Khulna University
Life Science School
Forestry and Wood Technology Discipline

Author(s): Jamila Khatun

Title: Contribution of Agroforestry to the household income in Manirampur Upazila of Jessore District

Supervisor(s): Dr. Md. Golam Rakkibu, Professor, Forestry and Wood Technology Discipline, Khulna University

Programme: Masters of Science in Forestry

Contribution of Agroforestry to the household Income in Manirampur Upazilla of Jessore District

JAMILA KHATUN

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

Contribution of Agroforestry to the household income in Manirampur upazila of Jessore district.

JAMILA KHATUN

FORESTRY AND WOOD TECHNOLOGY DISCIPLINE

KHULNA UNIVERSITY

KHULNA-9208

BANGLADESH

2017

Contribution of Agroforestry to the household income in Manirampur upazila of Jessore district.

COURSE TITLE: PROJECT THESIS

COURSE NO: FWT- 5112

[This project thesis has been prepared for the partial fulfillment of the requirement for M.S degree in Forestry from Forestry and Wood Technology Discipline, Khulna University, Khulna]

Supervisor

Dr. Md. Golam Rakkibu
Professor
Forestry and Wood Technology Discipline
Khulna University
Khulna-9208
Bangladesh.

Submitted by

Jamila Khatun
19/02/18

Jamila Khatun
Roll No:MS-150502
Forestry and Wood Technology Discipline
Khulna University
Khulna-9208.
Bangladesh.

DEDICATED TO

MY BELOVED PARENTS

DECLARATION

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

I do hereby-giving for my thesis, it accepted, to be available for photocopying and for inter-library loan, for the title and summary to be made available to outside organization.

Candidate... Jamila khatun

Date... 19/02/18

ACKNOWLEDGEMENT

First of all, I am very grateful to almighty Allah for his gracious glance upon me for the successful completion of this thesis paper.

I would like to express my special thanks to Dr. Md. Golam Rakkibu , professor, Forestry and wood Technology Discipline, Khulna University, Khulna, for his supervision, guidance, valuable suggestion, criticism, inspiration and co-operation for preparing this paper.

My Special thanks go to S.M. Rubaiot Abdullah, Associate professor, Forestry and Wood Technology Discipline, Khulna University for his effective guidance and Co-operation during my research work.

My special thanks go to my classmate's kamona mondol, Nasrin Sultana, My senior brother Md. Sazib Uddin and all of my friends and well-wishers for their technical assistance, suggestions and supports in the preparation process of this paper.

Finally, I would like to express my gratefulness to my family members who always sacrificed their happiness for my education at Khulna University.

Jamila Khatun

ABSTRACT

Bangladesh is an over populated country having about 14.4 million hectares of land with population of 152.52 million. With the increasing population pressure, the forest and forest related resources are depleting at a high rate. The existing forest cannot meet the demand for the nation. Most of the people were dependent on Agroforestry for the fulfillment of their needs. Agroforestry practices are satisfying the local people's consumption need and it can also contribute to increased family income for better livelihood. Income from Agroforestry is perceived to have two dimensions, Cash and Non-cash. The Cash benefits of Agroforestry generally tend to be better recognized, while the Non-cash contributions are largely "unseen." It is important to identify the Cash and Non-cash income in order to assess the contribution of Agroforestry for sustainable livelihood and greater family income. This study presents contribution of Agroforestry to the household income in Manirampur upazila of Jessore district. The study was conducted on one hundred respondents with semi-structured questionnaire. Most predominant Agroforestry type is Homegarden in the study area. About half of the total family income comes from Agroforestry practices. In Manirampur upazila Non-cash income contribute one -third of the total Agroforestry income. So, Non-cash value has important contributions to the livelihood of rural community which is usually under estimated. All the households get considerable amount of fuel wood from Agroforestry. About two-third of their cooking energy they gathered from Agroforestry. Agroforestry practices has the potential to sustain better livelihood in the study area

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

Bangladesh, being a subtropical country, enjoys a wide range of diversity of plants in Agroforestry. Land is the basic resources of human society. Bangladesh is an over populated and land hungry country having about 14.4 million hectares of land with population of 152.52 millions (BBS, 2011). Because of the rapid growth of population and indiscriminate destruction of forest cover, it is difficult to meet the country's huge demand for timber, fuel, food and fodder and maintaining ecological balance. In such a situation Agroforestry represents a land use system involving deliberate management of multipurpose trees and shrubs in close association with seasonal vegetables (Fernandes and Nair, 1986).These forests are described as a multistoried vegetation of shrubs, bamboos, palms, and trees surrounding homesteads that produce materials for a multitude of purposes, including fuel, shelter, structural materials, fruits and other foods, fodder, resins, and medicines (Hasan *et al.*, 1997).

Although the forest department presently considers 14.6% of total land area of Bangladesh as forested, in reality, only about 6-8% of the total land area of Bangladesh merits the term forested. Specifically 6.4% of total land areas of Bangladesh under tree cover (Salami, 2002).
Villages of Bangladesh have a long heritage of growing timber, fruit trees and medicinal plants along with other perennial shrubs and herbs (Rahman *et al.*, 2011). Bangladesh, being a small country, never had huge forest resources. Per capita forestland in Bangladesh is 0.022 ha which is among the lowest in the world (Hossain and Bari, 1996).
Naturally, Agriculture practice provides the seasonal rural income to the rural poor. But it will help to quantify the utilization of homestead forests and facilitate sustainable production from and conserve biological diversity at present in the study area.

1.2 Justification of the Study

Agroforestry is an age- old practice of integrating farming with practices, preferably on the same unit of land on sustainable basis. Agro forestry systems have received increasing emphasis in the recent years because of their potential to yield fodder, fuel wood and small timber in addition of food. Agroforestry may be defined as an integrated self- sustained land management systems, which involves deliberate introduction / retention of woody components with agriculture crops including pasture / livestock, simultaneous or sequentially on the same unit land, meting the ecological and socio – economic needs of people (FAO, 2011). Agroforestry is a collective name of land use system and technologies where woody perennials are deliberately used form the same land management units as agricultural crops and or animals in the same form of spatial arrangement of temporal sequence. In Agroforestry systems, there is both ecological and economic interaction between different components. The country is losing about 1.3 million hectare of forest every year due to deforestation. Forest meeting of fuel wood, wood for construction, river valley projects etc. is reason for deforestation (Abedin and Quddus, 1991).

At present, people are practicing various Agroforestry practices all over the country (Aktar *et al.*, 1992). In Jessore district, Manirampur Upazila is an important place where most of the people practice Agroforestry. Most of the people of Manirapur upazila are directly or indirectly dependent on Agroforestry due to their livelihood. They produce a lot of products. It helps their livelihood income. Cash and non-cash uses of forests are important because at the household and community levels that their contributions cannot be easily separated. The cash benefits of forests generally tend to be better recognized, while the noncash contributions of forests, including ecosystem services, tourism, and cultural benefits are largely "unseen."

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

Although several studies have been conducted on AF practice from various perceptions, but no study is so far carried out specifically to determine the socio-economic impact of Agroforestry on farmers' livelihood in the Manirampur upazila, at Jessore district. This study would deliver information about the contribution of agroforestry in household income of rural community. The rural people's livelihood is severely dependent on non-cash income that is usually underestimated in commercial evaluation. In Agroforestry practice, Non cash income is more important than that of cash income in Bangladesh. To encourage farmer for practicing Agroforestry so that it can contribute their household economy. For this, this study is conducted in Manirampur upazila to know the socio-economic impact of Agroforestry on farmer's livelihood. To inform governments, forest department and policymakers on the right value of forest resources, well data on the non-cash contributions of forests are needed.

1.3 Objectives of the study:

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

CHAPTER TWO

LITERATURE REVIEW

2.1 Concepts and definition of Agroforestry

Agroforestry, social forestry, community forestry, village forestry and farm forestry are all terms used to describe tree growing that is undertaken mainly outside gazetted forest areas. These terms are often used to describe very similar activities, but in theory they have slightly different meanings. Agroforestry is a land-use system in which trees or shrubs are grown in association with agricultural crops, pastures or livestock. This integration of trees and shrubs in the land-use system can be either a spatial arrangement, e.g. trees growing in a field at the same time as the crop, or in a time sequence, e.g. shrubs grown on a fallow for restoration of soil fertility ((Tengnas , 1994).

The word Agroforestry is derived from the combination of two words that is agro, meaning "agriculture crops," and forestry, meaning "forest trees". It is a farming method that allows trees and shrubs to grow along with agriculture crops and/or livestock that means blending agriculture and forestry in the same production system (Tengnas, 1994).

Agroforestry as a sustainable management system for land that increases overall production, combines agriculture crops, forest plants and tree crop and/or animals simultaneously or sequentially and applies management practices that are compatible with the cultural patterns of a local population (Bene ,1977).

Agroforestry is a sustainable land management system which increases the overall yield of the land, combines the production of crops (including tree crops) and forest plants and/or animals simultaneously or sequentially, on the same unit of land and applies management practices that are compatible with the cultural practices of the local population (King and Chandler, 1978).

Agroforestry as a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers (Nair 1979). A collective name for land use systems and technologies where woody perennials (trees, shrubs, palm, bamboo etc.) are deliberately used in the same land management unit as agriculture crops and or animals either in same form of spatial arrangement or temporal sequence (Lundgren and Raintree, 1983).

2.2 Types of Agroforestry

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. Agroforestry can also be defined as a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. In particular, agroforestry is crucial to smallholder farmers and other rural people because it can enhance their food supply, income and health. Agroforestry systems are multifunctional systems that can provide a wide range of economic, sociocultural, and environmental benefit (FAO, 2014).

Types of Agroforestry system

1. Structural basis
   A. Nature of components
   B. Arrangement of components
2. Functional basis
3. Socio-economic classification
4. Ecological classification (Nair, 1979).

A. Nature of components

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 upto two years under protective irrigated condition and under rainfed farming upto four years. The crops can be grown profitably upto 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.

Figure 2.1: Practice of Agrisilvicultural systems

II) Silvopastoral systems

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

This system is classified in to three categories

a) Protein bank

b) Livefence of fodder trees and hedges

c) Trees and shrubs on pasture

Figure 2.2: Practice of Silvopastoral systems

a) Protein bank

In this Silvipastoral 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. Example: *Acacia nilotica, Albizia lebbeck, Azadirachta indica, Leucaena leucocephala, Gliricidia sepium, 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. Example: *Gliricidia sepium, Sesbania grandiflora, Erythrina sp, Acacia sp.*

c) Trees and shrubs on pasture

In this system, various tree and shrub species are scattered irregularly or arranged according to Some systematic pattern to supplement forage production. Example: *Acacia nilotica, Acacia leucophloea , Tamarindus indica, Azadirachta indica.*

Iii) Agrosilvopastoral systems

The production of woody perennials combined with annuals and pastures is referred Agrosilvopastoral systems.

This system is grouped into two categories.

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

a) Homegarden (Mainly practice in the study area)

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 Homegardens 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 (Christanty *et al.*, 1980). Homegarden 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 labor. Homegardens 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 (Ahmad *et al.*, 1980).

Choice of species:

a) Woody species: *Anacardium occidentale, Artocarpus heterophyllus, Citrus spp, Psiduim guajava, Mangifera indica, Azadirachta indica, Cocus nucifera.*
b) Herbaceous species: Bhendi, Onion, cabbage, Pumpkin, Sweet potato, Banana, Beans, etc (Ahmad *et al.*, 1980).

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 luecocephala, Seshania grandiflora* are generally used (Ahmad *et al.*, 1980).

Iv) Other systems

a) Apiculture with trees

In this system various honey (nector) producing trees frequently visited by honeybees are planted on the boundary of the agricultural fields.

b) Aquasilviculture (Mainly practice in the study area)

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. The main role of this system is fish production and bund stabilization around fish ponds

c) Mixed wood lots(Mainly practice in the study area)

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.

B. **Arrangement of components**

a) Spatial arrangement

b) Temporal arrangement.

a) Spatial Arrangement: Spatial arrangement of plants in an Agroforestry mixture may result in dense mixed stands (as in Homegarden) or in sparse mixed stands (as in most systems of trees in pastures).

b) Temporal Arrangement: Temporal arrangements of plants in Agroforestry may also take various forms. An extreme example is the conventional shifting cultivation cycles involving 2-4 years of cropping and more than 15 years of fallow cycle, when a selected woody species or mixtures of species may be planted. Similarly, some silvipastoral systems may involve grass leys

in rotation with some species of grass remaining on the land for several years. These temporal arrangements of components in agroforestry are termed coincident, concomitant, overlapping, separate and interpolated.

2. Functional basis

All agroforestry systems have two functions.

A) Productive functions

B) Protective functions

A) Productive functions

The Productive functions are:

1. Food
2. Fodder
3. Fuelwood
4. Shelter
5. Clothes
6. Shelter
7. NTFPs

B) Protective functions

The protective functions are

1. Wind breaks
2. Shelterbelts
3. Soil conservation
4. Soil improvement

3. Socio-economic classification

Based on socioeconomic criteria as scale of production and level of technology input and management, agroforestry systems have been grouped in to three categories.

A) Commercial Agroforestry systems
B) Intermediate Agroforestry systems
C) Subsistence Agroforestry systems

A) Commercial Agroforestry systems

The term commercial is used whenever the scale of the production of the output is the major aim of the system **Examples:**

a) Commercial production of plantation crops such as rubber, oilpalm, and coconut with permanent underplanting of food crops, pastures.
b) Commercial production shade tolerating plantation crops such as coffee, tea and cocoa under overstorey of shade trees.

B) Intermediate Agroforestry systems

Intermediate systems are those between commercial and subsistence scale of production and management. **Examples:** Production of perennial cash crops and subsistence food crops undertaken on farms wherein the cash crops fulfill the cash needs and the food, crops meet the family's food needs.

C) Subsistence Agroforestry systems

Subsistence Agroforestry systems are those wherein the use of land is directed towards satisfying basic needs and is managed mostly by the owner and his family.

4. Ecological classification

A) Humid / sub humid

B) Semiarid / arid

C) Highlands (Chowdhury and Mahat,1993).

A) Agroforestry systems in Humid/Sub humid lowlands

Examples:
Homegarden, Trees on rangelands and pastures, improved fallow in shifting cultivation and Multipurpose woodlots.

B) Agroforestry systems in Semiarid and arid lands

Examples:
Various forms of silvopastoral systems, wind breaks and shelterbelts.

C) Agroforestry systems in Tropical High lands

Examples:
Production systems involving plantation crops such as coffee, tea, use of woody perennials in soil conservation and improved fallow (Chowdhury and Mahat, 1993).

2.3 Benefits of Agroforestry

A) Environmental benefits

i. Reduction of pressure non Natural forests.
ii. More efficient recycling of nutrients by deep rooted trees on the site.
iii. Better protection of by ecological systems.

iv. Reduction of surface run-off leaching and soil erosion through effect of tree roots and stems on these processes.

v. Improvement of microclimate, such as lowering of soil surface temperature and reduction of evaporation of soil moisture through a combination of mulching and shading.

vi. Increment in soil nutrients through addition and decomposition of litterfall.

vii. Improvement of soil structure through the constant addition of organic matter from decomposed litter.

B) Economic benefits

i. Increment in an outputs of food ,fuelwood, fodder, fertilizer and timber.

ii. Reduction in incidence of total crop failure, which is common to single cropping or monoculture systems.

iii. Increase in levels of farm income due to improved and sustained productivity.

C) Social benefits

i. Improvement in rural living standards from sustained employment and higher income.

ii. Improvement in nutrition and health due to increased quality and diversity of food outputs.

iii. Stabilization and improvement of communities through elimination of the need to shift sites of farm activities (ICRAF, 2002).

2.4 Cash income and non-cash income

Cash income

Cash income may be defined as immediate payment, in full or part, for goods or services. A huge amount of cash income derived from agroforestry products like fuelwood, timber, forest foods, vegetables etc. (IUCN, 2011).

Non-cash income

Non-cash income from forests is defined as the forest products which households collect but consume/use in the home rather than selling. These may be fuelwood, timber, forest foods and

medicines, fodder or fiber (for mat and basket-making and for aspects of house or fiber (for mat and basket-making and for aspects of house construction).This non-cash income is a fraction of the income drawn from forests by those who live in or near them and rely on them in part for their overall annual income from all sources –agriculture, livestock, off farm employment or trade, and forest (IUCN, 2011).

2.5 Contribution of Agroforestry to the household income

Agroforestry is a form of land management system that combines agriculture with trees. Agroforestry have been much practiced in rural areas to enhance the area's economic conditions. It is often practiced on community-owned land through the harvesting of fruits, timbers, and food plants like paddy, tubers, spices, and vegetable. As indicated by various literatures, most of the contributions were attained from fruits, followed by food plant and timbers (Riani, 2015). According to ICRAF (2002) and Garrity (2004), focus of AF is to regenerate land, to achieve food security, to generate income, build assets, and enhance ecological functions for sustainable livelihood.

Agroforestry contributes directly and indirectly to household food security, through the generation of income and employment from the sale. Agroforestry provides the raw materials for many small-scale rural enterprises such as wood for furniture and implement making. In addition, fuelwood provides the main energy source for many other small-scale processing enterprises such as fish-smoking and beer-brewing. Marketable forest products provide the opportunity to supplement household income, as well as providing a relief source in times of seasonal and emergency food and cash shortages. The role of these forest-based activities varies depending on the availability of alternative employment (especially agricultural tasks), the seasonal availability of the forest products, the need for cash income, access to the forest resource, the conditions of the forest resource and access to markets (FAO, 2014).

Gathering and sale of forest products is an important economic activity for many rural people. A multitude of products are gathered form Agroforestry practice. The fuelwood trade increasingly provides another source of cash income for many rural agriculturalists, especially women. Most studies about fuelwood focus on fuelwood consumption and the physical biomass supply. Only recently have studies begun to address issues such as the income to be earned by rural

households in the trade. In a detailed study of the production, marketing and household use of fuelwood in three rural and urban areas of Sierra Leone, Kamara (1986) found that the rural fuelwood market is located primarily in villages near roads leading to towns. Most traders sell fuelwood part-time in order to supplement their household income. The majority of fuelwood collectors and sellers are women both in the rural and urban areas, although rural men provide about 20% of the marketed fuel wood (IUCN, 2011).

The cash income earned from fuelwood collection plays an important role in the agricultural cycle: it provides the first cash income from land cleared for rice production; subsequently, fuelwood collection for the market is concentrated during the off-peak agriculture period, providing cash income in a period when food supplies are generally at their lowest (FAO, 2017).

The value of forests is well recognised both in timber terms and in terms of the non-timber forest products sold in great quantities out of forests all over the world. This section looks at a third, and equally vital, value for forests: the non-cash value of forests. The focus here is on the daily support provided by forests to households living in or near to forest. But it does not factor in 'non-cash' (consumption) income from forests. This income may be literally gathered and consumed in the case of forest fruits, nuts, vegetables, meat and medicinal, but consumption also refers to the use of wood and non-wood products in the household, such as fuelwood (IUCN, 2011).

CHAPTER THREE

MATERIALS AND METHODOLOGY

3.1 Study area Profile

3.2.1 Area and Location

Manirampur upazila is an upazila of Jessore district in the division of Khulna, Bangladesh. It is bounded by Jessore Sadar upazila on the north, Kalaroa and Jhikargachha upazilas on the west, Abhaynagar upazila on the east, and Dumuria and Keshabpur upazilas on the south. This upazila has a population of 382465; male 195338, female 187127; Muslim 310252, Hindu 71748, Buddhist 150 and others 315. It consists of one municipality, 9 wards, 17 union parishads, 246 mouzas and 249 villages (LGED and BBS, 2015).

3.2.2 Latitude and Longitude

It is located between 22°55' and 23°06' north latitudes and in between 89°09' and 89°22' east longitudes (LGED and BBS, 2015).

3.2.3 Main occupations

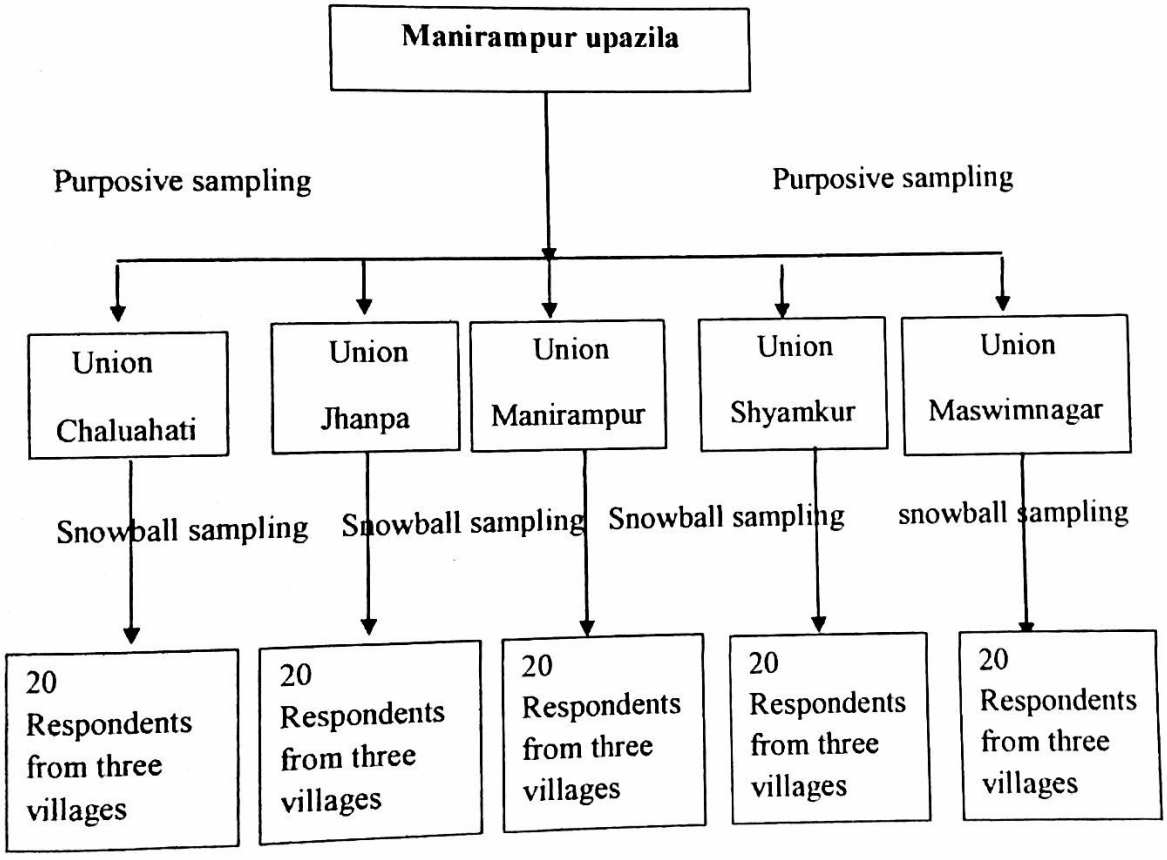
Main sources of income Agriculture 68%, non-agricultural laborer 2.54%, industry 1.49%, commerce 12.64%, transport and communication 3.04%, service 5.67%, construction 1%, religious service 0.13%, rent and remittance 0.52% and others 4.97% (LGED and BBS, 2015).

3.2.4 Common Agricultural practices

The main crops of Manirampur Upazila are Paddy, Wheat, Jute, Potato, Mustard etc. Extinct or nearly extinct crops Linseed, Indigo, Kaun, Arahar etc. Main fruits are Mango, Jackfruit, Papaya, Banana, Litchi, Coconut, Guava and Palm etc. Main Trees are Sissoo, Mahagoni, Neem, Akasmoni etc. (LGED and BBS, 2015).

3.2 Methodology

The relevant primary data were collected from Manirampur upazila through household survey by using purposive and snowball sampling methods. Five unions (Chaluahati, Jhanpa, Manirampur, Shyamkur and Maswimnagar) and three villages from each union were selected purposively. Primary Field data were collected from one hundred respondents following a snowball sampling technique with the help of semi-structured questionnaire. According to Yen, 60 to 120 samples are handsome enough for evaluating a fact in a social survey; a higher numbers has been selected because of diversification in population (Yen, 1984). Sampling process are given below-



Flow diagram of sampling method

Fifteen villages were selected from the five unions those are riched with Agroforestry practice. On the other hand secondary information such as statistical data, reports, and maps were collected from various Government, Non-government organizations, literature and internet. The collected data were processed by using Microsoft Excel in order to calculate necessary indices.

Table3.1: Surveyed villages in Manirampur upazila

Upazila	Unions	Villages	Sample size
Manirampur	Chaluahati	Gouripur	8
		Ratnassarpur	7
		Lakkanpur	5
	Jhanpa	Chondipur	7
		Hanuayer	7
		Jhanpa	6
	Manirampur	Mohonpur	7
		Bejoyrampur	7
		Kamalpur	6
	Shyamkur	shyamkur	7
		Laury	7
		Aminpur	6
	Maswimnagar	Hazrakhati	7
		Parkhajura	7
		Voratpur	6
Total	5	15	100

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

CHAPTER-FOUR

RESULTS AND DISCUSSION

4.1 Age classes of respondents

Table 4.1: Age classes of respondents

Age of family members	Percentage of respondents
31-39	9
40-48	32
49-57	35
58-66	19
67-75	5

The above table shows the age of sample households. There are about 35% households living under 53 ages. There are about 32%, 19%, 9% and 5% households living under 44 ages, 62 ages, 35 ages and 71 Age respectively. So most of the households are middle age. It was observed that respondents age do not have any effect on their Agroforestry practice because people of all ages practice Agroforestry.

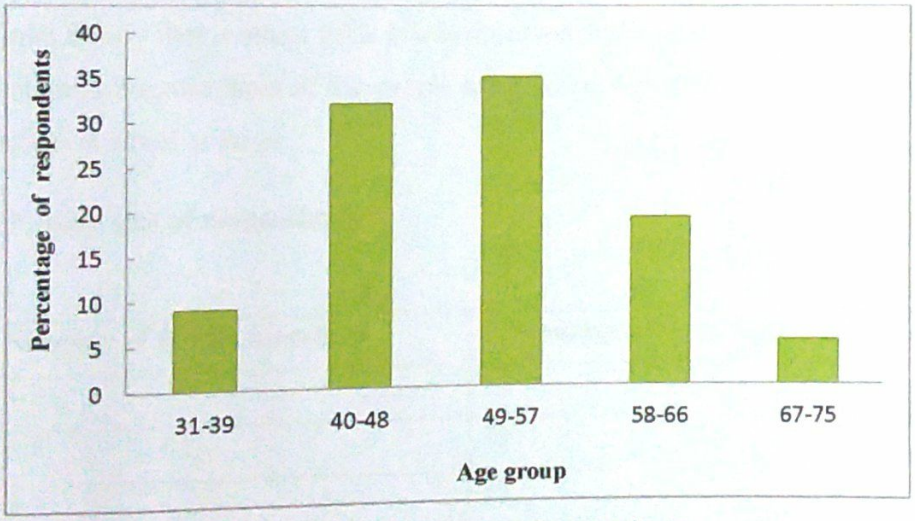


Figure 4.1: Age classes of respondents

There are different age groups people in the area but maximum number of the population are within 49-57 years of age group that is about 35% (Figure 4.1). Second most number of the population is within 40-48 years of the age group is about 32% (Figure 4.1).

4.2 Family size of respondents

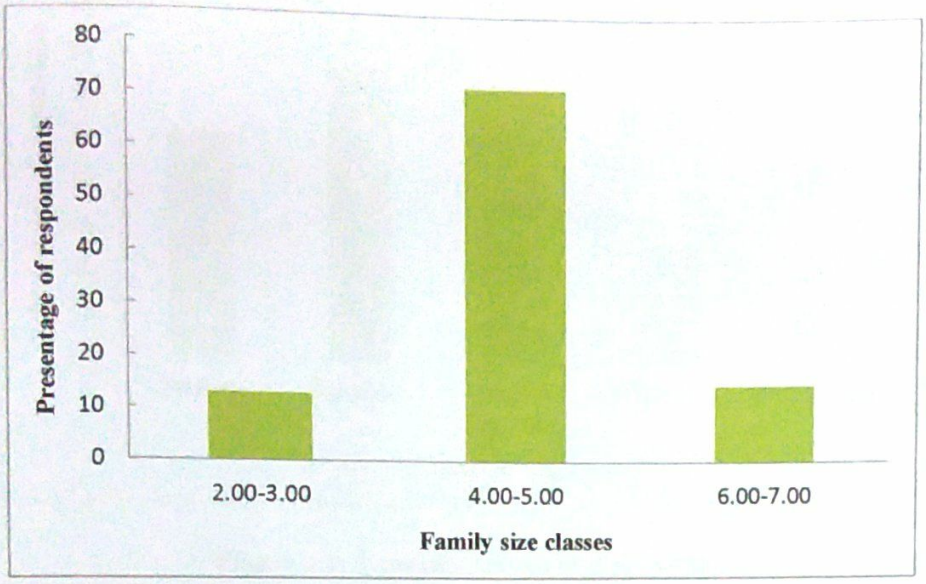


Figure 4.2: Family size of respondents

The above figure shows the family size of sample households. There are about 72% households living 4-5 members, so most of the family is medium in size in term of family members. Only a few are in joint family that is about 15%. It was observed that family sizes do not have any effect on their livelihood because most of the people are practice Agroforestry whether the number of family members is small or large.

Table 4.2: Family size of respondents

Number of family members	Percentage of respondents
2-3	13
4-5	72
6-7	15

4.3 Literacy level

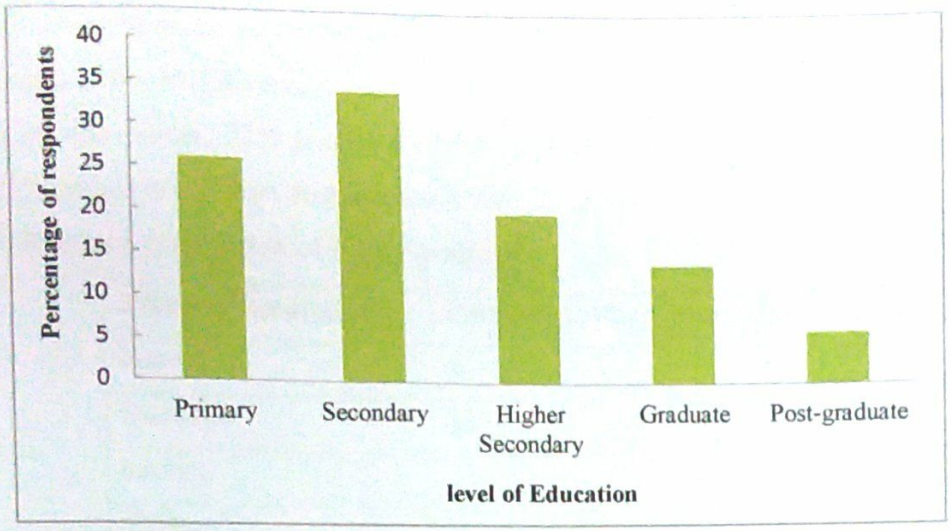


Figure 4.3: Education status of respondents

Education is the back bone of a nation. Significant percentages of the family members are Primary level around 26% and Secondary around 34% (Figure 4.3). Higher secondary, graduation and post-graduate level are (20% 14% and 6% respectively) among the households (Figure 4.3). Most of the people of the study area are educated. They practice Agroforestry for improving their livelihood status. They know about the benefits of Agroforestry. For this, most of the people have a prone to practice different Agroforestry types. So it is possible to reduce the dependency on natural forest of our country.

4.4 Primary Occupation of the respondents

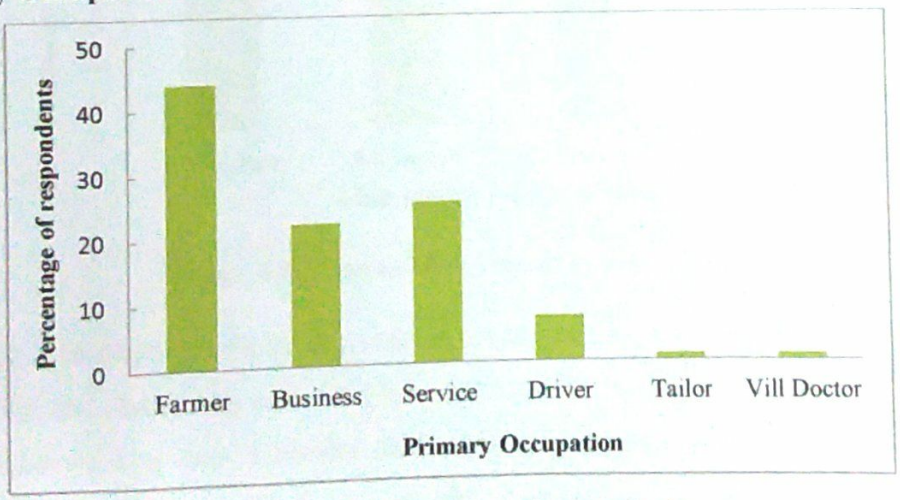


Figure 4.4: Occupation of respondents

Occupation is an important factor that reflects one's socio-economic position. One hundred respondents were surveyed from five unions (Chaluahati, Jhanpa, Manirampur, Shyamkur and Maswimnagar) in the Manirampur upazila. From the figure, about 44% people are farmer, 25% people are service holder, 22% people are businessman, 7% people are driver, 1% people are tailor and 1% people are village doctor respectively.

Table 4.3: Primary occupation of the respondents

Primary occupation	Percentage of respondents
Farmer	42
Business	22
service	25
Driver	7
Member	2
Tailor	1
Village Doctor	1

4.5 Land holding Classes of respondents

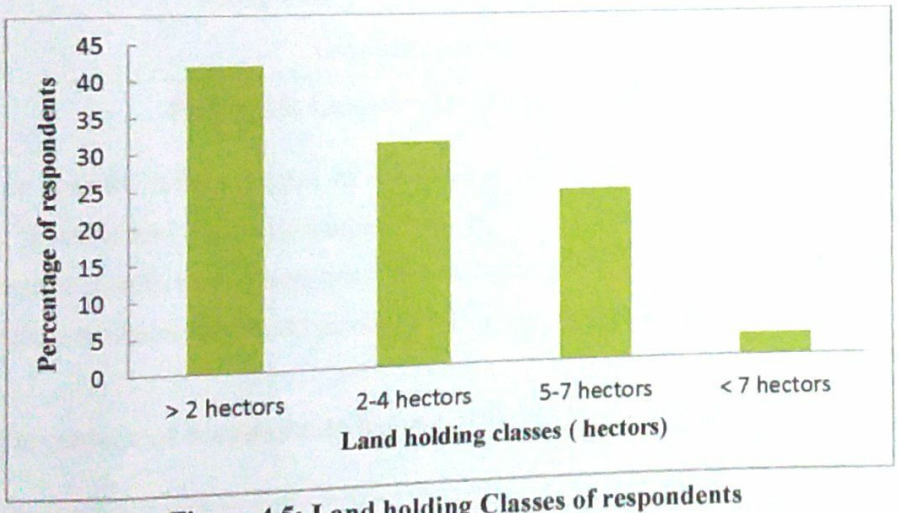


Figure 4.5: Land holding Classes of respondents

Land holding is an important factor that reflects social position of the respondents. In our society social position and status vary with land holding. From the figure it has been shown that, 42% respondents having less than 2 hectors land, 31% respondents having 2-4 hectors land, 24% respondents having 5-7 hectors land and 3% respondents holding above 7 hectors land respectively.

Table 4.4: Land holding Classes

Land holding Classes (hectors)	Percentage of respondents
>2 hectors	42
2-4 hectors	31
5-7 hectors	24
<7 hectors	3

4.6 Percentage of respondents having different types of Agroforestry practices

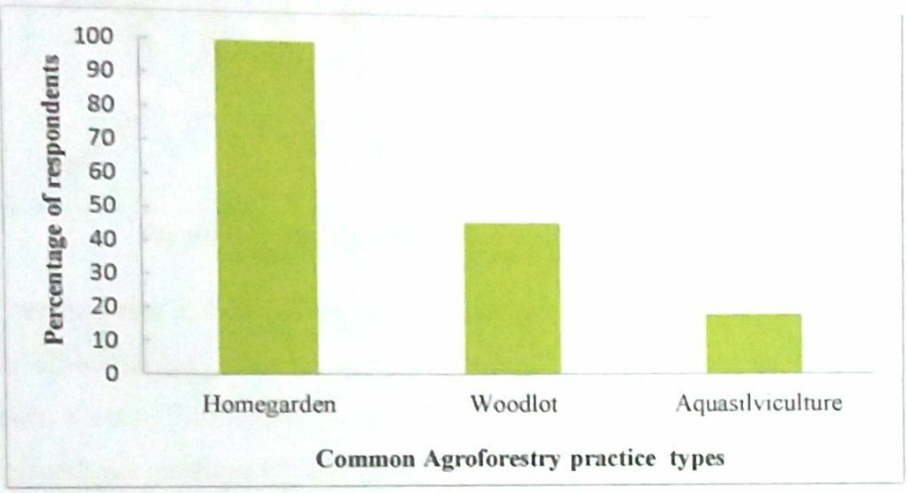


Figure 4.6: Common Agroforestry practice types

In Manirampur upazilla, different types of Agroforestry are practiced Most of the respondents practice Homegarden, Woodlot and Aquasilviculture. From the figure it has been shown that 100% respondent practice Homegarden, 46% respondents practice woodlot and 18% respondents practice Aquasilviculture So, Homegarden contributes household income more in Manirampur upazilla

Table 4.5: Percentage of respondents having different types of Agroforestry practices

Agroforestry types	Percentage of respondents
Homegarden	100
Woodlot	46
Aquasilviculture	18

4.7 Most common tree species and crops in Agroforestry practices

4.7.1 Most common tree species in Agroforestry practices

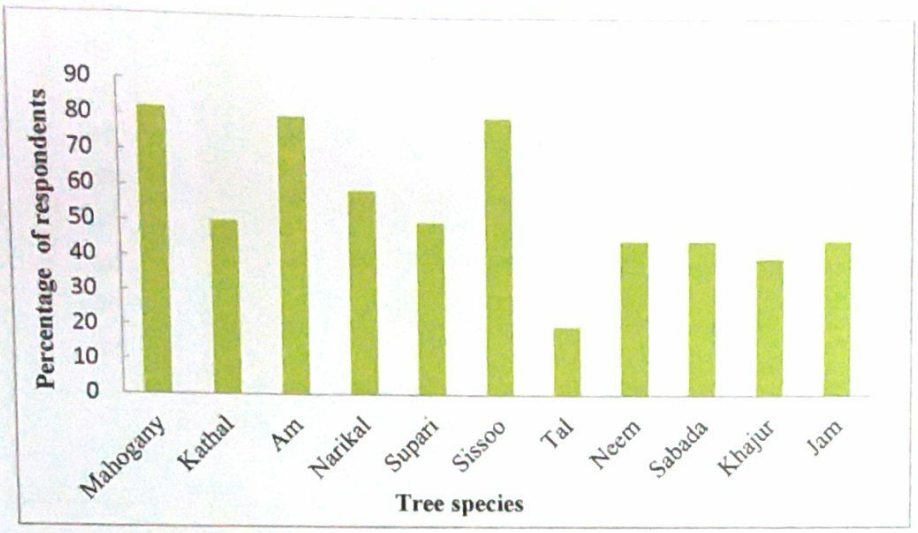


Figure 4.7: Most common tree species in AF practices

Most of the respondents in Manirampur upazilla mainly practice Homegarden. The respondents, who practice Homegarden, practice various types of tree species as Mahogany, Kathal, Am, Narikal, Supari, Sissoo, Tal, Neem, Sabada, Khajur, Jam etc. From this graph it has been shown that 82% respondents preferred Mahogany, 80% respondents preferred Sissoo and Am, 59% respondents preferred Narikal, 50% respondents preferred Kathal and Supari, 45% respondents preferred Neem, Sabada and Jam, 40% respondents preferred khajur and 20% preferred Tal respectively. It has been cleared that most predominant fruit species were Am and wood and fuel wood provide species are Mahogany and Sissoo in the study area. This tree species are good source of fruit, timber, fuel wood, fodder species and those species fulfill our nutrition and increased household income

4.7.2 Most common tree crops in Agroforestry practices

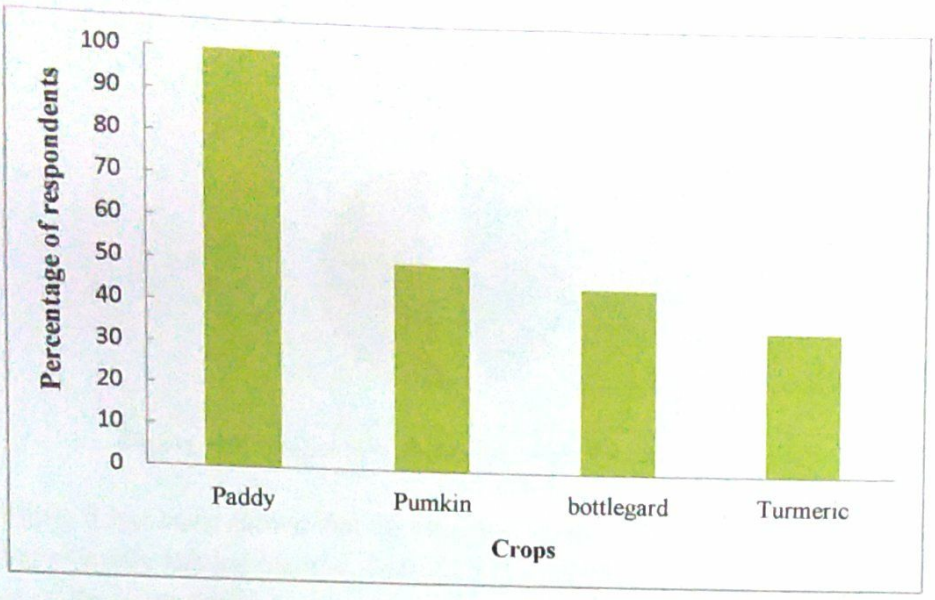


Figure 4.8: Most common annual/ seasonal crops in AF practices

The respondents, who practice homegarden and Aquasilviculture, practice various types of crops as Turmeric, bottlegard, pumpkin, paddy etc. From this figure it has been shown that 100% respondents cultivate paddy, 50% respondents cultivate pumkin, 45% respondents cultivate bottlegard and 35% cultivate Turmeric respectively. This crop species has large contribution in household cash and non-cash income.

4.8 Proportion of income related to Agroforestry and Non-Agroforestry

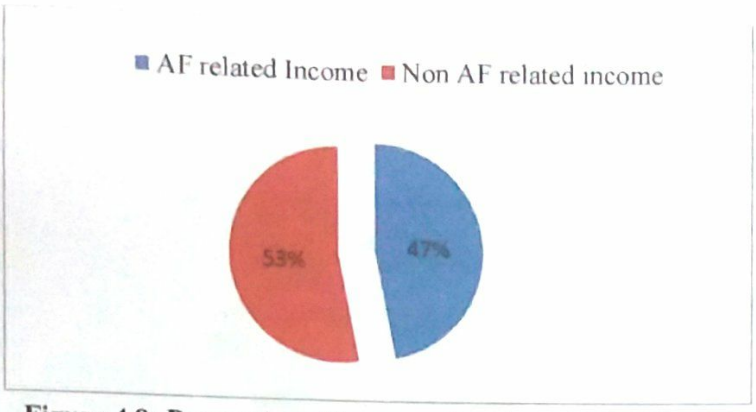


Figure 4.9: Proportion of income related to AF and non-AF

From this figure it has been shown that the respondents get 47% agroforestry related income and 53% non-Agroforestry related income. Agroforestry related income contribute around half of the total income of the households.

4.9 Proportion of Agroforestry related cash and non-cash income

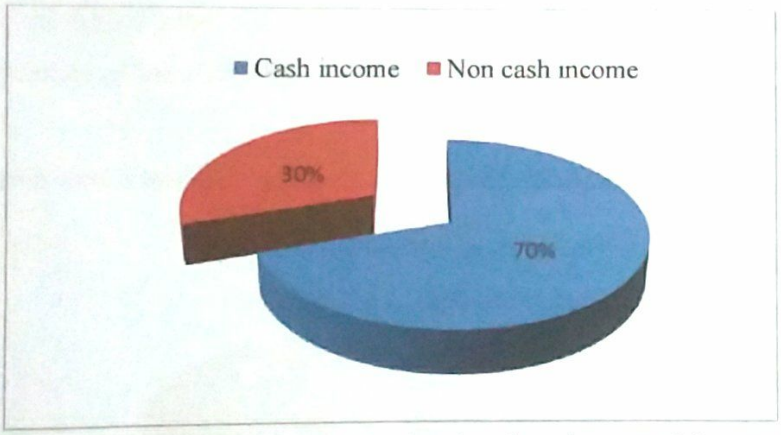


Figure 4.10: Proportion of AF related cash and non-cash income

In Manirampur upazila, it is found that the respondents generated 70% cash income and 30% non- cash income from Agroforestry related products (Figure 4.10). Non-cash income from Agroforestry products which households collect but consume/use in the home, or trade as barter for other goods and services rather than selling. These may be fuelwood, timber, forest foods, medicines, fodder or fibre. It plays a significant role to improve livelihood condition of the surveyed area.

4.10 Cash income and Non-cash income from Agroforestry related product and services

4.10.1 Cash income and Non-cash income from timber

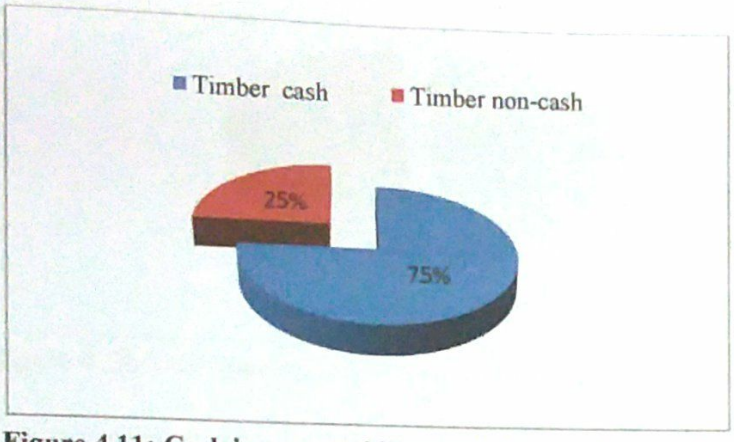


Figure 4.11: Cash income and Non-cash income from timber

Timber is an important agroforestry product. People mainly sell timber for cash income but some timber use for furniture making, door making, windows making and household necessary product etc. From the figure people get 75% cash income and 25% non-cash income from timber of Agroforestry practice of the study area.

4.10.2 Cash income and Non-cash income from fruits

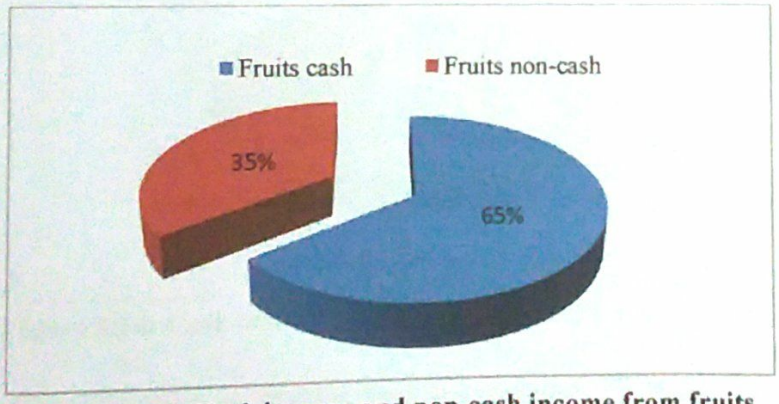


Figure 4.12: Cash income and non-cash income from fruits

Fruits are also an important agroforestry product. People consume fruits because it is a source of vitamin. People get 65% cash income and 35% non-cash income from fruits of Agroforestry practice of the study area (Figure 4.12).

4.10.3 Cash income and Non-cash income from fuel wood

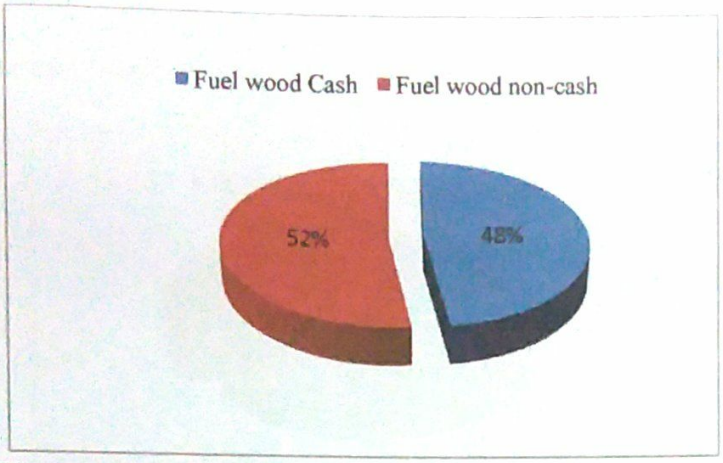


Figure 4.13: Cash income and non-cash income from fuel wood

Fuel wood is also an important agroforestry product and people use for cooking purpose. From the figure people get 48% cash income and 52 % non-cash income from fuel wood of Agroforestry practice of the study area.

4.10.4 Cash income and Non-cash income from vegetables

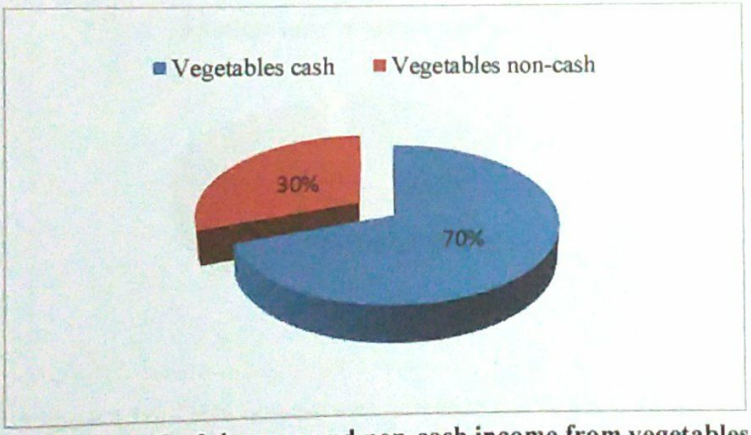


Figure 4.14: Cash income and non-cash income from vegetables

Most of the people collect their vegetables from Agroforestry .From the figure people get 70% cash income and 30% non-cash income from vegetables of Agroforestry practice of the study area.

4.10.5 Cash income and Non-cash income from paddy

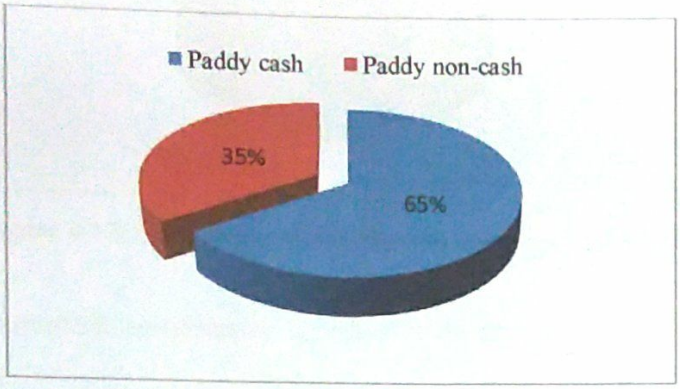


Figure 4.15: Cash income and non-cash income from paddy

From the figure people get 65% cash income and 35% non-cash income from paddy of Agroforestry practice of the study area. Paddy is the main food source of our country.

4.10.6 Cash income and Non-cash income from fodder

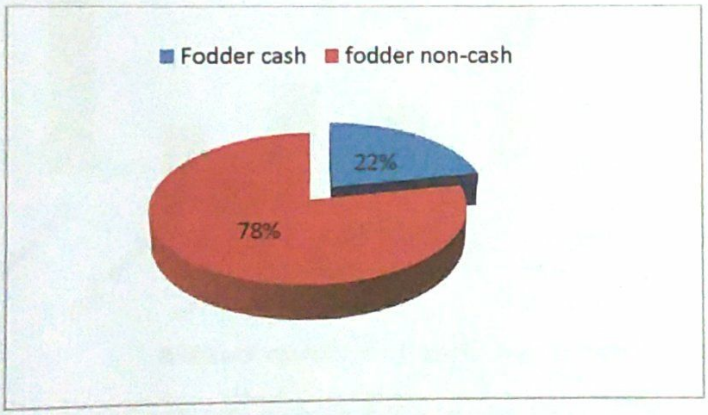


Figure 4.16: Cash income and non-cash income from fodder

Fodder is also an important agroforestry. From the figure people get 78% Non-cash income and 22 % cash income from fodder of Agroforestry practice of the study area.

4.10.7 Cash income and Non-cash income from manure

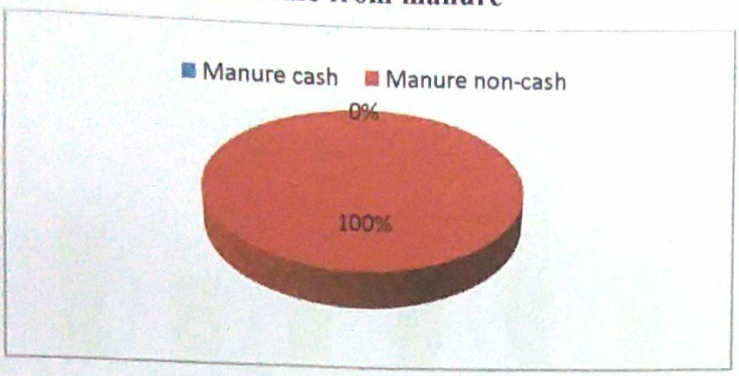


Figure 4.17: Cash income and non-cash income from manure

Manure is also an important agroforestry services. From the figure people get 100% non-cash income from manure.

4.11 Proportion of cash income from different sources of Agroforestry products and service

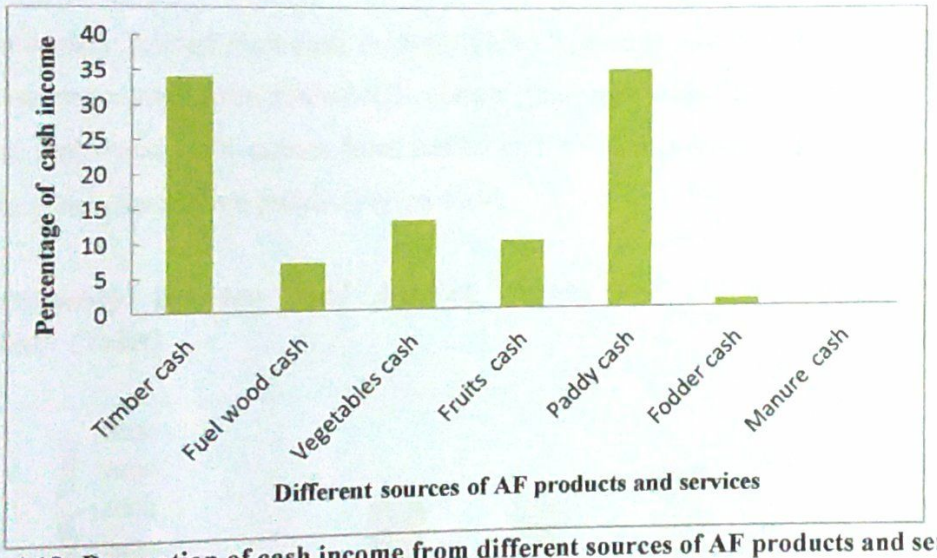


Figure 4.18: Proportion of cash income from different sources of AF products and services

Total Agroforestry related Cash income, 35% Cash income comes from paddy, 34% Cash income comes from timber,13% comes from vegetables,10% come from fruits,7% comes from fuel wood and 1% comes from fodder respectively. Highest amount Cash income comes from paddy and timber (Figure 4.18).

4.12 Proportion of Non-cash income from different sources of Agroforestry products and services

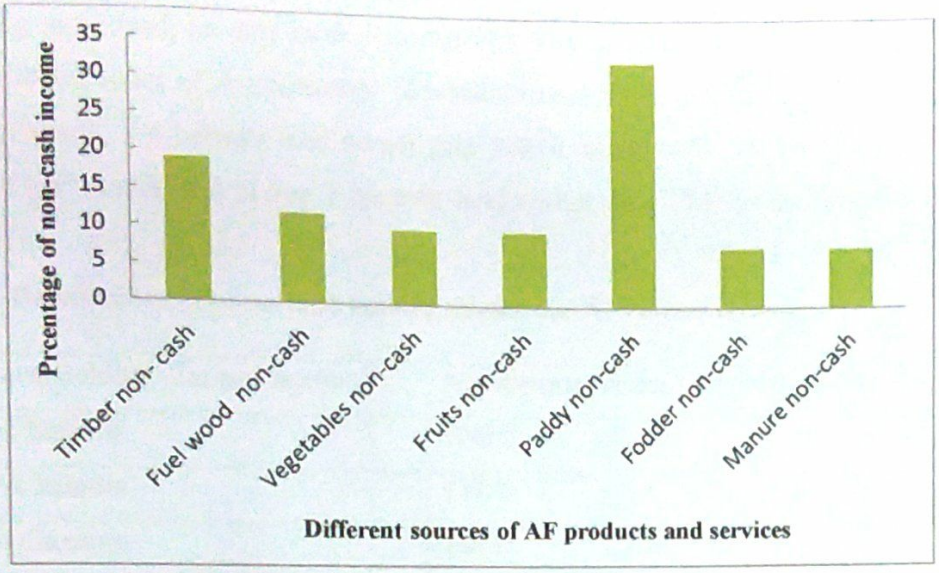


Figure 4.19: Proportion of Non-cash income from different sources of AF products and services

Total Agroforestry related Non-cash income,353% Non-cash income comes from paddy,19% Non-cash income comes from timber,10% comes from vegetables,10% come from fruits,12% comes from fuel wood , 8% comes from fodder and 8% comes from manure. Highest amount Non-cash income comes from paddy (Figure 4.19).

4.13 Relationship between land holding classes and Agroforestry related total income/month (Taka)

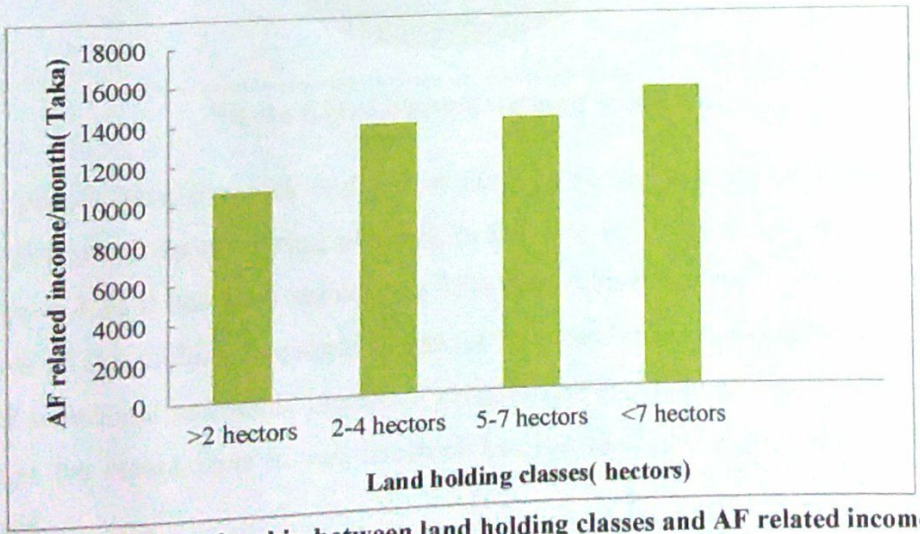


Figure 4.20: Relationship between land holding classes and AF related income

Land holding plays an important contribution to household income. Agroforestry related household income varies with their land holding. In the figure ,it has been shown that household who holding more land, he gets more Agroforestry related income because he has more area to practice different types of Agroforestry. Household who holding Less than 2 hectors land gets 10650taka /month, 2-4 hectors land owner gets 13870 taka/month, 5-7 hectors land owner gets 14035 taka per month and above 7 hectors land owner gets 15488 take/month respectively (Figure 4.20).

Table 4.6: Relationship between land holding classes and AF related income

Land holding classes(hectors)	Agroforestry related income/month (Taka)
>2 hectors	10650
2-4 hectors	13870
5-7 hectors	14035
<7 hectors	15488

4.14 Livestock, their types and sources of livestock feed

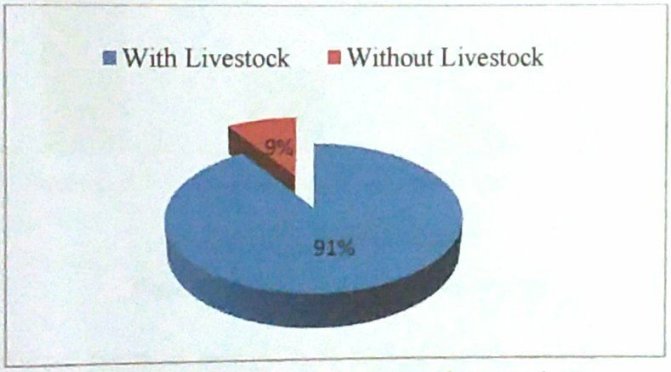


Figure 4.21: Livestock status of respondent

About 91% people have livestock and rest of the 9 % people have no livestock (Figure 4.21). There are a few problems of rearing livestock in this area but most of the people rear livestock. Form the figure 4.22 it has been shown that 33% respondents rear cattle, 27% rear poultry and 40% rear both of this. Selling livestock, people of this upazilla earn handsome amount of money. So, livestock contribute household income. 85% livestock feed comes from Agroforestry (Figure 4.23). It helps the respondents to rare livestock because they do not pay extra money for their livestock feed.

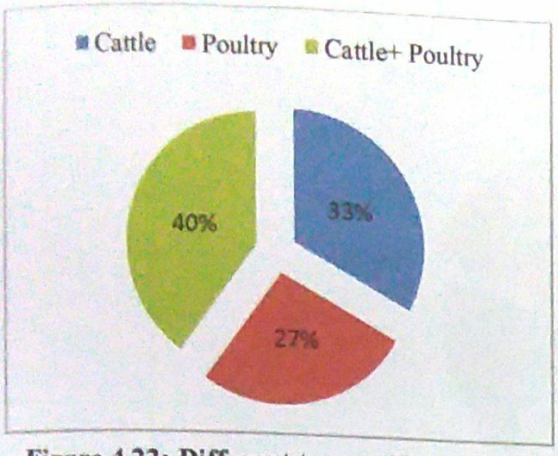


Figure 4.22: Different types of livestock

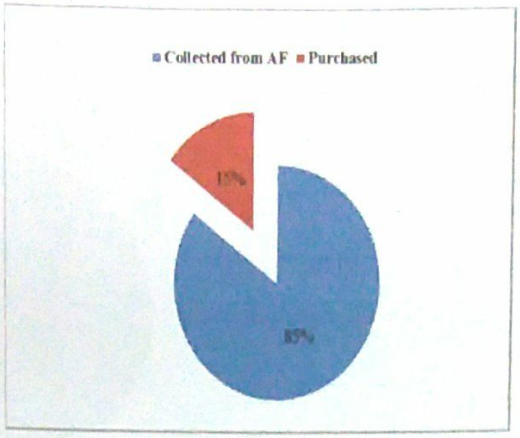


Figure 4.23: Sources of livestock feed

4.15 Types of Cooking energy and sources of fuel wood

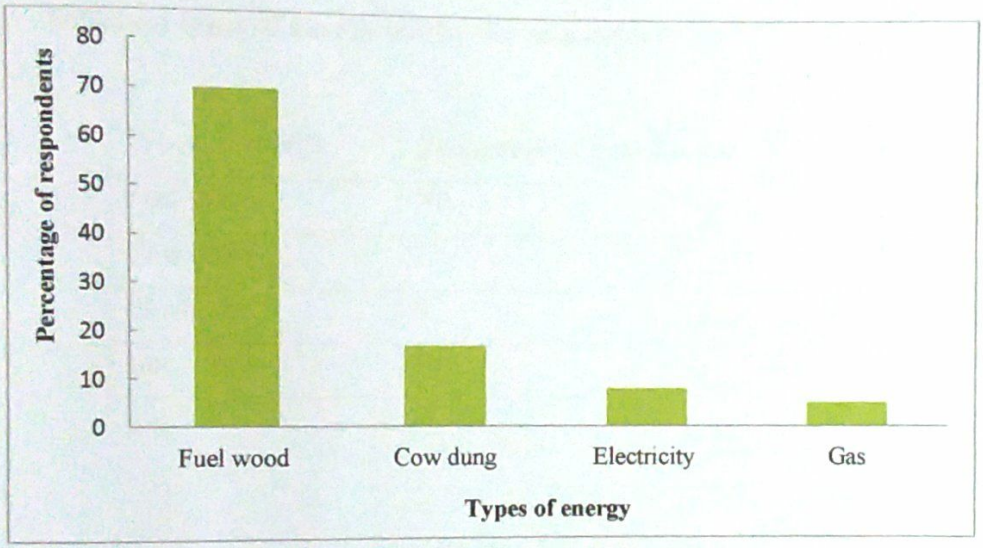


Figure 4.24: Types of cooking energy

People are using different types of energy such as fuel wood, cow dung, electricity, gas etc. to fulfill their fuel energy demand. Maximum people are using fuel wood and cow dung, as their major energy sources (Figure 4.24) because other sources are not available for this area. People collect their fuel wood from different sources such as Homegarden, Woodlot and Social forestry, small proportion is purchased too. 70% household use fuel wood, 17% household use cow dung, 8% household use electricity and 5% household use gas (Figure 4.24).From the figure (4.25), 80% of energy they gather from Agroforestry and they purchased only 20% for their energy consumption.

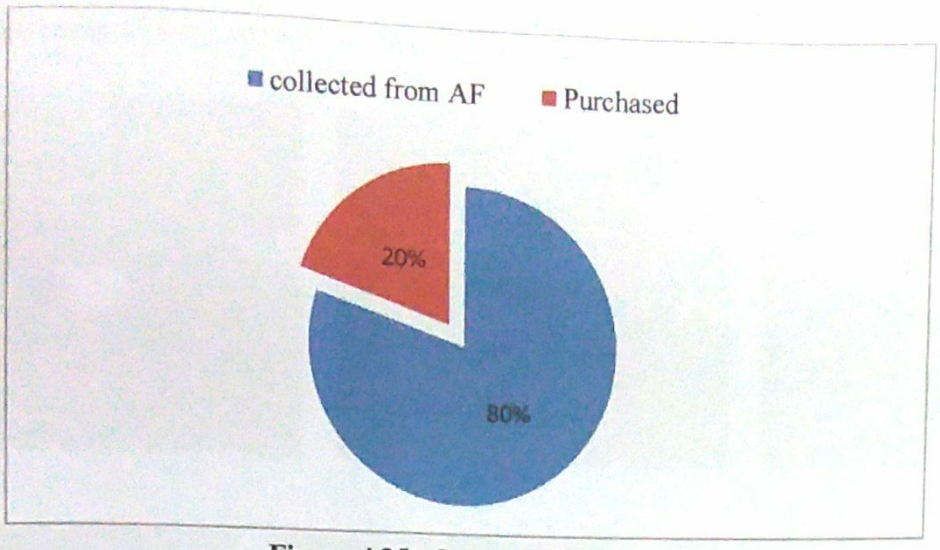


Figure 4.25: Sources of fuel wood

Table 4.7: Different types of energy use by the respondents

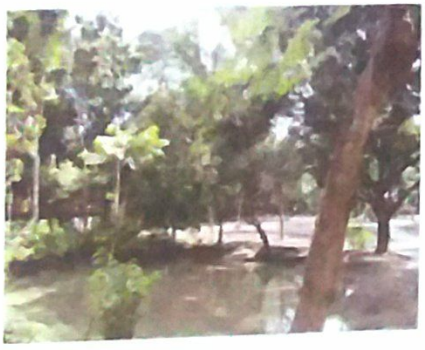
Types of energy	Percentage of respondents
Fuel wood	70
Cow dung	17
Electricity	8
gas	5

4.15 Some pictures of field survey in the study area









CHAPTER -FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Now-a-days population is increasing at alarming rate in our country. Because of the rapid growth of population, it is difficult to meet the country's huge demand for timber, fuel, food and fodder and maintaining ecological balance. So, Agroforestry practices are becoming more popular and important all over the country. In Manirampur upazila of Jessore district Agroforestry types of land use is becoming predominant which might have important contribution to livelihood income. Most predominant types are Homegarden. About half of the total family income comes from Agroforestry practices. Out of the income related to Agroforestry Non-Cash income constitutes 30% of the total which is usually not recognized but has very important contribution to the livelihood income. Most of the cooking energy and livestock feed comes from Agroforestry.

5.2 Recommendations

During the survey it was found that the conditions of Agroforestry resources were not good. However, the following suggestions are recommended to increase the income of people of this area.

- Encouraging more people to adopt Agroforestry types of land use.
- Selection of appropriate tree species which is suitable for Manirampur upazila.
- Proper use of fallow land so that they can practice Agroforestry.
- Proper management must be needed to improve the Agroforestry condition.
- Good quality seed and seedlings should be made available in the nearby nurseries of the study area.

References

Abedin, M.Z. and Quddus, M.A. (1991). Agroforestry Systems in Bangladesh with Particular Reference to Economics and Tenurial Issues, in Mellink W., Rao, Y.S. and MacDicken, K.G. (eds.), Agroforestry in the Asia and the Pacific, FAO and Winrock International, Bangkok, Thailand, pp. 13-33.

Agrawal, A. (2013). "Economic Contributions of Forests"

Ahmad, H. A. Martadihardja and Suharto. (1980). Social and cultural aspect of homegarden. In J.I.Furtado (ed.), Tropical ecology and 'development. Kuala Lumpur: The International Society of Tropical Ecology, Kuala Lumpur.

Aktar, M.S., Abedin, M.Z., Quddus, M.A. (1992). Trees in crop field under agroforestry system Bangladesh, J. Training and Development, 5(2):115-119.

Banglapedia (2015). Forest and Forestry, National encyclopedia of Bangladesh, Dhaka: Asiatic Society of Bangladesh, Retrieved January 3, 2015, from www.banglapedia.org.

BBS, (2011). Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics (BBS), Statistics Division, Ministry of Planning, Bangladesh Secretariat, The Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

BBS, (2015). Statistical Year Book of Bangladesh, Bangladesh Bureau of Statistics (BBS), Statistics Division, Ministry of Planning, Bangladesh Secretariat, The Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

Bene, A. (1977). The coming of age of agroforestry. Journal of the Science of Food and Agriculture 87(9) 1613-1619.

Chowdhury, M.K. and Mahat, T.B.S. (1993). Agroforestry is Farming System of Bangladesh. In: Agroforestry Farming Systems Linkages in Bangladesh, In: proc. Chowdhury, M.K. and Mahat, T.B.S. (eds.), BARC, Winrock International, Dhaka, pp. 1-19.

Christanty, L.M. Hadyana, Sigit and Priyono. (1980). Light distribution in a Sundanese homegarden. Paper presented at the seminar on the Ecology of Homegardens III. Institute of Ecology, Padjadjaran University, Bandung, Indonesia (Indonesian).

Chundawat, B.S. and Gautam, S.K. (1993). Textbook of Agroforestry, Oxford and IBH

Falanruw, M.V.C. 1985. The traditional food production system of Yap Islands. In Proceedings of the First International Workshop on Tropical Homegardens. Bandung, Indonesia: UN University and Institute of Ecology, Padjadjaran University (in press).

FAO, (2011). Global Forest Resources Assessment. Main Report. FAO Forestry Paper 140, Rome Italy. 479pp.

FAO, (2014). The AFNETA Alley Farming Training Manual - Volume 2: Source Book for Alley Farming Research. Alley Farming Research Network for Africa. International Institute of Tropical Agriculture, Ibadan Nigeria.

FAO, (2017). Better Forestry, Less poverty. A Practitioner's Guide, FAO Forestry Paper 149. Food and Agriculture Organization of the United Nations Rome. [http://www.fao.org/docrep/009/a0645e/a0645e00.htm] site visited on 25/06/2017

Fernandes, E.C.M. and P.K.R. Nair. 1986. An evaluation of the structure and function of tropical homegardens. Agricultural Systems 21: 179-310.

Garrett, H.E., *et al.* (1994). Agroforestry: an integrated land-use management system for production and farmland conservation, Assn. for Temperate Agroforestry

Garrity, D.P. (2004). Agroforestry and achievement of the Millennium Development Goals. Agroforestry Systems, 61(1-3), 5-17.

Hasan, M. K., Satter, M. A., Asaduzzaman, S. M., Hussain, M. A. and Haque, M. F. (1997). Agroforestry Systems in the Crop Field and Homestead at Bagherpara FSR Site, Jessore, Proc. National Workshop on Agroforestry Research, Dhaka, Bangladesh, pp. 55-62

Hossain, S.M.A. and Bari, M.N. (1996). Agroforestry Farming System, In Haque, M.A. (eds.), Agroforestry in Bangladesh, Swiss Development Co-operation (SDC), Dhaka and Bangladesh Agricultural University (BAU), Mymensingh, pp.21-28.

ICRAF, (2002). The Path to Prosperity through the Agroforestry. ICRAF Corporate Strategy 2001 – 2010. ICRAF, Nairobi. 43pp.

IUCN, (2011). A study on Social, Economic and Environmental Impacts of Forest Landscape Restoration in Shinyanga Region, Tanzania. A Consultant Final Report. 205pp.

Kamara, S. (1986). Constraints of Participatory Agroforestry Program to Poverty Reduction: The Case of the Sal Forests, Bangladesh, American-Eurasian Journal of Agriculture and Environment Science 9(4), 427-435.

King and Chandler. (1978). The cultivation of Solanum nigrum L. as a leaf and fruit vegetable in the homegardens of West Java: Surveys and experiments. Bandung; Indonesia: Institute of Ecology, Padjadjaran University, and Groningen Netherlands:Department of Plant Physiology, Groningen State University.

Lundgren and Raintree. (1983). Agroforestry in Bangladesh: Potentials and Opportunities, Paper presented in South Asia Regional Agroforestry Consultation workshop held on 23-25 November, 2002 at New Delhi, India.

Nair, P. K. R. (1979). Classification of Agroforestry Systems. In. Agroforestry Classification and Management. (Edited by MacDicken K. G. and Vergara N 76T.). A Willey Interscience Publication, John Willey and Sons New York. pp 31 – 57.

Rahman,S.A. (2011). Optimization of plant density of Akashmoni (Acacia auriculiformis) for production of fuel wood in the bunds of crop land, J. Agrofor. Environ. 5 (2): 1-6.

Riani, A. (2015). The Contribution of Agroforestry To Rural Household Income at the Grand Forest Park. Journal of Rural Indonesia **[JORI]**, [S.l.], v. 3, n. 1, apr. 2017. ISSN 2356-1882.

Salami, A. T., Ekanade, O. and Usongo, P. A. (2002). The Role of Women in an Environmetally Friendly Agro-System: Case Study of Ngie Clan, Northwest Province of Cameroon. AJEAM/RAGEE 4(2): 41-49.

Tengnas, B. (1994). Agroforestry extension manual for Kenya. Nairobi: International Centre for Research in Agroforestry.

Yen, R.K. (1984). Case study Research: Design and Methods. Beverley Hills: Sage Publication

Questionnaire

Questionnaire for contribution of Agroforestry to the household income in Manirampur Upazila of Jessore District.

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

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

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

1. Household information

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

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

2. Land Holdings (decimal):

Size (decimal)	Tenure	
	Own	Leased

3. **Types of Agro forestry usually practiced**

Types of AF	Tick mark	Species/Agroforestry Components
Homegarden		
Alley cropping		
Aquaisilviculture		
Woodlot		
Intercropping		
Others		

4. Agroforestry Trees and crop Species

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

Source of income

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

Non-AF related

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

5. Do you have livestock? Yes / No

If yes, income from livestock-

Name of livestock	Income
Cattle	
Poultry	
Others	

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

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

7.Differentiate between cash income and non- cash income

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