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**Title:** Farmer's attitude and perception towards agroforestry at Kaligonj Upazila in Satkhira District

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**Farmer's attitude and perception towards  
agroforestry at Kaligonj Upazila  
in Satkhira district.**



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**Khulna**  
**2015**

**Farmer's attitude and perception towards agroforestry at Kaligonj  
Upazila in Satkhira district**

**COURSE TITLE: PROJECT THESIS  
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## **Declaration**

I, Nurunnahar, declare that this project thesis is a result of my own independent work except for quotations and citations and it has not been previously or concurrently submitted or accepted for any other degree at Khulna University or other institutions.

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Signature :

**(Nurunnahar)**

## **Dedication**

Dedicated

To

My beloved parents

And

To my husband

And

To my sweet son

**Who have raised and helped me to complete the study**

## ACKNOWLEDGEMENT

First of all, I am very grateful to Almighty Allah who has enable me to accomplish the project thesis work successfully in due time with sound condition.

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**Nurunnahar**

## Abstract

This paper presents an overview of the different types of agroforestry practiced and farmer's perception and attitudes towards it at Kaligonj upazila in Satkhira district. Bangladesh is a densely populated agricultural country in the world. Its total land area is about 56,977 square miles. So the population density of Bangladesh is very high. Agroforestry, now considered as a sustainable agricultural system, is being widely promoted all over the world especially in Bangladesh. In study area agroforestry is widely used and for this purpose that area was selected. A survey was conducted at the Kaligonj Upazilla in Satkhira district to collect information about what types of agroforestry is practicing here and what about the perception and attitudes of farmers towards it. In study area different types of agroforestry is practiced in which homestead agroforestry, cropland agroforestry and fish farm agroforestry are the main. 104 farmers were selected to carry out the study. The survey was conducted during June-September, 2016. Majority of the farmers were middle aged (36-50) and there percentage is 54%. Most of the farmers 56% were educated to the primary level. Mostly the farmers (70%) have own land and they practiced agroforestry, but the farmers (12%) who taken leased land from other are not practicing it. Majority of farmers 38% had shown positive perception (agree) and 36% strongly agreed about agroforestry. 98% farmers have positive attitude towards homestead agroforestry, 66% farmers have positive attitude towards Cropland agroforestry and 82% for fish farm agroforestry.

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## Chapter one

### Introduction

#### 1.1. Background of the study

Bangladesh is a densely populated agricultural country in the world. Its total land area is about 56,977 square miles. Its population is about 16 cores 9 lucks 96 thousands. The density of population is about 1063 per square kilometer. The per capita income is \$ 1466 (BBS, 2016).

The percentage of forest cover in Bangladesh in relation to total land area is 11.1%; the area of forestland is 14420 sq km (The world factbook, 2016). Bangladesh Forest Department (BFD) manages 1.53 million hectares of forestland (Roy, 2004). Agriculture is the largest employment sector in Bangladesh. As of 2016, it employs 47% of the total labor force and comprises 16.33% of the country's GDP. Bangladesh has total agricultural land is about 70.1% of the total land, arable land 59%, permanent crops 6.5%, permanent pasture 4.6% (The world factbook, 2016).

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. Hence, scientific and proper utilization of every inches of land is very much essential for national interest. 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. Agroforestry is a sustainable management system for land that increases total production; combine agricultural crops, tree crops, forests plants and animals. Agroforestry 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 a sustainable management system for land that increases total production combines agricultural crops, tree crops, forests plants and / or animals. The forests of Bangladesh are too small to meet the demands of timber and firewood and to keep

the sustainable environment at present. So, to meet the increasing demand of forest products and to save the environment and ecological balance, agroforestry can be an important system. It is very essential for Bangladesh to increase the forest resources through agroforestry system. We should solve all problems related to Agroforestry practice (Nair, P.K.R., 2006).

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)

So ultimately agroforestry can be a great solution. 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

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 Satkhira 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. But there are some problems also which remain on the way of adoption agroforestry largely.

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

Land is the most valuable and scarce resource in the country. The per capita land holding is very merge. Faced with increasing rates of deforestation, and the attendant problems of loss of biodiversity and other socio-environmental costs, the issue of conservation and rational management of forests became an important item on the agenda of many national and international organizations. In recent years forest management practices have shifted from an emphasis on maximizing yield to maximize sustainability through increased participation of local forest Communities, conserving biodiversity, and maintaining forest-based ecosystem services (BFD, 2011).

The area of Bangladesh is very small in comparable to population. So, increasing people create new pressure on the various limited resources like forest and land resources. People build houses, roads, industry and other infrastructures by converting the agricultural and forestlands to fulfill their needs. Men also convert forestland to agricultural land and for other purposes. So forests are destructed and the environment is degraded. But it is very important to protect and increase our forest cover to retain our existence on earth.

So there is no scope to increase the forestland and agricultural land. In these circumstances, traditional land use pattern should be converted into sustainable land uses. Agroforestry is one of such land uses. By increasing the amount of this system we can increase the amount of forest and also help to reduce the pressure on natural forest to fulfill forest related needs such as timber, fuel wood, fodder etc. Considering all of these it is very essential for Bangladesh to increase the forest resources through agroforestry. But for introducing large amount agroforestry and new technology we have to know the attitudes and perception of farmers about agroforestry. Kaligonj upazilla of Satkhira is an important area of Bangladesh where the practice of agroforestry and fish farm are most extensive and the area is suitable for these practices. So, to know the attitudes and perception of farmers about agroforestry and to find the problems responsible for not adopting, this study is essential.

### **1.3. Objectives of the study:**

- To identify the major Agroforestry practices at Kaligonj upazila in Satkhira district.
- To know farmer's attitude (intention or view point) and perception (realization or appreciation) about agroforestry practice.

## Chapter two

### Literature review

#### 2.1. Concept of agroforestry

Trees play a very important role in ecosystem and provide a range of products and services to rural and urban people. But now-a-days natural vegetation is cut for agriculture and other types of development due to the increased population. So the benefits that trees provide are best sustained by integrating trees into agricultural system generally this practice known as agroforestry.

Agroforestry is the art and science of growing woody and non-woody plants together on the same unit of land for range of benefits.

#### 2.2. Definitions of Agroforestry

Agroforestry is a very efficient land use system in which agricultural crops, forest trees and / or animals are produced in the same unit of land at the same time. It is a part of social forestry.

Many scientists define 'agroforestry' from various directions. Some important definitions are referred here.

Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components (Lundgren and Raintree, 1982).

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.

Young (1989) defines agroforestry as a collective name for land use system in which woody perennials (trees, shrubs etc.) are grown in association with herbaceous plants (crops, pastures) and /or livestock in a spatial arrangement, a rotation or both and in which there are both ecological and economic interactions between the tree and non-tree components of the system.

GOI (2001) defined agroforestry as "a sustainable management system for land that increases overall production, combines agricultural crops, tree crops and forest plants and or animals simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of local population". World Agroforestry Centre (ICRAF) defined, "Agroforestry is a dynamic ecologically based, natural resource management system that through

the integration of trees in farm and rangeland, diversifies and sustains small holder production for increased social, economic and environmental benefits.”

Agroforestry is a form of multiple cropping which satisfies three basic conditions:

- There exists at least two plant species that interact biologically,
- At least one of the plant species is a woody perennial, and
- At least one of the plant species is managed for forage, annual or perennial crop production.

Summarizing, agroforestry is a land management system with a woody perennial as one of the components. It optimizes land productivity by involving positive interactions between its components in time and space.

### **2.3. Historical development of agroforestry in Bangladesh**

The historical development of Agroforestry in Bangladesh is mentioned here -

Betagi-pomora community forestry project (1979): This was the first agroforestry program started by the Forest department under social forestry program. Betagi and pomora are the two villages of Rangunia Thana of Chittagong district. These were two denuded ( devoid of trees ) hills where the Govt. rehabilitated 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 with the participation of 70 families of Betagi village in 1979. Then it was expanded in Pomora village in khas land and protected forest land. Then 235 families 83 in Betagi and 152 in Pomora village have been rehabilitated in these two villages.

In mid 80s on farm research division (OFRD) in BARI was established where agroforestry as a land use system were evaluated and its potential and essentiality in our farming system has been judged.

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

In 1988, the institute of forestry in Chittagong University 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) were initiated under the guidance of Prof. Abdul Haque (The professor of Crops Botany) with financial assistance of Swiss Agency for Development and Cooperation (SDC). This program deals with the exploration of feasibility of implementing of agroforestry works in different areas in to the country. This program actually helped in establishing Agroforestry department in the Bangladesh Agricultural University.

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

In 1990, Department of Agroforestry and Environment in IPSA was established now Banghabondhu Sheikh MujibarRahman Agricultural University (BSMRAU) 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 students of the faculty of Agriculture, the agroforestry movement gained momentum. In the newly established department he (Prof. AbdulHaque) was the founder head.

In 1997, the National Agroforestry Working Group was formed by the active initiation of the personnel engaged in the Bangladesh Agricultural Research Council (BRAC).

In 1998, first National Agroforestry Workshop was held at BRAC organized by NAWG during 21-25 June. (Mirza Hassanuzzaman, 2009)

The history of agroforestry intimately associated with the practice of shifting cultivation and taungua system.

### **2.3.1. Shifting cultivation**

The term shifting cultivation refers to farming or agricultural systems in which land under natural vegetation is cleared, cropped with agricultural crops for a few years, and then left untended while the natural vegetation regenerates. The cultivation phase is usually short (2-3 years), but the regeneration phase, known as the fallow or bush fallow phase, is much longer (traditionally 10-20 years). The clearing is usually accomplished by the slash-and-burn method (hence the name slash-and-burn agriculture), employing simple hand tools. Useful trees and shrubs are left standing, and are sometimes lightly pruned, other trees and shrubs are pruned down to stumps of varying height to facilitate fast regeneration and support for climbing species that require staking. The lengths of the cropping and fallow phases vary considerably, the former being more variable; usually the fallow phase is several times longer than the cropping phase. The length of the fallow phase is considered critical to the success and sustainability of the practice. During this period the soil, having been depleted of its fertility during the cropping period, regains its fertility through the regenerative action of the woody vegetation (Mirza Hassanuzzaman, 2009).

### **2.3.2. Tangua system**

In Burmese, 'taung' means hill and 'ya' means cultivation. So the word taungua means hill cultivation. The Taungya system in the tropics is, like shifting cultivation, a forerunner to

agroforestry. The taungya system consists of growing annual agricultural crops along with the forestry species during the early years of establishment of the forestry plantation. The land belongs to the forestry departments or their large scale lessees, who allow the subsistence farmers to raise their crops. The farmers are required to tend the forestry seedlings and, in return, retain a part or all of the agricultural produce. This agreement would last for two or three years, during which time the forestry species would grow and expand its canopy. Usually during this period the soil fertility declines, some soil is lost to erosion, and weeds infest the area, thus making crop production nonremunerative, if not impossible (Mirza Hassanuzzaman, 2009).

#### **2.4. The characteristics of agroforestry**

- Multiple plant components.
- A high level of interaction between woody and non-woody component.
- Usually multiple products, often of different categories (e.g. food, fodder, fuel wood).
- The cycle of agroforestry is usually more than one.
- More complex than monoculture. (Mirza Hassanuzzaman, 2009).

#### **2.5. Features of agroforestry**

Agroforestry practices are intentional systematic combinations of trees with crops and/or livestock that involve intensive management of the interactions between the components as an integrated agro ecosystem. These key features are the essence of agroforestry and are what distinguish it from other farming or forestry practices. To be called agroforestry, a land-use practice must satisfy following criteria:

- **Intentional:** Combinations of trees, crops and/or animals are intentionally designed and managed as a whole unit, rather than as individual elements that may occur in close proximity but are controlled separately.
- **Intensive:** Agroforestry practices are intensively managed to maintain their productive and protective functions; these practices often involve annual operations such as cultivation and fertilization.
- **Interactive:** Agroforestry management seeks to actively manipulate the biological and physical interactions between the tree, crop and animal components. The goal is to enhance the production of more than one harvestable component at a time, while also providing conservation benefits such as non-point source water pollution control or wildlife habitat.
- **Integrated:** The tree, crop and/or animal components are structurally and functionally combined into a single, integrated management unit. Integration may be horizontal or



vertical, and above or below ground. Such integration utilizes more of the productive capacity of the land and helps balance economic production with resource conservation. (Mirza Hassanuzzaman, 2009).

## 2.6. Component of agroforestry

Agroforestry has mainly three components. They are –

- Trees
- Crops
- Animals

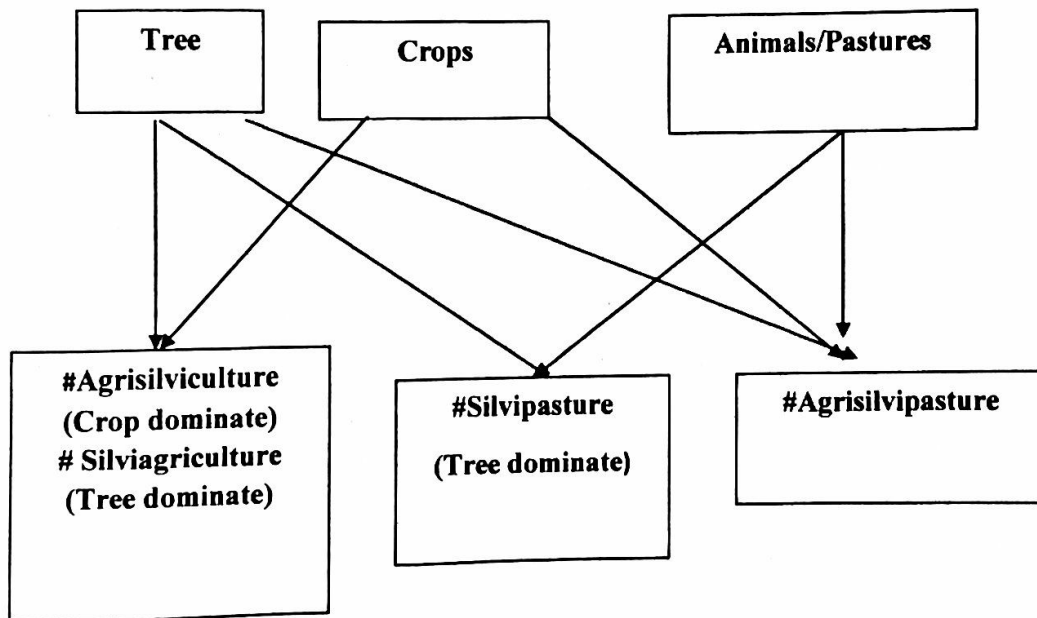


Fig:-2.1: Components of Agroforestry. (Hassanuzzaman, 2009)

### 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 rainfed 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 Silvopasture system. The trees and shrubs may be used primarily to produce fodder for livestock or they may be grown for timber, fuelwood, and fruit or to improve the soil. (Anon, 2008)

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

- Protein bank
- Live fence of fodder trees and hedges
- Trees and shrubs on pasture

### **a) Protein bank:**

In this Silvopastoral system, various multipurpose trees (protein rich trees) are planted in or around farmlands and range lands for cut and carry fodder production to meet the feed requirement of livestock during the fodder deficit period in winter. (Anon, 2008)

Example: *Acacia nilotica*, *Albizialebbeck*, *Azadirachta indica*, *Leucaenaleucocephala*, *Gliricidiasepium*, *Sesbania grandiflora*

### **b) Livefence of fodder trees and hedges:**

In this system, various fodder trees and hedges are planted as live fence to protect the property from stray animals or other biotic influences. (Anon, 2008)

Example: *Gliricidiasepium*, *Sesbania grandiflora*, *Erythrinasp*, *Acacia sp.*

### **c) Trees and shrubs on pasture:**

In this system, various tree and shrub species are scattered irregularly or arranged according to some systemic pattern to supplement forage production. (Anon, 2008)

Example: *Acacia nilotica*, *Acacia leucophloea*, *Tamarindus indica*, *Azadirachta indica*.

### **III) Agrosilvopastoral Systems**

The production of woody perennials combined with annuals and pastures is referred Agrisilvopastoral 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

#### **a) Home gardens**

This system is found extensively in high rainfall areas in tropical South and South east Asia. This practice finds expression in the states of Kerala and Tamil Nadu with humid tropical climates where coconut is the main crop. Many species of trees, bushes, vegetables and other herbaceous plants are grown in dense and in random or spatial and temporal arrangements. Most home gardens also support a variety of animals. Fodder grass and legumes are also grown to meet the fodder requirement of cattle. In India, every homestead has around 0.20 to 0.50 ha land for personal production. (Anon, 2008)

Home gardens represent land use systems involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and livestock within the compounds of individual houses. The whole tree- crop- animal units are being intensively managed by family labour. Home gardens can also be called as Multitier system or Multitier cropping. Home gardens are highly productive, sustainable and very practicable. Food production is primary function of most home gardens. (Anon, 2008)

#### **b) Woody Hedgerows:**

In this system various woody hedges, especially fast growing and coppicing fodder shrubs and trees are planted for the purpose of browse, mulch, green manure, soil conservation etc. The following species viz., *Erythrina* sp., *Leucaena leucocephala*, *Sesbania grandiflora* are generally used.

### **2.7. Attributes of agroforestry**

Additionally, there are three attributes which, theoretically, all agroforestry systems possess. These are:

- 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. These attributes are so characteristic of all agroforestry systems that they form the basis for evaluation of various agroforestry systems. (Hassanuzzaman, 2009)

## **2.8. The advantages of agroforestry**

Agroforestry provides a different land use option, compared with traditional arable and forestry systems. It makes use of both trees and crops, so that the available resources can be more effectively used. It is a practice that respects the environment and has an obvious landscape benefit. The agroforestry plot remains productive for the farmer and generates continuous revenue, which is not the case when arable land is exclusively reforested. Agroforestry allows for the diversification of farm activity and makes better use of environmental resources. Agroforestry has interesting advantages from three different perspectives. (Tewari, 2008)

### **2.8.1. From the arable perspective**

- Diversification of the activities of arable farmers, with the building-up of an inheritance of valuable trees, without disrupting the revenue from those plots which have been planted.
- Protection of intercrops and animals by the trees, which have a windbreak effect, providing shelter from the sun, from the rain, from the wind, holding the soil in place, and stimulating soil micro fauna and micro flora.
- Recovery of some of the leached or drained nutrients by the deep roots of the trees; enrichment of the soil organic matter by tree litter and by the dead roots of the trees.
- Possibility of combining the interest of the owner (for an inheritance of wood) and the farm (for access to cultivated land). Possible remuneration for the arable farmer for looking after the trees.

- An alternative to full reforestation of arable land, permitting the continuation of arable activity on land whose arable potential is therefore conserved. The tree component can be reversed, the plot stays "clean" (free from scrub) and is easy to dustup when the trees are clear felled (the stumps are in lines and few in number).
- In silvopastoral plots, fodder units can be available at different dates compared to full cropped plots, extending the grazing calendar.
- Increase the production by increasing pollination. Because trees are attractive to different birds and insects. (Tewari, 2008)

### **2.8.2. From the forestry perspective**

- Acceleration of the diameter growth of the trees by wide spacing (+80% over 6 years in the majority of the experimental plantations). Reduction of the capital cost of the plantation, by reducing the number of trees planted with no commercial future. A large reduction in the maintenance costs of the plantation, due to the presence of the intercrops.
- Improvement in the quality of wood produced (wide regular rings, suited to the needs of industry), because the trees are not subjected to cycles of competition and thinning.
- Guaranteed follow-up and tree care due to the arable intercropping activity. In particular, protection against the risk of fire in susceptible areas, with pastoralism or with intercrops like vine or winter cereals (clear bare ground in summer after stubble ploughing).
- Agroforestry plantations on arable land allow the development of a quality wood resource that complements, rather than competes with, the products from traditionally exploited forests. It is especially important to produce wood that can substitute for tropical saw logs, which will soon decline in availability and quality. The areas concerned will remain small in terms of their absolute value, but the production of wood from them could become a critical input to the European wood supply network. Tree species that are little used in forestry, but are of high value, could be grown in agroforestry systems. (Tewari, 2008)

### **2.8.3. From the environmental perspective**

- Improvement to the development of natural resources: the total wood and arable production from an agroforestry plot is greater than the separate production obtained by an arable-forest separate cropping pattern on the same area of land. Weeds, which are spontaneously present in young forestry plantations are replaced by harvested crops or pasture so maintenance is less costly and environmental resources are better used.
- Better control of cultivated areas of land: by substituting for arable plots, the agroforestry plots contribute to diminishing the cultivated area of land. The intensification of environmental resource use by agroforestry systems is not resulting in more crop products.

- Creation of original landscapes that are attractive, open and favoure recreational activities: Agroforestry plots have a truly innovative landscaping potential, and would improve the public image of farmers to society. This will be particularly the case in very sparsely wooded areas, where plots are developed by planting arable land, and in very heavily wooded areas, where plots are developed by thinning the existing forest.
- Counteract the greenhouse effect: constitution of an effective system for carbon sequestration, by combining the maintenance of the stock of organic material in the soil (the case especially with meadows), and the superimposition of a net fixing wooded layer.
- Protection of soil and water: reduce soil erosion, increase nutrient quantity, reduce temperature, and conserve the water level into the soil, increase nitrogen fixation, nutrient recycling etc. in particular in sensitive areas.
- Improvement of biodiversity: agroforestry improves the biodiversity especially by the abundance of "edge effects". This in particular, permits a synergistic improvement, by favoring the habitat of game. The integrated protection of crops by their association with trees, chosen to stimulate the hyper parasites (parasites of parasites) population of crops, is a promising way forwards.
- Reduce the destructive effect of natural calamities: It reduce the speed of cyclone, storm or other calamities that destroy the crops and house. (Tewari, 2008)

#### **2.8.4. From the socio-economic perspective**

- It improves the living standard of the rural poor people by increasing their income.
- It-improves the nutrition and health of the people due to quality and diversity of food.
- Increases the cooperation among the people. (Tewari, 2008)

### **2.9. Limitations of agroforestry**

#### **2.9.1. 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. (Hassanuzzaman, 2009)

### **2.9.2. Socio-economic aspect**

- Agroforestry is more complex practice.
- Required more labour inputs.
- Longer period required to get maturity of trees.
- Competition between trees and crops may reduce the production and thus income. (Hassanuzzaman, 2009)

## **2.10. Classifications of agroforestry:**

Nair (1985) classified the agroforestry systems on the basis of structure, function, socioeconomic and ecological status as the following.

### **2.10.1. Structural classification**

Structure refers to composition, stratification and dimension of the crop. On the basis of structure, Agroforestry systems classified into two categories:

- Nature of components
- Arrangement of components.

The classification of the agroforestry systems on the basis of the nature of composition is widely recognized and several workers have classified agroforestry systems on basis of composition into the followings -

- Agrisilvicultural systems.
- Silvopastoral systems.
- Agrosilvopastoral systems and
- Multipurpose tree plantation systems or other systems.

#### **2.10.1.1. Agrisilvicultural systems:**

The production system of agricultural crops and forests trees in the same land at the same time is called agrisilvicultural system.

### **2.10.1.2. Silvopastoral systems**

The silvopastoral system means a land management system in which forests are managed for the production of wood as well as for rearing of domesticated animals.

### **2.10.1.3. Agrosilvopastoral systems**

In this system, agricultural crops, trees are produced with animals in the same piece of land. For examples, the Aman paddy is grown in the mango garden in Rajshahi and Dinajpur. After harvesting the paddy, the people sowed the kolai for fodder and their cattle are grazed in this garden. This system is a combination of the agrisilviculture and silvopasture systems.

### **2.10.1.4. Multipurpose tree plantation systems**

The system in which forest tree species are produced and managed to produce not only wood but also leaves and/or fruits that are suitable for food and / or fodder.

## **2.10.2. Functional classification**

Agroforestry system produce not only various products but also perform various functions.

According to these functions, agroforestry can be classified as the following.

- Productive agroforestry systems
- Protective agroforestry systems
- Multipurpose agroforestry

## **2.10.3. Socioeconomic basis**

It refers to the level of inputs of management (low input, high input) or intensity or scale of management and commercial goals. Based on this agroforestry can be classified into

- Subsistence
- Commercial
- Intermediate

## **2.10.4. Ecological basis**

It refers to the environmental condition and ecological suitability of systems, based on the assumption that certain types of systems can be more appropriate for certain ecological conditions; i.e., there can be separate sets of agroforestry systems for arid and semiarid lands, tropical highlands, lowland humid tropics, etc. The agroforestry systems on the basis of climate may be as the following types



- Tropical
- Subtropical
- Temperate
- Sub-alpine and alpine

On the basis of moisture condition, each of these groups can be subdivided into the followings-

- Wet
- Moist and
- Dry

## **2.11. Agroforestry systems in Bangladesh**

Agro forestry systems can broadly be categorized into two major types.

- Farm land Agro forestry
- Forest based Agro forestry

### **2.11.1. Farmland Agro forestry:**

It is subdivided into three types.

- Homestead Agro forestry
- Cropland Agro forestry
- Commercial crop under shade tree.

#### **2.11.1.1. Homestead Agroforestry:**

Homestead agroforestry consisting of an assemblage of plants which includes trees, shrubs, and herbaceous plants, growing in or adjacent to a homestead or home compound, has a long tradition in the study site. These are planted and maintained by members of the household with their products intended primarily for household consumption; they have considerable ornamental value and provide shade to people and animals. (Sourovi ,Z, Salah Uddin. S, and Masato.k, 2010)

#### **2.11.1.2. Cropland Agroforestry:**

The innovative peasant on their land through informal research; trial and error basis has developed Cropland Agroforestry. The cropping pattern and choice of species varies in different Agro-ecological zones of the country.

#### **2.11.1.3. Commercial crop under shade tree:**

Commercial crop means the crop which has economic importance. In Agroforestry system commercial crop refers to tea (*Camellia sinensis*) where tea cultivation is practiced under shade tree. Shade tree is transplanted both as boundary and in-field plantation which provide protection to tea and ensures good return in form of fuel wood and cash. This system is tremendously followed in greater Sylhet and Chittagong districts where tea cultivation is being practiced

### **2.11.2. Forest based agroforestry:**

In Bangladesh forest land is rampantly encroached by the land grabber. In considering that condition, the forest department has inovated a system of Agroforestry in the forest area to rehabilitate and regain forest land. The systems are following-

#### **2.11.2.1. Alley cropping:**

In some encroached and denuded land, alley cropping mostly with 10 mx10m spacing in the north-south direction has been practiced in Sal forests. Because of irregular size of the plots given to the farmers, the alley size can not be stringently maintained. The land has become too hard to cultivate. One NGO ( prosika) has assisting the forest department, has promised to give cattle on credit. Now the forest department and NGO have extended their hand to co-operate with the peasant (Alam, *et al.*, 1997).

#### **2.11.2.2. Community Forestry Project:**

The most systematic and planned Agroforestry practice initiated in Bangladesh in 1985 in the denuded plain land forests of North Bengal ( Dinajpur, Rangpur and Rajshahi ) with the financial support of ADB and technical assistance of UNDP/FAO under the community forestry project(CFP) implemented during 1982-87 to replenish the depleted forest land(GOB 1982). The main tree species are Eucalyptus, Akashmony, Sissoo, Koroi, and Minjiry in conjunction with agricultural crops like paddy, wheat, banana, mango, lemon, jackfruit etc.

#### **2.11.2.3. Strip plantation:**

Strip plantations are being practiced by the side of national highways and embankments. It was first introduced Dhaka-Aricha highways where napier grass, papaya, lemon, date palm, jack fruit, koroi, ipil-ipil, mahogoni, sisssoetc. were raised. Now under system, babul, koroi, eucalyptus, etc tress in association with agricultural crops are being cultivated (Dey, 1996).

#### **2.11.2.4 Taungya:**

This practice is indigenous to Myanmar and had been introduced in Bangladesh in 1871. It is the modification of shifting cultivation. In this method, simultaneous planting of agricultural crops (mainly paddy, vegetables) and forest tree species are sown by dibbling during the initial stage of

plantation development. After collecting of agricultural crops, tree species are retained to attain mature. It is induced to reduced soil erosion ( Dey, 1996).

#### **2.11.2.5. Woodlot**

In Bangladesh woodlots of different tree species are also found. The main purposes of establishing woodlots are to protect the agricultural fields from soil erosion, prevent drying up of water springs, landslips and landslide, and maintain the stream regime. In many parts, farmers grow trees in separate blocks as wood-lots along with agricultural fields. Now the practice is expanding fast due to shortage of fuel-wood and demand of poles or pulp-wood in industry.

#### **2.11.2.6. Other Systems**

**a) Apiculture with trees:** In this system various honey (nectar) producing trees frequently visited by honeybees are planted on the boundary of the agricultural fields. (Anon, 2008)

**b) Aquaforestry:** In this system various trees and shrubs preferred by fish are planted on the boundary and around fish ponds. Tree leaves are used as feed for fish. (Anon, 2008).The main role of this system is fish production and bund stabilization around fish ponds. It may be called Aquaforestry or aquasilviculture.

**c) Mixed wood lots:** In this system, special location specific multipurpose trees ( MPTs) are grown mixed or separately planted for various purposes such as wood, fodder, soil conservation , soil reclamation etc.( Anon, 2008).

#### **2.12. Factors influencing farmer's adoption of Agroforestry:**

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). (Rabbi, 2014)

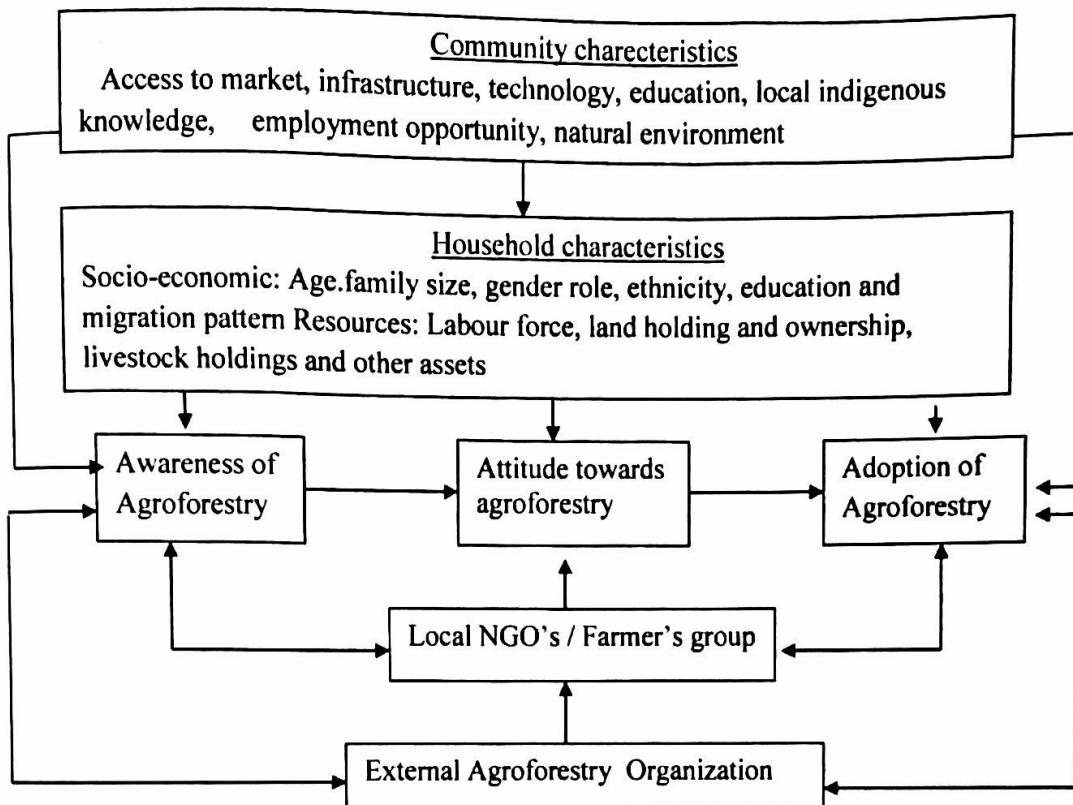


Fig: 2.2. Agroforestry adoption framework (Rabbi, 2014)

### 2.13. 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 equipments, 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.

#### 2.14. 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." (Rabbi, 2014)

- **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. (Rabbi, 2014)

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

- Strongly disagree
- Disagree
- Neither agree nor disagree or neutral
- Agree
- Strongly

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 (Rabbi, 2014)**

- **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. (Rabbi, 2014)

- **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. (Rabbi, 2014)

- **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. (Rabbi, 2014)

❖ **Broad classification of the area:**

**Table 3.1: Area Classification** (In sq. km.)

Upazila	Total area	Land area	Reserve forest	Riverine area
Kaligonj	333.79	324.34	0	9.35

Source : BBB, 2011

### 3.1.1. Administrative unit

Kaliganj has 12 Unions/Wards, 244 Mauzas/Mahallas, and 256 villages. Kaliganj Thana was formed in 1942 and it was turned into an upazila in 1983.( Banglapedia, 2016)

### 3.2. Demographic information

Kaligonj Upazila consists of 12 unions and 256 villages. The area of the town is 7.96 sq. km. According to population census, Kaligonj Upazila has a population of 274889, male 136089 and female 138800; male female sex ratio 98. Muslim 231610, Hindu 43027, Christian 242, Buddhist 1 and others 9. Population density per sq. km is 1046. Literacy rate among the people is 51.8%, male 55.4% and female 48.2%.

In Kaligonj Upazila number of total household is 64909, total number of population is 274889, in which 274762 people remain in household and 147 are floating.

Main sources of income is agriculture 56.81%, non-agricultural labourer 6.05%, industry 2.71%, commerce 19.88%, transport and communication 2.40%, service 4.37%. construction 0.93%, religious service 0.20%, rent and remittance 0.30% and others 6.35%. This upazila has a number of fisheries and poultries.

In Kaligonj Upazila total high land is about 4576 acres, medium land is 14590 acres and low land is 19670 acres.

Ownership of agricultural land is Landowner 52.48%, landless 47.52%; agricultural landowner: urban 43.45% and rural 53.03%.

In Kaligonj total operated land area is 58959 acres, permanently cropped area 3652 acres, temporarily cropped area 38836 acres permanently fallow land is 252 acres and others is 1647 acres. (BBS, 2011)



**Table 3.2. :Union wise population and literacy rate at Kaligonj Upazila in Satkhira district**

Union	Total area in Acres	Population			Literacy rate %		
		Total	Male	Female	Total	Male	Female
Bhara Simla	5777	24621	12312	12309	48.8	52.4	45.2
Bishnupur	4335	21927	10927	11000	49.3	52.3	45.2
Champaphul	7475	16468	8318	8150	49.4	53.5	45.1
Dakshin Sreepur	4601	17661	8611	9050	50.9	55.4	46.5
Dhalbaria	8432	19840	9751	10089	49.5	53.8	45.5
Krishnanagar	5573	25428	12148	13280	52.8	55.0	50.0
Kushlia	5152	22955	11537	11418	60.5	64.8	56.1
Mathureshpur	7473	26352	12962	13390	53.7	57.7	49.9
Mautala	3163	18899	9313	9586	47.6	49.9	45.4
Nalta	10117	34719	17433	17286	53.9	57.4	50.4
Ratanpur	7512	23901	11681	12220	51.5	54.3	48.9
Tarali	7338	22118	11096	11022	50.2	54.0	46.4

Source : BBS, 2011

### 3.3. Climate

The climatic condition depends on temperature, rainfall and humidity etc. The rainy season duration is June to October. The winter season duration is November to February. The dry season duration is March to May. The annual average temperature of this area varies maximum 24.8°C to minimum 8.6°C. The annual rainfall is 1374 mm. (BBS, 2013).

### 3.4. Crops which are grown:

#### Main Crops:

Paddy, jute, sugarcane, mustard seed, potato, onion, betel leaf etc. are main crops of this area.

Main Fruits: Mango, black berry, jackfruit, banana, papaya, litchi, coconut, guava etc are main fruits of this district.

## **Vegetables**

Farmers grow both summer and winter vegetables. Main vegetables are potato, brinjal, raddish, arum, lady's finger, cauliflower, cabbage, bean, tomato, patal, gourd, cucumber, pumpkinn, knoll-kal-turnip, dhundal, barbati, khirai, chichinga, carrot, kakrol and sak.

## **Cash crop**

Main cash crops are jute, mesta, sunhemp, cotton, sugarcane and tobacco.

## **Spices**

The main spices include turmeric, ginger, chillies, onion, garlic, coriander , black cumin and aniseed.

## **Fuel crops**

Dhaincha and other smaller plants used as cooking-fuel.

## **Main Fruits:**

Kaligonj is gifted with various fruits. Here everywhere in the district specially around the home people are interested in growing several delicious fruits. Some also grows fruit commercially. Some major fruits are mango, jackfruit, banana, guava, sofeda, lemons, olive, papaw, litchi, coconut, dates, palm etc. (Source: BBS- 2011)

## **Chapter Four** **Methodology**

### **4.1. Materials and Methods:**

The study was conducted at Kaligonj Upazilla in Satkhira district of Bangladesh during June-September 2016. An exploratory survey was conducted in Kaligonj Upazilla to explore information regarding the demographic profile of respondents, annual income of respondents, and cultivation practice, management technique, socio-economic value, attitude, perception and thinking towards agroforestry practice.

### **4.2. Selection of the study area:**

During the study a multistage random sampling technique is adopted. Kaligonj Upazilla was selected purposively as the study area. The criterion for selecting site was availability and diversity of agroforestry and for personal facilities to conduct the survey. This is first sampling unit. Then 6 unions were selected randomly as the second sampling unit. Twelve villages from those 6 unions (2 villages from each union) were selected randomly and this is the third sampling unit. Then from each village more or less eight to ten respondents (in accordance with availability) were selected purposively and total of 104 respondents were contacted to participate in the face-to-face interview. Information on this aspect was collected by interviewing the respondent by questionnaire and own observation of the author.

**Table 4.1: All sampling units at Kaligonj Upazila in Satkhira District.**

Name of the District	Name of the Upazila ( first sampling unit)	Name of the Union ( second sampling unit)	Name of the village ( Third sampling unit)	Number of the respondents	Total number of the respondents
Satkhira	Kaligonj	Bhara Simla	Sultanpur	19	104
			Kamdebpur		
		Champaful	Badhakul	16	
			Rajapur		
		Dhalbaria	Betbaria	17	
			Bahadurpur		
		Mathurespur	Basantapur	16	
			Chhanka		
		Mautala	Mautala	16	
			Ranitala		
		Tarali	Bathuadanga	20	
			Tentulia		

### 4.3. Reconnaissance survey

After collecting preliminary information, a reconnaissance survey was carried out to know about the existing agroforestry of the study area to prepare a set of questionnaire to fulfill the purpose of the study.

### 4.4. 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 village was carried out by using the semi structured questionnaire by the author. The questions were written in English but asked in Bengali language. The questionnaire covered information on:

- Demographic and socio-economic profile of respondents.
- Reason for practicing agroforestry.

- Management strategy of the agroforestry.
- Benefits of agroforestry.
- Problems of the agroforestry.
- Recommendation from the respondents.
- Attitudes and perception about agroforestry by likert scale.

#### **4.5. Data collection Process:**

The main focus was on obtaining data about agroforestry. Primary data were collected from the field survey questionnaire.

#### **4.6. 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:

##### **4.6.1. Primary data collection:**

The primary data were collected by conducting a survey work with a well prepared semi-structured questionnaire. For these reason, the interviewers were selected purposively from the farmers who practices agroforestry. 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.

##### **4.6.2. Secondary data collection:**

The secondary sources of data including Khulna University Library, Seminar Library, Forestry and Wood technology discipline, Khulna University, books, journals, various publications of Government, institutions and other organizations, articles of local and national newspapers and other research papers on same or similar issues, published and unpublished reports have been used for data collection. In addition to this, internet has also been used as secondary source of data collection.

#### **4.7. 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:

- Reviewed of collected data and information
- Discarded of unnecessary parts of the information and data

- Sorted of revised data and information
- Analyzed for easy explanation

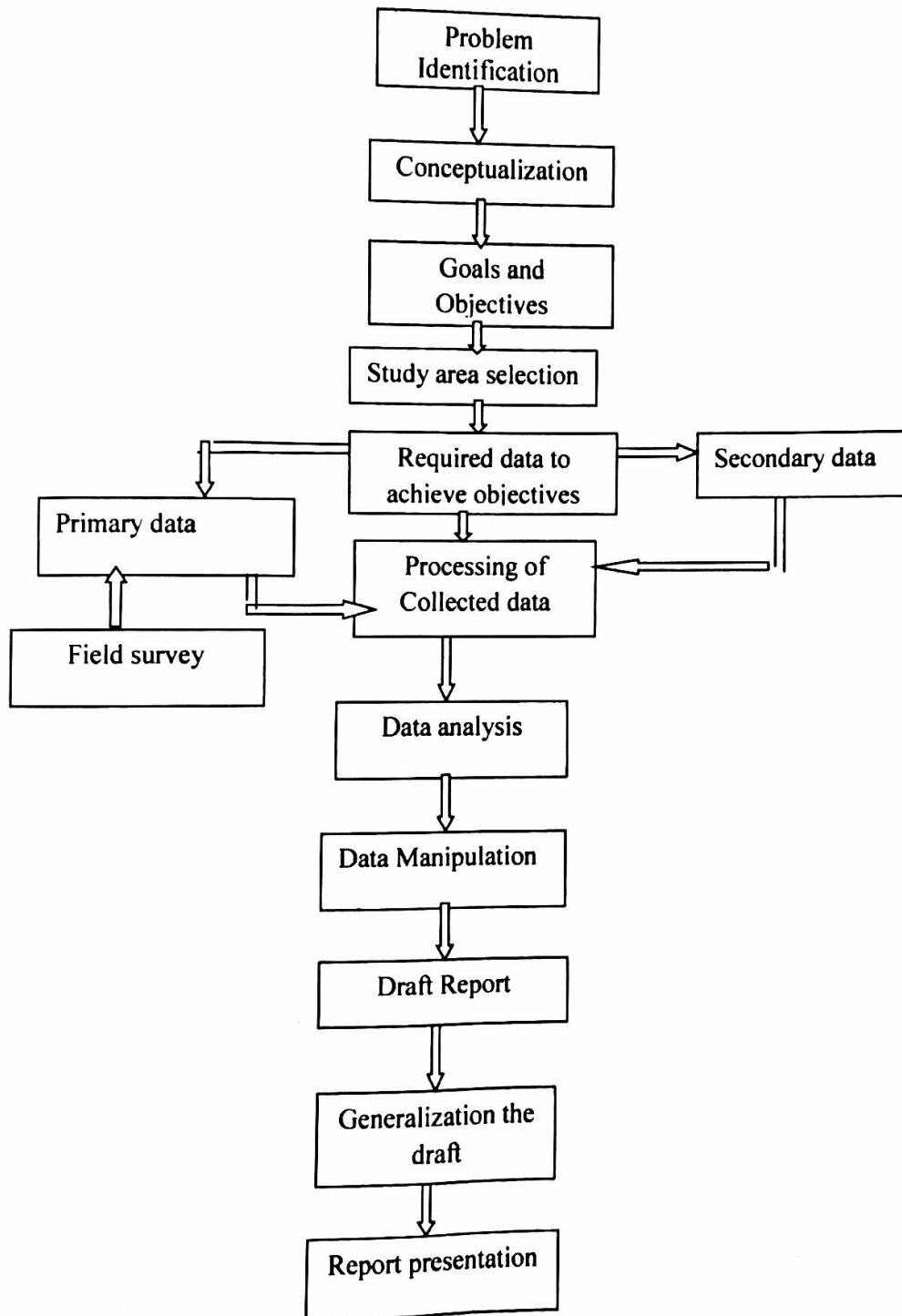
#### **4.8. Report writing:**

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

#### **4.9. Limitation of the study:**

During the study the author face some constrains which are listed below

- Extensive survey is costly and fund was provided by author himself, so extensive survey was not possible.
- Extensive survey was time consuming but time was limited.
- The result based on the information supplied the local people, so the real result may not come.
- Had to make the local people understand about the survey, which was time consuming.
- All people are not helpful; some people don't want to give answer of all questions.



**Fig 4.1. : Flow chart of Methodology**

## Chapter Five

### **Result and Discussion**

#### **5.1. Demographic information**

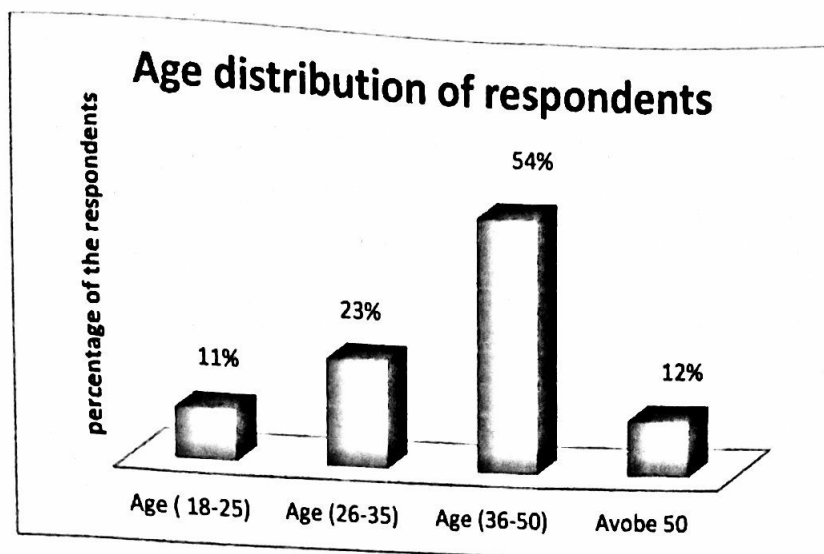
##### **5.1.1. Socio-economic characteristics of the respondents:**

The socio-economic characteristics are very important for any adoption measurement survey because it affects the adoption behavior. Different studies revealed that the socio-economic characteristics had much influence on the adoption behavior regarding new practices (Jamal, 2005). FAO (1989) reported that the innovators and early adopters were those who were higher in their socio-economic status than those who were lower in their socio-economic status. Here their attitude and perception in Agroforestry is our main focus. But the author also collected the socio-economic and biographical characteristics of the respondents. The biographical characteristics include age, education, land holding pattern etc. and occupation, income etc. are the economic characteristics. Both these characters show the socio-economic phenomenon. On the following basis now we are analyzing their socio-economic characteristics.

##### **5.1.2. Age Distribution of Respondents:**

Age of the respondents was classified into four categories. The categories were 18-25, 26-35, 36-50 and above 50. The major of the respondents (54%) were middle aged in between 36-50 years old. The main reason is they are the main decision making person of their family. Then the second highest percentage respondents were 23% who are in 26-35 years old and above 50 range people were 12%. Very little percentage (11%) of the respondents is in 18-25 range. Middle aged farmers were adopted to agroforestry much because they have tendency to take new technology. Most of the above 50 years old farmers were not interested with it and very young farmers (18-25) have little knowledge about it.

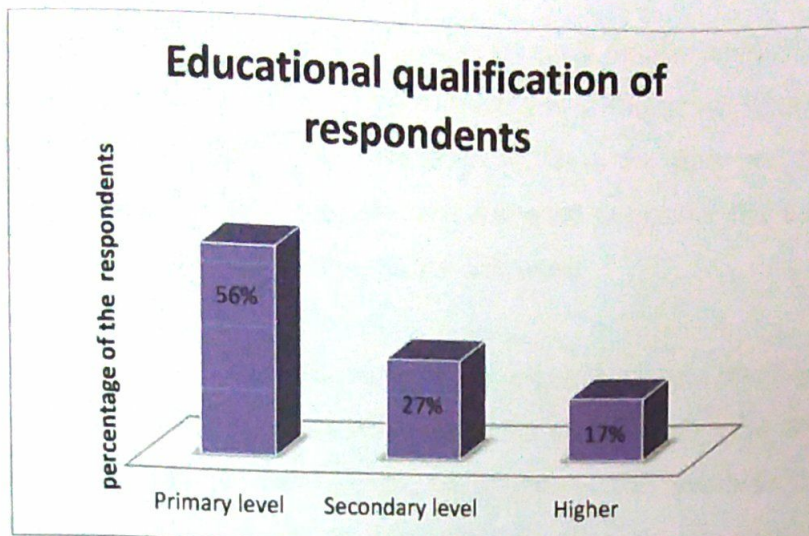




**Fig-5.1 Age distribution of Respondents**

### 5.1.3. Level of Farmer's Education:

As agroforestry techniques are include with modern method and materials; literacy, in this regard, plays a vital role for the success in this aspect. The high level of literacy rate would result in increase of Agroforestry technology. Amir (2003) reported that education was the main and vital weapon for bringing a positive change in the behavior of individual farmer, which develops knowledge and other desirable qualities of mind and general competence. According to Tripp (1993), education is an important socio-economic variable that may make a farmer more receptive to advice from an extension agency or more able to deal with technical recommendation that requires a certain level of literacy. It was confirmed many research studies that the education played a significant role in the adoption process of recommended agricultural practices. Hence the illiteracy among the farmers is much influencing their behaviour to adopt agroforestry practices. It is one of the main hindrances because it creates ignorance and unawareness among the individuals.

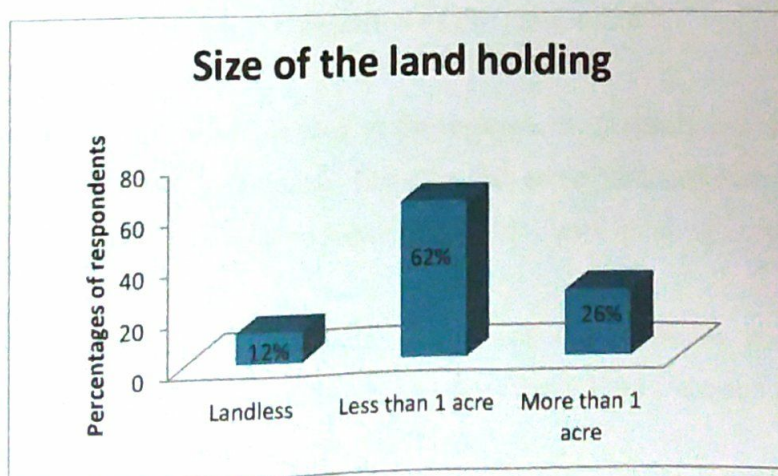


**Fig-5.2. Education level of the respondents**

The graph indicates that a majority of the respondents (56%) studied primary level. Here primary level assumed that the respondent who have studied between class-I to class-V. About 27% respondents have studied secondary level which is assumed from class-VI to SSC examination. The least percentage (17%) respondents have studied above secondary level. So, it is clear that educated farmers were interesting and practicing agroforestry.

#### 5.1.4. Size of land holding:

The land holding size was categorized in three groups i.e., land less, less than 1 acres and more than 1 acre. The land, which the respondents own and manage, was asked.



**Fig 5.3.: Size of the land holding of the respondents**



The graph indicate that mostly the respondents (62%) are small farmers having land holding less than 1 acre, (12%) respondents are landless (taken lease) and (26%) respondents are more than 1 acre. These results show that mostly the respondents (62%) in the study area have small land holding (<1 acre). The respondents (26%) are more interested to practice fish farm agroforestry and to grow cereals/trees for their domestic use and cash crops.

#### 5.1.5. Occupation:

Though this study was carried out in the farmers, the respondents were involved other various occupations also. All of the respondents were farmer but some people have mixed profession along with cultivation. There are businessmen, teacher, job holder, administrative services i.e. Member, chairman, handicraft production (tent industry), tailor etc. But point to indicate that most of them were only farmer.

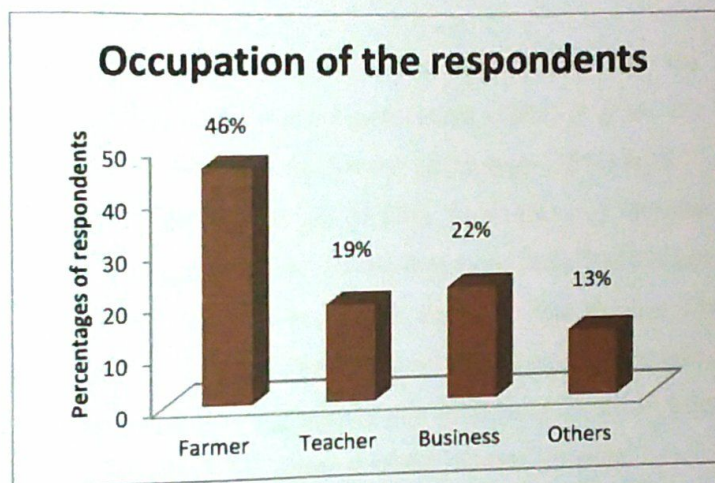


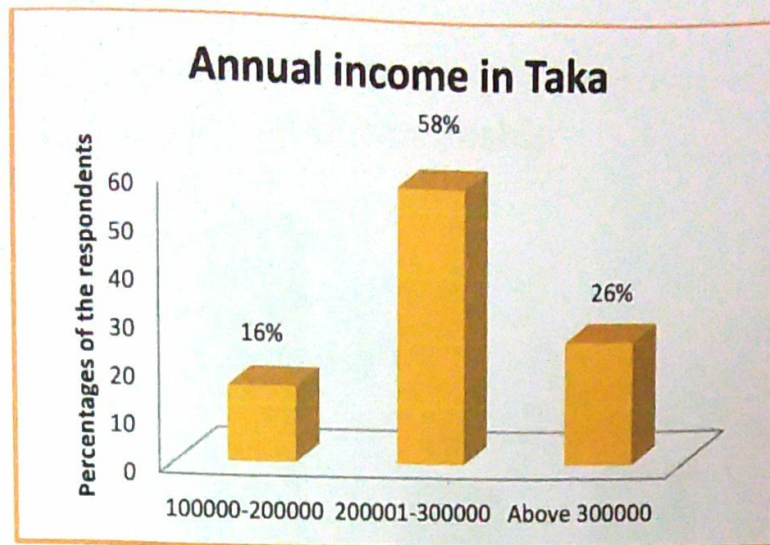
Fig 5.4. :Occupation of the respondents

The graph shows the variety of occupation of the respondents. It clearly indicates that most of them (46%) are confined in only farming. There are also some other occupations but in a little number. 19% were teacher, 22% were businessman and 13% were involved in other occupation.

#### 5.1.6. Income:

Income is a vital characteristic for measuring socio-economic consequence. Income talks about the family status and working pattern or occupation of a farmer. Here is the annual income of the respondents which shows the economic status of them.





**Fig-5.5. Annual income of the respondents ( in taka)**

The graph is expressing the annual income of the respondents. Here the income amount is classified into three categories. The highest percentage (58%) is from 2-3 Lakhs tk who are actually the medium class farmers and the lowest percentage (16%) is in 1-2 Lakh tk who are poor and landless. Above 3 lakh tk, they are 21.34%. From this it is revealed that, poor farmers are not so much interested to agroforestry because they need daily basis or seasonal basis income to live. They have little or no land and money so, they also fear to plant trees within cropland whether crop production would reduce. They are practicing homestead agroforestry. But who are economically feasible are practicing agroforestry in both farm land and homestead land. They want a large amount of cash after a long time with the seasonal income.

### **5.2. Land Tenureship:**

The land tenureship (Fig- 5.3) shows that 70% respondents have own land. 12% respondents take land leased from others which is known as borga system. 18% respondents both have own land and give land to another people by Borga system. By this study we know that the people (70%) who have own land for agricultural practice, they are interested in Agroforestry practice. But who have no own land (12%) they are not interested in Agroforestry practice. They didn't want to practice any permanent or long term system on other's land. They practice traditional monoculture, cereal crops etc. The people (18%) who have some own land and some leased land were interested to agroforestry.



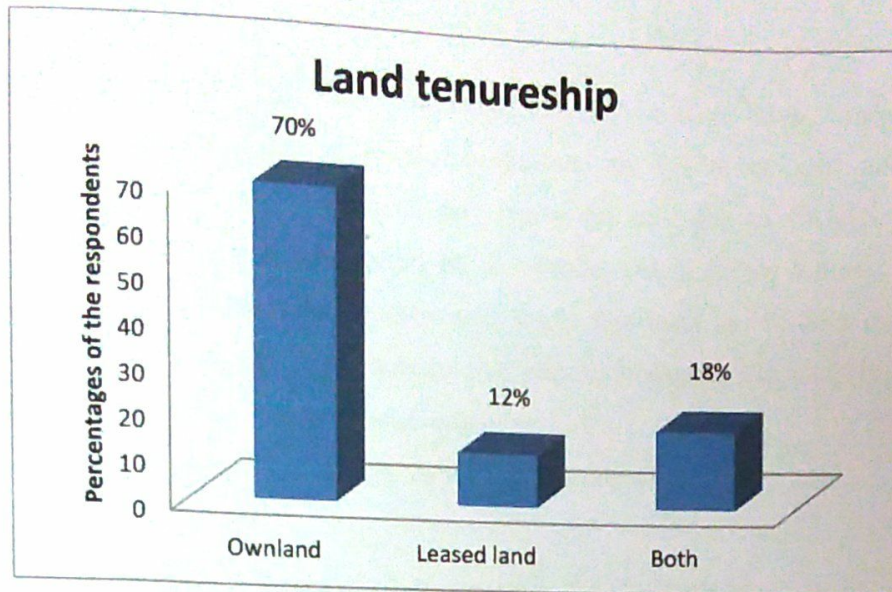


Fig-5.6. Land tenureship of the respondents

### 5.3. Agroforestry Practices in the Study Area

The survey results showed that, on average about 96% of the respondents practice agroforestry while 4% do not practice agroforestry. Therefore, agroforestry practice was not new in the study area which might be due to various sources of information that contributed to the practice of agroforestry.

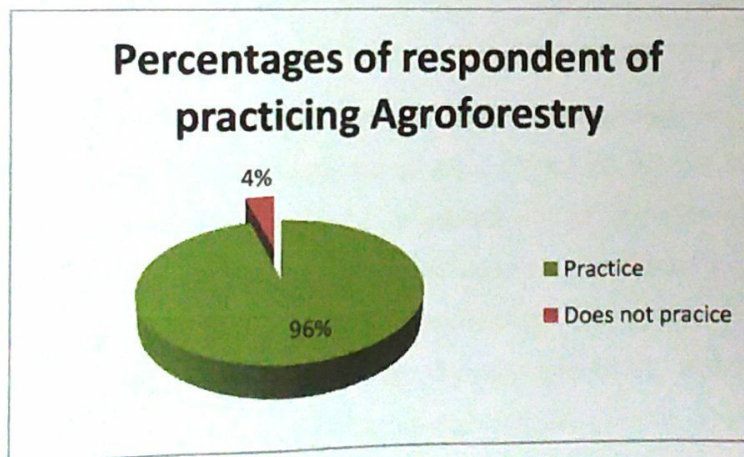


Fig 5.7. : Percentages of the respondents of practicing agroforestry

#### 5.3.1. Present agricultural and Agroforestry land use system in Kaligonj Upazila :

The land use systems in the study area include annual crop production, fish farm (gher culture), agroforestry and Horticulture. Agroforestry practices undertaken by farmers in the study area

include homestead agroforestry, boundary plantation, Private woodlot, mixed cropping and aquasilviculture etc. The annual crops cultivated in the land use system included paddy, jute, papaya, banana, mustard oil seed, potato, betel leaf, masur dal, mug dal, til, brinjal, lal shak, misti cumra, chal kumra, laü, bean, cucumber, onion, corolla, lady's finger, tomato, cabbage, cauliflower, green papper etc. and many other vegetables. The trees in the land use system included mango, jackfruit, Jam, date palm, coconut tree, supari, mehagani, kul, rain tree, ipil-ipil, akashmoni, babla, kadam, gamar, sisso, neem, bamboo etc.

**Land use system and the type of crops Cultivated in the study area:**

**Table-5.1. Types of crops grown in the study area**

Type of crops	No of farmers	Percentage of farmers
Annual crops	19	18.26%
Annual crop + Tree	41	39.43%
Annual crop + Domestic animals	23	22.12%
Annual Crop + Tree + Domestic animals	21	20.19%

Table-5.3 presents that 19% of the farmers largely depends on annual crop production. In consideration of agroforestry system significant number (37%) of user is involved in agri-silvicultural system. Other system is practiced in a limited portion. 23% farmers rear domestic animals with annual crops. By this study we found that, people are interested in rearing domestic animals (21%) with annual crop and tree because immediate high cash return.

Most of the people in Kaligonj Upazila learn agroforestry inheritantly and from indigenous knowledge systems and have a tradition of practicing Agroforestry practice. They don't have any training on it also. 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**

**a. Agri-silvo-pastural**

## B. Cropland Agroforestry Practice

- a. Agrisilvicultural systems
- b. Boundary Plantation
- c. Mixed Cropping
- d. Woodlot

## C. Fish farm agroforestry

### A. Homestead Agroforestry:

The most widely practiced and the most highly productive system of agroforestry in this area is homestead agroforestry. About every home there is homegarden. Homegardens, mixed plantings of annual, tree crops and pasture around dwelling area, are a common type of multistory agroforestry system. Multistory means that there are at least two layers of plants growing to different heights in the system. In homegardens, the lowest level often consists of vegetables or root crops and flower trees; the second level includes fast-growing trees or crops such as bananas, lemon etc.; a third higher level may consist of large trees that provide fruit, timber and shade. Homegardens also provide a pleasant shaded living area. Many farmers already grow multipurpose trees in their homegardens for flowers, fruits, and seeds, trees, fish, agricultural crops, cattle, etc. In the study area almost 98% farmers practice homegarden traditionally. The another 2% farmers do not practice it and they mentioned the cause for not practicing homestead agroforestry which are the absence of available homestead area, frequent natural calamities which may cause the damage of house and salty soil.

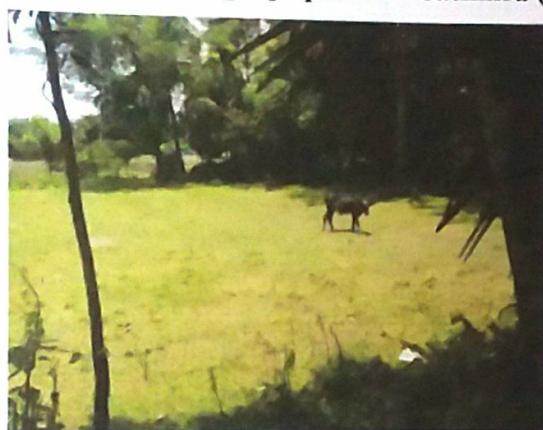
#### **Agrisilvipastural system**

In the study area agrisilvipastural agroforestry also found inR . In this system trees, crops and animals are produced in together. In homestead agroforestry in the study area following species were found –





**Pic- 5.1: Homestead Agroforestry at Kaligonj upazila in Satkhira (Field survey 2016)**



**Picture 5.2.: Agrisilvipastoral system (field survey, 2016)**

#### **Tree species**

Narikel, supari, aam, kanthal, jam, keora, tentul, peyara, kul, neem, katbadam, mahogoni, koroj, sirish etc.

#### **Vegetables**

Halud, ada, lau, chal kumra, banana, pepe, misti kumra, lebu, sim, begun, piu sak etc.

#### **Animals**

Cow, goat, hen, duck, buffalo, pegin etc.

### **B. Cropland Agroforestry:**

Cropland Agroforestry combines the production of agricultural crops and trees in the cropland through intercropping. There are mainly following types of cropland agroforestry were found in the study area.



### **Agrisilvicultural systems**

In this system, agricultural crops are intercropped with tree crops in the inter space between the trees. Under this system agricultural crops are grown under the trees. In this area different types of trees are found in this system such as mahogoni, neem, aam, lichu, khejur etc. In some villages of the study area specially in the Muthurespur and Dhalbaria union the soil are salty so, crops are not grown well all time. Farmers said that in rainy season crops are grown well. 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. All of the respondents (100%) said that performance of the tree crops is better in this system when compared to monoculture. 65% farmers said that there are no reduction in crop production also but other 30% farmers said that there is a little effect on crop production and another 5% said there is reduction in crop production. In the study area Mango are mixed cropped with paddy, kachu, zinger, halud and different types of vegetables. Mahogoni, neem, tal, khejur are also mixed with it.

### **Boundary Plantations:**

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-5.3: Boundary plantation in Kaligonj Upazila (Field survey 2014)**



Commonly used trees for boundary plantation are Mahagoni, Babla, neem, Supari, Date palm, Coconut, Rain tree, kocha (jiga) etc are grown along field boundaries or bunds of paddy, jute, halud, zinger fields and gher (fish farm) also. Babla and Mahagani also have high commercial values. Boundary plantations are so popular in the study area for their benefits.

### **Mixed Cropping**

Mixed Cropping constitutes one of the main agricultural land use practice in the study area. Most of the farmers (72%) 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, different vegetables along with jute and paddy are the common practice in mixed cropping system.



**Pic-5.4. : Mixed Cropping with boundary plantation Kaligonj upazila (Field survey 2016)**

These farmers have a multi – cropping system and provide farm stability, and he efficiency in the use of land and labour, as well as ensure annual security. Different types of vegetables are cultivated.

### **Woodlot:**

Woodlot plantation is another most common agroforestry practice at Kaligonj upazila in 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

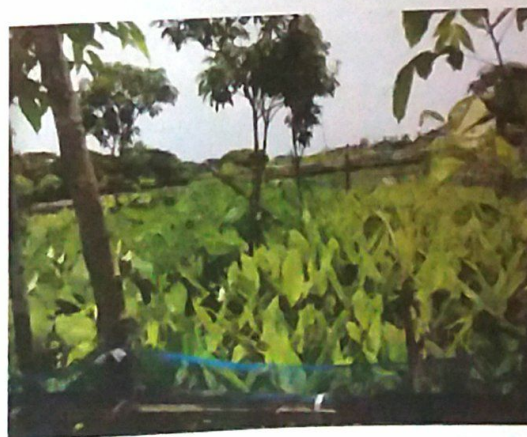


climbing crops; food and animal components may be integrated into woodlots, especially during the initial establishment phase (Nair, 1993). The main purposes of establishing woodlots are to protect the agricultural fields from soil erosion, prevent drying up of water springs, landslips and landslide, and maintain the stream regime (Amatya and Shrestha, 2003).



**Pic-5.4: Woodlot plantation in Kaligonj (Field survey 2016)**

Mainly the MPT's species are preferable in this system. The major woodlot species in Kaligonj are like Mehagani, Rain tree, Babla, Gamar, Ipilipil, Eucalyptus, Akashmoni etc. About 37% farmers of the respondents have woodlots. Farmers mentioned some reason of growing that woodlot which are to achieve a large amount of cash after a time, because of the reduction of soil fertility of the land, no time to grow seasonal crops, for the security of the land (to keep possession of land), and easily manageable.



**Fig-5.5 Agrisilvicultural systems** (Source- Field survey 2016)

### **C. Fish farm agroforestry**

In the study area this types of agroforestry is available. In this system various trees and shrubs preferred by farmers are planted on the boundary and around fish ponds. Growing crops and fish together raises productivity and helps relieve pressure on land and water resources. This could help many developing countries where land and water are under extreme pressure. Simple forms of community management make good use of water and nutrients and boost harvests of fish from rice fields, ponds and traps. In this area this practice are becoming popular day by day. Tree leaves are used as feed for fish. The main role of this system is fish production and bund stabilization around fish ponds. Banana, Papaya, Coconut tree also planted as a incorporating at the embankments. Sometimes duck are also included. It may be called Aquaforestry or aquasilviculture. In the study area 38% respondents are practicing this system.

**Table-5.2. Type of Crops Grown in the study area:**

<b>Agroforestry Practice</b>	<b>Types of trees</b>	<b>Types of crops</b>	<b>Pasture</b>
Boundary plantation	Khejur, Coconut, Babla, Akasmoni, Mahagoni, Neem, Rain tree	Paddy, Jute, Papaya, Banana, Halud, Mustard, different types of dall.	X
Mixed Cropping	Supari, Coconut, Mahagoni, Sajina, Khejur, Tal, Jam, Kamrang, Neem, Jackfruit, etc.	Rice, Maize, Kachu, Halud, Banana, Ginger, Tomatoes, Cabbage and Marich etc.	Cow, Goat, Buffelo.
Monoculture	X	Paddy, jute, banana, kachu, halud.	X
Agrisilvicultural Systems	Supari, Coconut, Mahagoni, Sajina, Khejur, Tal, Jam, Mahogoni, Neem, Jackfruit, etc.	Rice, Kachu, Halud, Banana, Ginger, Tomatoes, Cabbage and Marich etc.	X
Homegarden	Supari, Coconut, Mahagoni, Sajina, Khejur, Tal, Jam, Kamrang, Neem, keora, Jackfruit etc.	Different vegetables.	Cow, Goat, Buffalos, Duck, Hen, pigon etc.
Woodlot	Mahagani, Akashmoni, Sisso, Raintree, gamar etc.	X	X

#### **5.4. 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 (Sharmin and Rabbi, 2016). In this thesis paper, perception indicates that the farmer's awareness and understanding about the Agroforestry systems at Kaligonj upazila in Satkhira District.

Perceptions about Agroforestry in the villages were diverse. The farmers of Kaligonj upazila 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.

The farmers also 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."

It can be the good example about the farmer's perception of Agroforestry in Kaligonj. 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



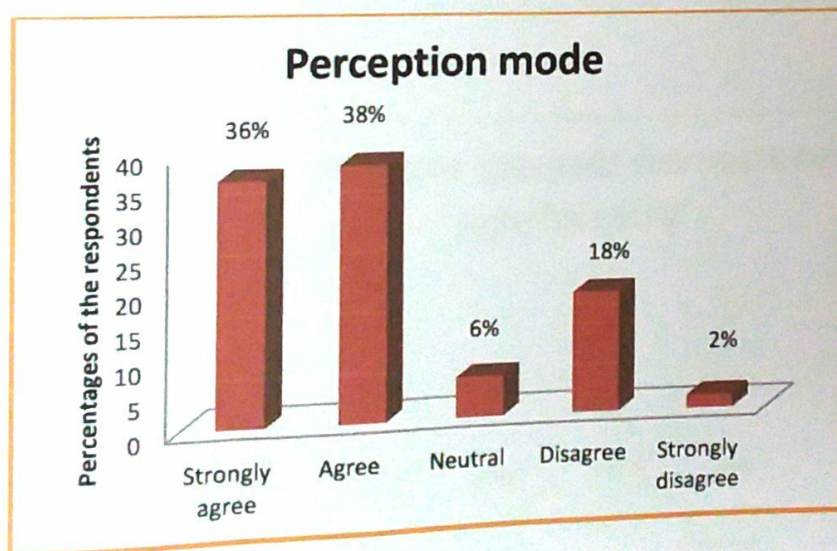
systems, long term in profit earning, land of technical assistance, do not have suitable land for this cultivation practice, probability of risks and unstable market price for Agroforestry product.

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-5.3. Farmer's perception on Agroforestry in Likert Scale**

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

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 38% had shown positive perception (agree) and 36% strongly agreed about agroforestry.



**Fig: 5.8. Farmer's perception on Agroforestry**

### 5.5. Farmer's Attitude towards agroforestry:

The results revealed that majority of the farmers had 'favorable' attitude towards agroforestry. The farmers of Kaligonj upazila 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 followingly.

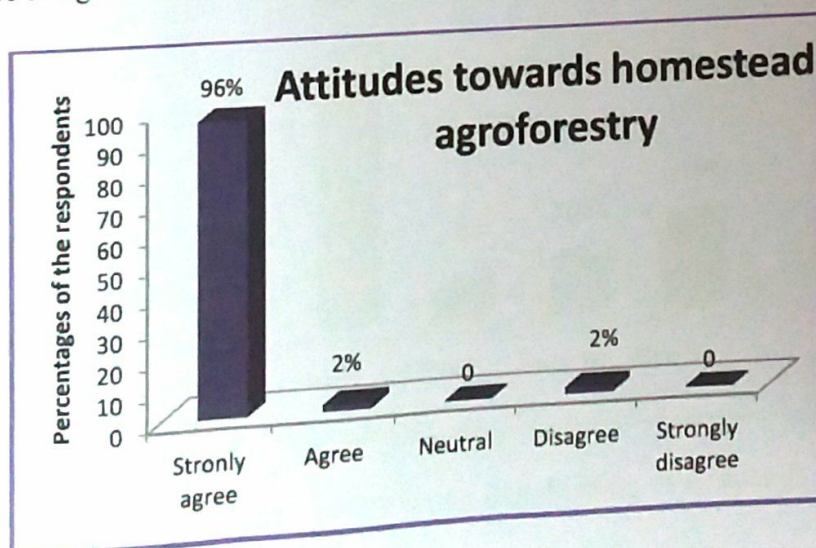
### 5.5.1. For Homestead:

As 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-5.4. Farmer's attitude for homestead in Likert Scale**

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

For the homestead the farmers of the study area showed so much positive thinking and attitude. 96% of the farmers strongly agreed with homestead agroforestry, 2% agree with it. 2% of the farmers were disagree it and no farmers strongly dis agree it.



**Fig: 5.9. Farmer's attitudes on Agroforestry in Homestead**



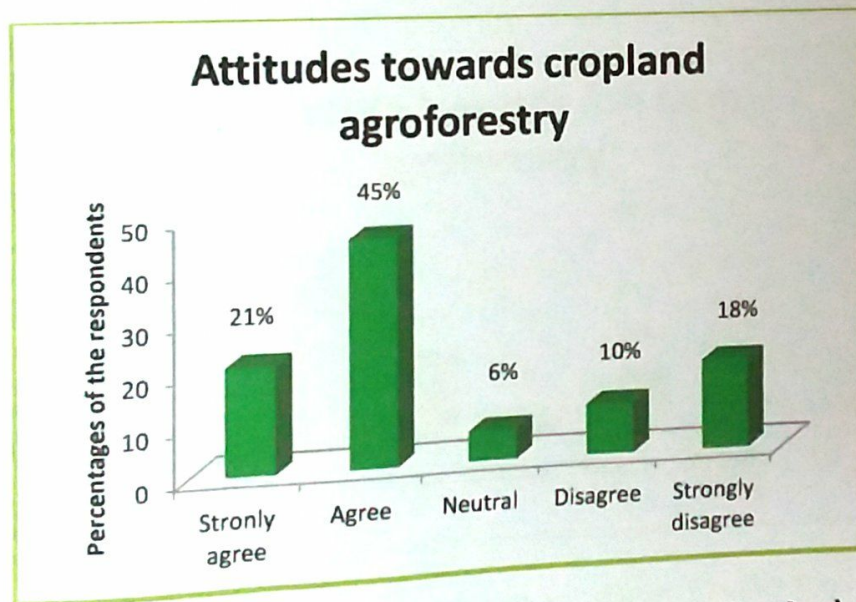
### 5.5.2. For Cropland:

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

**Table-5.5. Farmer's attitude for cropland in Likert Scale**

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

So For the cropland agroforestry the farmers of Kaligonj upazila showed a little less interest than the homestead. Most of them are quite positive in this regard. They are agreed with this.



**Fig: 5.10. Farmer's attitudes on Agroforestry in Cropland**

From the above graph we find that majority of the respondent (45%) are in positive side with agroforestry practice on cropland. But there also exist some disagreement with this. Some of



them (18%) are not totally interested in this. 10% respondents think negatively and 6% respondents had no comments in this regard.

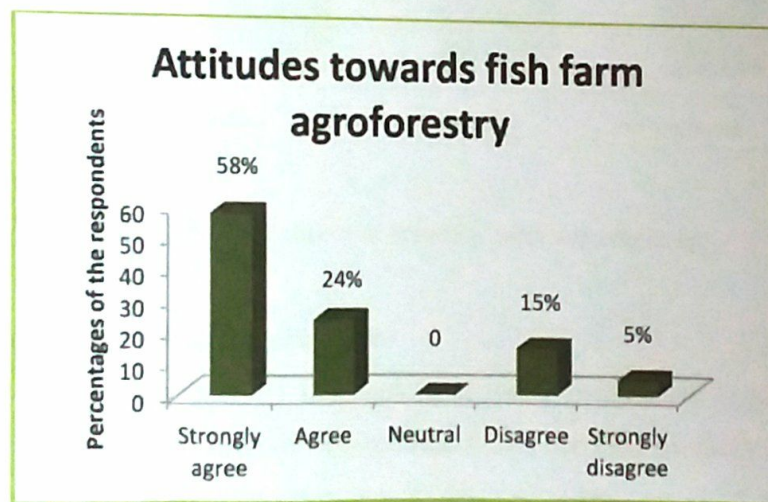
### 5.5.3. For fish farm

For fish farm the farmers of the study area showed positive attitudes. They said that it is very much beneficial.

**Table 5.6.: Farmer's attitude for fish farm Agroforestry in Likert Scale**

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

For fish farm agroforestry most of the respondents (58%) showed strongly interest. 24% respondents interest on it they agreed to it but 15% think that it has some negative impact and other 5% strongly opposite to it.



**Fig: 5.11. Farmer's attitudes on Agroforestry in fish farm**

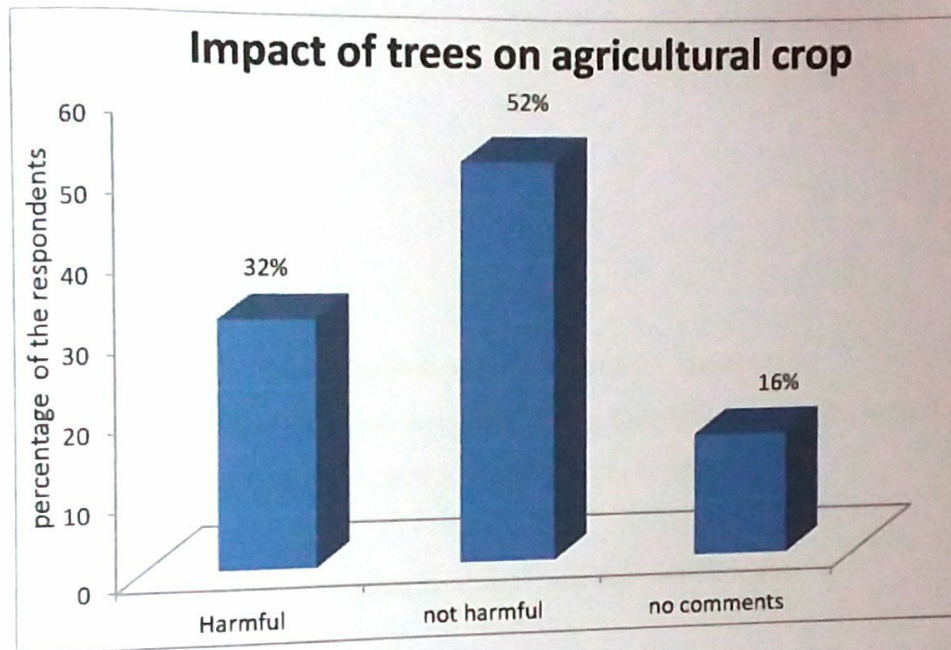
### 5.6. Impact of Trees on Agricultural crops:

Farmer's perception on Agroforestry is positive. Most of the respondents (52%) said that trees dose not harmful for agricultural crops, it have a great role in managing and space utilization on



land 32% respondents said that trees are harmful for agricultural practice because of some managing problem. They said that trees have significant disturbance on crop which reduces the production by shade and nutrient, water competition and rise possibility for crop failure and pathogenic attack. 16% respondents have no comments. They are confused about it.

On the following graph the percentage of farmer's perception on impact of trees on agricultural land are given.



**Fig-5.12.: Impact of trees on agricultural crops.**

### **5.7. Reasons for planting trees on farmlands:**

Most of the respondents who practice farmland agroforestry 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, fruit production 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.

### **5.8. 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
- ↓ Water and nutrient competition

#### 5.9. 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: 5.7. Problems and suggestions from the respondents**

Problems faced by the Respondents	Suggestion by the Respondents
Presence of salt in the soil	Salt resistance species invention
Lack of technical skills	Arranging training
Limited capital	Organizing workshops
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 watering problem	Deep tubewel/ pump required

## Chapter Six

### Recommendations and Conclusion

#### 6.1. Recommendations:

From the direct observations of the field survey and according to the respondents response following recommendation can be followed-

- Salt resistance species for this particular area should be invented where farmers want to grow trees and crops together but they can not do it for the problem of salty soil.
- Well accepted easy interest-free loan for the farmers should be generated.
- Most of the farmers said that they don't have proper knowledge about agroforestry, they don't know which combination is beneficial for crops and trees in case of both ecologically and economically. They used their indigenous knowledge for practicing agroforestry. So, different training and workshops are needed to be arranged regarding agroforestry.
- Government and non Government organizations should come forward with Agroforestry development programs through field visiting and providing technical assistance.
- Create awareness in the target audience about agroforestry technologies showing short stage drama, documentary etc. live and through mass media.

#### 6.2. Conclusion:

It has been proved that agroforestry is becoming an important and ecologically suitable land use system in Bangladesh by some previous field experiment and a great portion of farmers of our country have positive attitudes to it. 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 Kaligonj Upazila of Satkhira 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 and they showed high interest to practice it in a wider range. Since the findings of the study pointed out that there is a scope for improving the perception level and creating more favourable attitude of farmers towards agroforestry. Though in this area some natural findings remain in the way of successful agroforestry practice we can mitigate them by the application of advanced technology. Agroforestry is becoming popular in Kaligonj Upazila. Majority of farmers 38% had shown positive perception (agree) and 36% strongly agreed about agroforestry. Those farmers who showed positive attitude toward agroforestry are most of middle aged farmers (36-50 years old). Young farmers are also interested in Agroforestry practice than traditional practice. The adoption of Younger (26-35) 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 (56%) are the major portion of the area. But others who studied more have better interest in agroforestry. The farmers (12%, they taken lease from other people) who have no own land they are not interested in Agroforestry. 98% farmers have positive attitude towards homestead agroforestry, 66% farmers have positive attitude towards Cropland agroforestry and 82% for fish farm agroforestry. 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. So there should create more facility, encouraging program and convenient environment for agroforestry system by the Govt. as well as NGO.

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## Appendix

### 1. Species with scientific name

Local name	Scientific name
Tree species	
Mahogoni	<i>Swietenia mahogoni</i>
Raintree	<i>Samanea saman / Albizia saman</i>
Koroi	<i>Albizia procera</i>
Ipil-ipil	<i>Leucaena leucocephala</i>
Sissoo	<i>Dalbergia sissoo</i>
Kadam	<i>Anthocephalus chinensis</i>
Neem	<i>Azadirachta indica</i>
Babla	<i>Acacia nilotica</i>
Simul	<i>Bombex ceiba</i>
Gamari	<i>Gmelina arborea</i>
Kathal	<i>Artocarpus heterophyllus</i>
Jam	<i>Syzygium cumini</i>
Agricultural crops	
Halud	<i>Curcuma longa</i>
Kachu	<i>Colacasia esculenta</i>
Ginger	<i>Zingiber officinale</i>
Labu	<i>Citrus aurantifolia</i>
Brinjal	<i>Solanum melongena</i>

Misti kumra

Lau

Lal shak

Pepe

Sim

Chal kumra

*Cucuebita maxima*

*Lagenaria vulgaris*

*Amaranthus beitung*

*Carica papaya*

*Lablab purpureus*

*Benincasa hispida*

## 2. Questionnaire for the field survey

### Farmer's attitude and perception towards agroforestry at Kaligonj Upazila in Satkhira District

(Only for research purpose)

Date:

Survey No: 1

#### Part-A: General Information

##### General information about the respondent:

1. Name of the respondent:
2. Village of the respondent:
3. Union of the respondent:
4. Demographic & Socio-economic profile:

Gender		Age	Educational qualification			Profession	Income
Male	Female		Primary	secondary	Higher		

#### Part-B: Agroforestry Information

1. a. Size of farm:

b. Size of homestead area :

2. Type of the Farm land

- a. Own land under cultivation
- b. Own land given to others on lease (borga )system
- c. Area taken from others on lease (borga) system
- d. Area given to others on lease
- e. Cultivated area taken as lease from others

3. Does he practice AF?

- a) Yes      b) No

4. If yes; why?

Ans:

5. From where he got interested in AF?

- a) By Article b) From neighbor c) Training d)NGO

6. Does he get any support from GO's or NGO's ?

- a) Yes      b) No

7. Is it beneficial for your family?

- a) Yes      b) No

8. What are the component of AF you practice?

Types	Trees	Crops	Animals	Others
Cropland agroforestry				
Homestead agroforestry				

Fish farm				
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9. Type of tree species:

Wood	Fuel	Fodder	Fast Growing	MPTS	Fruit

10. Benefit from the farm:

A. Homestead:

a. Wood

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

b. Fuel

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

c. Fodder

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

d. Vegetables

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

e. Pasture

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

f. Aqua

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

B. Cropland:

a. Wood

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

b. Fuel

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

c. Fodder

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

d. Vegetables

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

e. Pasture

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

f. Aqua

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

C. Fish farm

a. Wood

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

b. Fuel

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

c. Fodder

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

d. Vegetables

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

e. Pasture

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

f. Aqua

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

11. Per year benefit from AF:

Wood	Fuel	Fodder	Crop	Fruit	Cattle

12. Financial Backup for AF:

a. Bank b. Money lenders c. Personal savings d. others

**Part C: Attitude on Agroforestry (Likert Scale)**

1. Attitude on AF:

A. Homestead:

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

B. Cropland:

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
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1	2	3	4	5
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C. Fish farm

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

2. Perception in AF:

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

3. Impact of trees on AF:

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

4. Impact of crops on trees

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

5.

Topic	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
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Increased soil fertility					
Increased farm income					
Reduced chances of complete crop failure					
Maintained/improved surrounding condition					
AF should be adopted in your locality					

6. Management Strategies

Mgt. Strategies	Mgt. Schedule	Strongly Disagree(1)	Disagree(2)	Neutral(3)	Agree(4)	Strongly Agree(5)
Soil working						
Weeding						
Pruning						
Thinning						
Vacancy feeling						
Protection						
Fertilizer						

7. Do you have any suggestion?

8. Problems faced in AF: