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AGRICULTURAL EXTENSION | ORIGINAL ARTICLE

# Homestead Farming Systems and their Impact on Livelihood of the Ethnic Minority People of Northwestern Hilly Area of Bangladesh

**Iffat Ara Mahzabin[1] ✉, Eiji Nawata[2]**

[1] Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

[2] Kyoto University ASEAN Center, Klongtoey Nua,Watthana, Bangkok 10110, Thailand

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**Correspondence**
Iffat Ara Mahzabin
✉:
mahzabinagext@bau.edu.bd

**ABSTRACT**

Homestead farming has been playing an important role in the livelihood of the ethnic minority groups, including *Garo* and *Koch* in Bangladesh. It secures the integrated production of crops, trees and livestock in the premises of household and its surrounding areas. The northwestern hill forest is decreasing day by day at an alarming rate. In the context of the prevailing shortage of fuel wood and excessive deforestation, the existing homestead farming system of the ethnic people needs to be strengthened for their better livelihood. From this point of view, the study was conducted in two villages of Jhenaigati Upazila (the smallest administrative unit of Bangladesh) of Sherpur District of Bangladesh to find out changes of the homestead farming systems and their impact on people's livelihood. Fourteen different homestead farming systems were categorized by the presence of different livestock populations. A total of 109 plant species from 60 families were recorded in the study area. Among them 28 percent were identified as fruit species, 20 percent medicinal, 13 percent vegetable, 10 percent timber, 10 percent ornamental, 5 percent spices and 5 percent fuel wood. Fruit tree species like mango and jackfruit showed dominance. This dominance may be associated with the multipurpose usage of fruit trees as food, fuel wood, fodder and timber. About 20% households replaced their cassava plantation area with a mixed garden of fruits and timber yielding species. Exotic timber yielding species and medicinal plants were grown for commercial purposes as well as daily consumption. About fifty percent households had mixed garden of fruit and timber yielding species. Almost all households planted exotic timber yielding species in their mixed gardens. Medicinal plants were grown commercially, which was not practiced ten years back in the study area. The livestock species found in the homestead were cattle, chicken, duck, pig, goat, sheep and rabbit. Households having large homestead area had a tendency to raise more diversified livestock species. Pig rearing has shown a declining trend due to high price of piglets.



## 1. Introduction

Bangladesh is a densely populated country of subtropical Asia. The density of population is about 1015 per km2 (BBS, 2011). The small agriculture-based country is a habitat of people from different religions, races and casts. Around 30 ethnic minority groups are living throughout the country (ASB, 2006). Among them, Chakma, Shantal, Marma, Tripura, Garo, Manipuri, Mog, Koch, Khasia, Hajong are dominant (order according to the population size). According to the 2011 population census, 1.1% of the total population of Bangladesh was occupied by ethnic minorities (Barman and Noe, 2014). Around 20 % of ethnic minority population lives in Mymensingh Division. Agriculture is now the only major means of living of indigenous people of Bangladesh (Chakma and Maitrot, 2016). The Garo are one of the oldest ethnic minorities in Bangladesh. They were unknown to the world before the advent of the British in India, especially before 18th century (Burling, 1997). The Garo hills became a separate District under the name of "Garo Hills" (part of Assam) in 1872. In 1972, the Garo indigenous groups in Bangladesh mostly live in Haluaghat, Dhubaura, Durgapur and Kolmakanda (Mymensingh and Netrokona Districts), Jhenaigati, Nalitabari (Sherpur District), Madhupur (Tangail District) and Sunamgonj and Moulavi Bazar (greater Sylhet Division) with their own culture, language and appearances (Bal, 2007). The mixture of the Dravidian and Mongoloid races in Bangladesh includes Koch, Hajong, Rajbangshi and Monipuri (Methei).

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However, the Koch resembles more Mongolian than Dravidian. It is presumed that the origin and ancient home of the Koch indigenous group is Tibet of India (Gain, 1998).

The indigenous communities, Garo and Koch are mostly dependent on agriculture. Mainly these two ethnic minority groups are living in the hill forest of the northwest border of the country, which is connected with the hill of Meghalaya state of India. The natural habitats of those people are the hills, hillocks, deep forests and places near fountains, springs, and other water bodies (Bal, 2007; Doha, 2008). Usually most of them do not have own land except the homestead. Whatever land they hold in possession, they do so without any official ownership documents. The most important challenge ethnic people face now is the statutory rights to land. The existing law on Vested Enemy Property Act does not recognize their entitlements to the land or land ownership. With historical and long-standing processes of land dispossession, ethnic minorities both in the hills and in the plain lands have had to adapt their livelihood strategies to their environment and socio-economic conditions. According to the ethnic minority people, they are the aborigines of the area and as such regard themselves as the traditional and legitimate owners of the land. Their economic conditions are poor. Homestead farming can be the best answer to improve their economic conditions through growing vegetables and fruit yielding plants by enabling the people to get income throughout the year.

Jhum' (shifting cultivation following slash and burn of natural vegetation) was being practiced by the ethnic people in Chittagong hill tracts and in other areas including Madhupur Sal forest of Tangail and Garo hills of Sherpur (Gain, 2005). The exposure of land due to 'Jhum' has increased the chance of soil erosion and further degradation of land. In addition, there always existed crisis related to fuel wood and it increased with the population pressure. Thus, natural forest of Bangladesh has been severely degraded due to human activities. The protection and preservation of these forest area is under the jurisdiction of the Forest Department of Government of Bangladesh. The Forest Department restricted the access of forest-dwelling indigenous people to the forest and they have lost their traditional rights to forest resources. At present 'Jhum' (shifting cultivation) only exists at Chittagong Hill tracts. When 'Jhum' came to an abrupt end, the ethnic people of the Northwest hill forest of Bangladesh have tried to make them acquainted with other forms of agriculture. Homestead farming was getting more importance since then. The overexploitation of resources from natural forest has influenced them to change their traditional subsistence farming. This phenomenon will subsequently cause some changes in farming systems of the ethnic minority people, especially homestead farming due to insufficiency of farm land.

A number of studies have been conducted on farming systems of ethnic minority communities living in Chittagong Hill Tracts of Bangladesh (Jamaluddin et al., 2010; Alam, 2002). However, there is a lack of significant research on the northwest hill forest of Mymensingh region in general and homestead farming in particular. In this context, this study aimed to clarify the present situation of homestead farming and changes occurred in the recent past on the northwest hill forest of Mymensingh region.

## 2. Materials and Methods

### 2.1. Study site

The study site was located in two villages (Rangtia and Nakshi) of Jhenaigati Upazila (the smallest administrative unit of Bangladesh) in Sherpur District. The Upazila occupies an area of 242.07 km2. It is located between 25º04´ and 25º16´north latitudes and between 89º58´ and 90º08´east longitudes (Figure 1). The Upazila is surrounded by India, Nalitabari Upazila, Sherpur Upazila and Sreebardi Upazila in north, east, south and west, respectively. The area belongs to the "Northern and Eastern Hills" agro-ecological zone (FAO, 1988). The forest area located in the northern part of the Upazila is situated on irregular masses of broken hills along the foot of the Garo Hills. In between these irregular masses of hills there are flat lands in the form of narrow and wide valleys which are cultivated with paddy. There are irregular patches of Sal (Shorea robusta) and miscellaneous forests in the slightly higher land of valley which is not suitable for cultivation (BBS, 2013).

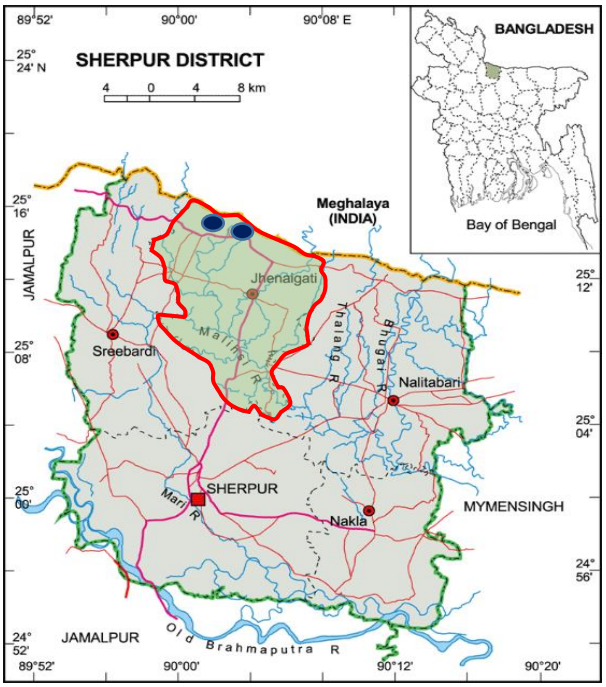


Figure 1. Map of the study area. Black circels indicate study location

The soils are brown in colour, usually loamy in texture and very strongly acidic. The study villages were situated in a region of subtropical monsoon climate and characterized by high temperatures and heavy rainfall during the Kharif season (the rainy season, April to September) and scanty rainfall associated with moderately low temperatures during the Rabi season (the dry season, October to March). The annual average temperature varies from

minimum 12°C to maximum 33.3°C. The annual rainfall is 2174 mm (BBS, 2013).

The two ethnic groups (Garo and Koch) live on the western edge of the Garo hills. Both Garo and Koch are identified by their mothers' clan title. But they are separated by their language and religion. Historically, they were traditional shifting cultivators (Jhum). However, they managed their homestead farming in a similar pattern. Therefore, data on homestead farming including existing farming system, species composition, plantation of cassava and livestock components are discussed combinedly. On the contrary the socio-economic characteristics of the two ethnic group are discussed separately in results and discussion.

### 2.2. Population and sample size

The study was conducted in Sherpur District that consists of five Upazilas. Among them Jhenaigati Upazila was purposively selected. It consists of seven unions. The village Nakshi from Kangsha union was selected for Garo ethnic people and the village Rangtia under Nalkura union was selected for Koch ethnic people. There was 87 Garo households at Nakshi and 123 Koch households at Rangtia. Out of 210 households, a sample of 30 percent, i.e., 28 and 36 households were randomly selected from Nakshi and Rangtia, respectively.

### 2.3. Data collection

#### *2.3.1. Household information*

Primary information about the two study villages were collected from the Agriculture Office of Jhenaigati Upazila. Local government officers, village leaders, local medicinal practitioners, school teachers and NGO workers were interviewed as key informants. Data were collected both by the interviews and from direct observations during the researcher's stay at the study area. Sample households were visited to observe the production system of homestead farming. Each household head was interviewed using a semi-structured questionnaire to obtain data on household size, age, sex and occupation of the household members, size of homestead, amount of operated land, annual family income, plant and animal species composition, categorization of plants based on their major usage, utilization pattern of homestead products, with their utilities (percentages consumed and sold), sources of seedlings, changes on plant and animal species selection and collection of items from the hill forest.

#### *2.3.2. Information on plant species*

All plant species in each homestead were listed. Specimens of plants that could not be identified in the field were later identified by consulting with an expert from the Department of Crop Botany, Bangladesh Agricultural University.

## 3. Results and Discussion

### 2.4. Socio-economic characteristics of the interviewed villagers

#### *2.4.1. Age of the interviewed villagers*

The age of the interviewed villagers ranged from 29 to 77 years. On the basis of their age the interviewed villagers were classified into three categories, i.e. young (up to 35 years), middle aged (36-55 years) and old (above 55 years) ones. The number and percentage distribution of farmers according to their age group and ethnicity was shown in Table 1. It was revealed that two-fifths of the surveyed Garo people belongs to old category. Barkat et al. (2009) stated that the proportion of older population is larger in the Garo community than the country's total population. Around half of the population (46 percent) belongs to middle aged category. Among the Koch people majority (67 percent) were in middle aged category.

Table 1. Distribution of the interviewed villagers according to their age

| Category | Ethnic groups | | | |
|---|---|---|---|---|
| | *Garo* | | *Koch* | |
| | Number | Percentage | Number | Percentage |
| Young (Up to 35 years) | 4 | 14 | 5 | 14 |
| Middle aged ( 36-55 years) | 13 | 46 | 24 | 67 |
| Old (Above 55 years) | 11 | 40 | 7 | 19 |
| Total | 28 | | 36 | |

#### *2.4.2. Household size*

The number of family members of the interviewed farmers ranged from 2 to 12. The average household size among Garo community is 4.9 and this is roughly same as the national average of 4.8. Household size among the Koch community is 4.5, which is less in comparison to the above mentioned national average. Bengalese people tend to have a bigger household size than the ethnic minority people (HPNSDP, 2011). On the basis of their household size, both of the ethnic groups were classified into three categories, small (2-4 members), medium (5-10 members), and large (more than 10 members) categories (Table 2). Most of the families among the Garo and Koch population are nuclear. Nuclear families make up 50 percent among Garo people and 58 percent among Koch people.

Table 2. Household size of the interviewed villagers

| Category | Ethnic groups | | | |
|---|---|---|---|---|
| | *Garo* | | *Koch* | |
| | Number | Percentage | Number | Percentage |
| Small (2-4 members) | 14 | 50 | 21 | 58 |
| Medium (5-10 members) | 13 | 46 | 15 | 42 |
| Large (More than 10 members) | 1 | 4 | 0 | 0 |
| Total | 28 | | 36 | |

Table 3. Categories of educational level of the interviewed villagers

| Category | Ethnic groups | | | |
|---|---|---|---|---|
| | *Garo* | | *Koch* | |
| | Number | Percentage | Number | Percentage |
| Illiterate (no formal education) | 7 | 25 | 16 | 45 |
| Sign only | 1 | 4 | 3 | 8 |
| Primary level (class I-V) | 7 | 25 | 7 | 19 |
| Secondary level (class VI-X) | 12 | 42 | 8 | 22 |
| Above secondary level (college and university) | 1 | 4 | 2 | 6 |
| Total | 28 | | 36 | |

### *2.4.3. Education*

The educational level of the interviewed villagers was categorized according to the national standard of classification (BBS, 2014). These were illiterate (no formal education), sign only, primary level (class I-V; elementary level), secondary level (class VI-X), and above secondary level (college and university). The range of educational level of the interviewed villagers ranged from non-formal education to college level. The level of the education of the both ethnic groups was shown in Table 3. This observation is found similar to the adult literacy rate of rural Bangladesh, 54 percent (BBS, 2014). The literacy level is quite high among the Garo people as compared to Koch people. Gain et al. (2015) reported that Garo people are well ahead of Koch people in education and financial status. As many of the Garo people embraced Christianity after Baptist missionaries began to work at the study area. This contributed in their financial and educational progress. On the other hand, the Koch people want to improve their educational and financial status but they do not want to convert to Christianity. It is difficult for Koch people to send their children to school due to their poor economic condition.

### *2.4.4. Occupation*

Agriculture was the main occupation of the Garo and Koch communities in the study area. Historical documents have revealed that 'Jhum' cultivation or shifting cultivation was practiced by their ancestors, which is still practiced by some of ethnic minority people of other parts of the country (Doha, 2008; Rahman and Fardusi, 2012). Traditionally they were engaged in hunting and trapping wild animals, gathering wild plants as food and medicine from forests, and collecting fuel wood. Nowadays these become secondary or tertiary occupation of the ethnic minorities. They have shifted to production of surplus crops in a few decades ago, being prompted to do so for the sake of livelihoods in context of increased needs and competition in consumption. It was found that there were four types of occupation recently they are holding. Agriculture was the major occupation of the Garo and Koch people followed by day laborers, small merchant and service holders, such as school teacher, NGO worker and village police (Table 4).

### *2.4.5. Homestead size*

A homestead of the study area usually comprises of a single house for living, kitchen, yard, homestead garden, poultry and cattle shed. Whereas, a typical homestead in Bangladesh accommodates a single or several houses of single or joint families and a space for vegetable gardens, a yard for threshing ground and communal activities, a shed for cattle, ponds, trees, shrubs, and bamboo (Khaleque, 1987; Abedin and Quddus, 1990; Haque, 1996). The size of 64 selected homesteads ranged from 0.04-0.73 ha with a mean of 0.17 ha. The homestead sizes of the study area were classified into 3 groups, viz. large

Table 4. Occupational categories of interviewed villagers

| Category | Ethnic groups | | | |
|---|---|---|---|---|
| | *Garo* | | *Koch* | |
| | Number | Percentage | Number | Percentage |
| Farmers | 11 | 39 | 23 | 64 |
| Day laborers | 11 | 39 | 6 | 17 |
| Small businessmen | 4 | 14 | 4 | 11 |
| Service holders | 2 | 8 | 3 | 8 |
| Total | 28 | | 36 | |

Table 5. Existing homestead farming systems observed in the study area

| Sl. No. | Homestead Farming Systems | Percentage of Households |
|---|---|---|
| 1 | Plant+Cattle+Poultry | 43.8 |
| 2 | Plant+Poultry | 15.6 |
| 3 | Plant+Cattle | 7.8 |
| 4 | Plant | 6.3 |
| 5 | Plant+Cattle+Goat+Poultry | 4.7 |
| 6 | Plant+Cattle+Poultry+Pig | 4.7 |
| 7 | Plant+Goat+Poultry | 3.1 |
| 8 | Plant+Poultry+Pig | 3.1 |
| 9 | Plant+Pig | 3.1 |
| 10 | Plant+Cattle+Pig | 1.6 |
| 11 | Plant+Cattle+Goat+Poultry+Rabbit | 1.6 |
| 12 | Plant+Cattle+Goat+Poultry+Pig | 1.6 |
| 13 | Plant+Cattle+Poultry+Pig+Sheep | 1.6 |
| 14 | Plant+Cattle+Poultry+Rabbit | 1.6 |
| | Total | 100 |

Poultry includes chicken and duck

Table 6. Categorization of ethnic groups according to homestead size

| Type of households | Ethnic groups | | | |
|---|---|---|---|---|
| | *Garo* | | *Koch* | |
| | Number | Percentage | Number | Percentage |
| Small (< 0.05ha) | 2 | 7 | 2 | 6 |
| Medium (0.05-0.20 ha) | 18 | 64 | 32 | 88 |
| Large (> 0.20 ha) | 8 | 29 | 2 | 6 |
| Total | 28 | | 36 | |

(larger than 0.20 ha), medium (0.05-0.25 ha) and small (smaller than 0.05 ha) ones. The study revealed that majority of the Garo and Koch people had a medium sized homestead area. Around 60 percent Garo homesteads had medium sized area. Four-fifths of the Koch households had medium homestead area. Garo people were possessing more large size homestead comparing with Koch people (Table 6). The reason for this is not clear. Around one third of the sample households (31.25%) had no land except the homestead area.

## 2.5. Existing farming system in the homestead area

### *2.5.1. Homestead farming systems*

Fourteen different homestead farming systems were practiced by the rural households in the study area (Table 5). This type of categorization was previously used by (Rahman et al., 2013). Among these fourteen different homestead farming systems, the plant-cattle (Bos indica)-poultry system was the most popular one and practiced by 43.8 percent of the total households. This data agreed with those of the homestead farming systems of rural Bangladesh (Miah and Hussain, 2010). Majority of the households (93.7 %) were practicing farming systems including plants and animals, including cattle, goat (Capra aegagrus hircus), poultry, pig (Sus scrofa), sheep (Ovis aries) and rabbit (Oryctolagus cuniculus). A few farmers (6.3 %) informed that they did not raise any animals due to some constraints. The major constrains were lack of capital, prevalence of diseases and limited space. Women were found as the labor force in raising plant and livestock species in their home yard. They were involved in growing plants from its sowing to harvest and also in post-harvest activities. They also gather fodder and feed for livestock and poultry.

### *2.5.2. Plant species composition in homestead farming*

A total of 109 plant species from 60 families were recorded in the study area. The family Fabaceae showed the highest number of species (8), followed by Meliaceae, Palmae and Rutaceae (5 for each family). The mean number of plant species per homestead was 15, with values ranging from 2 to 36. Among 109 species, 28 percent were recorded as fruit yielding species, 20 percent medicinal, 13 percent vegetable, 10 percent timber, 10 percent ornamental, 5 percent spices and 5 percent fuel wood providing species (Figure 2). Others include fiber producing species, sugar crops etc. Miah and Hussain (2010) reported that 105 tree species were recorded in 15 districts covering southwestern, eastern and northwestern regions of Bangladesh. Among them 42 were perennial and annual fruits, 31 forest trees (timber and fuel wood), 7 medicinal and 22 ornamental/aesthetic species. Rahman and Fardusi (2012) recorded a total of 9 foods, 15 fruits, 12 fuel and 11 timber species that the Garo used in their daily life. Yoshino (1996) recorded 115 plant species in homesteads of Old Brahmaputra floodplain. Atikullah et al. (2016) identified 189 different plant species in the homesteads of the southwestern coastal zone of Bangladesh. Thus, it can be said that the total number of plant species grown in the rural homesteads of Bangladesh varies from region to region.

### *2.5.3. Plantation of cassava in the homestead*

Cassava, Manihot esculenta, is a perennial shrub with enlarged tuberous roots. In Bangladesh, cassava is produced traditionally for meeting household consumption by majority of the farmers. Recently, few private farms are cultivating cassava in an area of 12–15 hectares land by

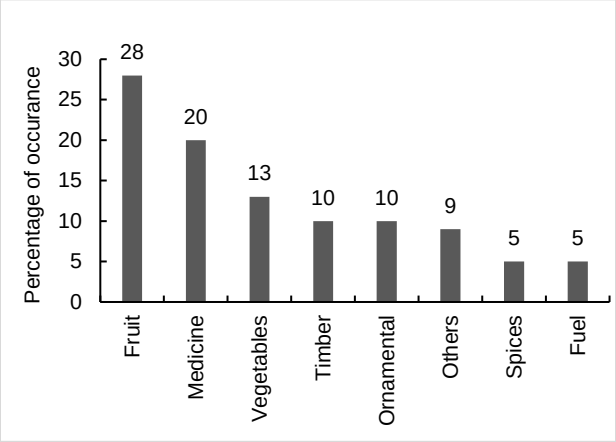


Figure 2. Different category of plant species (=109) with their percentages of occurrence

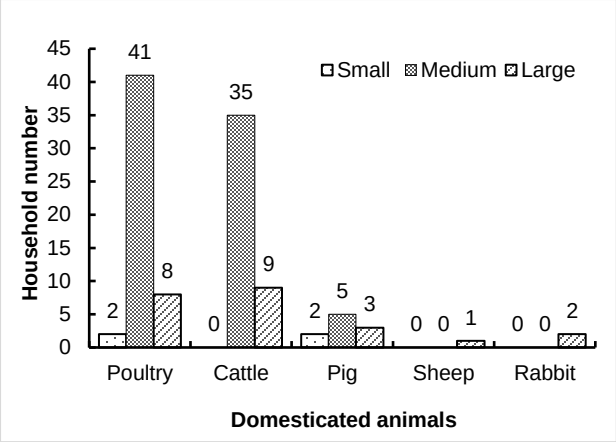


Figure 3. Distribution of livestock according to the homestead area

employing farmers on contract basis in Bangladesh (Afreen and Haque, 2014). Plantation of cassava in and around the homestead is a distinctive feature of the homestead farming in the study area. It has been found that around 60% of the local people were cultivating cassava for their own consumption and also for selling the surplus to the local markets for cash. Ethnic minority (Garo and Koch) people, who are consuming cassava, often take it as their alternative carbohydrate source at breakfast. This practice is rarely found in other parts of Bangladesh.

At the end of January, the ethnic minority people prepare their land around homestead. They add the kitchen waste as an organic fertilizer to the soil during the land preparation. No other fertilizers including chemical ones are used for cassava cultivation. The planting of cassava continues up to the late February. Usually weeding is done when necessary. The harvest of cassava starts from November and continues up to early January. Stem cutting of cassava is mainly used for its reproduction.

Cassava growers of the study area were found to use both home supplied and purchased stem cutting for the reproduction of cassava. Around 20–30 good quality plants are kept as planting materials for the next year. These plants are kept in a cool and humid place of the homestead, usually near the well or tube well.

Commercial contract growers in Bangladesh use chemical fertilizers, namely urea, triple super phosphate and muriate of potash in the cultivation of cassava. On the contrary, ethnic minority farmers in this study only apply some extent of organic fertilizers to increase yield, but they do not apply any kind of chemical fertilizers. It may be due to the fact that the main purpose of cassava utilization is household consumption at the study area.

### *2.5.4. Livestock components*

Cattle, goat, chicken (Gallus gallus), duck (Anas poecilorhyncha), pig, sheep and rabbit were reared by the households in the study area. Rearing livestock including poultry is an integral part of homestead farming in rural Bangladesh. Animals and plants live in a symbiotic way, in which plant refuse is used as fodder and bedding materials, while animal excreta are used as manure. It is known that cattle, goat, sheep, water buffalo, chicken, duck and pigeon are usually reared in the homestead with plants in the other area of Bangladesh (MoF, 2019). Pig and rabbit rearing are hardly found in other parts of Bangladesh. Households having large homestead areas managed more diversified livestock species than those with the medium and small homestead areas (Figure 3). This may be due to the fact that they have enough space in their homestead for rearing several livestock and poultries. Among seven types of livestock species it was found that large farmers possess all these types of livestock in their homestead, whereas small farmers got only two types of livestock, namely poultry and pig.

### *2.5.5. Relationship between aspects of homestead farming with selected characteristics of ethnic people*

The section deals with the relationship between selected characteristics of ethnic people and aspects of homestead farming (number of plant species grown and kind of reared animals). The selected characteristics are age, household size, educational level and homestead size. To explore the relationships Pearson's Product Moment Co-efficient of Correlation (r) has been used (Table 7). It was found that age, household size and educational level of Garo people had no significant relationship with the number of plant species grown and kind of animals reared in their homestead. But number of plant species and type of animal species maintained at their homestead had significant positive relationship with homestead size. The study also revealed that age, household size and educational level of Koch people had no significant relationship with the number of plant species. The homestead size of the Koch people had significant positive relationship with number of plant species grown in their homestead. The kind of animals reared in homestead of Koch people had no significant relationship with their age and educational level. Koch people having large household and homestead size reared more livestock species.

Table 7. Computed co-efficient of correlation (r) between selected characteristics of ethnic people with existing homestead farming

| Aspects of homestead farming | Ethnic groups | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Garo* | | | | *Koch* | | | |
| | Age | Household Size | Education | Homestead size | Age | Household size | Education | Homestead size |
| Number of plant species | 0.104 | 0.248 | -0.239 | 0.427* | -0.108 | 0.070 | 0.101 | 0.529** |
| Types of animal species | 0.304 | 0.170 | -0.078 | 0.396* | -0.194 | 0.349* | 0.195 | 0.423* |

* Significant at 5% level of probability; ** Significant at 1% level of probability

Table 8. List of fruit species found in the homestead of the study area

| Percentage of growing household | Bengali name | English name | Scientific name | Utilization* | Sources of seedling** |
|---|---|---|---|---|---|
| > 80 | Aam | Mango | *Mangifera indica* | Fr, W, Fu | O, NGO, M, Ag, Ne |
| | Kanthal | Jackfruit | *Artocarpus heterophyllus* | Fr, C, W, T, Fu, Fr, Fd | O, M, NGO, Ne |
| 61-80 | Narikel | Coconut | *Cocos nucifera* | Fr, Ju, Br, Fu | O, M, NGO, Ag, Ne |
| | Litchu | Litchi | *Litchi chinensis* | Fr, W, Fu | O, M, NGO, Ag |
| | Pepe | Papaya | *Carica papaya* | Fr, Vg | O, Ne, M, NGO |
| | Supari | Betel nut | *Areca catechu* | Fr, Cw, W, Cm, Fu | Ne, M,O |
| 51-60 | Peara | Guava | *Psidium guajava* | Fr, W, Fu, Fd | M, O, NGO |
| 31-50 | Kola | Banana | *Musa* spp. | Fr, Vg | O, Ne, Re, Ag |
| | Boroi | Jujube | *Zizyphus mauritiania* | Fr | O, Ne, M, H, NGO |
| | Jambura | Pomelo | *Citrus grandis* | Fr | O, Ne, M |
| | Tetul | Tamarind | *Tamarindus indica* | Fr | M, O, H, Ne |
| 20-30 | Jalpai | Indian olive | *Elaeocarpus floribundus* | Fr | M, O |
| | Lebu | Lemon | *Citrus* spp. | Fr | O, M, NGO, Re, Ne, BAUGC |
| <20 | Anaros | Pineapple | *Ananas sativus* | Fr | O, Ne, Re |
| | Jam | Black plum | *Syzygium* spp. | Fr, W | H, O, NGO, M |
| | Bel | Wood apple | *Aegle marmelos* | Fr, Rw | O, M, H, Ne, Ag |
| | Khejur | Date palm | *Phoenix sylvestris* | Fr, Ju, Cr | O, M |
| | Amloki | Indian gooseberry | *Phyllanthus emblica* | Fr | M, H |
| | Kamranga | Star fruit | *Averrhoa carambola* | Fr | M, O, Ne, H |
| | Arboroi | Star gooseberry | *Phyllanthus acidus* | Fr | M, O, NGO |
| | Amra | Hog plum | *Spondias pinnata* | Fr | M |
| | Chalta | Elephant apple | *Dillenia indica* | Fr, Rw | O, M |
| | Atafal | Sugar apple | *Annona squamosal* | Fr | O |
| | Tal | Palmyra palm | *Borassus flabellifer* | Fr, Hf | O, M |
| | Lotkon | Bermese grape | *Baccaurea ramiflora* | Fr | H, M |
| | Dewa | Monky jack | *Artocarpus lakoocha* | Fr | H |
| | Komla | Orange | *Citrus sinensis* | Fr | M |
| | Dalim | Pomegranate | *Punica granatum* | Fr | M |
| | Gab | Indian persimmon | *Diospyros embryopteris* | Fr | Ne |
| | Jamrul | Wax apple | *Syzygium samarangense* | Fr | M, BAUGC |
| | Sofeda | Sapota | *Manilkara zapota* | Fr | M, Ag |

* B: Broom; C: Cook; Cm: Construction materials; Cr: Craft; Cw: Chewing; Fd: Fodder; Fr: Fruit; Fu: Fuel; Hf: Hand fan; Ju: Juice; Rw: Ritual work; T: Timber; Vg: Vegetable; W: Wood; ** Ag: Agricultural office; BAUGC: Bangladesh Agricultural University Germplasm Center; H: Hill; M: Market; Ne: Neighbour; NGO: Non-governmental organization; O: Own; Re: Relatives.

Table 9. List of vegetables and spices found in the homestead of the study area

| Percentage of growing household | Bengali name | English name | Scientific name | Sources of seedling * |
|---|---|---|---|---|
| > 60 | Morich | Chili | *Capsicum frutescens* | O, Ne, H |
| | Sheem | Lablab bean | *Lablab purpureus* | O |
| | Lau | Bottle gourd | *Lagenaria siceraria* | M,O |
| 41-60 | Shojna | Drumstick | *Moringa oleifera* | O, H, Ne |
| | Shimul alu | Cassava | *Manihot esculenta* | O, H |
| 31-40 | Gach alu | Air potatoes | *Dioscorea bulbifera* | O, Ne, H, Re |
| | Dudh Kochu | Coco yam | *Xanthosoma violaceum* | O, H |
| 21-30 | Chui | Roselle | *Hibiscus sabdariffa* | O, Ne |
| | Misti alu | Sweet potato | *Ipomoea batatas* | M |
| | Mula | Radish | *Raphanus sativus* | M |
| <20 | Borboti | Yard long bean | *Vigna sesquipedalis* | M |
| | Kalmi shak | Kangkong | *Ipomoea aquatic* | M |
| | Lal shak | Red amaranth | *Amaranthus gangeticus* | M |
| | Dhundol | Sponge gourd | *Luffa cylindrical* | O |
| | Gol alu | Potatoes | *Solanum tuberosum* | O |
| | Tejpata | Bay leaf | *Laurus nobilis* | M |
| | Daruchini | Cinnamon | *Cinnamomum zeylanicum* | M |
| | Halud | Turmeric** | *Curcuma longa* | O, Ne |
| | Bilati dhonia | Culantro | *Eryngium foetidum* | O |
| | Ada | Ginger** | *Zingiber officinale* | O, Ne |

* H: Hill; M: Market; Ne: Neighbour; O: Own; Re: Relative; ** Turmeric and ginger are utilized as medicine also.

Table 10. List of medicinal plants in the homestead of the study area

| Percentage of growing household | Bengali name | English name | Scientific name | Sources of seedling* |
|---|---|---|---|---|
| > 60 | Tulsi | Holy basil | *Ocimum tenuiflorum* | O, H, Ne |
| 41-60 | Ghretokumari | Aloe vera | *Aloe barbadensis* | O, M, Ne |
| 21-40 | Neem | Neem | *Azadiracta indica* | M, Ne, NGO, O |
| <10 | Kharajora | Indian-laurel | *Litsea glutinosa* | H, O |
| | Pathorkuchi | American life plant | *Bryophyllum calycium* | O, H |
| | Kalo dhutora | Thorn-apple | *Datura metel* | H |
| | Shatomuli | Asparagus | *Asparagus racemosus* | M, H |
| | Haritaki | Chebulic myrobalan | *Terminalia chebula* | M, H |
| | Mukundo | Bayur tree | *Pterospermum acerifolium* | H |
| | Chirota | Green chirayta | *Andrographis paniculata* | O, H |
| | Shibjota | Red-hot cat's tail | *Acalypha hispida* | H |
| | Akando | Crownplant | *Calotropis gigantean* | H |
| | Arjun | White marudah | *Terminalia arjuna* | H |
| | Agor | Agarwood | *Aquilaria malaccensis* | H |
| | Jamalgota | Physic nut | *Jatropha curcas* | M |
| | Agnishor | Fire lily | *Gloriosa superba* | H |
| | Jostimadhu | Licorice | *Glycyrrhiza glabra* | H |
| | Hurhuri | Asian spider flower | *Cleome viscosa* | H |
| | Hargoja | Holly-leaved acanthus | *Acanthus ilicifolius* | M |
| | Keshraj | False daisy | *Eclipta alba* | H |
| | Ulatcombol | Devil's cotton | *Abroma augusta* | M |
| | Pitraj | Rohituka tree | *Aphanamixis polystachya* | M |
| | Nayantara | Madagascar periwinkle | *Catharanthus roseus* | O, Ne |

* H: Hill; M: Market; Ne: Neighbour; NGO: Non-Governmental Organization; O: Own

## 2.6. Usage of homestead major plant species and their impact on livelihood

### *2.6.1. Fruits*

A list of fruit tree species with their uses and source of seedling was presented in the Table 8. Mango (Mangifera indica) and jackfruit (Artocarpus heterophyllus) were the most popular fruit tree species in the study area and the percentage of the household growing these two species was more than 80%. The other major fruit tree species were coconut (Cocos nucifera), litchi (Litchi chinensis), papaya (Carica papaya), guava (Psidium guajava), banana (Musa spp.), jujube (Zizyphus mauritiania) and pumelo (Citrus grandis). Fruit yielding plant species have shown dominance over others in different parts of Bangladesh (Millat-e-Mustafa et al., 1996). The people of the study villages paid more attention to growing fruit trees in view of getting both fruits and timber/fuel wood from the same species. They collected the seeds and propagating materials from local markets, neighbors and relatives. Sometimes they raised seedlings by their own. Especially seedlings of fruit trees were distributed among the villagers by the NGOs and agriculture offices. The utilization pattern of those species was associated with their indigenous knowledge and traditional food habit. Nasrin and Khalifa, (2004) reported that ethnic people have developed an indigenous knowledge system of their own in practicing the special type of the utilization pattern of different plant parts.

### *2.6.2. Vegetables and spices*

A list of vegetables and spice crops found in the study area was presented in the Table 9. Many kinds of vegetables and spices were grown by the sample households in their homestead area. Almost half of the surveyed households produced chili, lablab bean, bottle gourd, drumstick and cassava. The exceptional feature of the study area was cassava plantation in the homestead. Besides these, creepers and shade tolerant species, such as air potatoes, turmeric and ginger were mainly found during the survey. Miah and Hussain (2010) stated that creeping vegetables such as bitter gourd, bottle gourd, and hyacinth beans were placed on trellis over the pond in saline areas of Bangladesh. Yoshino (1996) observed that bottle gourd, squash, ash gourd, giant taro, taro and turmeric were grown in the homesteads of Old Brahmaputra floodplains throughout the year.

Table 11. List of timber, fuel wood and other tree species observed in the homestead

| Percentage of growing household | Bengali name | English name | Scientific name | Utilization * | Sources of seedlings** |
|---|---|---|---|---|---|
| >60 | Akashmoni | Acacia | *Acacia auriculiformis* | W, T | M |
| 41-60 | Goraneem | Persian lilac | *Melia azedarach* | W, Cm | H |
| | Gamari | Goomar teak | *Gmelina arborea* | W, Cm | H |
| 31-40 | Eucalyptus | Eucalyptus | *Eucalyptus camaldulensis* | W, T, Fu | M |
| | Bash | Bamboo | *Bambusa* spp. | C, Cm, Fi, Hi, Ba | Ne, H |
| | Shegun | Teak | *Tectona grandis* | W, T | M |
| | Mehogony | Mahogany | *Swietenia mahogany* | W, T | M |
| 20-30 | Joba | China rose | *Hibiscus rosa-sinensis* | Or | Ne |
| | Rangin | Red cedar | *Toona ciliata* | W, T, Fu | H |
| | Bera chita | Jew's slipper | *Pedilanthus tithymaloides* | He, Me | H |
| <20 | Fanimonsha | Cactus | *Cactaceae* spp. | Fe | H |
| | Bazna | Prickly ash | *Zanthoxyllum* spp. | W, Fu | H |
| | Koroi | White siris | *Albizia procera* | W, T, Fu | H |
| | Shirish | Indian siris | *Albizia lebbeck* | W, T, Fu | H |
| | Mandar | Indian coral tree | *Erythrina variegate* | W, Fu, Fe | H |
| | Golap | Rose | *Rosa* spp. | Or | M |
| | Jiga | Indian ash tree | *Lannea coramandelica* | W, Fu | SP |
| | Shefali | Coral jasmine | *Nyctanthes arbortristis* | Or | Ne |
| | Rangan | West Indian Jasmin | *Ixora coccinea* | Or | Ne |
| | Mehedi | Henna | *Lawsonia inermis* | Dy | Ne, M |
| | Sal | Sal tree | *Shorea robusta* | W, T | M, H |
| | Radhachura | Yellow flame tree | *Peltophorum pterocarpum* | Or | M |
| | Chaosupari | Fishtail palm | *Caryota* spp. | W, Fu | H |
| | Gandhoraj | Cape jasmine | *Gardenia jasminoides* | Or | M |
| | Togor | Crape jasmine | *Tabernaemontana divaricatae* | Or | M |
| <10 | Beli | Arabian jasmine | *Jasminum sambac* | Or | M |
| | Cosmos | Cosmos | *Cosmos bipinnatus* | Or | M |
| | Chameli | Jasmine | *Jasminum grandiflorum* | Or | M |
| | Arhor | Pigeon pea | *Cajanus cajan* | Pl | M |
| | Pan | Betel leaf | *Piper betle* | Cw | Ne |
| | Karpash tula | Cotton | *Gossypium herbacium* | Ct | SP |
| | Sheora | Siamese roughbush | *Trophis aspera* | W, Fu | SP |
| | Aakh | Sugarcane | *Saccharum officinarum* | Ju | M |
| | Shimul | Silk cotton tree | *Bombax ceiba* | Ct | H |
| | Gada | Marigold | *Tagetes* spp. | Or | Ne |

* Ba: Basketry; C: Cook; Cm: Construction material; Ct: Cotton; Cw: Chewing; Dy: Dye; F: Fodder; Fe: Fence; Fi: Farming implements; Fr: Fruit; Fu: Fuel; He: Hedge; Hi: Household implements; Ju: Juice; Me: Medicine; Or: Ornamental; Pl: Pulse; Rw: Ritual work; T: Timber; W: Wood; ** H: Hill;M: Market; Ne: Neighbour; SP: Self Propagation

These findings are in conformity with the interviewed households of the study area. Seedlings of vegetables and spices were collected from the local markets and nearby hill forests. The seedlings of seasonal vegetables were grown by the women in the front yard.

#### *2.6.3. Medicinal plants*

A total of 23 plant species were recorded in the sample households, which have medicinal values (Table 10). Garo and Koch ethnic minority groups lack appropriate access methods to medical facilities and they greatly rely on the herbal medicine prescribed by tribal medicinal practitioners, locally called “kabiraj” for their primary health care. Holy basil is the most popular species among them as it also has a ritual value to the people of ethnic minority group of Koch. Field survey revealed that medicinal plants were grown commercially which was not practiced ten years back in the study area. Around 10 percent of households planted aloe vera (Aloe barbadensis) commercially as they sold it at local markets. The study revealed that the major portion of propagating materials of the medicinal plants were collected from the nearby hill forests.

#### *2.6.4. Timber, fuel and other plant species*

A list of timber, fuel wood and other tree species was presented in the Table 11. The major timber yielding species were acacia (Acacia auriculiformis), Persian lilac (Melia azedarach), goomar teak (Gmelina arborea), eucalyptus (Eucalyptus camaldulensis) and teak (Tectona grandis). Some fruit yielding species like jackfruit and mango also produce timber. The bamboo and betel nut provide useful house building materials, locally called “roa” and “sharok” respectively. The nearby hill forests are a good source of fuel wood. Household members, especially women collected the fuel wood from the hill forests. Additionally, Indian ash tree (Lannea coramandelica), siamese rough bush (Trophis aspera), prickly ash (Zanthoxyllum spp.), fishtail palm plants (Caryota spp.) were planted in the homestead for the fuel wood. The seedlings were usually collected from the local markets. Many of the households used branches of other fruit and timber yielding species for this purpose.

### 2.7. Changes of homestead farming over time

#### *2.7.1. Factors causing changes*

Homestead farming of the study area has undergone several changes over time. These changes are associated with socioeconomic changes of the ethnic minority people of the study area. The ethnic minority people of the study area have their own style of living and livelihood, but these are changing gradually because of frequent interactions with mainstream of Bangladeshi people, which is also accompanied by different interventions of GOs and NGOs, namely World Vision, Brac, Association for Social Advancement (ASA), Pidim Foundation, SONNE International, Caritas Bangladesh and Batighar Initiative. These changes may have an impact on their homestead farming as follows.

#### *2.7.2. Changes in cassava production*

The study revealed that a good number of ethnic households had shifted from cassava production to mixed plantation of timber and fruit yielding species. Although they were satisfied with subsistence farming until recently, gradually they are showing interest in the commercial one. In 2000, 61 percent of the households planted cassava and this proportion declined to 42 percent in 2012. Around 20 percent of the total households converted their cassava production area to mixed gardens of fruits and timber yielding species. This scenario still prevailed in the study area.

#### *2.7.3. Medicinal plants*

Medicinal plants have been used by the traditional medicinal practitioners since very long time ago. Some of these medicinal plants were naturally grown in the nearby forest and some were planted by the villagers in their homestead. Usually they use these plants for daily health care. Nowadays, they have started planting medicinal plants for commercial purpose, especially in the case of aloe vera.

#### *2.7.4. Plantation of exotic timber yielding species*

The field survey revealed that mixed gardens of fruit and timber yielding species were getting popularity in the study area. The fruit trees dominated much more over timber trees a few decades ago but the gap between them has diminished over time remarkably. In 2000, almost 20 percent households had exotic timber yielding species in their homestead. Now, almost all households having mixed garden have exotic timber yielding species. Introduction of exotic species has a long history in Bangladesh. The British mostly contributed to the introduction of some economically important forest plants from almost all the continents in the 19th century and this trend continued after colonial period. The idea of 'social forestry' came along with loans from the Asian Development Bank (ADB) in late 1980s with a view to involving women and local poor people to have an alternative source of income and to overcome rural fuel crisis through planting of some quick growing tree species. The implementing agency was Forest Department of Government of Bangladesh. Unfortunately, the rich mixed forest of Modhupur was transferred to monoculture stands of eucalyptus (Eucalyptus camaldulensis) and acacia (Acacia auriculiformis). Consequently, all over northern Bangladesh, indigenous trees began to be replaced by exotic foreign species of acacia and eucalyptus under ADB funded Thana Afforestation and Nursery Development Project (TANDP) and Forestry Sector Project (FSP) (Gain, 2005). In study villages, exotic plants such as acacia, eucalyptus, and mahogany (Swietenia mahogoni), replaced with local root and tuber crops like cassava. The seedlings of these exotic species are collected by the villagers from local market. These exotic plant species are quick-growing and economically profitable. But in the long run, they may spoil the quality of soils, adjacent environmental balance and also living patterns of local communities in the forestland (Afrin et al., 2010).

### *2.7.5. Pig rearing*

Pig rearing is restricted to few regions of Bangladesh. Usually sweepers and people from ethnic minorities raise pigs in their backyard (Nahar et al., 2013). In the study area pig raisers raised pigs mostly in their backyards maintaining a short distance from cattle shed. These pigs were semi-scavengers, which means that they were partially fed by their owners and they also searched for their own food. Pigs were mainly reared for generating income, meeting the protein requirement and performing ritual activities. They sell the reared pigs on the occasion of Christmas. But the popularity to pig rearing showed a slight declining trend. The high price of piglet was identified as the main reason of this. Pig raisers used to buy piglets from mobile pig herders. Herders moved with the pigs from one district to another based on the seasonal availability of food and water for pigs.

## 4. Conclusion

Access to land is one of the major concerns for ethnic minorities to secure livelihoods. Many relied on access to natural resources for their livelihoods. But nowadays these forest resources are decreasing and the Government has already declared those natural forests as reserved ones, which means that the access to nearby forests is strictly prohibited unless special permission is given. Therefore, the dependency on homestead farming is increasing. This small but intensively cultivated farming space is the source of food, cash, fuel wood and medicine. Homestead farming of the ethnic communities are moving towards the commercialization from the diversified subsistence farming. They are trying to manage their homestead farming in a different manner than the earlier days. The purpose of this study was to explore those changes and existing homestead farming practiced by the ethnic minority people. Almost all the households raised plant, livestock and poultry in their homestead. The household characteristics are in conformity with other parts of rural Bangladesh with few exceptions. Usually, acacia (Acacia auriculiformis), eucalyptus (Eucalyptus camaldulensis), mahagoni (Swietenia mahogoni), sissoo (Dalbergia sissoo), and koroi (Albizzia lebbeck) were not planted in the homesteads, but recently their plantation has been intensified, and are replacing the cassava plantation to some extent. This may indicate that people are more interested in multipurpose trees with timber and fuel values. Besides these, medicinal plants were started to be grown for the commercial purpose. Ethnic minority people were found to earn a significant amount of cash income from selling homestead products at local markets

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## Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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