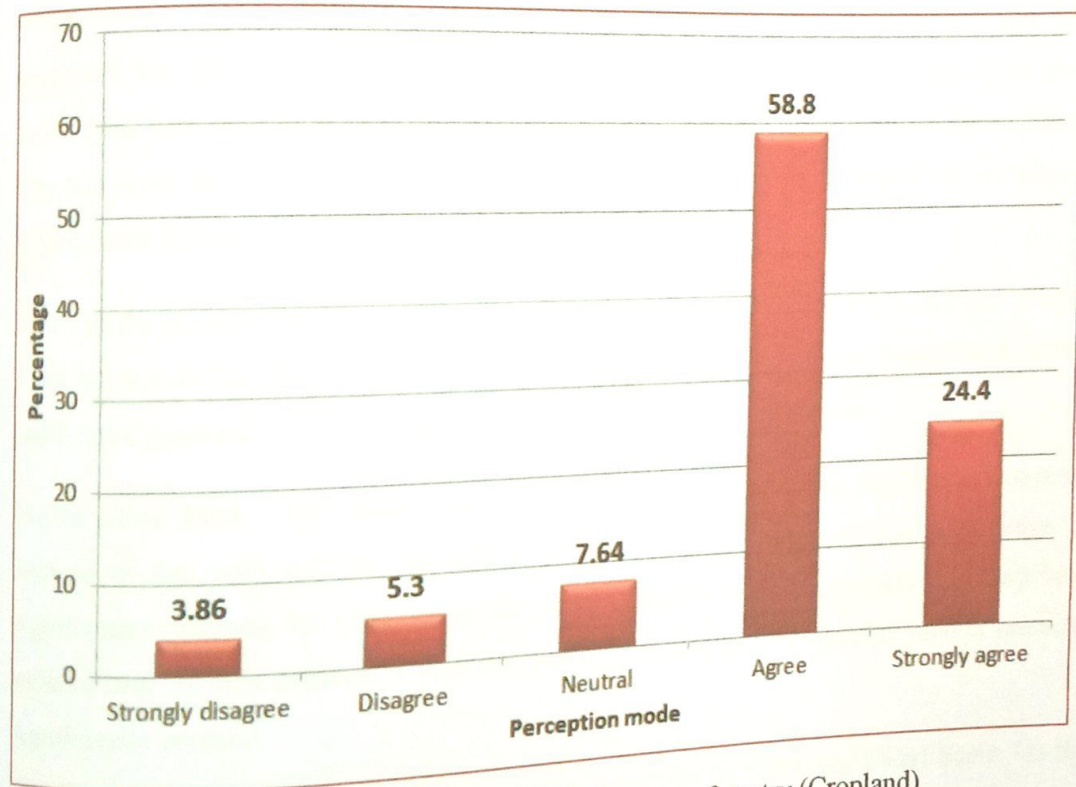
Figure 5.10: Farmer's Attitude towards agroforestry (Cropland)

(Source: Author calculation from field survey, 2017)

From the above graph we find that majority of the respondent (83.2%) are in positive side with agroforestry practice on cropland. But there also exist some disagreement with this. Some of them (9.16%) are not interested in this. 7.64% respondents had no comments in this regard.

5.7. Perception of Farmers on Agroforestry system:

Perception is a way of seeing, understanding and interpreting about something, it is the deeper natural understanding and awareness that usual. In other word, perception is the ability see, hear or understand. In this thesis paper, perception indicates that the farmer's awareness and understanding about the Agroforestry systems in Kushtia district.

Perceptions about Agroforestry in the villages were diverse. The farmers of Kushtia district practices Agroforestry traditionally within their agricultural cropland as well as their homestead. They perceived that the practice is done for their own satisfaction and household consumption. In the study area farmers thinks positively about Agroforestry systems. They perceived that the Agroforestry does not hamper their traditional Agricultural system and it has a great role in managing, space utilization and recreational role. They perceived that the tree has more important role in terms of production. The villagers meet their demands of wood, firewood and other forest products from their village forest.

It can be the good example about the farmer's perception of Agroforestry in Kushtia district. They perceived that the Agroforestry does not hamper their traditional Agricultural system and it has a great role in managing, space utilization and recreational role.

On the other hand a few farmers are not willingly to perceive the Agroforestry systems because of the main reasons are lack of capital, lack of interest, lack of knowledge on Agroforestry systems, long term in profit earning, land of technical assistance, do not have suitable land for this cultivation practice, probability of risks and unstable market price for Agroforestry product.

So ultimately the perception of farmer's can be expressed by following Likert Scale. On the average Likert Scale shows the following **result 4** that is agree.

Table 5.9: Farmer's Perception on Agroforestry in Likert Scale

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

(Source: Author calculation from field survey, 2017)

These results were encouraging, which showed that the farmers were realizing the importance of trees, crop and pasture to meet their demand of protein, timber, fuel wood, fodder

requirements and increase the capital formation. Finally we found majority of farmers 46.48% had shown positive perception about agroforestry.
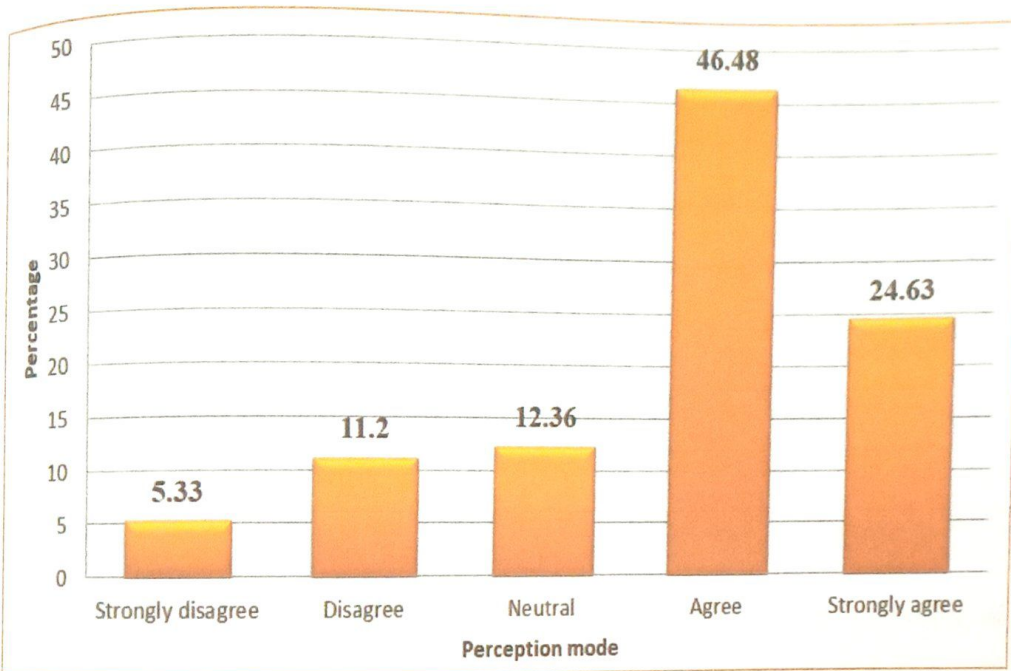
Figure 5.11: Perception of Farmers on Agroforestry system

(Source: Author calculation from field survey, 2017)

The graph shows the perception of the respondents on agroforestry. Here 46.48% respondents are agreed, 24.63% respondents are strongly agreed on agroforestry practices which is positive in position.

On the other hand most of the people are agree with that agroforestry practice increased soil fertility, increased farm income and strongly agree on that agroforestry need help from government and other NGOs. People are also agree on that agroforestry should be adopted in other areas also.
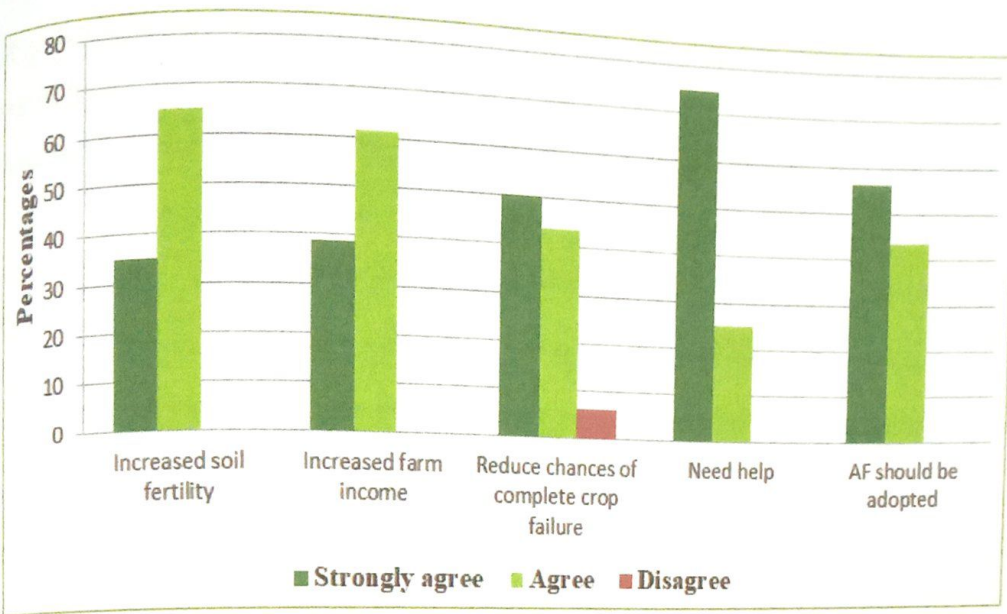
Figure 5.12: Farmers perception on individual category

(Source: Author calculation from field survey, 2017)

5.8. Impact of Trees on Agricultural crops: On the following graph the percentage of farmer's perception on impact of trees on agricultural land are given. Here most of the people (57%) have concept that trees are not harmful in cropland rather it helps to produce quality product. On the other hand 22% people think that trees have significant disturbance on crop which reduce the production and rise possibility for crop failure and pathogenic attack.
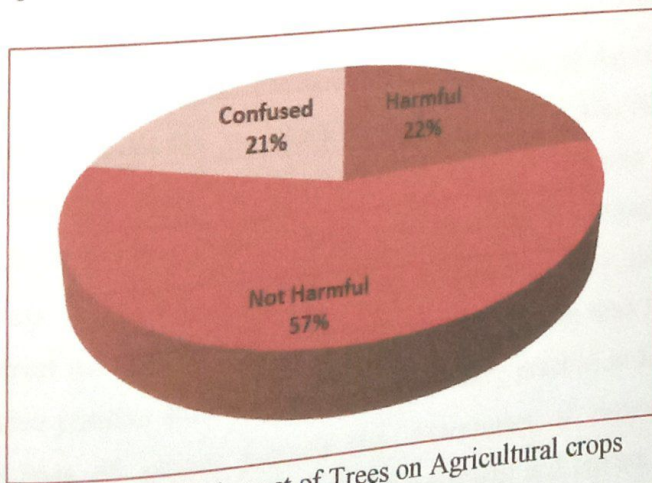
Figure 5.13: Impact of Trees on Agricultural crops

(Source: Author calculation from field survey, 2017)

5.9. Reasons for planting trees on farmlands: Most of the respondents 57% gave reason to grow trees on their farmlands for high cash return from timber, produce fodder for their livestock and fuel wood to grow trees to fulfill their combustion needs, while other respondents gave reasons to meet shelter or shade requirements for their crops and livestock

and timber were also reasons to plant trees. Some also mentioned that trees in farmland also work as living fence which save the crops from destroying by the cattle or other wild animal. These percentages may overlapping because of respondents have multiple reasons.

5.10. Reasons for not planting trees on farmlands: Some of the farmers showed negative effect for planting trees on farmland. They mentioned the following reasons for not planting trees on farmland.

- Tree shade problem
- Possibility of crop failure
- Reduction of crop production
- Pathogenic dispersal
- Reduction of soil quality
- Reduction of soil nutrition
- Management problem
- Leaf fall problem

5.11. Discussion:

The farmers perceived that Agroforestry is more profitable and less risky, that other agricultural options. Aside from the tree species, the advantage of Agroforestry is the early return from non-timber crops that are interplant with the trees and also other main reason for perceived the system because of the multiple benefits the farmers gain from the crop-tree combination. In field survey it was found that the farmers think "Though trees in cropland cause some damage of crops like shade problem, leaf fall problem, nutrition problem; it returns a good smart money together in one time but quite a long time later." Most of the farmers (90%) have positive attitudes towards Agroforestry practice in Kushtia district that supports the findings of various journals (i.e. Assessment of Farmers' Perception of Agroforestry Practices in Jhenaidah District of Bangladesh) and reports (i.e. A case study about the obstacles and opportunities for agroforestry adoption in Babati, Tanzania).

5.12. Problems and suggestion faced by respondents in agroforestry practice:

The respondents were asked to report about the problems, being faced by them in the adoption of agroforestry. Their main responses are mentioned in the following table.

Table 5.10: Problems and suggestions from the respondents

Problems faced by the Respondents	Suggestion by the Respondents
Lack of technical skills	Arranging training
Limited capital	Organizing workshops
Improper technical assistance	Providing technical assistance
Lack of co-ordination of GO's and NGO's	Provide easy loan
Marketing and transportation facilities	Co-operation of the Agricultural officer
Lack of proper planning	Publicity in mass media
Sometimes irrigation problem	Proper water management

Chapter 6: Conclusion and Recommendations

6.1. Conclusion:

Agroforestry is becoming popular in Kushtia district. Gradually here the farmers are adopting agroforestry widely. There are wide spread practice of Agroforestry in Kushtia district. Farmers have adopted agroforestry in large scale because of high income, suitable use of land and space, erosion control and protection, crop diversification and risk reduction.

Since the findings of the study pointed out that there is a scope for improving the perception level and creating more favorable attitude of farmers towards agroforestry, development functionaries can intensify their efforts to achieve the increased perception and attitude level of farmers. It was found that there was a big gap in full adoption of all recommended agroforestry practices. In order to bridge this, development agencies should further intensify the extension activities to motivate and adopt all the practices. The agroforestry has brought improvement in socio-economic and ecological conditions of farmers by generating employment, increasing family income, enhancing the crop diversity and reducing dependency on natural forest. Therefore, development agencies can use the success story of agroforestry to stimulate other farmers to attain both natural resource and socio-economic sustainability.

Agroforestry is an integrated approach of using the interactive benefits from combining agricultural and forestry technologies to create productive, profitable, and sustainable land-use systems.

Agroforestry is becoming popular in Kushtia district. Middle aged farmers (26-35) (42.5%) are interested in Agroforestry practice than traditional practice. The adoption of Younger (18-25) 6.3% farmers are increasing day by day, since they have had more schooling than the older generation or perhaps have been exposed to new ideas as migrant. Primary studied people (24%) are the major portion of the area. But others who studied more have better interest in agroforestry. The farmers (30%, they taken lease from other people) who have no own land they are not interested in Agroforestry. Paddy, Coconut tree, supari are the best combination. Above 83.2% respondents have taken positively agroforestry practice, but they have not got enough training skill or facility but just inherit idea from the superior. If they get this facility, they are more interested in agroforestry practice. Finally we have found that most of the farmer's (90%) have positive attitude towards Agroforestry. So there should

create more facility, encouraging program and convenient environment for agroforestry system by the Govt. as well as NGO.

6.2. Recommendations:

From the direct observations of the field survey the following recommendation can be followed-

- ➢ Create awareness in the target audience about agroforestry technologies showing short stage drama, documentary etc. live and through mass media.
- ➢ Government and non-Government organizations should come forward with Agroforestry development programs through field visiting and providing technical assistance.
- ➢ Different training and workshops are needed to be arranged regarding agroforestry
- ➢ There should generate well accepted easy interest-free loan for the farmers.

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Appendix

Questionnaire for field survey
Farmer's Perception and Attitude toward Agroforestry in Kushtia District

(Only for research purpose)

Date:

Survey no:

Part-A

General Information about the respondent:

1. Name of the respondent:

2. Age of the respondent:

3. Union of the respondent:

4. Thana of the respondent:

5. Demographic and socio economic profile:

Age	Sex	Educational status	Family member	Income(Yr) cropland Tk.	Income(Yr) Homestead Tk.	Expenditure(Yr) Tk.	Saving

Part-B

1. Size of farm:

2. Types of the farmland:

   a) Own land under cultivation
   b) Own land given to others on lease (Borga) system
   c) Area taken from others on lease (Borga) systems
   d) Area given to other on lease
   e) Cultivated area taken as lease from others

3. Does he practice AGF?

a) Yes   b) No

If yes, Why?

Ans.

5. From where he got Interested in AGF?

   a. By article
   b. From neighbor   c. Tanning
                                                d. NGO

6. Does he get any support from NGO or Govt.?

   a) Yes   b) No

7. Is it beneficial for your family?

   a) Yes   b) No

8. What are the components AGF you practice?

Ans.

9. Types of Agro forestry practices:

   a) Homestead   b) Cropland agroforestry

10. Benefit from the farm:

   a) Homestead:

   b) Cropland:

11. What are reasons for planting trees on your farmland?

Ans.

12. Per year benefit from AGF?

Wood	Fuel	Fodder	Crop	Cattle	Fruit

13. What type of crop(s) do you grow?

Wood	Fuel	Fodder	Fast growing	MPTS	Fruit

14. Financial Backup for AGF:

   a. Bank   C. Personal saving

   b. Money lender   d. Others

Part-C

1. Attitudes of Agroforestry (By using Likert scale):

a) Attitudes of Agroforestry (homestead):

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

b) Attitudes of Agroforestry (Cropland):

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

c) Perception in Agroforestry:

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

1	2	3	4	5

d) Impact of trees in Agroforestry :

Strongly disagree	Dsagree	Neutral	Agree	Strongly agree
1	2	3	4	5

2. Do you have any change level of income before and after adoption of Agroforestry?

    a. Increase   b. Decrease   c. About the same

3. Perception in Agroforestry:

	Agree	Strongly agree	Disagree
Increased soil fertility			
Increased farm income			
Reduce chances of complete crop failure			
Maintain or improved surrounding condition			
AF should be adopted in your locality			

4. Market facilities: Excellent/ Good category /Poor

5. Did you face any problem to make new agro-forestry practice?

        a. Yes   b. No

if yes, What kinds of problem did you face? (List them)

Ans.

6.Do you have any suggestion for developing Agroforestry practice?
7.Ans.