

**POTENTIALITY OF HOMESTEAD AGROFORESTRY
IMPROVING THE LIVELIHOOD OF THE FARMERS IN
CHITMAHALS OF LALMONIRHAT AND KURIGRAM
DISTRICT**



A THESIS

BY

JANNATUL MAOWA

Registration No. 1605114

Session: 2016-2017

Thesis semester: January-June, 2017

**MASTER OF SCIENCE (M.S.)
IN
AGROFORESTRY AND ENVIRONMENT**

**DEPARTMENT OF AGROFORESTRY AND ENVIRONMENT
HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY
UNIVERSITY, DINAJPUR**

JUNE 2017

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*Submitted to the Department of Agroforestry and Environment, Hajee Mohammad
Danesh Science and Technology University, Dinajpur in partial fulfillment of the
requirements of the degree of*

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*Dedicated To
My Beloved Parents*

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The Author

POTENTIALITY OF HOMESTEAD AGROFORESTRY IMPROVING THE LIVELIHOOD OF THE FARMERS IN CHITMAHALS OF LALMONIRHAT AND KURIGRAM DISTRICT

ABSTRACT

A study was conducted to determine the potentiality of homestead agroforestry practices improving the livelihood of the farmers of the Northern parts of Bangladesh especially of Angarpota Chitmahal of Lalmonirhat District and Dashiarchora Chitmahal of Kurigram District compared with non-chitmahal area Kutichandrakhana of Kurigram District. A structured interview schedule was used to collect data and correlation test was conducted to ascertain the relationship between concerned dependent and independent variables of the study. Semi-structured interview, focus group discussion, participatory rural appraisal techniques were also used for data collection and the information was analyzed by using descriptive statistics. The study focused on the present status of study area, composition, structure of home garden, diversity of plant species and contribution of home garden to household food security, conservation of plant species, farmers perception about homestead agroforestry, socio-economic importance and the constraints of the total production system. It also explored the relationships among the selected characteristics of the farmers namely age, education, family size, homestead area, knowledge of homestead agroforestry, annual income from homestead area, problem confrontation with homestead agroforestry practices and opinion regarding changes of livelihood. Total income was found higher in large farm category than marginal. In Dashiarchora chitmahal total 142 plants species were recorded of which 69 timber species, 36 fruit trees, 12 medicinal species and 25 vegetable species. Again in Angarpota chitmahal total 140 plant species from of which 72 timber species, 41 fruit species, 8 medicinal species and 19 vegetable species. In non-Chitmahal 140 species from non- chitmahal area of which 52 timber species 43 fruit species 16 medicinal species 29 vegetable species. Among these different plant species Jackfruit, Akashmoni, Mango, Mahogany and Eucalyptus were found as dominant tree species were found in almost 80% respondents houses. The diversity of timber species in the study area was rich compared to medicinal, fruits species. Mango and Jackfruit were identified as an important cash-growing fruit tree while mahogoni and Eucalyptus as timber trees in all the study areas. The respondents faced many problems during tree plantation among them two major causes were poverty and lack of technical knowledge to adopt homestead agroforestry practices. Being the detached people of the country, they have little education and their learning level is very low. They have also little or no training on improving homestead agroforestry, they have lower annual income and maximum people involved in work with agriculture and they do not have much homestead area and cropland area. The findings suggests that homesteads of Chitmahal area can be improved by proper management practices, providing, co-operative and extension services in comparison to non chitmahal one. However there are a good scope to improve the homestead agroforestry in chitmahal area of northern part of Bangladesh to improve their livelihood.

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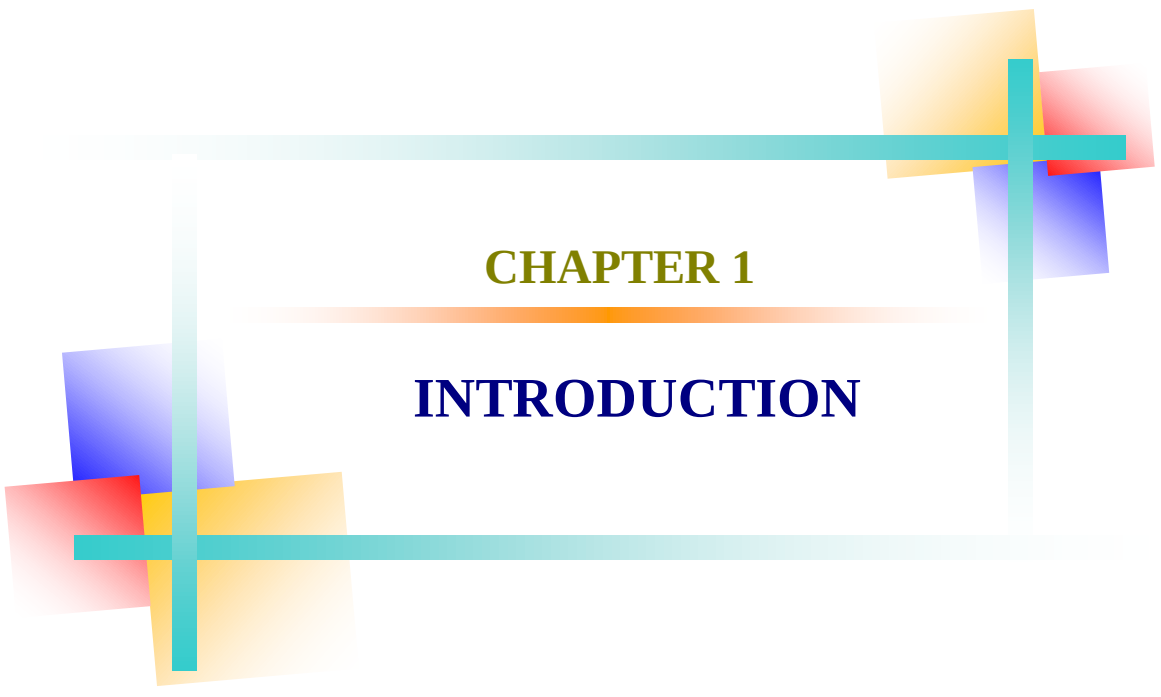
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An abstract geometric design featuring two sets of intersecting lines forming a cross. The lines are light blue and have a slight gradient. Overlaid on these lines are several semi-transparent squares in yellow, red, and blue. The squares are positioned at the intersections and along the lines, creating a layered effect. The overall composition is centered on the page.

CHAPTER 1

INTRODUCTION

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INTRODUCTION

1.1 General Background

Bangladesh is mainly an agriculture based country and agriculture plays a vital role in the national economy of the country. About 15.33% of the GDP comes from the agriculture (Bangladesh Economic Survey, 2016) and it creates 66% employment opportunity of the country. This sector is playing a vital role in achieving self-sufficiency in food production. However, the contribution of agriculture to the GDP and incremental employment is likely to diminish day by day. Bangladesh is one of the most densely populated countries of the world having 160 million people (Bangladesh Economic Survey, 2016) with more than 1077 persons per km²(BBS,2016) About 85 per cent of population lives in the rural areas spreading over 87191 villages (BBS, 2016).There are only 399589 hectares of homestead land having 0.03 hectare per household. There are 20.1 million of cultivated land(Bangladesh Agriculture census 2008) and about 1.60 million hectare of forest in Bangladesh (Bangladesh Economic Survey, 2016).The country annually requires about 9.4 million M³ of fuel wood against supply of about 6.18 million M³ (FRA, 2000). But this meets only 10% of the national fuel energy need. But Bangladesh has only 13.4% forest land of the total area as officially recorded report, where trees cover only 6.4% of the total area which is decreasing day by day for the last few decades (BBS, 2016). Due to shortage of agricultural land, homestead agroforestry practices may be a good strategy for survival and existence of the client system

1.2 Concept of Chitmahal (Enclaves)

The term enclaves refer as a country, or esp. an outlying portion of a country, entirely or mostly surrounded by the territory of another country. In the Indian subcontinent since the Middle Ages the term chitmahal or enclave came into discussion as an international geopolitical entity in the post-colonial period. However, the most of the world's chitmahal (enclaves) are now located in Bangladesh and India. The geopolitical entity of the enclaves has occurred frequently through the history, and Western Europe was

particularly rich in enclaves. There was often an expression of decentralized forms of rule, which admitted discontinuous territories. During and after the Crusades, enclaves were a fairly widespread phenomenon in the eastern Mediterranean region, and presumably also existed elsewhere during the periods of feudal rule.

In the sub continental context, the zamindars or the local chiefs often tried to extend their territories by marriage, war or purchase. In doing so, they often owned some territories far away from their own jurisdictions, laying in the others. Such a pattern of the growth of enclaves had a gradual evolution. Over the administrative control, various complications developed in the chit (abridged version of chitmahal) lands resulting in numerous conflicts among the neighboring zamindars, but as there was no international boundary, it did not seem as problematic as of the later days. While executing their revenue reforms, the British noticed the enclave problems and sometimes tried to settle those. Since there were two conflicting parties in each case, and the British-doings were always concerned with their own interests, the intricate boundary problems remained unresolved. But now the issue being solved in the process of colonization.

India, the largest country in South Asia has its disputed boundary with most of the neighboring countries. The carving out of Bangladesh from the geographically separated eastern wing of Pakistan added a new dimension to this problem. There remain many trivial which could perhaps be resolved through a neighborly relation of friendship and cooperation. Unfortunately the disputes still remain unresolved, which have been a source of tension in the bilateral relations. The partition of India (1947) along with other boundary disputes conjured up a particular landscape on the previously existed chitmahal, because, the boundary, drawn in a very casual manner turned the chitmahal into international enclaves embodied with numerous complications.

Bangladesh has its 4200 kilometres long boundary all around with India (except the Bay of Bengal and the relatively short boundary with Myanmar in the south). Though boundary disputes existed in many places on that long boundary, enclaves are found only in a small and narrow section in the northern boundary, covered by the present districts of Kurigram, Lalmonirhat, Nilphamari and Panchagarh.

Being detached from the mainland by the international boundary of nation states, thousands of innocent inhabitants of the enclaves perhaps have been among the most deprived people in the world. They are totally excluded from all kinds of economic,

social, political and development activities of both the government and non-government organizations. Their vulnerability and uncertainty of very basic needs as well as inhuman coping with the ever backward livelihood for survival is utterly contrary to the very notion of modern civilization. The partition with artificial boundary through the densely populated agrarian area has been found to be a disaster for the people, entailing a serious socio-economic impact at the micro level. Remarkably the enclave people have been mostly victimized by the partition. But their grievance could not draw even minimum attention either from the governments of the respective countries or from the social workers and civil societies during the long period of almost six decades. Although some initiatives were taken to resolve the issue and optimism also appeared in 1974, it was only a part of macro events in the bilateral politics and that is why this problem still remains unresolved with other bilateral issues understandably due to the reluctance of India.

Since the Agreement of 1974 and its immediate dead-lock, the inhabitants of the Bangladesh-India enclaves have been receiving little importance from either of the countries except some incidental media coverage and occasional bilateral talks (including the special agreements for the Tin Bigha Corridor of Dahagram-Angorpota) as one of many other bilateral issues in macro politics. Unfortunately, the concerned organizations of Human Rights as well as the civil societies have also been silent about the sub-human livelihood of the people living therein. The enclave-people both in India and Bangladesh are found simultaneously subaltern, marginal and minority in regard to basic needs and the right of self-determination.

In terms of the human aspects, the plight of the enclave-people was apparently as like as that of illegal immigrants' in their very homeland. Generally it appears that the enclaves of Bangladesh and India had virtually become stateless limbos. The few literatures, available on enclaves hardly reveal the political and socio-economic aspects of the individuals thereof. In fact, the enclave dwellers have no connections with the contemporary literature on nation states and nationalism. Only exception is that the Bangladesh government has dealt seriously with the Indian government about its largest enclave Dahagram-Angarpota (a composite enclave as indicated by the name) laying in India which has been linked with the mainland by a passage namely Tin Bigha Corridor since 1992. Perhaps, for this reason some news reports and articles on Dahagram-Angarpota were occasionally published in some newspapers and journals. But there is a

dearth of information about the rest of the Bangladeshi enclaves. The case is almost same in the Indian side also. However, some articles especially studies undertaken by the bureaucrats were published in India in the 1960s. It may be noted that any in-depth work on the post-partition development of the enclaves is yet to be found.

1.3 Status of Chitmahal (Enclaves) in Bangladesh

There are 111 Indian enclaves in Bangladesh, including 59 in Lalmonirhat, 36 in Panchagarh, 12 in Kurigram and 4 in Nilphamari (Brenden R. Whyte, 2002). The Prime Ministers of India and Bangladesh signed the Land Boundary Agreement in 1974 to exchange enclaves and simplify their international border. A revised version of the agreement was adopted by the two countries on 7 May 2015, when the Parliament of India passed the 100th Amendment to the Indian Constitution. Under this agreement, which was ratified on 6 June 2015, India received 51 Bangladeshi enclaves covering 7,110 acres in the India mainland, while Bangladesh received 111 Indian enclaves covering 17,16A acres in the Bangladesh mainland. Bangladesh has its 4200 kilometers long boundary all around with India. Though boundary disputes existed in many places on that long boundary, enclaves are found only in a small and narrow section in the northern boundary, covered by the present districts of Kurigram, Lalmonirhat, Nilphamari and Panchagarh (Januzi, 1977). Being detached from the mainland by the international boundary of nation states, thousands of innocent inhabitants of the enclaves perhaps have been among the most deprived people in the world. They are totally excluded from all kinds of economic, social, political and development activities of both the government and non-government organizations. Their vulnerability and uncertainty of very basic needs as well as inhuman coping with the ever backward livelihood for survival is utterly contrary to the very notion of modern civilization. But there have been a lot of scope to overcoming this condition through Agroforestry farming practices. Because Agroforestry farming is getting importance as the way of investing minimum capital but earning maximum income with increased participation of farmers in economic activities (Rahman, 1995). Agricultural production will be increased by the contribution of both male and female of household to improve their livelihood. (Sultana, 1993) But in order to prepare a good agroforestry plan, first we need to know its present status and its impact on local farmers livelihood. But there is very little information about the present status and farmer's perception about the homestead agroforestry in the Chitmahal area of Lalmonirhat and Kurigram District. Because the

accessible opportunity of these area were previously restricted. But now these area are the internal part of Bangladesh and there are a huge scope to develop the livelihood improvement of these area through proper farming systems like homestead agroforestry. However for future planning - current status, farmer's perception and potentiality of agroforestry should be studied. Considering these the study was carried out to determine the role of traditional agroforestry practices on the livelihood improvement in Angarpota (Lalmonirhat District) and Dashiarchora (Kurigram District) chitmahal area and nearby a non chitmahal area.

This is a great challenge against socio-economic and environmental development of the country. Forests are known as world blanket, without it, this world will be an inhospitable place to live in. Forest is important for maintaining ecological balance and preserving the life supporting system of the earth. They are essential for food production, health and other aspects of human survival and sustainable development of all the ecosystems.

1.4. Homestead Agroforestry and Bangladesh

Bangladesh possesses a glorious tradition of agroforestry systems practiced by her farming communities. Well planned interacted land use system combining woody perennials and other production enterprises in accordance with the farmers' need, goals and resources base can only lead to viable farming system towards sustainable livelihood in the coming future. The homestead of rural people is a unique feature of combination of trees, shrubs, vegetables, livestock, ducks, poultry, and pigeon from ancient time.

Homestead agroforestry is an age old practice and an integral part of traditional farming system in Bangladesh. Agriculture is very important for the economy of Bangladesh. It contributes about 15.33 percent to the gross domestic products (GDP) and about 66 percent of employment of labor forces (Bangladesh Economic Survey, 2016). The sector will continue to play a vital role in achieving self-sufficient in food production, in reducing rural poverty and fastening sustainable development. Conducive environment is the key for healthy survival for any living being, however, reclaiming a countries environment is not an easy task, neither is shorter time, space, nor pouring capital alone. It is our shared responsibility to protect our environment. We can protect environment through growing more trees. It plays a key role in our lives by protecting us from bad effect of environment and unhitching rural production and urban lifestyles.

The homestead agroforestry is very important in the economy of Bangladesh. The trees and other woody species grown in the homesteads are a significant source of fuel wood. They also provide fruits, fodder, building materials and other forms of wood. Trees in the homesteads, often called "homestead forests", play an important role in the rural economy of Bangladesh. They are particularly important source of fuel wood that can easily be collected and carried for home use. Besides, existing natural and plantation forests are generally managed for commercial products. Therefore, constitute an inadequate fuel wood source even for nearby residents, and are of no use for larger populations living shortage of fuel wood and excessive deforestation in Bangladesh, the homestead agroforestry system needs to be strengthened.

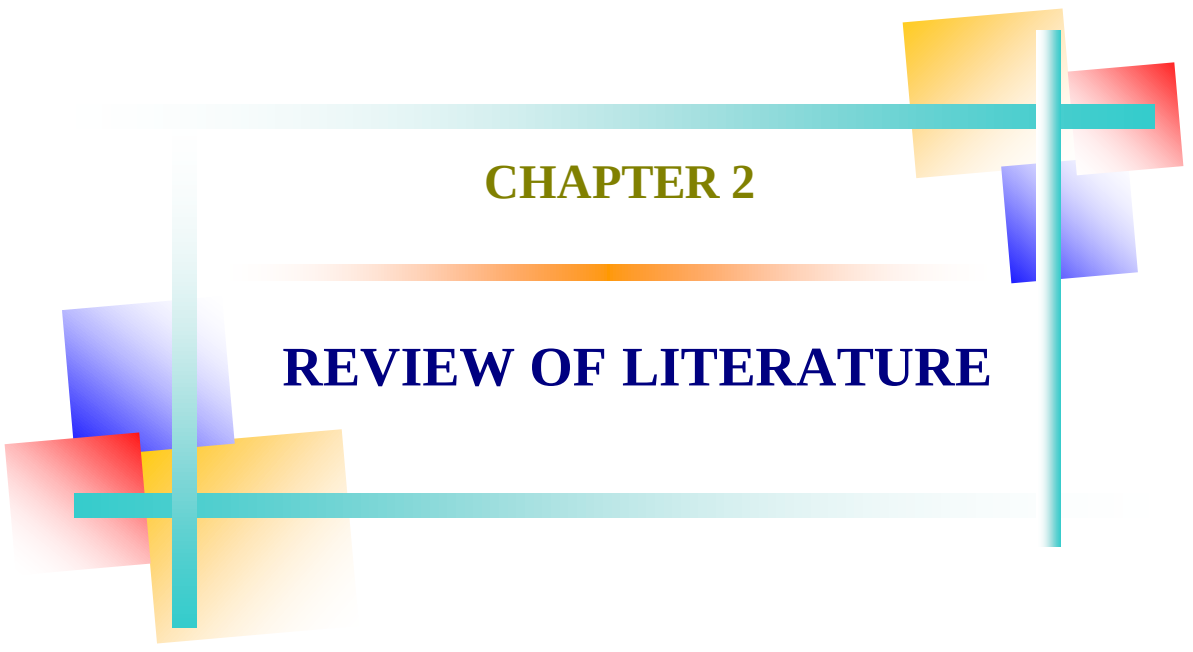
In North Bengal of Bangladesh, innovative farmers have spontaneously developed agroforestry systems in their homesteads and croplands. This provides benefits to the rural community because trees offer facility such as shade, shelter, recreation, agro-ecological balance and so on (Roy *et al.*, 1996). Homestead agro-production has special significance in the context of Bangladesh where about 50% of rural households are landless (Januzi and Peach, 1977). Homestead farming is getting importance as the way of investing minimum capital but earning maximum income with increased participation of farmers in economic activities.

But there are lacking of information regarding socio-economic impacts of homestead production system with respect to concept of agroforestry in Angarpota chitmahal of Lalmonirhat district and Dashiarchora chitmahal of Kurigram District. Earlier it was full with natural vegetation having trees, shrubs, herbs. Due to lack of consciousness all plants were completely destroyed except homestead vegetation.

Considering the above facts it is expected that this study was able to generate valuable information on the existing homestead agroforestry and its impacts on social and economic aspects of local people livelihood in the Angarpota chitmahal of Lalmonirhat district and Dashiarchora chitmahal of Kurigram District. Moreover, it would be possible to arrive at some concrete recommendations for further developmental steps to be taken for effective homestead agroforestry in Bangladesh and more especially in the study area.

1.5 Objectives of this study

- To know the existing Homestead agroforestry status in the selected Chitmahal and Non-Chitmahal areas.
- To determine the farmers perception and role of Homestead agroforestry systems and its impacts on livelihood security and local climatic variability.
- To explore the relationship between livelihood improvement of chitmahal area with non-Chitmahal area, and
- To detect the problem faced by farmers for homestead agroforestry practices.



CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

This chapter presents a brief review of the past studies and opinions of researchers having relation to this investigation which were gathered from text books, journals, dissertations, reports and other form of publications

2.1 Concept of agroforestry and homestead agroforestry

Anam (1999) reported that vegetables were grown in three types of micro sites within the homestead viz. in shady, open place and creeping on the tree.

Awal *et al.* (2000) observed that homestead fruit and vegetable practices earned substantial income for all categories of farmers. The women were involved in the household decision making process to a greater extent. The evidence was more spectacular in aspects like family planning, education of children, poultry rearing, plantation of fruits and vegetables and marriages of sons and daughters.

Akter *et al.* (1989) mentioned that farmers considered trees as savings and insurance against risk of crop failure and low yield, as well as assets for their children. Some farmers stated that tree would contribute toward expenses for marriage of their daughters

Douglas and Hart (1973) stated that trees are integral part of homestead as well as nature. Trees provide direct and also indirect benefits to human being and to the nature. It has the great potentials for feeding men and animals, regenerating soil, restoring water systems, controlling floods and droughts, creating more benevolent micro-climates and more comfortable and stimulating living conditions for humanity.

Lundgren and Raintree (1982) stated that agroforestry is a collective name of all land use systems and technologies where woody perennials are deliberately grown on the same land management units as agricultural crops and/or animals in some form of spatial arrangement or temporal sequence.

Michon *et al.* (1983) and Soemarwoto and Conway (1991) stated that home garden agroforestry maintains high levels of productivity, stability, sustainability and equitability.

According to FAO (1986) homestead is one of the most elaborate systems of indigenous agro-forestry found most often in tropical and sub-tropical areas where subsistence land use systems predominate.

Ninez (1987) defined home gardens as a small scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing and wage earning.

Fernandes and Nair (1990) mentioned that homestead represent a land-use systems involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and invariably livestock within the compounds of individual house, the whole crop -tree-animal unit being intensively managed by family labor.

Khandaker (1991) reported that agroforestry system is traditional in the homesteads of moist tropical world including rural areas of Bangladesh since the establishment of houses. This system could be considered as potential technology for rural poverty alleviation because of its diversified functions.

Sultana (1993) stated that homestead vegetables and fruits form an integral part of the family diet and a part of them enter the commercial market. Although every member of the family has some contribution, the major labor impute was seed preservation, land preparation, transplanting, watering and harvesting are done by women. Men usually help in fertilizer and pesticide application.

Sing et al. (2003) reported that medicinal plants are integral part of rural and urban lifestyle, but many of them medicinal plants species have reached endangered already and threatened because of over exploitation of forests, uncontrolled grazing and fire. India, nearly 175 million ha of land is degraded, 93 million ha of which is wasteland. This land is not suitable for growing agricultural crops economically but can be effectively used for growing medicinal plants after proper management

Halladay and Gilmoure (1995) mentioned that the homestead have multiple functions in relation to everyday human life and environment and also act as a bridge between all living beings and non-living environment. The man values derived from home garden are foods, energy for domestics use, source of nutrients, fodder for domestic animal,

medicinal products, timber for house construction, and a pleasant environment for dwellers.

Mazher (1996) pointed out that a typical homestead agroforestry in Bangladesh provides an excellent opportunity for a number of economic activities to be undertaken in and around it. The homestead enterprises such as vegetables and fruits cultivation, fish culture, forest, poultry rearing etc. can contribute to have increased food availability and generate income of the rural farm families.

Yoshino and Anodo (1999) conducted a study entitled "Homestead (Bari-Bhiti) utilization and management in Dakshin Chamurai village located in the floodplain of the tributary of the Jamuna River in Bangladesh." It came out from the study that in the whole village, 1245 species (82 species from perennial plant and 43 species of annually grown plant) were observed and 13 each plant had various uses. Seventy species were used as food materials about 80 species were used for fuel, 48 species were as medicines, eight species were used as fodder, eight species as livestock medicine, 24 species were as timber and 17 species as material for various tools, three species were used for soil protection, and other uses such as hedge, child's play, ornamentals, etc. for the villager daily needs. One plant was used for 2.5 purposes on the average among all the plants and 2.8 among the perennial plants. Multiple uses were conspicuous for the indigenous and common species to the locality, indicating the presence of a close relationship with the living environment of the village.

2.2 Homestead agroforestry and its benefits

Abedin and Quddus (1990) conducted a study at six agro-ecologically different locations of Bangladesh and reported that the small homesteads, owned by the marginal and small farmers, have 20-21% area under housing, 29.37% under tree coverage and 9-14% under vegetable cultivation. In bigger homesteads owned by big farmers, about 16% land is under housing, 33% under tree coverage and 12% under vegetable cultivation.

Abedin and Quddus (1990) recorded 28 different tree species in the homesteads of the Barind Tract in Rajshahi district. *Mangifera indica* and *Phoenix sylvestris* were the most dominant species, whereas *Artocarpus heterophyllus* was only of minor occurrence. They also mentioned that the average tree density was higher in Patuakhali and Rangpur (1.5

and 1.4 trees/10m², respectively) than in Rajshahi (0.7) where the annual rainfall is the lowest in Bangladesh.

Agarwal (1986) pointed that the crisis of fuel wood relates to its country especially, zone specificity and its rural urban implications. Wood provides less than 1% of the energy in most developed countries as compared to more than 90% in the majority of developing countries. So it is clear fuel wood crisis exists in developing world.

Awal *et al.* (2000) observed that homestead tree and vegetable practices earned substantial income for all categories of farmers. The women were involved in the household decision making process to a great extent. The evidence was more spectacular in aspects like family planning, education of children, poultry rearing, plantation of trees and vegetables.

Belali (2011) studied on homestead agroforestry and species composition in Sonargaon Upazila of Narayangonj District. He stated that the homesteads in Sonargaon Upazila of Narayangonj District are cluster with nearly 78 different tree species, 11 crop species and on average 25.75 tree species were found in homestead. There are the habitats for many herbs, shrubs and creeper species.

Byron (1984) mentioned that trees from home gardens were estimated to produce about 65 to 70% of timber and both 90% of fuel wood and bamboo consumed in Bangladesh. Fuel is a basic for human nourishment and is essential to make food suitable for human consumption.

Chandra (2011) studied on species richness and tree diversity in the homestead and he found that a total of 75 different tree species was recorded in the homestead of the study area of which Jackfruit, Mango, Eucalyptus, Akashmoni and Guava were dominant species.

Das and Das (2005) stated that home gardens are traditional agroforestry systems with complex structure and multiple functions. To understand the system, the socio-economic and biophysical aspects of home gardens in Dorgakona village, Barak Valley, North East India were studied. Since home gardens are also important sites for in situ on-far in conservation, the role of the rural people in the management and preservation of biodiversity in their traditional home gardening systems will be examined. The home garden size ranges from 0.02 to 1.20 ha with an average of 0.30 ha. The total number of

species encountered in the home gardens will be 122, with fruits as the dominant use component. The home gardens are the sites of conservation of a large diversity of plants both wild and domesticated, because of their uses to the households. Thus the home gardens were found to be complex systems with plant diversity conserved through their use.

Deweese (1989) reported that fuel wood consumption is related to its economic cost and supply. It is not a static variable which can be extrapolated only from population growth rates. Energy consumption to development must be evaluated by balanced energy consumption with other variables and cost which influence demand, such as income, price and substitution effects.

Karyono (1981) found in a study of West Java home gardens in the Citarum Watershed an excess of 500 species in 350 gardens, with Shannon diversity indices of greater than 2.7. In other areas of West Central Java, tree species count and species diversities were also the norm, with the diversity indices higher (3.71) in Sundanes than in Javanese (2.79) home garden.

Fernandes and Nair (1990) stated that the magnitude and rate of output of products as well as cash and rhythm of maintenance of the home garden system depends on species composition. The choice of species was determined to a larger extent by environmental and socio-economic factors, as well as dietary habits and local markets demands.

Hague (1994) showed that trees of the homesteads can be given suitable structure of the canopy as desired by the house owners under which vegetables, spices and some ornamental herbs, shrubs can be raised.

Hague (1996) mentioned that most of the native fruits, country vegetables, fuel wood and timber come from homestead and marginal lands attached to or nearby homesteads. Use of indigenous tree species, the potentiality of agroforestry for environmental improvement and in sustaining incensement of food and forest products in the savanna region needs to be exploited.

Halim and Hossain (1994) observed that the vegetable raising did not generate any significant income within homestead because the space for vegetable production was very limited and most of the homestead areas were shaded by the tree.

Hossain and Bari (1996) reported that generally wives (39.8%) were more involved than husbands (34.8%) in the application of manure (decomposed leaves, household wastes, cowdung, etc.) and fertilizers to homestead vegetable gardens. However, this pattern was prominent amongst landless and marginal farm categories but husbands were more involved in soil fertility management than wives on small, medium and large farms.

Heywood and Watson (1995) reported that worldwide concern about the extent to which biodiversity is being lost at the same time a growing appreciation of the importance of this diversity, whether measured in economic, social, aesthetic or moral terms. Wild species, in-situ conservation is supposed to be the normal way of protection and the ex-situ only the emergency.

Islam (1991) found that village forest mainly covered by homesteads accounts only 0.27 million ha and out of 64 districts as estimated 28 districts had no public forestland.

Jahan (2010) identified that a total of 50 different tree species was recorded in the homestead area of which Jackfruit, Betel nut, Rain tree, Mango, Mahogoni and Banana were dominant species.

Khan (2007) suggested that agroforestry might be considered to be practiced whenever trees and agricultural crops are grown in mixture, provided that the combined widths of the rows of agricultural crops do not exceed the heights of the forest trees at maturity.

Leuschner and Khaleque (1987) stated that the homestead agroforestry system is very important in the economy of Bangladesh. Agroforestry is a term that invariably brings up the homestead to be forefront and in a country like Bangladesh, the very act of concentrating on the homestead areas would cover more than the fourth of all matters concerned with agroforestry at large.

Linda (1990) stated that the high diversity of plant species in village homegardens ensure continuous production of fruits and vegetables, fuelwood, timber, medicinal and cash crops.

Mahamud (2010) studied on species composition and its diversity in the homesteads and found that a total of 69 different tree species was recorded in the homestead of the study area of which Akashmoni, Mahogoni, Jackfruit, Coconut and Papaya were dominant species.

Mamun (2009) observed that the role of rural women practicing homestead afforestation activities was measured on the basis of this performance and scores obtain through 10 statements, each of those put against a 4 point scale.

Miah and Hossain (2001) conducted a study of Narsingdi district of Bangladesh about indigenous knowledge on homestead forestry and they explored that the households were engaged to tree planting programs (*Azadirachta indica* with *Artocarpus heterophyllus*), forestry products and services, women involvement, spacing of plantation, tending and cultural operations and problems in the homestead forestry. The study also reveals some important indigenous management techniques.

Millat-e-Mustafa *et al.* (1997) conducted a vegetation survey in four physiographic region of Bangladesh viz. deltaic, dry land, hilly and plain regions. He recorded that in total of ninety two perennial species from home garden of Bangladesh. The highest number of species were recorded in deltaic region (67) followed by plain (56) and hilly region (56), and the lowest in the dry land region (46). He also mentioned that, in the dry land region, adverse environmental condition (such as low rainfall, intense heat and low soil fertility) restricts the variety of species that could be grown.

Mohiuddin and Chowdhury (1997) studied about tree diversity and economic returns in homestead agroforestry and they found that there were more tree species diversity producing timber and forests. They also observed that there was a clear sharing of tasks among family members. Farmers spent only 4.8-12.2% of their total labor in home garden management.

Moontasir *et al.* (2009) studied about different agroforestry practices for socio-economic improvement of the farmers in Comilla Sadar. The findings revealed that majority (40.75%) of the farmers belong to medium category possessed medium (21-30 trees) number of diversified tree species. The majority 33.33% of the farmers had low attitude regarding contribution of diversified tree species for their socioeconomic condition, where 25.92% was found to large category respectively. Within 40 different tree species, the high relative density of the study area was Mango (21.34%), Betel-nut (12.89%) and Jackfruit (8.73%) respectively.

Mosabber and Niar (1999) studied about the floristic composition and socio-economic aspects of rural homestead forestry. They found that home gardens are located close to

houses and characterized by a mixture of annual and perennial species. The proximity of natural forests and the availability of timber in local markets also have been seen to influence the propensity to plant timber and fuel wood species in home gardens. Fruit trees dominate the gardens, followed by fuel wood species.

Nahar (2000) reported that the extent of participation of rural women in homestead vegetable cultivation, post-harvest activities, poultry raising and goat rearing were 42 percent, 62 percent, 54 percent and 47 percent, respectively age of the rural women and no significant relationship with their participation in homestead agriculture activities. It has also mentioned that majority of the respondents.

Nahar (2009) observed that the average size of the homestead in the study area was 0.12 ha which increased with the increased of farm size. The homestead production system was found to be poor due to management practices. It was also observed that the major problem of planting new trees in the homestead was damaged by grazing animals (80%) followed by unavailability of space (61%); damaged by flood (55%), Lack of good quality.

Nair (1993) stated that today there is a consensus of opinion that agroforestry is practiced for a variety of objectives. It represents, as depicted in an interface between agriculture and forestry and encompasses mixed land use practices. These practices have been developed primarily in response to the special needs and conditions of tropical developing countries that have not been satisfactorily addressed by advantage in environmental agriculture or forestry.

Noppen *et al.* (2004) observed the rural firewood markets and village dynamics; the impacts of the strategy (in relation to poverty, the environment/ forests, and rural urban tradeoffs etc.); the challenges that still need to be faced; the potential offered by Niger's rural fuel wood markets.

Paddy cum-fish culture and Bamboo-cum -pine forestry, and agrohorti-pisci-silviculture and animal husbandry systems, respectively. Overall, the plants have been distributed contagiously (83.19%). Shannon diversity index varied between 0.73 and 1.22 for tree species and between 0.98 and 1.08 for the herbaceous species. The cost-benefit ratio was lowest in the system practiced by Naishis, whereas it was highest in the paddy cum -fish culture systems of the Apatanis, Nonetheless, the variation in species 10 compositions,

diversity and the economic returns are linked to the traditional belief and the day to day requirements of the people.

Pearson and Stevens (1989) reported that the energy problem as choice between energy shortages, with their attendant loss of production or comfort, and the sacrifices to be made elsewhere to overcome the energy shortage and the increased harshness of the consequences of the choices which create the crisis dimension of the fuel wood problem.

Perera and Rajapakse (1991) distinguished that four canopy layers, the tallest being over 10m, third layer 2.5-10m, second layer 1-2.5m and first layer is less than 1m in Kandyan home garden. Possessed moderate level of knowledge about homestead agriculture management systems, while innovativeness and extension tendency was lower. Scientific management technique to sustainably manage the homestead forestry resources in Bangladesh.

Rahman (1995) showed that the consequences of homestead crop production under homestead agroforestry (HAF) practices on the family income and women's status. The data from HAF practicing households reveal that these farms earned substantial income and production gains. The women of the households gained in terms of higher social status. The gender status in particular improved significantly on these households as evidenced by the increased participation of HAF practicing women in decisions making on crucial socio-economic matters in the households.

Rebeka (1994) studied about economic aspects of homestead enterprises in some selected areas of Jessore district. She estimated that total cost of production of vegetables produced in homestead area was Tk. 1226.44 while gross and net return per household was Tk. 1753.83 and 527.39, respectively. Per household total cost of production of fruits and other perennials was Tk. 947.32 while gross and net return per household was Tk. 10555.65 and 9608.33, respectively. Per household total cost of livestock and poultry enterprise was tk. 10860.13 while gross and net returns per household were Tk. 15012.42 and 4152.42, respectively. Maximum net return was earned from fruits and other perennials production.

Roy *et al.* (2005) reported that significantly gap between traditional cultivation methods and improved systems in socio-economic terms. Improved agroforestry systems provide approximately double income per capita in comparison to traditional methods. More

intensified cash crop cultivation in the highlands of the East Usambara also results in double income compared to that in the low lands. However, people are sensitive to risks of changing farming practices. Encouraging farmers to apply better land management and practice suitable cultivation of cash crops in combination with multipurpose trees would be relevant in improving their economic situation in the relatively short term. The markets of most cash crops are already available. Improved agroforestry methods could ameliorate seeds (64%) and insect pest infestation (56%). There is enough scope to improve productivity in the homestead by replacing the existing tree species with the improved and/or exotic ones, planting trees in planned ways and improving management practices.

Shabuj *et al.* (2010) observed that a total of 32 different tree species recorded in the homestead area of which Jackfruit, Eucalyptus, Ipil-Ipil, Mango, Neem and Mahogany were dominant species. On an average 21.25 tree species were found in homestead. Ten different agroforestry practices were identified from the study area within four layers.

Shalaby (1991) conducted a study in Egypt which revealed that women were engaged in gardening to supplement incomes and to provide food for family. About 30% of the farmers did not buy vegetables from the market and claimed to be self-sufficient in this product.

Sing *et al.* (2003) reported that medicinal plants are integral part of rural and urban lifestyle, but many of them medicinal plants species have reached endangered already and threatened because of over exploitation of forests, uncontrolled grazing and fire. India, nearly 175 million ha of land is degraded, 93 million ha of which is wasteland. This land is not suitable for growing agricultural crops economically but can be effectively used for growing medicinal plants after proper management.

Tangang *et al.* (2004) stated that agroforestry systems have been maintained as a part of rural survival over generations, with the multi-story vegetation structure and diverse type of plant composition. In the present study, plant species composition and diversity of the traditional agroforestry systems practiced by different ethnic groups in Arunachal Pradesh, India were evaluated. The total number of tree shrubs and herbs species recorded is 41, 22, and 35 respectively. The Nyishi practice jhum and terrace cultivation, salvo- horticultural and agro-salvo-horticultural systems. The Apatani and Kalit practices

Tewari *et al.* (2003) reported that the homestead agroforestry has been practiced throughout the central Himalayan region for a very long time. However, the structure of agroforestry system is more than a simple combination of woody and herbaceous components on the same unite of land. This subsistent strategy has evolved under the constraint and opportunities peculiar to the region and has permitted the rural folk to thrive in an environment of inherently low productivity. It features interaction among five component (i) crop fields (ii) a private land support system (iii) a forest support system (iv) livestock (v) man in the uniquely specific socio economic cultural setting of the region.

The gardens often feature low capital input and simple technology and are intensively managed by family labor. Yields are generally low but stable and sustainable the living conditions of the local population and protect the natural reservoirs from human disturbance.

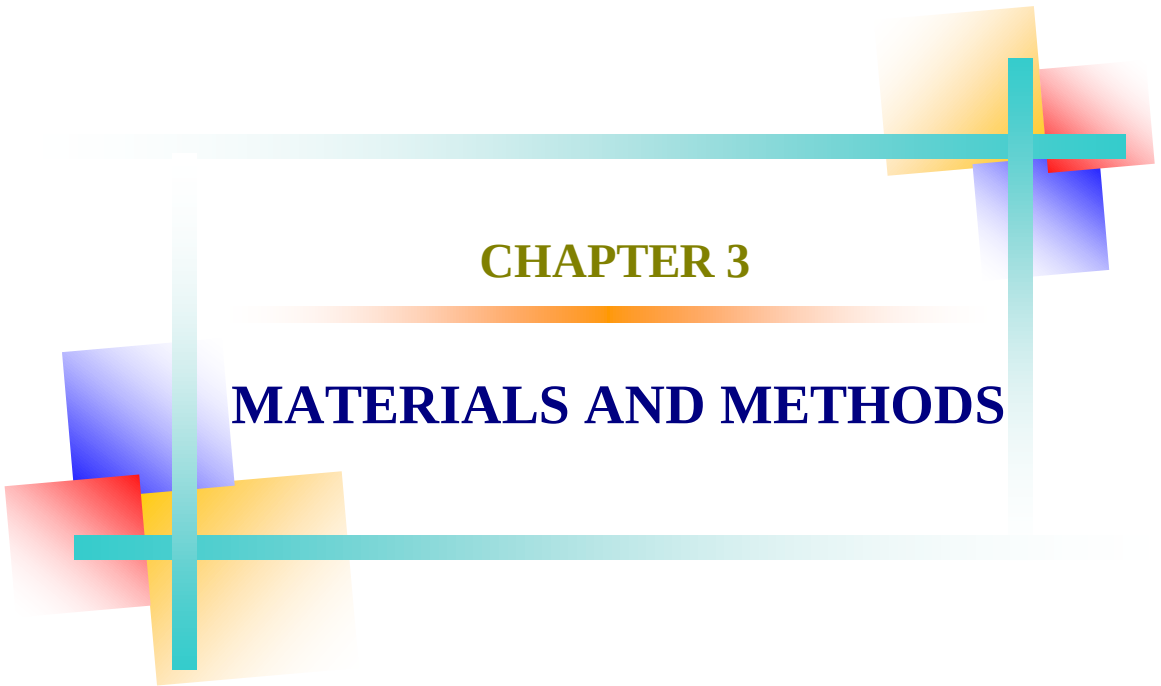
They stated that home gardens are characterized by high species diversity and by usually three to four vertical canopy strata, thus indicating the intimacy of plant associations. The layered canopy configuration and compatible species, admixture are the most conspicuous characteristics of all home gardens. Contrary to the apparent appearance of random arrangement of species, the gardens are carefully structured systems with every component having a specific place and function.

Tolunay *et al.* (2007) observed that traditional agroforestry practices of West Mediterranean Region of Turkey. Each agroforestry practice will be determined and classified in the agroforestry systems. Many of the agroforestry production patterns are being seen as a traditionally in the entire region. Results showed that, agroforestry application in the region studied can be put in major agroforestry practices like, agricultural systems, alley cropping, multilayer tree gardens, multipurpose trees on crop lands, home gardens, trees in soil conservation and reclamation, shelter belts and windbreaks, silvopastoral systems; trees on range land or pastures, protein banks, plantation crop with animals, agro-silvopastoral systems; home garden involving animals, multipurpose woody hedgerows, apiculture with trees, aqua forestry, multipurpose woodlots. As an agroforestry practice, shifting cultivation and taungya are determined in the region; however, both practices are not applicable, because of causing forest degradation.

Vankatash *et al.* (2003) found that in tropical home gardens species diversity is generally believed to be very high. Home gardens reached high levels of developments in terms of plant diversity, labor input and income derived from garden in region where population densities are high and create a forest like multistory canopy structure. Moreover, species diversity sue, shape and plant density also vary from place to place depending on cultural, ecological and socio-economic factors.

Wihkramasinge (1997) illustrated that agroforestry is important for income, nutrition and health, for reducing economic risk and for improving food security at household level. Home farmers were seen as having potential role to play in maintaining biological diversity at both the species and sub-species level.

Yasmin *et al.* (2010) observed that a total of 68 different tree species recorded in the homestead, cropland and on the bank of pond of the study area of which Akashmoni, Jackfruit, Coconut, Mango, Neem, Eucalyptus and Bokain were dominant. On an average 22.75 and 4 tree species were found in homestead and cropland area respectively.

An abstract geometric design featuring a central teal cross. Overlapping this cross are several squares in yellow, red, and blue. The squares are positioned at the corners of the cross, creating a layered effect. The background is white.

CHAPTER 3

MATERIALS AND METHODS

CHAPTER 3

MATERIALS AND METHODS

3.1 Geographical location of the study area

Bangladesh is located between 20°34' and 26°38' North latitude and between 88°01' and 92°41' East longitude. It is bordered by the Bay of Bengal on the South and by India on all other sides along with a small South-eastern border with Myanmar. (Fig. 1) The study area is located in the North region of Bangladesh 26.350° north and 89.017° east of Patgram Upazilla of Lalmonirhat District and 25.950° N and 89.567° E of Phulbari Upazilla of Kurigram District. The Patgram Upazilla covers a total area of 100.97sq. km while Angarpota chitmahal cover 18.7 km². Total number of households in this district is 30271 and the average size of household is 4.5 hectare (BBS, 2016). Patgram has eight union named Patgram, Dahagram, Kuchlibari, Jagatber, Jongra, Baura, Sreerampur. Phulbari Upazilla covers a total area of 63.18 sq mi. and total population is about 129,668 (BBS, 2016). Total household is 25236 and average literacy rate is 24%. National Literacy rate is 32.40% (BBS, 2016). Phulbari has 6 union named Baravita, Bhangarmore, Phulbari, Kashipur, Naodanga, Shimulbari. The study was conducted in angarpotachitmahal of Patgram upazilla in Lalmonirhat District and Dashiarchora Chitmahal of Phulbari Upazilla in Kurigram.

3.1.2 Physiography

According to the BRAC (1989) agro-ecological zoning the kurigram and lalmonirhat district belongs to the agro-ecological zone- 2 i.e Active Tista Flood Plain. (Source: Banglapedia 2003)

3.1.3 Soil Condition

The northern part of the district is mostly occupied by the Tist aflood plain. The floodplain deposits are mainly silty on ridges and clay in the basins. The soil Tista Flood plain is generally well structured and looks dark grey in color. In the tista floodplain it is silty and sandy of loamy. (Source: Banglapedia 2003)

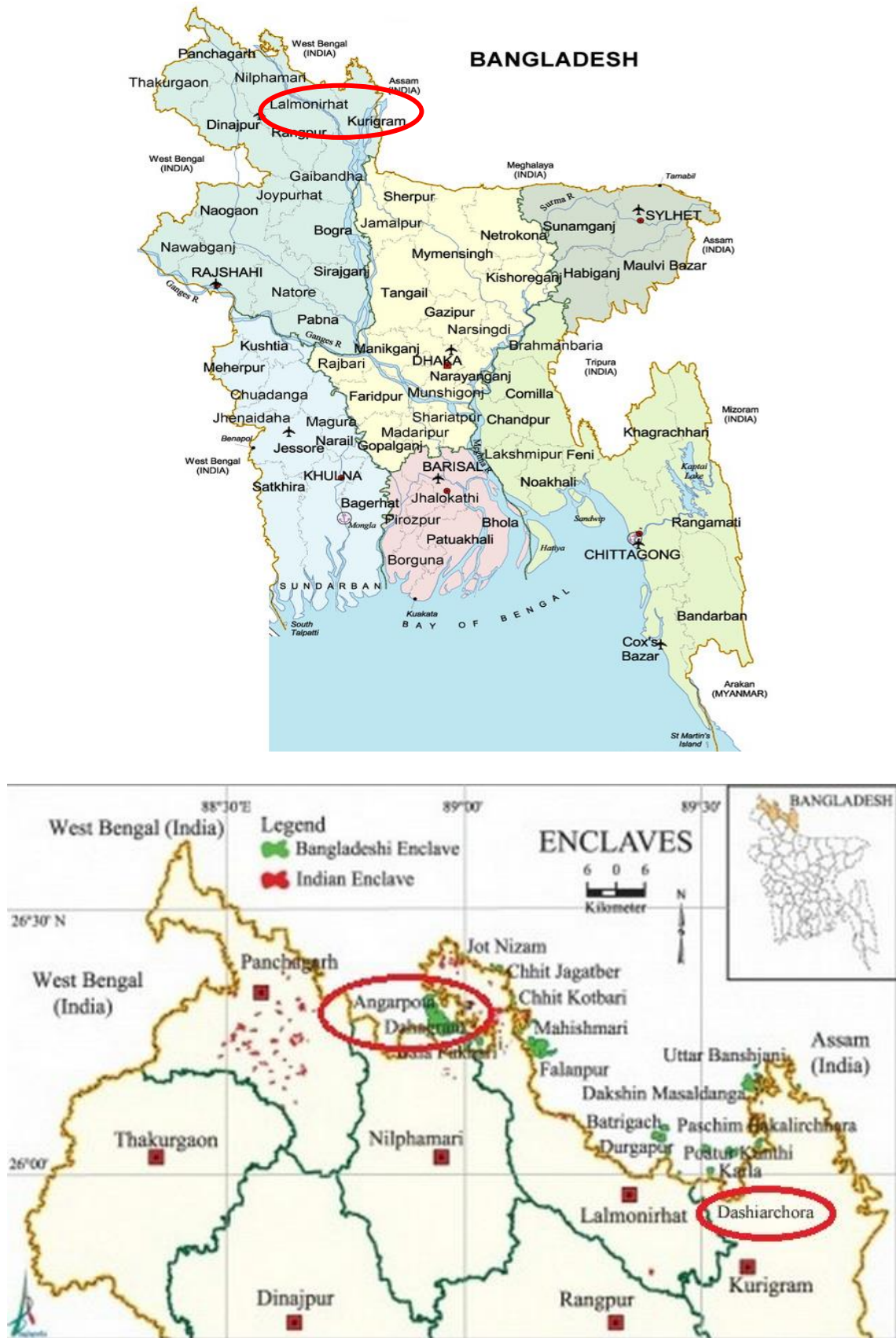


Figure 1. Map of Bangladesh showing location of the study area of Patgram and Kurigram District (Source: Wikipedia)

3.1.4 Climate

The climate of the study area is moderate. Average temperature continues to rise uniformly from February and reaches the maximum in April at around 36°C the minimum temperature is usually recorded in January, which is 11.8°C

Total cultivable land and Mean relative humidity is high throughout the year and does not fall below 65%. The average annual humidity is 80%. The monsoon commences from June and continues till October. The average annual rainfall is 1467 mm. (Source: Banglapedia 2003)

3.1.5 Land Use Pattern in the Study Area

Kurigram District:

Mostly subsistence and crop based farming system is prevailed in study area. Rice is the principal crop covering about 65% and 25% for maize of the total cropped land of the selected area. Cultivated upland soils grow crops like Aus rice, tobacco, maize, pulses, oil seeds, spices, potato, jute, sugarcane and some other cereal crops. Fruit trees are jackfruit, mango, pineapple, Berry, litchi etc. The rabi season is dry and extends from November to late March. Irrigated Boro rice is grown in this season. Non-irrigated crops such as wheat, potatoes, pulses and oil seeds also cultivated. The local people use rainy season until December and this overlap with the Rabi season when Aman rice is only major crops. Here Tobacco production is common starts from mid-December to March.

Temperature and Rainfall:

The annual average temperature of the district varies maximum 32.3°C to minimum 11.2°C and the average annual rainfall of the district is recorded 2931 mm.

Main Rivers:

The Brahmaputra, Dharala, Tista, Dudhkumar, Phulkumar, Sonaburi, Jinjiram Gangadhar, Halhali and Jalchira are the main rivers of this district.

Main Crops:

This district is essentially an agricultural district. The major agricultural crops of Kurigram District are paddy, jute, wheat, potato, corn, chilli, peanut, bamboo, betel nut, betel leaf, pulses and vegetable.

Main Fruits: The common fruits found in this district are mango (*Mangifera indica*), date (*Phoenix sylvestris*), jackfruit (*Artocarpus heterophyllus*), coconut (*Cocos nucifera*) and tal/palm (*Borassus flabellifer*).

Lalmonirhat District:

Lalmonirhat can be called a zilla of enclaves. The total areas of the 33 enclaves (27 are in Patgram) are 1807 hectares. The biggest and most important enclaves are Dahagram and Angarpota. The Tin-Bigha Corridor connects these two enclaves with the main land. The important food crops are wheat and maize in Patgram upazilla (Angarpota) whereas jackfruit is main fruit.

Temperature and Rainfall:

The annual average temperature of the district varies from maximum 32.3°C to minimum 11.2°C and the annual average rainfall of the district is 2931 mm.

Main Rivers:

The principal rivers of this district are Tista, Dharla and Saniajan. The river Saniajan originated from the Himalaya and has strong current. Sarnamati, Trimohoni, Ratnai and Sati rivers are almost silted. The biggest irrigation project of the country Tista Barrage Project (length 615m) is located at Doani of Hatibandha upazila.

Main Crops:

The major agricultural crops of Lalmonirhat district are paddy, jute, wheat, potato, tobacco, cotton and ginger. Extinct or nearly extinct crops are linseed, sesame, indigo, arahar, kaun, aus paddy etc.

Main Fruits:

The common fruits found in this district are mango, black berry, jackfruit, coconut, banana, betel nut, etc.

3.2 Method of Investigation, selection of study area and sampling procedure

The research work was carried out from May 2016 to September 2016 in two Chitmahal named Angarpota Chitmahal (Patgram Upazilla) and Dashiarchora Chitmahal (Phulbari

Upazilla) and 1 non Chitmahal named Kutichandrakhana (Phulbari Upazilla) in Kurigram District.

From the selected Chitmahal villages and nearby non-Chitmahal villages each of 30 respondents were purposively selected for successful assessment of the opinion of farmers on effectiveness of homestead agroforestry towards socio-economic aspects on the basis of practicing homestead agroforestry. Among the farm families of the villages agriculture was the major occupation, some were service holder, farm labors and others were businessmen.

Table 1: Selected Study Area from two chitmahal and a non-chitmahal village in Bangladesh

District	Upazilla	Chitmahal and non-chitmahal area	No. of farm families primarily selected	No. of farm families for data collection (sample Size)
Lalmonirhat	Patgram	Angarpota (Chitmahal)	35	30
Kurigram	Phulbari	Dashiarchora (Chitmahal)	37	30
Kurigram	Phulbari	Kutichandrakhana (Non-Chitmahal)	30	30
Total	2	Two Chitmahals and One Non-Chitmahal area	112	90

3.2.1 Method of investigation

As the farmer of Bangladesh do not usually maintain records and accounts of their farm operations. So, to minimize errors, several repeated visits were made to collect data properly.

3.2.2. Selection of the study area

Keeping in view all the objectives of the study and considering the limitations on the research with respect to time, manpower and other facilities three villages were selected from two upazilla of two districts for the study. (Table 1).

The selected Upazilla is moderately rich in natural vegetation compared to other areas of Lalmonirhat and Kurigram District. The selection of the study area, however, was based on the following main consideration:

- i. The study site had available home gardens as a major production system.
- ii. The sites were the representatives of Lalmonirhat and Kurigram District in respect of chitmahal and non-chitmahal area.
- iii. Co-operation from the farmer was expected to be high and, therefore, reliable data could be collected.

In this study, the total sample size was ninety. Thirty sample farmers were selected from each of 3 villages. A stratified random sampling technique was followed to select the sample farmers. Farmers were classified into the following four groups on the basis of their homestead size in terms of hectare. Haque (1996) reported that the average area of Bangladesh homesteads ranges from 0.1 to 1.0 ha depending on the locality and financial condition of the house owner. These categories were as follows:

Categories	Homestead area size (ha)
Landless and marginal farmers	: Up to 0.02-0.08 ha
Small farmers	: <0.08-0.14 ha
Medium farmers	: <0.14-0.20 ha
Large farmers	: above 0.20 ha

3.3 Method of Data Collection

3.3.1 Questionnaire survey

A set of preliminary survey schedule were used to collect the information. The survey schedule was carefully designed keeping the objectives of the study in view. The schedule contained both open and closed form questions (Appendix). Very easy, simple, direct questions and different scales were used to obtain information. About 90 survey schedule were filled up taking information from farmer.

3.3.2 Period of data collection

To get valid and pertinent information the researcher made all possible effort to explain the purpose of the study to the respondents. With the help of leader farmers appointments with the interviewer were made in advance. The researcher administered the interview schedule personally to the respondents. Rapport was established with the respondent's

though informal discussion regarding objectives of the interview. Co-operation was obtained from respondents during data collection. Data were collected from 01 June to 31 July 2016.

3.4 Variables of the study

3.4.1 Independent variables

The followings viz. age, education, household size, farm size, homestead area, annual income, communication exposure, source of income were used as independent variables of the study.

3.4.2 Dependent variable

Impact of homestead agroforestry on their livelihood improvement were used as dependent variable of the study.

3.5 Measurement of variables

3.5.1 Measurement of independent variables

3.5.1.1 Age

The age of farmer was measured in terms of complete years at the time of interview.

3.5.1.2 Education

The level of education of a farmer was measured by the number of years of schooling.

3.5.1.3 Family size

The family size of a farmer was measured in terms of numbers in his family including his wife, children and those who are dependent on his family. The total number of family members was considered as the family size score of a farmer.

3.5.1.4 Farm size

The farm size of a farmer was measured to the total area of land on which family carried farming operation. The farm size of a farmer was expressed as hectare.

3.5.1.5 Homestead area

It was measured by the area of the raised land in which the household has its entire dwelling unit including living room, kitchen room, cattle and goat shed, farm yard court, vegetables, fruit and timber trees, backyard, bushes, bamboo bunches, pond, etc.

3.5.1.6 Annual income

Annual income of a farmer was measured in taka on the basis of his total yearly earnings from farming, livestock, fisheries and other sources (business, service, etc.).

3.5.1.7 Communication exposure

The respondent's communication media was calculated through different tools.

3.5.1.8 Source of income

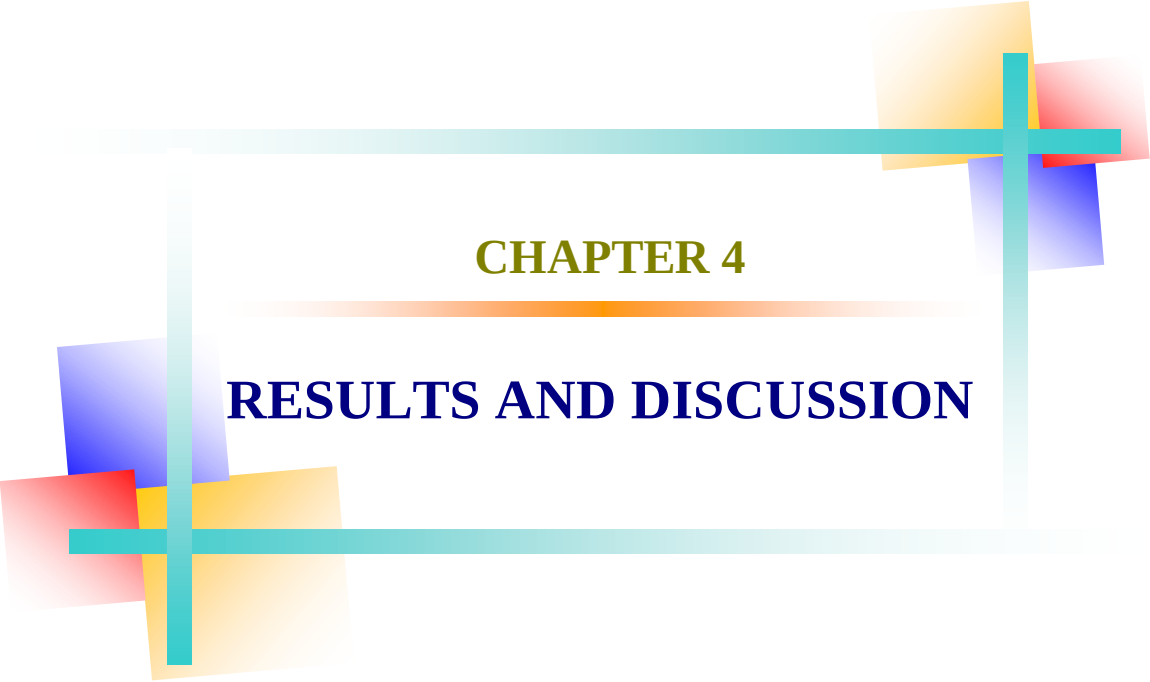
Different types of income were measured in the study area.

3.6 Measurement of dependent variable

Impact of homestead agroforestry as perceived by the farmers was the dependent variable of the study. It consists of changes in socio-economic aspects of the farmers. The changes in socio-economic aspects of the farmers were referred to as the improvement of social as well as economic status. The farmers were asked to give their opinion regarding the improvement in socio-economic aspect of their livelihood due to the contribution of homestead agroforestry. It was measured on the basis of opinion obtained from the farmers on some statements containing information on the improvement of socio-economic aspects of their livelihood. A 4-point scale: "strongly agree", "agree", "partially", and "disagree" was used to measure of the farmers with the statement. The score assigned to each of the scale for measuring were 4, 3, 2 and 1 respectively for positive impacts.

3.7 Processing and analysis of data

The collected data were scrutinized and edited before putting the data in the master sheets. It may be noted here that information was collected initially in local units, after checking it was converted into standard international units. The data were entered into computer by using the SPSS package program. On the basis of farm size these data were classified and presented in tabular form to realize the cost, return, homestead income and other information. Responses of the completed questionnaires were numerically coded and analyzed. In addition, graphs and tables were also used to interpret the findings.



CHAPTER 4

RESULTS AND DISCUSSION

CHAPTER 4

RESULTS AND DISCUSSION

The present study focused on homestead agroforestry along with other related matters. The findings of this study presented in three part of this chapter. The first part deal with the description of selected individual characteristics of the respondents, the second part deal with the dependent variables and the third part dealt with the relationship between dependent variable and the selected characteristics of the respondents

4.1 Selected characteristics of the Respondents

Nine characteristics which were the independent variables of the study were investigated and the individual chitmahal and non-chitmahal wise characteristics have been presented in Table 1, 2 and 3. Moreover, graphical presentation of the three selected areas were also presented through Figure no.2 to Fig.10.

Age

Average age of the farmers of Dashiarchora chitmahal in Kurigram District was 38 years. On the other hand in Angarpota chitmahal of Lalmonirhat district was 35 years and in case of non chitmahal village in kurigram was 43 years. Among the age group, the middle aged people are more in all he selected areas. However, the maximum (50%) middle aged people were in Angarpota chitmahal whereas the lower (23.3%) were in Dashiarchora chitmahal and (26.7%) (Fig. 2).were in non-chitmahal area. Again, above 50 years old people were more (46.70%) in Angarpota chitmahal and less number in non-chitmahal area which was only 10%.

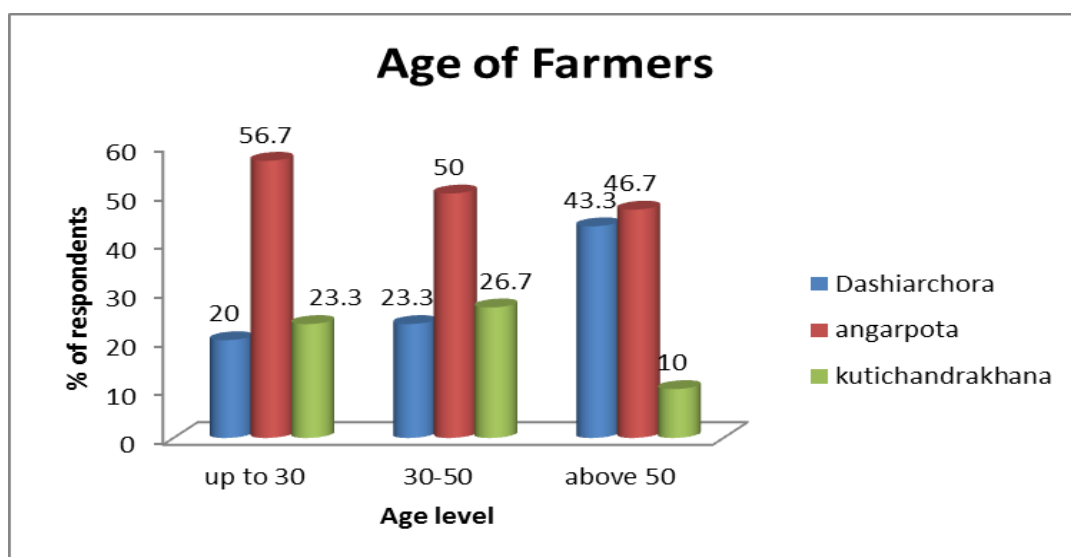


Fig 2. Graphical presentation of age of the respondent in study area

Education

Among the education level, maximum respondents were in can't read and write category. The result showed that maximum (70%) people were uneducated in Angarpota chitmahal, whereas the minimum people (53.3%) in Dashiarchora chitmahal were uneducated and lower number (23.3%) people were uneducated in non-chitmahal area (fig.3). Again, in case of primary education, SSC, HSC and above level, the people of non chitmahal area were more literate due to having more access with mainland and govt. facilities compare to two study area of chitmahal.

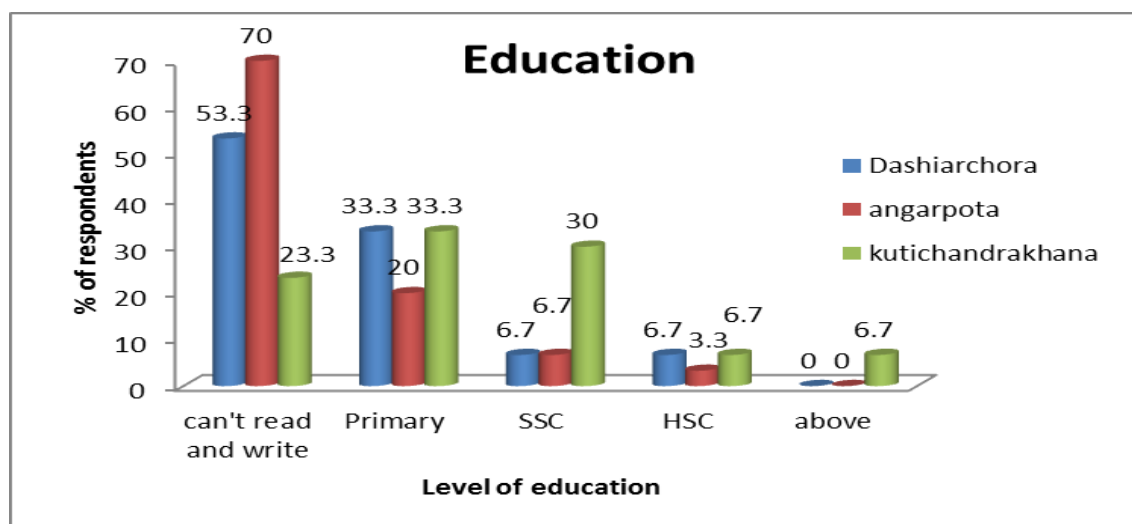


Fig 3. Graphical presentation of Education level of the respondent in study area

Family type

Among the family type group, maximum family were found in joint category. Maximum (60%) family were joint type in non- chitmahal area and minimum respondents (50%) were in Angarpota chitmahal and also 53.3% family were joint type in Dashiarchora chitmahal area. Again, in case of extended type family, only 6.7% (Fig. 4). people were found in non-chitmahal area and maximum (16.30%) number were found in Dashiarchora chitmahal area.

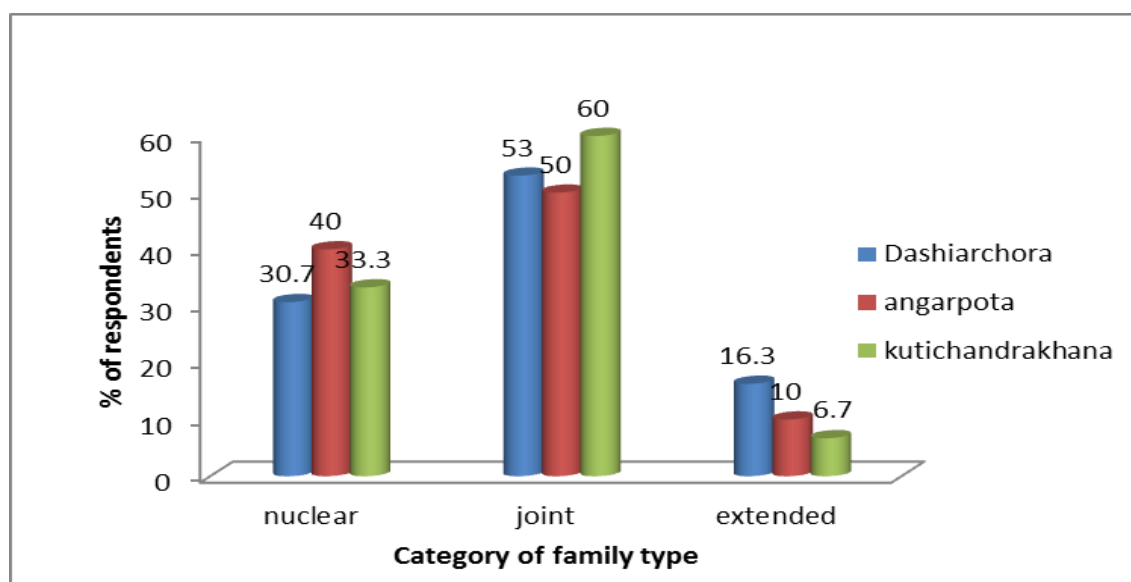


Fig 4. Graphical presentation of Family type of the respondent in study area

Farm size

The study result revealed that, in case of farm size group maximum respondents have small farm. About (50%) number of small category farm size were found in Angarpota chitmahal whereas lower number (40%) in non chitmahal area. Again, there were no large farm category in Dashiarchora chitmahal while maximum (10%) were found in non-chitmahal area. In case of marginal category, maximum were found in Angarpota chitmahal and minimum in Dashiarchora chitmahal and non chitmahal area (Fig. 5).

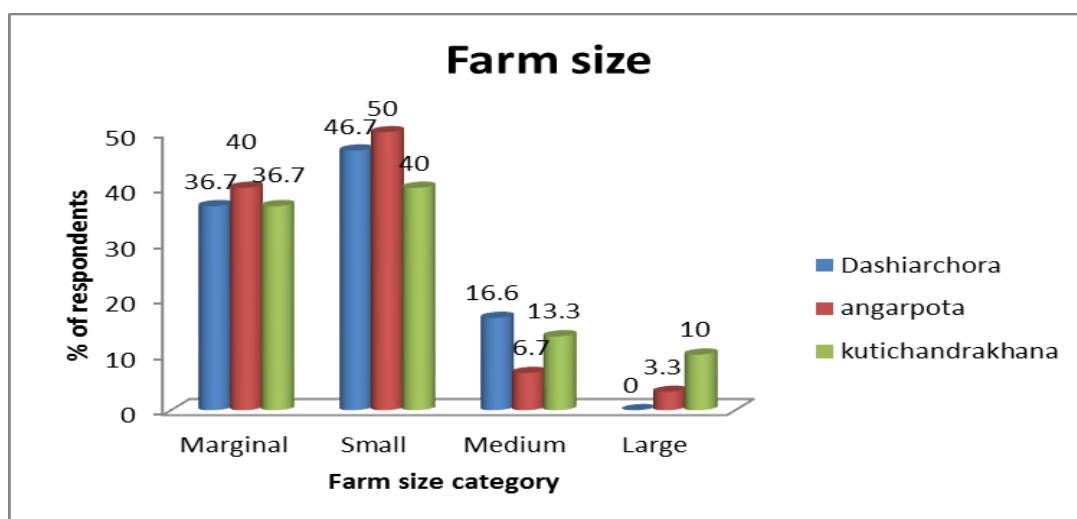


Fig 5. Graphical presentation of Farm size of the respondent in study area

Homestead size

The study result revealed that, in case of homestead size group maximum respondents have small homestead and maximum (45.7%) number of small category farm size were found in Angarpota chitmahal whereas lower number (40.30%) in Angarpota chitmahal and minimum (41.3%) (Fig.6) .in non-chitmahal area chitmahal In case of marginal category, maximum were found in Angarpota chitmahal and minimum in Dashiarchora chitmahal and non chitmahal area were found and the number of large size homestead were found higher number in Non-Chitmahal area.

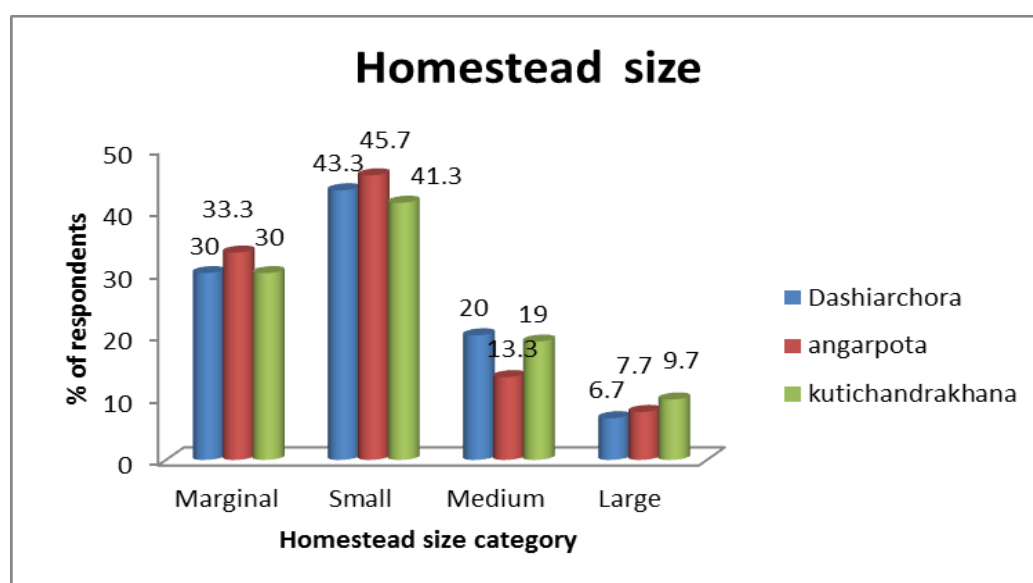


Fig 6. Graphical presentation of Homestead size of the respondent in study area

Annual income

Annual income of the farmers was an average of 20000.47TK in Daashiarchora chitmahal, which was low category and in Angarpota chitmahal this average was 41200 Tk., which was small category and in non chitmahal area the average income was 70122.55 TK, which was medium category. The study result concluded that maximum people in all the three study area were in 25000-50000 TK annual income category. Small income people were in higher in Dashiarchora chitmahal and lower in non chitmahal. (Fig. 9). On the other hand higher income level, above 100000 Tk. was found more in non chitmahal than in chitmahal. So it was concluded that the non chitmahal people were more well to do than chitmahal area people due to having doing different job.

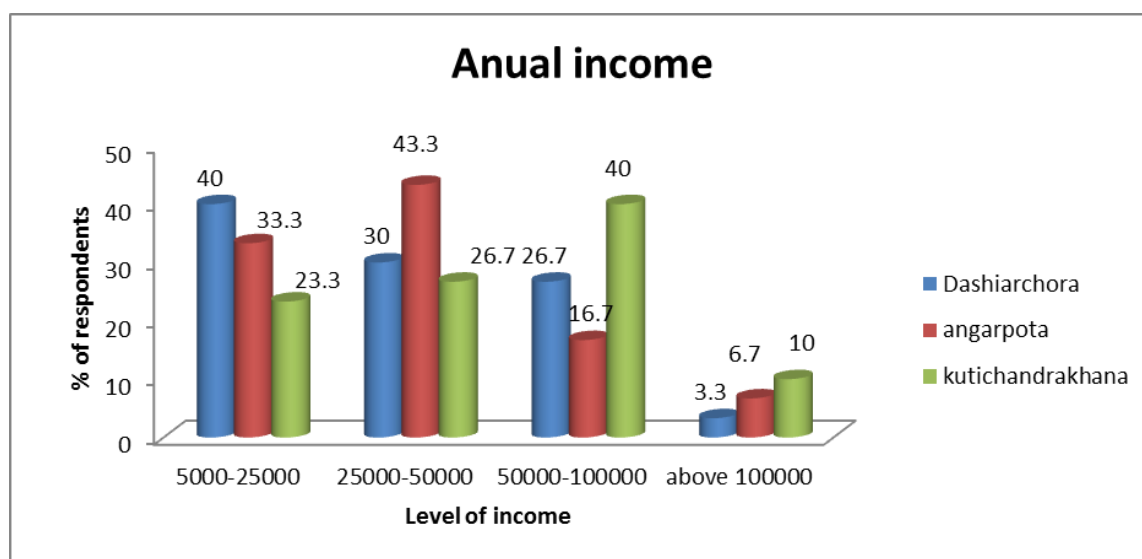


Fig. 9. Graphical presentation of Annual income of the respondent in study area

Receive any training

In case of receive training the maximum people of both two chitmahal were not receive any type of training from government and non-government organization. But in non-chitmahal, the maximum (56.7%) people were received different training.(Fig. 10).This may be due to the availability of education and getting support from govt. and non govt. organization the people of non chitmahal were able to receive any type of training to improve their livelihood.

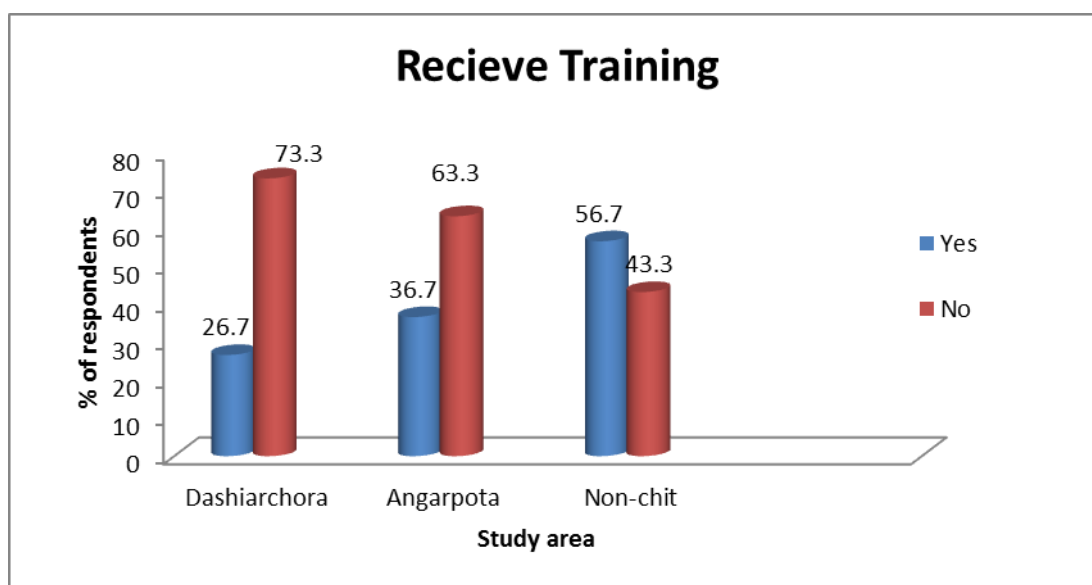


Fig 10. Graphical presentation of Received training of the respondent in study area

Table 2: Description of farmer's characteristics treated as independent variables of the study in Dashiarchora chitmahal (N=30)

Characteristics	Category	Number of respondents	Percentage (%) of respondents
Age (years)	Young (up to 30)	6	20.0
	Middle (30-50)	17	56.7
	Old (above 50)	7	23.3
Level of education (class)	Can't read and write (0)	16	53.3
	Primary (1-5)	10	33.3
	SSC (6-10)	2	6.70
	HSC (11-12)	2	6.70
	Above (above 12)	0	0.00
Family type (score)	Nuclear (3-4)	11	36.7
	Joint (6-9)	16	53.3
	Extended (>10)	3	10.0
Farm size (score)	Marginal (<0.05)ha	11	36.7
	Small (0.05-1)	14	46.7
	Medium (1-1.5) ha	5	16.6
	Large (>1.5)ha	0	0.00
Homestead size (Score)	Marginal (0.02-0.08 ha)	9	30.0
	Small (0.08-0.14) ha	13	43.3
	Medium (0.14-0.20) ha	6	20.0
	Large (>0.20) ha	2	6.70
Occupation	Agriculture (1)	21	70.0
	Govt. job (2)	1	3.30
	Business (3)	3	10.0
	Others (4)	5	16.7
Annual income (Tk)	5000-25000 (low)	12	40.0
	25000-50000 (small)	9	30.0
	50000-100000 (medium)	8	26.7
	Above 100000 (High)	1	3.30
Received training	Yes (1)	8	26.7
	No (2)	22	73.3

Table 3: Description of farmer's characteristics treated as independent variables of the study in Angarpota Chitmahal (N=30)

Characteristics	Category	Number of respondents	Percentage (%) of respondents
Age (years)	Young (up to 30)	7	23.3
	Middle (30-50)	15	50.0
	Old (above 50)	8	26.7
Level of education (class)	Can't read and write (0)	21	70.0
	Primary((1-5)	6	20.0
	SSC (6-10)	2	6.70
	HSC (11-12)	1	3.30
	Above (above 12)	0	0.00
Family type (score)	Nuclear (3-4)	13	43.3
	Joint (6-9)	15	50.0
	Extended (>10)	2	6.70
Farm size (score)	Marginal (<0.05)ha	12	40.0
	Small (0.05-1)	15	50.0
	Medium(1-1.5) ha	2	6.70
	Large (>1.5)ha	1	3.30
Homestead size (score)	Marginal (0.02-0.08 ha)	10	33.3
	Small (0.08-0.14) ha	14	45.3
	Medium (0.14-0.20) ha	4	13.3
	Large (>0.20) ha	2	7.70
Occupation	Agriculture (1)	19	63.3
	Govt. job (2)	2	6.70
	Business (3)	6	2.00
	Others (4)	3	10.0
Annual income (TK)	5000-25000 (low)	10	33.3
	25000-50000 (small)	13	43.3
	50000-100000 (medium)	5	16.7
	Above 100000 (High)	2	6.70
Received training	Yes (1)	11	36.7
	No (2)	19	63.3

Table 4: Description of farmer's characteristics treated as independent variables of the study in KUTICHANDRAKHANA chitmahal (N=30)

Characteristics	Category	Number of respondents	Percentage (%) of respondents
Age(years)	Young (up to 30)	13	43.3
	Middle (30-50)	14	46.7
	Old (above 50)	3	10.0
Level of education (class)	Can't read and write (0)	7	23.3
	Primary((1-5)	10	33.3
	SSC (6-10)	9	30.0
	HSC (11-12)	2	6.70
	Above (above 12)	2	6.70
Family type (score)	Nuclear (3-4)	10	33.3
	Joint(6-9)	15	50.0
	Extended (>10)	5	16.7
Farm size (score)	Marginal (<0.05)ha	11	36.7
	Smal (0.05-1)	12	4.00
	Medium (1-1.5) ha	4	13.3
	Large (>1.5)ha	3	10.0
Homestead size (score)	Marginal (0.02-0.08 ha)	9	30.0
	Small (0.08-0.14) ha	13	41.3
	Medium (0.14-0.20) ha	6	19.0
	Large (>0.20) ha	2	9.70
Occupation	Agriculture (1)	10	33.3
	Govt. job (2)	5	16.7
	Business (3)	7	23.3
	Others (4)	8	26.7
Annual income (TK)	5000-25000 (low)	7	23.3
	25000-50000 (small)	8	26.7
	50000-100000 (medium)	12	40.0
	Above 100000 (High)	3	10.0
Received training	Yes (1)	17	56.7
	No (2)	13	43.3

Table 5. Farmers opinion about the impact of homestead agroforestry on their livelihood improvement

Types of Respondents	Dashiarchora		Angarpota		Kutichandrakhana	
	No. of respondent	% of respondent	No. of respondent	% of respondent	No. of respondent	% of respondent
Disagree	6	20	7	23.3	1	3.3
Partially agree	12	40	10	33.3	10	33.3
Agree	10	33.3	9	30	13	43.3
Strongly agree	4	13.3	4	13.3	6	20

The result of the study revealed that the maximum respondents were agree that homestead agroforestry has a good impact on livelihood improvement. Among the three area the respondents of kutichandrakhana (43.3%) were more agree than other two study area. It was interesting that kutichandrakhana is a non chitmahal area. On the other hand the respondents of the two chitmahal i.e. Dashiarchora (33.3%) and Angarpota (30%) were less agree about the impact of homestead agroforestry in their livelihood. This may be due to the knowledge level of the farmers. The non chitmahal area's farmers were knowledgeable due to close contact of the government and nongovernment extension workers. But in case of chitmahal area, the farmers were not so knowledgeable. Again the respondents of Angarpota chitmahal, maximum (23.3%) people were in disagree category and only 3.3% people were found in disagree category in non-chitmahal area. In case of strongly agree category, the respondents of non-chitmahal area were in higher category (20%), whereas in Angarpota (13.13%) and Dashiarchora (13.13%) chitmahal which was very lower percentage. people of strongly agree category were higher percentage in non chitmahal area than two study chitmahal areas may be due to the contact level of extension services.

The study result is in agreement with the result of Miah and Hossain (2001), who got indigenous knowledge on Homestead Agroforestry where the study result found that maximum respondents told that Homestead Agroforestry has a good impact on livelihood improvement.

4.2 Plants species and vegetables species diversity in Citmahal and non Chitmahal area

Among the different plants species were observed in the homestead area of all the selected areas total 142 plants species were recorded from Dashiarchora chitmahal of which 69 timber species, 36 fruit trees, 12 medicinal species and 25 vegetable species. Again in case of Angarpota chitmahal there were 140 plant species were found of which 72 timber species, 41 fruit species, 8 medicinal species and 19 vegetable species. And 140 species from non- chitmahal area of which 52 timber species 43 fruit species 16 medicinal species and 29 vegetable species. Among the tree species Jackfruit, Akashmoni, Mango, Mahogany and Eucalyptus trees were found as dominant tree and in case of timber trees Mahogoni, Akashmoni and Euclyptus were found as commonly in almost 80% respondents houses. The diversity of timber species in the study area was rich compare to medicinal and fruits species. Among the fruit species Mango, Jackfruit, Papaya, Boro and Bel were dominant and found up to 75% respondents houses.

Table 6. Plant species diversity in study areas

Plant Species	Dashiarchora		Angarpota		Kutichandrakhana	
	No. of plants	% of plants	No. of plants	% of plants	No. of plants	% of plants
Timber	69	48.65	72	51.42	52	37.14
Fruit	36	25.35	41	29.29	43	30.71
Vegetables	25	17.60	19	13.57	29	17.85
Medicinal	12	8.40	8	5.71	16	11.43
Total	142	100	140	100	140	100

Among the medicinal tree species Amloki, Bohera and Arjun were dominant. The diversity of medicinal species in the study area was low compare to timber and Fruit species. In case of Angarpota chitmahal Timber trees percentage (%) is 51.42 % which is higher percentage than in Dashiarchora (48.65%) and Kutichandrakhana (37.14%) and fruit tree species is higher in Kutichandrakhana (30.71%) than Dashiarchora (25.35%) and Angarpota (29.29%) and also in case of medicinal and vegetable species, these species are higher in kutichandrakhana than Dashiarchora and Angarpota chitmahal. Being little knowledge because of illiteracy about the value of medicinal and fruit tree species among chitmahal people they are less active to grow these type of tree species and lack of knowledge, skill opportunities and transportation problem in chitmahal area there were less diversification of value able fruit, medicinal and vegetable species than

non chitmahal area on the other hand in non chitmahal area people are more educated and they are learned about importance of growing medicinal, fruit and vegetable species by getting government and non-government support and so in non chitmahal area there were much diversity in tree and vegetable species diversity. So the people of chitmahal area they should be raised up about the consumption value and market value to improve their health condition and economic condition.

The result of study is in agreement with the result of Abedin and Kuddus (1990), who recorded 9-14% vegetable cultivation and 33% under tree coverage whereas the study result found from Chitmahal and Non-Chitmahal area the vegetable cultivation was 13-17%, 37-48% timber tree coverage 25-30% fruit tree coverage and 8-12% medicinal species cultivation.

4.3. Major plants species found in chitmahal and non- chitmahal area

Jackfruit	<i>Artocarpus heterophyllus</i>	Brinjal	<i>Solanum longum</i>
Mango	<i>Mangifera indica</i>	String bean	<i>Vigna squipedalis</i>
Coconut	<i>Cocos nucifera</i>	Wax gourd	<i>Benincasa hispida</i>
Betel nut	<i>Areca catechu</i>	Stem amaranth	<i>Amaranthus spinosus</i>
Guava	<i>Psidium guajava</i>	Turmeric	<i>Curcuma longa</i>
Blackberry	<i>Syzygium cumini</i>	Chili	<i>Capsicum species</i>
Date palm	<i>Phoenix sylvestris</i>	Banana	<i>Musa paradisiaca</i>
Lemon	<i>Citrus limon</i>	Giant	<i>Alocasia indica</i>
Gamer	<i>Gmelina arborea</i>	Elephant foot aroid	<i>Amorphophallus campanulatus</i>
Wood apple	<i>Aegle marmelos</i>	Jute	<i>Corchorus capsularis</i>
Palm	<i>Palmyra palm</i>	Papaya	<i>Carica papaya</i>
Litchi	<i>Litchi chinensis</i>	Cucumber	<i>Cucumis sativus</i>
Neem	<i>Azadirachta indica</i>	Arjun	<i>Terminalia arjuna</i>
Teak	<i>Tectona grandis</i>	Rain tree	<i>Samanea saman</i>
Kadam	<i>Anthocephalus cadamba</i>	Minjiri	<i>Cassia siamea</i>
Blacksiris	<i>Albizia lebbek</i>	Babla	<i>Acacia nilotica</i>
Mahogany	<i>Swietenia macrophylla</i>	Mangium	<i>Acacia mangium</i>
Sissoo	<i>Dalbergia sissoo</i>	Bot.	<i>Ficus bengalensis</i>
Eucalyptus	<i>Eucalyptus camaldulensis</i>	Jigni	<i>Trema orientalis</i>
Akashmoni	<i>Acacia auriculiformis</i>	Babla	<i>Acacia nilotica</i>
Bohera	<i>Terminalia bellerica</i>	Basak	<i>Adhatoda vasica</i>
Horitoki	<i>Terminalia chubela</i>	Tulsi	<i>Ocimum americanum</i>
Kathbel	<i>Feronia elephantum</i>	Pineapple	<i>Ananas sativa</i>
Harjora	<i>Vitex quadrangularis</i>		
Olatkambal	<i>Abroma augusta</i>	Pudina	<i>Mentha spicata</i>
Khoir	<i>Acacia catechu</i>		

4.4 Existing Agroforestry Practices

The diversity of trees and vegetables in the study area found as rich condition. As a results there is a combination or mixed association of tree-vegetable was found. Each combination treated as separate Agro-forestry practices. This type of combination was critically observed in the study area and total fifteen different combinations were recorded as different Agro-forestry practices.

4.4.1 Agroforestry practices in Dashiarchora:

In Dashiarchora chitmahal, there were eight agroforestry practices found. These were:

1. Betel nut- betel leaf based agro forestry system
2. Ridge gourd-betel nut based agro forestry system
3. Bean-Banana-Jackfruit based agroforestry system
4. Coconut-Jackfruit-Betel nut-Papaya-Spinach based agroforestry system
5. Lau-data based agroforestry system
6. Chalkumra-kolmi based agroforestry system
7. Papaya-Okra based agroforestry system
8. Lambu-kachu based agroforestry system

Here the most preferable cultivation system is .Betel nut- betel leaf based agroforestry system and the second most was ridge gourd-betel nut based agroforestry system

4.4.2 Agroforestry practices in Angarpota:

In Angarpota chitmahal, there were nine agroforestry system found. These were:

1. Papaya-Bean-Potato based agroforestry system
2. Turmeric-Data based agroforestry system
3. Papaya-Bean-Potato based agroforestry system
4. Mehogoni-kachu based agroforestry system .
5. Potal-Papaya-Mango based agroforestry system .
6. Jackfruit –pineapple based agroforestry system).
7. Eucalyptus-Sissoo-Sweetgourd based agroforestry system.

8. Akashmoni-Rice based agroforestry system.

9. Banana-Papaya-Turmeric based agroforestry system

Here the most preferable cultivation system is Jackfruit –pineapple based agroforestry system.

4.4.3 Agroforestry practices in Kutichandrakhana

In Kutichandrakhana chitmahal, there were eight agroforestry systems found. These were:

1. Ridge gourd-kolmi based agroforestry system
2. Lau-data based agroforestry system
3. Betel nut-jhinga based agroforestry system
4. Papaya-holud based agroforestry system
5. Banana-ada based agroforestry system
6. Chalkumra-data based agroforestry system
7. Eucalyptus-rice based agroforestry system
8. Neem-chilli based agroforestry system

Here the most preferable cultivation system is betelnut-jhinga based agroforestry system and the second most practice was Eucalyptus-rice based agroforestry system.

The study result is in little agreement with the result of Moontasir *et al.* (2009).

4.5 Structures of homestead in the study area (Vertical stratification)

The vertical structure of the home garden over time is not static. It is perpetually changing and being renewed by the interplay of floristic and structural factors. It can, therefore, be termed as dynamic. The home garden has a multistoried canopy configuration. Basher (1999) identified four vertical canopy strata (within 1m, 2-5m, 5-10 m and > 10 m) and Millat-e-Mustafa (1997) identified six vertical canopy strata (< 1m, 1-3 m, 3-5m, 5-7m, 7-9m and > 10 m). Sabuj (2010) identified four vertical canopy strata (0-1.5, 1.5-3.50m, 3.52-7.00m and > 7.00m). This study identifies five vertical strata which were as follows- S1 = > 1m, S2 = 1.5-3.0m, S3 = 3.0-4.5 m, S4 = 4.6-6.0m, and S5).

Table 7: Vertical stratification of homestead of the study area (Dashiarchora, Angarpota and Kutichandrakhana)

Stratum	Height (m)	Existing Plants		
		Dashiarchora	Angarpota	Kutichandrakhana
S1	> 1.00	Sweet gourd, Spinach, Brinjal, Chili, Wax-gourd, Shosa.	Pineapple, Turmeric, Chili.	Turmaric, Zinger, Gerlicetc
S2	2.0-3.0	Banana, Papaya.	Papaya, Banana, Jujube.	Papaya, Bananaetc
S3	3.0-5.0	Litchi, Jujube, Payara, Gab, Golapjam, Bilatigap.	Litchi, Gab, Dalimetc	Litchi, Dalim, Golapjam, Bokuletc
S4	5.0-7.0	Mango, Jackfruit, Ipil-Ipi, Jamrul, Jam, Arjun.	Mango, Jackfruit, Jam, Jaruletc	Mango, Jackfruit, Jam.
S5	> 7	Tal, Eucalyptus, Mahagoni, Raintree, Sisso	Tal, Bash, Supari, Eucalyptus, Mahagonietc	Eucalyptus, Mahagoni, Gamar, Jiga, Bashetc

Here, S1=very lower stratum S2=lower stratum. S3=moderate stratum S4=Higher stratum.

S5 = very higher stratum

4.6 Agroforestry Adoption

The majority of the farmers in the study area have a good knowledge of agroforestry i.e., planting and raising the seedlings, grow crops with trees use of pesticides and fertilizers, etc. All farmers adopted agroforestry for its high profitability. Research also indicates erosion control, crop diversification, suitable use of land and space and presence of information and technical assistance are also other important causes for agroforestry adoption. Ninety traditional farmers (farmer who are not practicing agroforestry) were also questioned for identify the reasons for their failure to adopt agroforestry. The main causes for the failure of agroforestry adaptation were lack of capital; lack of interest, suitable land, knowledge of agroforestry systems and technical assistance (Table 8).

Table 8. Problem intensity faced by farmers adopting agroforestry practices

Problem confrontation with ranking	Dashiarchora (% of respondents)	Angarpota (% of respondents)	Kutichandrakhana (% of respondents)
Low	19	23	59
Moderate	10	9	24
High	71	68	17

The result of the study revealed that, the maximum people (71%) were faced high problematic condition. In case of Dashiarchora chitmahal, (71%) people were faced more problem to adopt agroforestry practices whereas in Angarpota chitmahal (9%) people were faced moderate problematic condition which was lower percentage than Dashiarchora chitmahal and non chitmahal. In case of non-chitmahal area there were less problematic condition, 59% people faced lower category problem and only 17% people were in high problematic condition. So, it is concluded that in chitmahal area there were many problem to adopt agroforestry and non-chitmahal there were less problem.

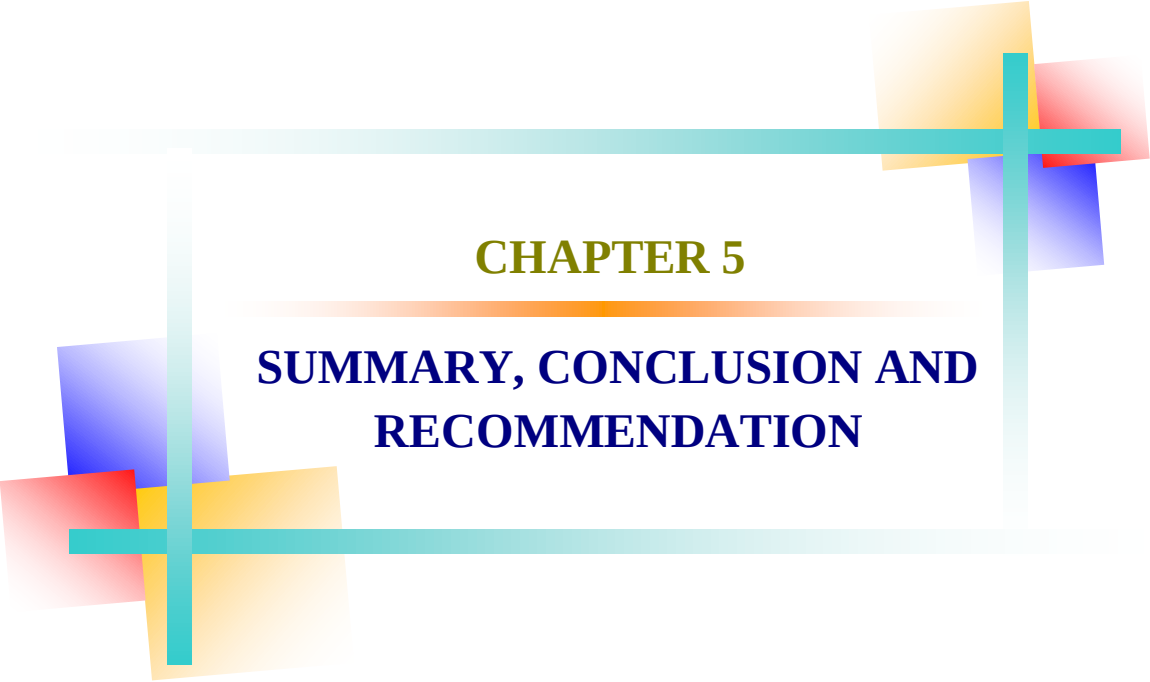
Table 9. Computed Correlation value of 'r' between Dependent Variable and Independent Variable

Dependent variable	Independent variable	Computed value of 'r' (Dashiarchora)	Computed value of 'r' (Angarpota)	Computed value of 'r' (kutichandrakhana)
Impact of homestead agroforestry on socioeconomic condition	Age	0.014(NS)	0.025 (NS)	0.016 (NS)
	Level of education	0.144(*)	0.251(*)	0.298 (*)
	Homestead size	0.155(*)	- 0.189(*)	0.115 (*)
	Farm size	- 0.161(*)	- 0.113 (*)	0.114 (*)
	Annual income	0.144 (*)	0.376 (**)	0.170 (*)
	Receive training	0.107(*)	0.151 (*)	0.341 (**)
	Knowledge about trees	0.289(**)	0.122(*)	0.427(**)

* Correlation significant at the 0.05 level; ** Correlation significant at the 0.01 level, NS-Non significant

Correlation between dependent variable as impact of homestead agroforestry and independent variable on livelihood improvement

To explore the relationship between selected characteristics and their opinion about the impact of homestead agroforestry on their livelihood development, Pearson's product moment co-efficient of correlation (r) value has been used (Table 9). In case of Dashiarchora Chitmahal all the selected characteristics except age and farm size had significantly positive relationship with the impact of homestead agroforestry on livelihood development. Farm size of farmers had negatively significant and age of farmers had no significant relationship with impact of homestead agroforestry. Again, Angarpota Chitmahal all the selected characteristics except age, homestead size and farm size of the farmers had significantly positive relationship with the impact of homestead agroforestry on livelihood development. Farm size and homestead size of farmers had negatively significant and age of farmers had no significant relationship with impact of homestead agroforestry. However, Non-Chitmahal (Kutichandrakhana) all the selected characteristics except age had significantly positive relationship with the impact of homestead agroforestry on livelihood development. Farm size of farmers had negatively significant and age of farmers had no significant relationship with impact of homestead agroforestry. Actually age is not dependent on the impact of homestead agroforestry in the livelihood improvement. Because the impact or benefit of homestead agroforestry was age irrelevant and it was same for all age group.



CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted in Angarpota chitmahal under Patgram Upazilla in Lalmonirhat District and Dashiarchora Chitmahal under Fulbari Upazilla of Kurigram District and nearby non Chitmahal in Kutichandrakhana village. Sites were selected purposively as the locale. A sample of 15% farm families were selected stratified random sampling procedure. Then 90 farmers were selected through preference sampling method. The survey was selected based on four different farm categories. Data were collected by using pre-tested interview schedule, PRA, focus group discussion, reference ranking. Then the collected data were summarized to meet the objectives of the study. Finally, the collected data were coded, compiled and tabular analyzed to fulfill various researchers from the sample farmers during July 2016 to February 2017. Farmer economic statuses were selected before, regarding the effect objectives. Data were collected through personal interview by the respondents opinion regarding impact of homestead agroforestry on socio-economic condition was the dependent variable of the study. Nine selected characteristics of the farmers were taken as independent variables. The characteristics were age, education, family size, farm size, homestead size, annual income, received training, MPTS, composition constituted the dependent variables in this study.

The study revealed that the socio-economic characteristics of the study not very different from the farmers of other parts of the country. The finding in respect of farmers opinion regarding the effect of homestead agroforestry on socio-economic aspects of farming indicate that majority of the farmers opined the effect of homestead agroforestry as moderately positive to highly positive on farming while the rest considered homestead agroforestry as less positive. Therefore it is concluded that almost all the farmers of the study area had positive feeling towards the impact of homestead agroforestry on farming activities. Majority of farmers 56.7%, 50% and 46.7% people were middle aged. Age of the farmers had positive and insignificant relationship with the farmer's opinion regarding the effect of the homestead agroforestry on the selected schooling on an average in all 3 study area. A positive and significant relationship has been observed

between the educational level of the farmers and farmer's opinion homestead agroforestry on the selected aspects of farming in all study area. Family size of the farmers was found to have positive and highly significant relationship with the farmer's opinion regarding the effect of homestead agroforestry on the selected aspects of farming. A negative and moderate significant relationship with the farmer's opinion regarding the effect of homestead agroforestry on the selected aspects of farming was founded in Angarpota Chitmahal. Homestead area of the farmers was found to have 1.97 ha, 2.20 ha and 3.20 ha in Dashiarchora, Angarpota and Kutichandrakhana respectively on an average. A positive and significant relationship was observed with the farmer's opinion regarding the effect of homestead agroforestry on the selected aspects of farming in Dashiarchora Chitmahal and Non Chitmahal in Kurigram and negatively significant in Angarpota chitmahal in Lalmonirhat District. As ranged annual income 40% of the farmers were found small income in Dashiarchora Chitmahal and 43.3% of the farmers were found in lower income in Angarpota Chitmahal and only 40% were found medium income in non Chitmahal area. Annual income of the farmers had positive and significant relationship with the farmer's opinion regarding the effect of homestead agroforestry on the selected aspects of farming.

A total number of 142 species were identified in Dashiarchora chitmahal of which 69 were timber tree and 36 were fruit tree, 25 vegetable and 12 medicinal species. Among the fruit species, the most prevalent species was mango followed by coconut, guava, jackfruit and date palm. A few number of vegetables (25 species) were found to grow in the study area but largely for own consumption. Datasak, kachu, turmeric, lalshak were grown in the shaded area of homestead in Dashiarchora chitmahal identified. In Angarpota chitmahal of which 72 were timber tree and 41 were fruit tree, 19 vegetable and 8 medicinal species. In case of non chitmahal area 52 were of timber species, 43 were of fruit, 29 were of vegetable and 16 were of timber. Dominant Agroforestry practices found rice based and eucalyptus tree found in all study areas as dominant tree. Rearing of livestock and poultry were a traditional practice in almost all the households in the study area. Homestead agroforestry is one of the traditional land use systems in Lalmonirhat district and Kurigram District like elsewhere in Bangladesh. The size of the home garden was the primary factor that determined the total production of wood, fruits and vegetables. The production increased with increasing farm size from landless to large farms. The home gardens were found underutilized and there were some vacant

niches that could be used for growing more trees and vegetables especially in the larger farms. Increased tree areas strongly feel that the homestead agroforestry practices in its present form had significant role in improving socio-economic status.

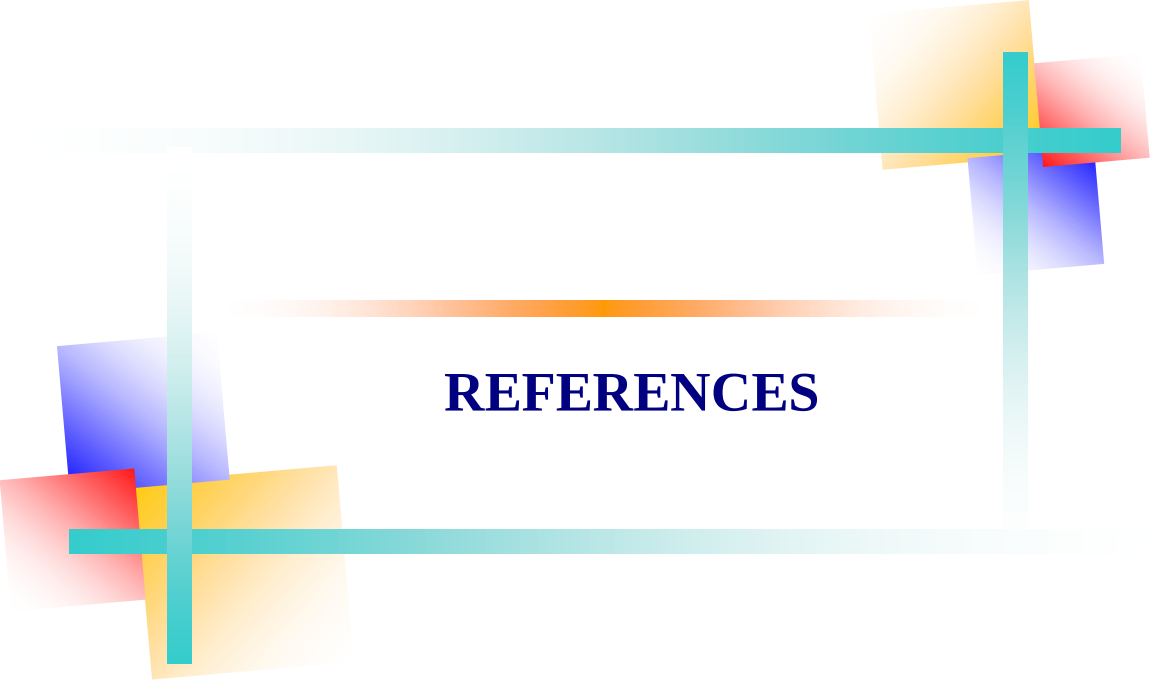
Conclusion

From the findings of this study it can be concluded that the chitmahal people are mainly of less or non educated, little or no technical knowledge, have no training and mostly depend on agriculture based occupation compared with non chitmahal area and they do not have much cropland area. They have no other qualification and they were also found more problem to adopt improved farming system in their livelihood. So, there is a great scope to improve the prevailing homestead agroforestry practices with modern homesteads agroforestry technologies for maximization of income of the chitmahal farmers irrespective of the farm size. As homestead agroforestry is a labour intensive enterprise round the year, so it can provide the opportunity of employment for a large number of redundant labours in the chitmahal areas.

Recommendations

The following recommendations are made on the basis of findings of the current study:

- The homestead agroforestry system can be improved by proper care and management. Crops having low economic value should be replaced by high economic value crops. These will ensure sustainable production of the system.
- More income generating activities should be created from homestead sources. Since mango is a multipurpose fruit tree commonly found in all locations, income generating industry can be made on the basis of mango production nearby chitmahal areas.
- It is strongly recommended that the interaction between farmer's and extension workers should be strengthened and the present extension services should be improved. The government should check out this problem.



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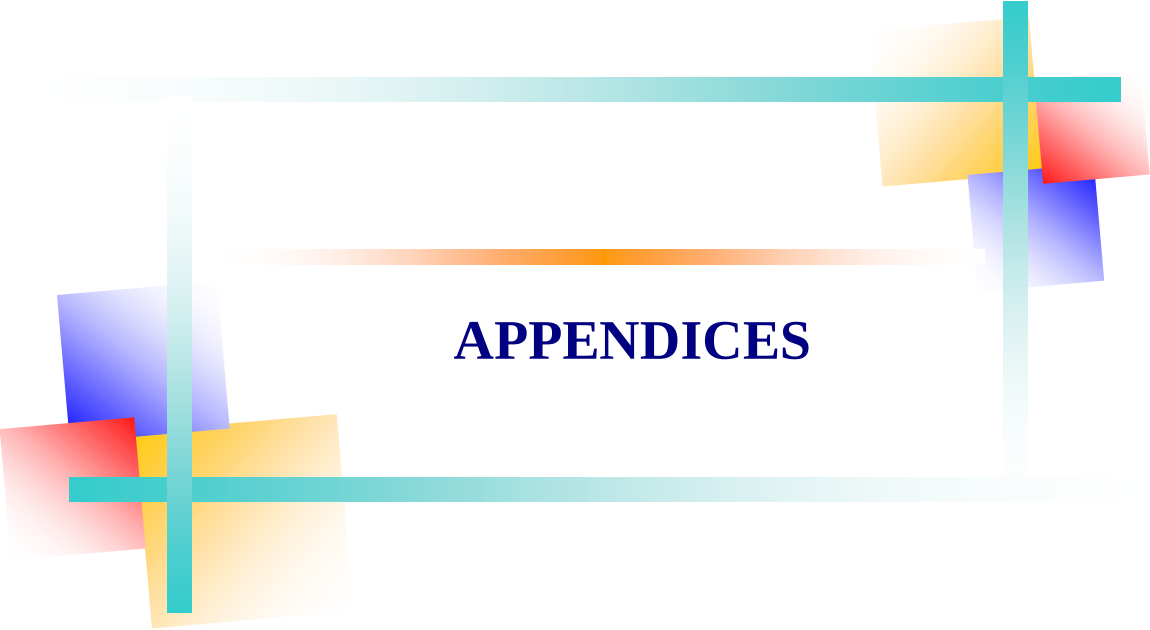
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An abstract geometric design featuring two intersecting teal lines forming a cross. Overlaid on these lines are several semi-transparent squares in yellow, red, and blue. The squares are positioned at the intersections and along the lines, creating a layered effect. The word "APPENDICES" is centered within the white space created by the lines.

APPENDICES

APPENDICES

Department of Agroforestry and Environment

Hajee Mohammad Danesh Science and Technology University, Dinajpur

A questionnaire on

Potentiality of homestead agroforestry in three chitmahal area in Lalmonirhat district

Date...../...../.....

Sample no.

Appendix-I: English version of the interview schedule

A. Personal information:

1. Respondent's Name:

Age (years)	Sex		Family size		Religion				Farming experience (years)
			Male	Female	Islam	Sonatn	Tribal	Others (specify)	
	Male	Female							

2. Level of education (Please, put tick mark):

- a. No formal education b. Primary education
c. S.S.C d. H.S.C. e. Above

3. Received any Agricultural training /workshop/public hearing (NGOs, GOs):

- 1) Yes 2) No

If yes, please mention the duration.....days

Sponsoring organization.....

Name of training course.....

4. Let us know about your household size (area):

5. Land holding (please put tick mark) a. Large b. Medium c. Poor

6. Family type (Please, put tick mark): a. Nuclear b. Joint c. Extended

7. What are your main sources of income please, indicate all the activities that you practice and that contributes to sustain your household average putting at the first the main one)? (Multiple answers)

Occupation	Income Generated (In Tk)
Agriculture	
Wage job	
Handicraft	
Private business	
Remittances	
Pension	
Others(please specify)	

B. Homestead Agroforestry and Its Socio-Economic Impact:

1. Which category of homestead size do you have? (Put tick mark below)

Category of homestead	Amount	
	Tick mark	Local unit
Marginal homestead (>0.02-0.08 ha)		
Small homestead(<0.08-0.14ha)		
Medium homestead(<0.14-0.20ha)		
Large homestead(<0.20ha)		

2. From which sources you get information about gardening? (Please, put tick mark)

Extension worker/name of agenda	Frequency of communication			
	High	Medium	Low	Not ever
Upazila agricultural officer				
Agriculture extension officer				
Sub-assistant agriculture officer				
NGOs staff				
Group discussion				
Participation in field day				
Watching agricultural program in TV, listening radio				
Reading leaflet, bulletin, news paper				

3. Can you tell me about the structure and composition of your homestead agroforestry?

Different micro site of the homestead	Name of the plant species
Home yard	
Front yard	
Back yard	
Marginal land between two household	
Pond site	
Approach road	
Boundary of the homestead	

4. Please tell me your existing timber, fruit, medicinal and vegetable producing MPTS (tree species) which have in our homestead?

Name of the MPTs			
Timber	Fruit	Medicinal	Vegetable

5. What do you think about the number of plant species in your home garden during the last 5 years (please, put tick mark)?

A. Increased

b. Decreased

c. Not changed

6. Among the total species, please mention the species, which have medicinal value?

Name of the plant	Uses and benefits	Either cultivated or naturally grown species

7. Please mention the production of different products and annual income from your homestead

Items	Production(use measuring unit)				
Fruit trees	Family consumption	Distribution	Sale	Annual Income	Total
Vegetables					
Timber and fuel wood					
nurseries					
others					

**8. Who take participation in the care and management of homestead gardening?
Please mention**

Management practices	Yes/not	Participators			
		Farmer	Wife	Children	Others
Seed collection and seed sowing					
Watering					
Weed control					
Manuring and fertilization					
Pruning					
Insecticides spray					

9. Please give your opinion about the impacts of homestead agroforestry

Impact of homestead agroforestry	Extent of villagers opinion			
	Strongly	Agree	Partially	Disagree
Getting fresh air due to increase of trees				
Income increase for tree plantation				
Increase supply of fruits and vegetables				
Increase availability of fuel wood				
Decrease air temperature				
Increase greenish view				

Thank you for your cooperation

.....
Signature of the interviewer

Appendix II: Plates of some agroforestry system in the study areas



Plate 1. Data collection using questionnaire by interview



Plate 2. Jackfruit tree with fruit



Plate 3. Betel nut tree



Plate 4. Betelnut-Betelleaf agroforestry system



Plate 5. Jhinga-betel nut agroforestry system



Plate 6. Jhinga-kachu agroforestry system



Plate 7. lambu-kachu based agroforestry system



Plate 8. Watergourd-Kolmmi agroforestry system



Plate 9. Okra plantation agroforestry system



Plate 10. Data-Bottle gourd agroforestry system



Plate 11. Rice-Akashmoni agroforestry system