



## Diversity of Homestead Plants in Sreemangal Upazilla, Bangladesh

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### Authors' contributions

This work was carried out in collaboration among all authors. Authors RN and SAS devised the project, the main conceptual ideas, and the proof outline. Author JB worked out almost all the technical details and performed the numerical calculations for the suggested experiment. Author SAS with help from author JB, verified the numerical results by an independent implementation. Author RN proposed the data collection and analyzing process in discussions with authors SAS and JB wrote the manuscript. All authors read and approved the final manuscript.

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### ABSTRACT

The research was carried out in the Kalighat union of Sreemangal Upazilla, Moulvibazar district, Bangladesh with the objective of discovering the diversity of homestead plants. Five villages were selected randomly from the Kalighat union named Kalighat tea garden, Baraura Tea Garden, 8 No. Line, 8 No Kalighat and 9 No. Basti. To determine the plant diversity, 105 households were surveyed. In comparison to the other villages, the 8 No. Line had more plant diversity, in this study. In the study region, 73 valuable plant species were identified, including fruits, woods, fuel wood, aesthetics, and medicinal. The highest Shannon Wiener Index value was found as 2.95 in 8 No. Line and the lowest Shannon Wiener Index value was 2.21 in Kalighat Tea Garden. On the other hand, Baraura Tea Garden had the highest Index of Dominance (0.47), while 8 No. Kalighat and 8 No. Line had the lowest Index of Dominance (0.09). The Evenness Index was found in the plot of Kalighat tea garden (0.76), Baraura tea garden (0.7) and 8 No. Line (0.77) were more evenly distributed except 8 No. Kalighat (0.84) and 9 No. Basti (0.64) indicated irregular even distribution. Plant species diversity among different villages of Sreemangal Upazilla was found statistically significant ( $p$ -value = 0.0001173 < 0.05). The most important value index and top-ranked planted species were Bamboo (*Bambusa* sp.) (42.20) followed by Mango (*Mangifera indica*) (37.79), Kathal

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(*Artocarpus heterophyllus*) (15.19) and Supari (*Areca catechu*) (35.88) respectively. Agro-crop diversity was also found to be predominant in different unions of Sreemangal Upazilla. A total of 24 agro-crop species were found in the study area. Rice crop was found the most important crop in the study area. Rice production in each family is 1200 kilograms per year, whereas consumption is 500.5 kilograms per year. Farmers can be authorized more specific species for more production and sustainable homestead forest management in the study area based on findings from the analysis of soil conditions and properties. The present study revealed that homestead plant diversity and homestead crops are the prime resources for the socio-economic development of rural people.

**Keywords:** Homestead plants; diversity; agri-crops.

## 1. INTRODUCTION

Bangladesh is a developing country and a score of the poor people of the rural area depends on natural resources for their livelihoods. Among all the natural resources, land, water, forests, and livestock are the main sources of their livelihoods. Poverty and deforestation are the most common and critical problems in our country. As the people of our country are becoming impelled to produce more from the remaining limited land resources for which they are intensively cultivating the lands. This also results in changes in the species configuration and managing of the home gardens of the country. The rural economy relies on the productivity of the natural resources which is intimately linkage with the biodiversity in the ecosystem. As a subtropical country, Bangladesh has a diverse assortment of plants in its homestead forests. Homesteads are privately owned residential spaces in rural and semi-urban settings with a kitchen, backyard, front yard, and possibly a pond and home garden. A homestead forest or home garden is a complex collection of carefully grown vegetation intended to provide natural items for use in the house or for sale [1-4].

Bangladesh is situated at the complicated crossroads of the Himalayan and Southeast Asian biogeographic zones, and its flora and fauna have historically been abundant on both land and sea [5]. In Bangladesh, homestead forests encompass 0.27 million hectares (occupied by 15.4 million people), whereas state-owned forests cover 2.25 million hectares [6]. A homestead is a working unit that produces a range of crops, including trees, as well as livestock, poultry, and fish, mostly to support the farmer's fundamental needs. It is also the family's shelter and the most promising type of manufacturing place. It is the most promising type of production location, as well as the family's seat/shelter. In Bangladesh, homestead

forests encompass 0.27 million hectares (occupied by 15.4 million people), whereas state-owned forests cover 2.25 million hectares [7]. Homesteads provide for people's basic needs such as food, shelter, and money, and the homestead's high species diversity helps to counteract the environmental deterioration associated with monoculture production systems. Furthermore, they have been producing regular harvests while conserving resources for over a century. As a result of the recent situation of rapidly increasing population leading to overexploitation of natural resources and potentially irreversible environmental impact, homestead forest is now viewed as the most effective option for preserving natural resources [8].

Sreemangal is bordered on the north by Moulvibazar Sadar, on the south by Tripura, on the east by Kamalganj, and on the west by Chunarughat and Nabiganj. The town's center, which was recognized as a pourashova in 1935, is located at 24.3083°N, 91.7333°E and covers 450.74 km<sup>2</sup>. It is located at 24.3083°N, 91.7333°E [9] and contains 43,952 homes. Sreemangal is notable for its extensive tea gardens as well as its continuous rain. The presence of lush trees has enriched this location. The terraced tea gardens, plantations, and evergreen hills of Sreemangal are popular tourist destinations. As a result, this study region was chosen to conduct homestead plant diversity research at the homestead level, as well as to see if there is any variation in plant diversity across Sreemangal Upazila.

The homestead garden is a traditional agroforestry method that is an important part of the rural poor's livelihoods and the country's rural economy. In the last 40-50 years, the emphasis has changed from traditional forestry to homestead forestry. In such circumstances, the homestead garden serves as a vital source of firewood, fodder, medicine, fruit, and timber.

Homestead forests provide over 70% of lumber, 90% of firewood, 48% of sawn and veneer logs, and nearly 90% of bamboo [10]. Homestead gardens, which represent a well-established traditional land use system in Bangladesh, where natural forest cover is less than 10% and homestead gardens are maintained by at least 20 million families, are one possible strategy for biodiversity conservation [11]. The traditional homestead garden has evolved in response to a variety of variables including cultural, economic, and environmental concerns, as well as personal preferences [12]. The preservation of cultivated plants in our country's domestic gardens not only protects a valuable resource for humanity, but it also ensures household food security by providing a source of food, fruits, and vegetables [13].

This study will describe the plant and agro-crop diversity and it will identify the challenges that households in the study area experience when cultivating plants. The study was conducted in the villages of Kalighat tea garden, Baraura Tea

Garden, 8 No. Line, 8 No Kalighat and 9 No. Basti.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Sreemangal is located at 24.3083°N and 91.7333°E. It has 43,952 households and total area 450.74 km<sup>2</sup> [9]. The study was conducted in Kalighat Union of Sreemangal Upazila. The Sreemangal lies on 17m above sea level. In Sreemangal the climate was warm and temperate. In winter there is much rainfall than in summer. The average annual temperature is 24.7 °C / 76.5 °F in Sreemangal. The annual rainfall is 2420 mm.

The information and relevant literature for this paper were gathered from different books, journals and published paper of the library of Institute of Forestry and Environmental Science of Chittagong University. The most recent and up-to-date data was collected from the internet.

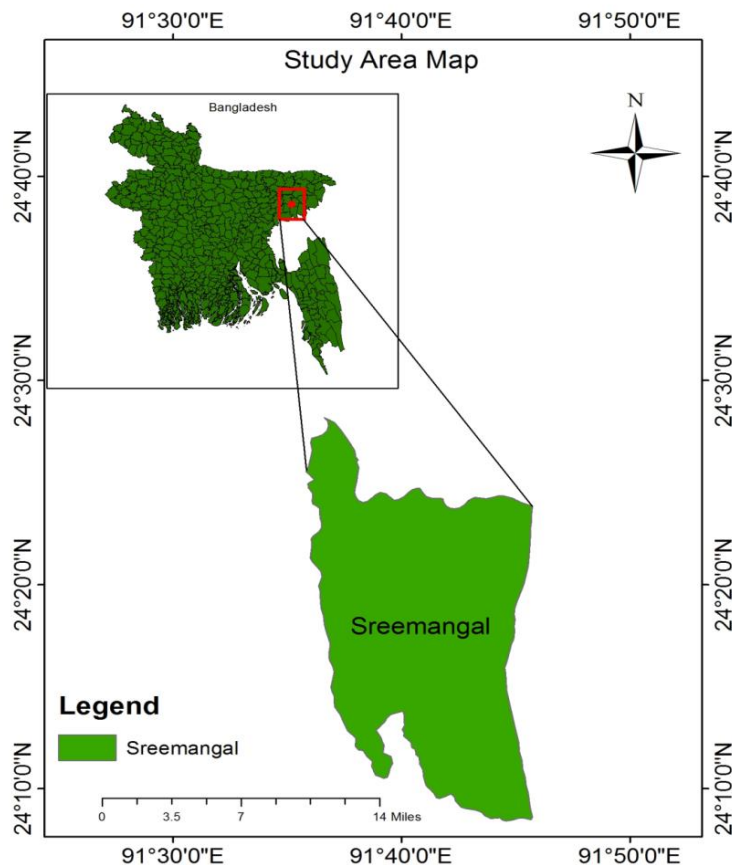


Fig. 1. Map of Sreemangal Upazilla

## 2.2 Study Design

The study was based on the primary data collected from the study area from June to September 2019 through physical measurement. During the study, purposive sampling method was adopted for data collection. A field study was carried out in the Sreemangal Upazilla under Moulvi Bazar district. One union (Kalighat) was selected from Sreemangal Upazila. From this union five villages were selected randomly. The selected villages were 8 Number Kalighat, Kalighat Bagan, Baraura Tea Garden, 9 Number Basti, 8 Number Line. In total, 105 households were chosen for the interview, with around 21 households recruited from each community.

A reconnaissance survey was conducted at the research site before the actual survey began. The goal of the survey was to get to know the community and gain a sense of the vegetation composition from the individuals who live in the research area.

## 2.3 Data Collection

### 2.3.1 Formal interview

The interview schedule was very carefully designed to collect the relevant information so that the objective of the study can be achieved. The questionnaire contains both open-ended and closed forms of questions. All the households were visited with the assistance of local students living in the study area. Most of the information was obtained through an interview with household members. The distribution of tree species on the homestead was surveyed physically. Collected information was verified through conversation with the household respondent. Information on agro-crop production cost, consumption, sale value per year was also collected from the household member. Besides information on particular issues like the source of seedlings, the problem of home garden plantations, preferences of species selection were also collected from the household level.

### 2.3.2 Vegetation survey procedure

During the interview, a vegetation survey was conducted at each dwelling unit to find out plant diversity. The interviewee was asked for the plant species local name. Seasonal crops like vegetables of the herb category were also included in the study.

### 2.3.3 Secondary information collection

Secondary data and information obtained from a variety of places, including the IFESCU library and a number of scientific journals and papers. A specialist from the University of Chittagong's Institute of Forestry and Environmental Sciences assisted in the identification. Local names were collected from local individuals as well as other sources of information.

## 2.4 Data Analysis

### 2.4.1 Basal area, relative density, relative frequency, relative abundance of a species, and important value index

Using following 8 formulas for the quantitative structure of species were calculated as follows:

1. Basal area =  $\Pi D^2/4$  where D = diameter at breast height and  $\Pi = 3.1416$
2. The density of a species = Total no. of individuals of a species in all homesteads / Total no. of homesteads studied
3. Relative density of a species = Total no. of individuals of a species in all homesteads / Total no. of homesteads studied  $\times 100$
4. Frequency of a species = Total no. of homesteads in which the species occurs / Total no. of homesteads studied
5. Relative frequency of a species = Frequency of one species / Sum of all frequencies  $\times 100$
6. The abundance of a species = Total no. of individuals of a species in all homesteads / Total no. of homesteads in which the species occurs
7. Relative abundance of a species = Abundance of the species / Total abundance of all the species  $\times 100$
8. Important Value Index = Relative density + Relative frequency + Relative dominance

### 2.4.2 Species diversity index

To ensure the abundance and diversity of different plant species Shannon-Wiener species Diversity Index (H) as shown below was used:

$$\text{Shannon index (H)} = - \sum (P_i \ln P_i)$$

In the Shannon index, P is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), ln is the natural log,  $\sum$  is the sum of the calculations and s is the number of species.

The Shannon-Wiener index for diversity [14].

$$\text{Shannon index } H = - \sum p_i \ln p_i$$

In the Shannon index, P is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), ln is the natural log,  $\sum$  is the sum of the calculations and s is the number of species.

**Simpson's index:** Simpson's index [15] measured the concentration of dominance (CD):

$$CD = \sum (p_i)^2$$

Where CD = Index of dominance, Pi = It is the same as for Shannon-Wiener information function.

**Evenness index:** Evenness was calculated by Pielou's index from the formula given by [16].

$$E = H/\ln S$$

Where E = Species evenness index  
H = Shannon-Wiener index of diversity  
S = Total number of species

### 3. RESULTS

#### 3.1 Plant Diversity

A total of 73 species were identified from 105 homesteads in 5 study sites. The total number of the all the species was 1362. Among them the number of all the timber species were 19, tree species were 4, shrubs species were 4, fuel wood species were 7, fruit species were 16, ornamental species were 21 and medicinal species were 2. So it was concluded that the highest number of species distributed in study area were timber yielding species. On the other hand, some alien tree species such as *Acacia* was also found in the homesteads. The lower Shannon diversity index value was obtained in the village of Kalighat tea garden (H = 2.21) whereas the highest value was obtained in the village of 8 No. Line (H = 2.95). That means the village of 8 No. Line has higher plant diversity and the village of Kalighat Tea Garden had lower diversity (Table 2). The index of dominance was also calculated for each plot, and it was lowest in the villages of 8 No. Kalighat (0.09) and 8 No. Line (0.09), and the highest was in the village of Baraura Tea Garden (Table 2). So, it was concluded that these two villages, named 8 No. Kalighat and 8 No. Line, had less diversity, while

Baraura Tea Garden had higher diversity. In the village of Kalighat tea garden (0.76), Baraura tea garden (0.7) and 8 No. Line (0.77), the species were more evenly distributed, except for 8 No. Kalighat (0.84) and 9 No. Basti (0.64), which showed a high and less even distribution (Table 2). The diversity of plant species among different villages of Sreemangal upazilla was found to be statistically significant (p value = 0.00011730.05) (Table 4).

#### 3.2 Agriculture Crop Production and Status

A total of 24 species were found in the Kalighat union. Common species were rice (*Oryza sativa*), begun (*Solanum melongena*), papaya (*Carica papaya*), lalshak (*Amaranth dubius*), lieshak, dhonopata (*Eryngium foetidum*), morich (*Capsicum frutescens*), ada (*Zingiber officinale*), holud (*Curcuma longa*), and sheem (*Lablab niger*). And rare species are tomato (*Solanum lycopersicum*), borboti (*Vigna unguiculata ssp. Sesquipedalis*), mistialu (*Ipomoea batatas*), corolla (*Momordica charantia*). Various agro-crops were found in Sreemangal Upazilla such as tomato (*Solanum lycopersicum*), sheem (*Lablab niger*), borboti (*Vigna unguiculata ssp. sesquipedalis*), corolla (*Momordica charantia*), morich (*Capsicum frutescens*), dhonopata (*Eryngium foetidum*), lalshak (*Amaranth dubius*), lieshak, dheros (*Abelmoschus esculentus*), mula (*Raphanus sativus*), rice (*Oryza sativa*), papaya (*Carica papaya*), begun (*Solanum melongena*), shasha (*Cucumis sativus*), ada (*Zingiber officinale*), holud (*Curcuma longa*), cauliflower (*Brassica oleracea*), potato (*Solanum tuberosum*), lau (*Lagenaria siceraria*), dugi, jhinga (*Luffa acutangula*), mistialu (*Ipomoea batatas*), kumra (Table 5). Rather, rice plays the most significant role in the rural economy of the study area. Each family produced 1200 kg of rice per year, with consumption of 500.5 kg per year. By selling extra rice, the respondents received an average of 24,482.5 taka (Table 5). After own consumption, there was no surplus for morich, borboti, dhonopata, lalshak, lieshak, shosha, lau, dugi, or jhinga. These crops were only farmed for self - consumption.

#### 3.3 Relative Density, Relative Frequency, Relative Dominance of a Species and Important Value Index of Whole Kalighat Union

The most Important Value Index and top-ranked planted species were Bamboo (42.20) followed

by Mango (37.789232) Kathal (15.18795629), Supari (35.87985443) (Fig 2).

### 3.4 Source of Seedlings in Sreemangal Upazilla

In this study region, various seedling sources were identified. These include private sources, self-production, and other sources such as relatives, neighbors, and non-governmental organizations. Private sources (70%) were the most common seedling sources, followed by own (10%) and others (20%) (Fig 3).

### 3.5 Preference of Species Selection

The research area's current species choices are confined to fruit, timber, fuelwood, and medicinal plants. Among them, more preference was given to fruit species. However, the percentage varied from each other. People of the study area 65%

people chose fruit species, 20% people chose timber species, 10% people chose fuelwood species, 5% people chose medicinal species. (Fig 4a,4b) Past choice of species was confined to fruit, timber, fuelwood, medicinal and aesthetic species. Among them, more preference was given to fruit species for the study area. In the study area 60% of people choose fruit species, 25% people chose timber species, 7% people chose fuelwood species, 6% people chose medicinal species and 2% people chose aesthetic species in before. (Fig 5).

### 3.6 Purpose of Planting Trees in Homesteads

Deposit, house construction, fuelwood, furnishings, and cultural activities in the research region were all major reasons for tree planting in household gardens. Fig 5.

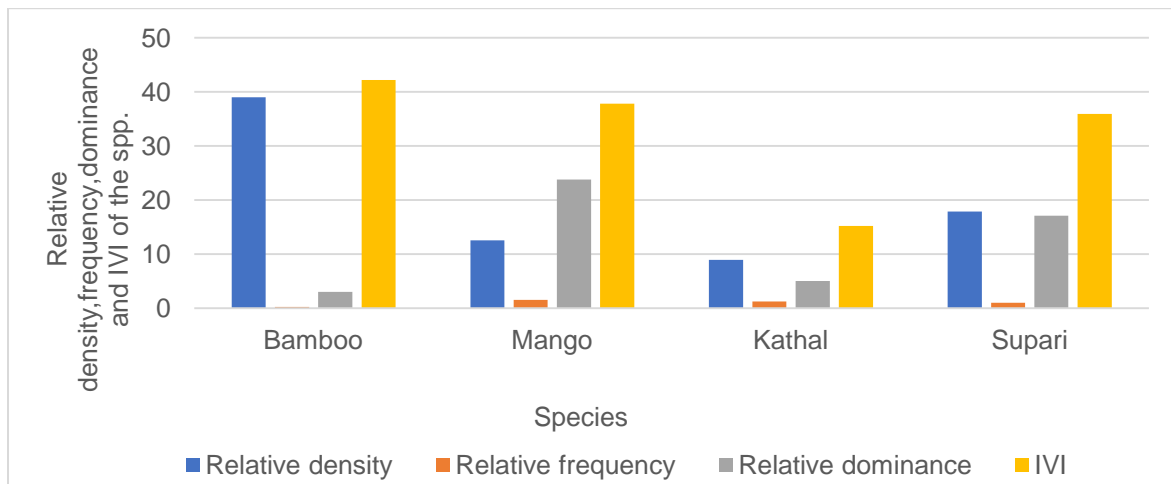


Fig. 2. Relative density, Relative frequency, Relative dominance IVI of tree species of whole Kalighat Union

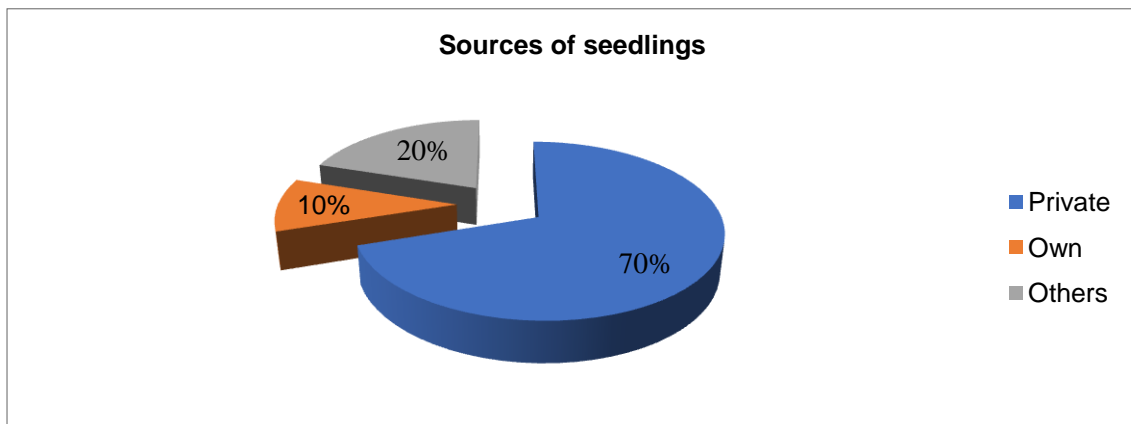


Fig. 3. Source of seedlings in Sreemangal Upazilla

**Table 1. Plant diversity in whole Kalighat Union**

Local Name	Scientific Name	Local Name	Scientific Name
Atafof	<i>Annona squamosa</i>	Kadam	<i>Neolamarckia cadamba</i>
Peyara	<i>Psidium guajava</i>	Chickrassi	<i>Chukrasia tabularis</i>
Bel	<i>Agle marmelos</i>	Rubber	<i>Hevea brasiliensis</i>
Neem	<i>Azadirachta indica</i>	Tentul	<i>Tamarindus indica</i>
Kalahuja	Unknown	Minjiri	<i>Senna siamea</i>
Kathal	<i>Artocarpus heterophyllus</i>	Doka	Unknown
Rongi	Unknown	Kaloudal	<i>Sterculia spp.</i>
Mango	<i>Mengifera indica</i>	Pipor	Unknown
Jambura	<i>Citrus maximus</i>	Simul	<i>Bombax ceiba</i>
Jam	<i>Syzygium cumini</i>	Ziol	Unknown
Sajna	<i>Moringa oleifera</i>	Simol	Unknown
Mahagony	<i>Swietenia mahagony</i>	Kaimula	Unknown
Debdaru	<i>Polyalthia longifolia</i>	Gadaful	<i>Tahetes patula</i>
Supari	<i>Areca catechu</i>	Banana	<i>Musa spp.</i>
Udal	<i>Sterculia villosa</i>	Togor	<i>Tabernae montana</i>
Raintree	<i>Samanea saman</i>	Timeful	<i>Portulacha spp.</i>
Segun	<i>Tectona grandis</i>	Kochu	<i>Colocasia spp.</i>
Akashmoni	<i>Acacia auriculiformis</i>	Jaba	<i>Hibiscus-rosasinensis</i>
Litchi	<i>Litchi chinensis</i>	Sheuly	<i>Nictanthesar bortristists</i>
Bokam	Unknown	Patabahar	<i>Codiaeum variegatum</i>
Tulsi	<i>Ocimum tenuiflorum</i>	Noyontara	<i>Catharanthus roseus</i>
Narikel	<i>Cocos nucifera</i>	Dhutra	<i>Datura stramonium</i>
Amra	<i>Spondias mombin</i>	Mehedi	<i>Lawsonia inermi</i>
Boroi	<i>Ziziphus mauritiana</i>	Rongon	<i>Ixora spp.</i>
Pakhiara	Unknown	Beli	<i>Jasminum sambac</i>
Kamranga	<i>Averrhoa carambola</i>	Sondhamaloti	<i>Mirabilis jalapa</i>
Olboroi	<i>Ziziphus spp.</i>	Krishnochura	<i>Delonix regia</i>
Arjun	<i>Terminalia arjuna</i>	Maloti	<i>Aganosma dichotoma</i>
Gamar	<i>Gmelina arborea</i>	Olkanonda	<i>Allamanda catharica</i>
Shal	<i>Shorea robusta</i>	Cactus	<i>Mammillaria elongate</i>
Bamboo	<i>Bambusa spp.</i>	Garjan	<i>Dipterocarpus turbinatus</i>
Koroi	<i>Albizia spp.</i>	Jalpai	<i>Elaeocarpus floribundus</i>
Polash	<i>Butea monosperma</i>	Cherka	Unknown
Jarul	<i>Lagerstroemia speciosa</i>	Darchini	<i>Cinnamum cassia</i>
Mali	Unknown	Tejpata	<i>Cinnamomum tamala</i>
Mangium	<i>Acacia mangium</i>	Silkoroi	<i>Albizia procera</i>
Sonali	Unknown		

**Table 2. Shannon-Wiener Diversity Index of tree diversity, Index of dominance and Evenness Index of different villages of Kalighat Union**

Areas	Diversity Index	Dominance Index	Evenness Index
1. 8 No. Kalighat	2.57	0.09	0.84
2. Kalighat Tea Garden	2.21	0.39	0.76
3. Baraura Tea Garden	2.36	0.47	0.7
4. 9 No. Basti	2.25	0.17	0.64
5. 8 No. Line	2.95	0.09	0.77

**Table 3. Shannon-Wiener Diversity Index of tree diversity, Index of dominance and Evenness Index of whole Kalighat Union**

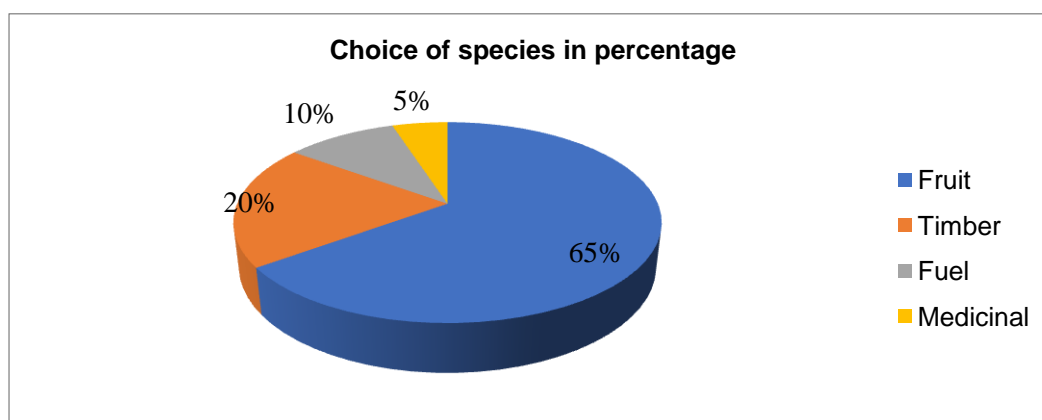
Diversity Index	2.9
Dominance Index	0.11
Evenness Index	0.65

**Table 4. ANOVA for comparison of the species diversity among the villages**

Tree parameter	Height range	ANOVA	
		F	P
Species richness	(>2m<6cm dbh)	21.12017979	0.00011726

**Table 5. Average production of agro-crop in the study area**

Name of the crops	Average production (kg/yr) in each family	Average consumption (kg/yr)	Average production cost (tk)	Average sale value (tk) for surplus crop
Tomato	15	10	250.2	160.5
Morich	10	10	200.7	0
Borboti	10	10	220	0
Shim	20	8	202	400.3
Korolla	8	2	216.6	65
Dhonepata	5	5	111.43	0
Lalshak	5	5	101.76	0
Lieshak	7	7	153	0
Dheros	10	3.5	250.9	175.7
Mula	20	4.5	650	750
Rice	1200	500.5	30000	24,482.5
Pepe	20	7.5	250.73	700
Begun	12	5	220	300
Shosha	5	5	100	0
Ada	15	5	252.9	600
Holud	10	4.5	252.5	650
Fulkopi	10	3.5	230	280
Potato	15	8.5	250	160
Lau	6	6	200.6	0
Dugi	5	5	220	0
Jhinga	3	3	180	0
Misti alu	8	3.5	146.6	150
Kumra	7	2.5	240	70.8

**Fig. 4(a). Types of present choice of tree species**

#### 4. DISCUSSION

The research area's homestead forest has moderately high biodiversity and species richness, according to an analysis of the current

tree composition structure and richness. According to [17] reported the number of tree species discovered in Tangail (52 species), Ishurdi (34 species), Jessore (28 species), Patuakhali (20 species), Rajshahi (28 species),



and Rangpur (21 species) districts were higher than those found in other Bangladeshi homesteads. In this study, it was found a total number of 73 species were identified from 105 homesteads in 5 study sites. There were 19 species of timber, 4 species of shrubs, 7 species of fuelwood, 16 species of fruit, 21 species of ornamental plants, and 2 species of medicinal plants among them.

People in rural and peri-urban areas in Bangladesh typically plant and maintain a wide variety of plants to suit household needs, including fruits, vegetables, fuelwood, and timber [18]. Homestead plants provide support directly & indirectly not only to the nature but also to the human being as well. They supply fruits, fuel, furniture, shelter & all the other necessary items as well. On the contrary, the saline system homesteads are the only place on which most of the people depend. In this study, the the exploration of homestead plant diversity in Sreemangal Upazilla was carried out. Sreemangal Upazilla under Moulvibazar district is an area of various hill tracts with huge plant & biodiversity as well [19].

The Shannon-Wiener index was used in order to determine the plant diversity. The lower Shannon diversity index value was obtained in the village of Kalighat tea garden ( $H = 2.21$ ), whereas the highest value was obtained in the village of 8 No. Line ( $H = 2.95$ ). That means 8 No. Line had higher plant diversity than the other four villages in the study area. The index of dominance was lowest in the villages of 8 No. Kalighat (0.09) and 8 No. Line (0.09) and highest in the Baraura Tea Garden (0.47). So, it could be

evaluated that these two villages, named 8 No. Kalighat and 8 No. Line, had less diversity, while Baraura Tea Garden has higher diversity. In the plots of Kalighat tea garden (0.76), Baraura tea garden (0.7) and 8 No. Line (0.77), the species were more evenly distributed, except for 8 No. Kalighat (0.84) and 9 No. Basti (0.64), which showed a high and less even distribution. Plant species diversity among different villages of Sreemangal Upazilla was found to be statistically significant ( $p$  value = 0.0001173 < 0.05).

Relative density, Relative frequency, Relative dominance of a species and Important Value Index also varies from species to species. The most Important Value Index and top ranked planted species were Bamboo (42.1970499) followed by Mango (37.789232), Kathal (15.18795629), Supari (35.87985443) respectively. The different sources of seedlings were found in the study area as well. These are private source, own production, and other sources i.e., bringing from relatives, neighbours, NGOs etc. These include private sources, self-production, and other sources such as relatives, neighbors, NGOs, and so on. Private sources (70 percent), own (10 percent), and others (20 percent) were the most common seedling sources. The respondents' preferences for plant species differed greatly.

From the study, it was found that most of the respondents (76%) were involved in the Finlay tea garden as tea garden workers. Surprisingly, only 5% of the respondents were involved in agriculture & rest were involved in business, service, day labour etc.

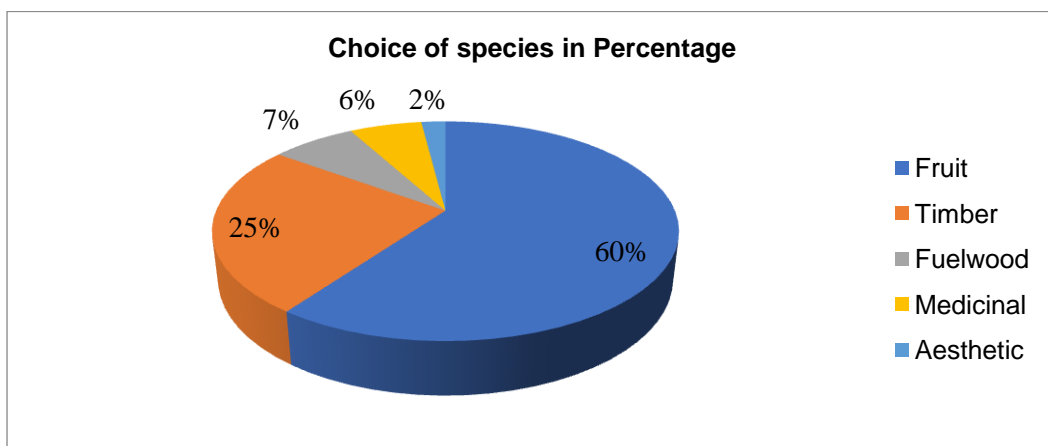
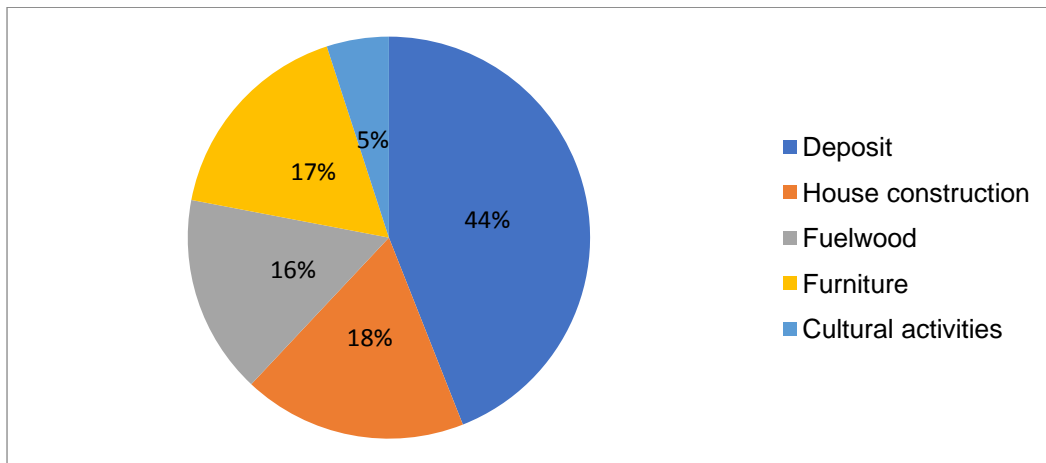


Fig. 4(b). Past choice tree species



**Fig. 5. Purposes of tree planting in homegardens**

The current study investigated the role of women in homestead forestry practice, which was limited to watering, planting, sowing seed, collecting debris, and collecting cow dung as fertilizer, which was similar to the findings of [20] and [21], who found that 42 percent, 62 percent, 54 percent, and 47 percent of rural women participated in homestead vegetable cultivation, post-harvest activities, poultry raising, and goat rearing, respectively.

Because of the monetary incentives and family necessities, most families were found to favor largely food or fruit species (45 percent), according to various studies around the country [18]. In this study, around 65% of the respondents chose fruit species and 20%, 10%, and 5% of the respondents chose timber species, fuelwood species, and medicinal species, respectively, similar to the findings of [22]. But 60%, 25%, 7%, 6%, and 2% of people preferred fruit, timber, fuelwood, medicinal, and aesthetic species before.

On the other hand, people had several objectives in terms of tree planting in homegardens such as for deposit (18%), house construction (17%), furniture (16%) and fuelwood (5%). However, the majority of respondents choose tree species as an output based on financial revenue, followed by construction, furniture, and fuelwood. Typically, farmers rely on plants that grow organically on their homestead.

Discussion Regarding the Crop Production and Consumption Is Needed (Table 5).

## 5. PROBLEMS AND RECOMMENDATIONS

In terms of management and production, as well as homestead plant diversity, there were a total of seven key issues found. The following are some of them:

- Insects and diseases,
- Insufficient space,
- High seedling costs,
- Infertility of the soil,
- Inadequate technological expertise,
- Damage by children,
- Damage by livestock.

The following are some recommendations to all these issues:

- Increased production systems and environmentally friendly cultivation methods should be introduced,
- To ensure the source of safe and reliable planting materials and availability and supply of quality seeds, seedlings and propagating materials should be increased,
- Farmers' traditional farming methods should be modernized,
- Awareness-raising programs should be taken by the government and private organizations,
- Appropriate authority should provide proper training and technical support,
- An in-depth large-scale study should be conducted to explore homestead plant diversity elaborately.

## 6. CONCLUSION

The home garden is northmost diverse traditional forestry systems, found primarily in tropical and sub-tropical regions. The study discovered that about 65% homesteaders prefer fruit species. Rather the rest of villagers prefer 10% of fuel wood, and 20% of timber species over plants. Because that species provides a direct source of financial income and help them meet their own requirements. For the sake of biodiversity conservation, producers should be given an opportunity to plant their chosen tree species while also threatened tree species. In the research area, 73 useful plant species were identified including fruits, woods, fuel wood, aesthetics, and medicinal. The greatest plant diversity has been found at the village of 8 No. Line, while the lowest plant diversity has been found at the village of Kalighat Tea Garden. Diversification of agri-crops is also an important source of income for landowners. Finally, effective collaboration between many stakeholders in agriculture, forestry, and local communities can help to establish sustainable homestead forest management.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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