Study on homestead Agroforestry and plant diversity in Gopalpur upazila of Tangail district

M. Begum, M.A. Haque[1], M.R. Karim[2], M. Akter[1] and M.A. Wadud

Department of Agroforestry, [1]Department of Agroforestry, Bangladesh Agricultural University, Mymensingh - 2202, [2]Department of Finance and Banking, Dhaka University.

Abstract: This study was conducted at Gopalpur Upazila of Tangail District, Bangladesh to observe the socio-economic characteristics of the farmers in the study area and to explore the relationships among the selected characteristics of the farmers and plant species diversity. Data were collected by face to face interview with the help of structures during the period from 01 August to 31 October 2012. Pearson's correlation was also used to find out the relationship between the farmer characteristics and plant species diversity. The result demonstrated that a total of 133 species, 36 vegetables species, 15 Agroforesry practices and 5 different vertical layers were recorded in the homestead of the study area. Out of different categories of tree species, 68 timber, 28 fruits and 35 medicinal trees were recorded. Among the trees species, Mango, Jackfruit, Akashmony, Mahogony, Eucalyptus, and Papaya were dominant species. Average of 27 plant species were recorded in each homestead and species density was 2.27 per $50m^2$ in the homestead area. Average tree population density was 67.6 per homestead and tree population density was 5.92 per $50m^2$ in the homestead area. Regarding to different Agroforestry practices, a total of 15 different combinations were observed in the study area. Among the agroforestry practices, Banana-Turmeric, Eucalyptus-Sissoo-Bottle gourd–Raddish, Jackfruit-Bottle gourd, Eucalyptus-Raddsih, Bean-Banana-Jackfruit, Bean-Mango were the dominant practices in the study area and others practices were found sporadically. In this study total five vertical layers were identified that are represented as S_1 (> 1m), S_2 (2.0-3.00), S_3 (3.0-5.0), S_4 (5.0-7.0), S_5 (> 7m). In case of farmer characteristics education, family size, farm size, homestead size, cultivable land size and annual income showed significant positive relationships with the diversity to tree species while no such relationship was observed with age. The result concludes that homestead Agroforestry is a unique area for maintaining both plat diversity and productivity; however, farmers' socio-economic characteristics are considered as a main factor for presenting such biodiversity in the homestead area of Bangladesh.

Key words: Tree diversity, plant species, Agroforestry, Tangail district.

Introduction

The Homestead agroforestry system is very important in the economy of Bangladesh. The many woody species grown in the homesteads are a significant source of fuelwood; they also provide fodder, building materials and other forms of wood. In the context of the prevailing shortage of fuelwood and excessive deforestation in Bangladesh, this homestead agroforestry system needs to be strengthened (Leuschner and Khaleque, 1987)

Homestead Agroforestry play a vital role in the economy of Bangladesh. Trees and other woody species grown in the homesteads are a significant source of food fodder, fuelwood and timber. Most of the vegetable produced consumed in the country are coming from the homesteads. There are about 25.49 million of homesteads in our country covers about 0.80 million ha of lands (BBS, 2010). Trees in the homesteads, often called, "homestead forests", play an important role in rural economy as well as national economy of Bangladesh.

Homestead is the most plant diversified ecosystem in Bangladesh. Plant diversity plays an important role for maintaining ecological balance as well as environmental stabilization. So diversity in plant species is desirable for sound environment. Considering the above facts present study was undertaken- (i) to observe the socio-economic characteristics of the farmers in the study area, (ii) to record the species diversity of the study area, (iii) to find out tree-crop mixed combination agriculture practices in the study area, (iv) to observe the impact of Agroforestry on the livelihood status of the farmers, and (v) to explore the relationships among the selected characteristics of the farmers and plant species diversity.

Materials and Methods

Location of the Study Area: The study was conducted in 9 Villages of 3 Unions of Gopalpur Upazila of Tangail district. Gopalpur is located between 24°.29°and 24°.41 north latitudes and between 89°.45° and 90°.00° east longitudes. The Gopalpur Thana, now an Upazila, was established in 1920. The Upazila consists of one municipality, 10 Union Parishads, 162 Mouzas and 146 villages. With an area of 193.37 sq km it is bounded by madhupur Upazila on the north, Ghatail and Bhuapur Upazilas on the south, Ghatail and Madhupur Upazilas on the east, sarishabari and Bhuapur Upazilas on the west. Main rivers are Jhinai, atrai and Bairan; main depressions are Helancha Beel, Barashila Beel and Gaila Beel. (Banglapedia, 2003)

Physiography: According to the BRAC (1989) agro-ecological zoning the Tangail district belongs to the argo-ecological zone- 7, 8 and 9 i.e Active Brahmaputra and Jamuna Flood Plain, Young Brahmaputra and Jumuna Floodplain and old Brahmaputra Floodplain.

Method of investigation: As the farmer of Bangladesh do not usually maintain records and accounts of their farm operations, the survey method was followed to achieve the objective of this study. To minimize errors, several repeated visits were made to collect data properly.

The steps followed in the present study are selection of the area, specific records of the relevant factors, sampling technique, period of investigation, preparation of the interview schedule, reporting with respondents, collection of data, processing and analysis of data

Preparation of survey schedule: In order to collect relevant information form the respondents a set of preliminary survey schedules was used. The survey schedule was carefully designed keeping the objective of the study in view. The schedule contained both open and closed form questions. Very easy simple, direct questions and different scales were used to obtain information. The draft schedule was pretested by interviewing some sample farmers of selected areas by the researcher herself. Thus, some part of the draft schedule were improved, rearranged and modified in the light of the actual and practical experience gained by the researcher from the pretesting. Thus, the final survey schedule was prepared on the basis of valid suggestions, logical sequences, and comment of the research supervisor and also presented in Appendix.

Period of data collection:

Method of data collection: Data were collected from 01 August to 31 October 2012 by using the questionnaire. Before going to make interview, each farmer was given a brief introduction about

the nature and purpose of the study and the researcher assured them that, all information would be kept confidential.

Variables of study and development of research instruments: Independent variables of the study area were- Age, Education, Family size, Homestead size, Farm size, Annual income, Cultivable Land Size and the Dependent variable is Tree Species Diversity.

Measurement of dependent variable: Impact of homestead agroforestry as perceived was the dependent variable of the study. It consists of diversified tree species of the homestead. The changes of diversified tree species of homestead agroforestry are measured by calculating number of tree species. Number of tree species obsrved in homestead agoforestry system was the focus of the study. On the basis of this main aspect the researcher gain knowledge by visiting the study area and discussing with farmers before collection of data. Tree species are the important component of the homestead flora. Predominating plant species (fruit, timber, crops, vegetable and others) observed in the study area was calculated in homestead area and it was expressed by numbers.

Data processing and analysis: After completion of field survey data form all the interview schedules were coded, complied,

tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative once by means of suitable scoring whenever necessary. The responses to the questions in the interview schedules were transferred to a master sheet to facilitate tabulation. For describing the different characteristics and their constraint facing, the respondents were classified into several categories. Theses categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible score system.

Results and Discussion

Characteristics of the respondents: Nine characteristics of the farmers were investigated viz Age, Education, Family size, Homestead size, Farm size, Annual income, Cultivable Land Size and knowledge about Agroforestry. Measuring system of the each characteristic, their observed range, mean and standard deviation are presented in the Table 1.

Table 1. Description of farmer's characteristics treated as independent variables of the study (N=90)

Characteristics	Measuring system	Observe range	Mean	Standard deviation
Age	Years	19-70	41.68	9.936
Education	Level of schooling	0-15	5.66	4.566
Family size	Numbers	3-10	5.83	1.855
Farms size	Hectare	.13-1.62	.739	.409
Homestead size	Hectare	.02-.75	.257	.217
Cultivable land size	Hectare	.0581-1.307	.4827	.2439
Annual income	Taka	25000-200000	85260.8222	55356.94625
Knowledge about trees	Scale score	42-133	84.8556	30.7196

Tree species diversity: Different tree species were observed in the homestead area as diversified condition. Total 133 tree species were recorded from the study area of which 68 timber species, 28 fruit species, 35 medicinal species (Table 2). Among these 133 different plant species Jackfruit, Akashmoni, Mango, Mahogany and Eucalyptus were found as dominant tree in the Gopalpur upazila. Out of 68 timber species Mahogoni, Akashmoni and Euclyptus were found as commonly in almost 80% respondent houses and others 12 species found in 6-56% respondent homestead area. The diversity of timber species in the study area was rich compare to medicinal, fruits. Similar type of timber species diversity was observed by Saadat (2007) in Gaibandha and he observed total 21 timber species in his study area. Total 28 fruit tree species were found in the study area. Among the fruit species Mango, Jackfruit, Papaya, Boroi and Bel

were dominant and found upto 75% respondent houses. The diversity of fruit species in the study area was rich compare all other species. Similar type of fruit species diversity was observed by Belali (2011) in Narayangonj and he observed total 28 fruit species in Narayangonj area. Among the 35 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. Similar type of medicinal species diversity was observed by Yasmin et al. (2010) in Tangail and they observed total 35 medicinal species in Tangail study area and medicinal species diversity was very low in my study area compare to her study area. Among the total tree species fodder, ornamental and other species were in a very low in number 6, 4, and 2, respectively. Shabuj et al. (2010) also observed lower number of fodder, ornamental and other species in Natore district.

Table 2. Tree diversity in the study area

Timber species					
Sl.	Local name	Scientific name	Sl.	Local name	Scientific name
1	Akashmoni	*Acacia auriculiformis*	35	Jam	*Syzygium cumini*
2	Acacia hybrid	*Acacia sp.*	36	Bokain	*Melia sempervirens*
3	Mangium	*Acacia mangium*	37	Bara mahogoni	*Swietenia macrophiylla*
4	Nilotica	*Acacia nilotica*	38	Choto mahogoni	*Swietenia mahogoni*
5	Albida	*Acacia albida*	39	Dewa	*Artocarpus lacucha*
6	Khoir	*Acacia catechu*	40	Chapalish	*Artocuarpus chaplasha*
7	Bilati babul	*Acacia farnesiana*	41	Ashatha	*Ficus religiosa*
8	Kalokori/Sirish	*Albizia tebbeck*	42	Jogya dumur	*Ficus racemosa*
9	Sadakori/Silkoroi	*Albizia procera*	43	Khoksha	*Ficus hispida*
10	Raintree	*Albizia saman*	44	Bot	*Ficus bengalensis*
11	Sesrakoroi	*Albizia Chinensis*	45	Shaora	*Sterblus asper*
12	Rajkoroi	*Albizia richardiana*	46	Mulberry	*Morus indica*
13	Ipil-Ipil	*Leucaena leucocephala*	47	Hijal	*Baringtonia acutangula*

14	Khaibabla/Zitapi	*Pithecelobium dulce*	48	Kumbhi	*Careya arborea*
15	Minjiri	*Cassia siamea*	49	Simul	*Bombax ceiba*
16	Mayflower	*Cassia nodosa*	50	Jiga	*Garuga pinnata*
17	Sonalu/bandartathi	*Cassia fistula*	51	Gamar	*Gmelina arborea*
18	Krisnachura	*Delonix regia*	52	Kharajora	*Litsea monopetala*
19	Ashok	*Saraca indica*	53	Karpur	*Cinnamomum camphora*
20	Radhachura	*Caesalpinia pulcherima*	54	Bakul	*Mimosops elengi*
21	Kanchan	*Bauhinia acuminata*	55	Garjan	*Dipterociarpus turbinatus*
22	Karanja	*Pongamia pinnata*	56	Sal	*Shorea robusta*
23	Sissoo	*Dalbergia sissoo*	57	Telsur	*Hopea odorata*
24	Bakphul	*Sesbania grandiflora*	58	Jangli katbadam	*Sterulia foetida*
25	Fomosa	*Sesbania Formosa*	59	Tamal	*Diospyros moutana*
26	Mander	*Erythrina orientalis*	60	Gab (Deshi)	*Diospyros pergrina*
27	Polash	*Butea monisperma*	61	Bajna	*Zanthoozyluym rhetsa*
28	Glirichida	*Gliricidia sepium*	62	Pine	*Pinus longifolia*
29	Arhar	*Cajanus cajan*	63	Muli bans	*Melocanna baccifera*
30	Gila lota	*Derris trifoliata*	64	Talla Bans	*Bambosa tulda*
31	Katbadam	*Terminalia catappa*	65	Bon Bans	*B. cacharensis*
32	Pitali	*Trewia nudflora*	66	Boilam	*Anisopetra scaphula*
33	Kainjal	*Bischofia javanica*	67	Lohakat	*Zylia dolabiformis*
34	Kadam	*Anthocephalus Chinensis*	68	Eucalyptus	*Euclyptus citriodora*

Fruit species

69	Am	*Mangifera indica*	84	Arboroi	*Phyllanthus acidus*
70	Jamrul	*Syzygium cumini*	85	Papaya	*Carica papaya*
71	Golapsam	*Syzygium Jambos*	86	Ataphal	*Annona reticulata*
72	Kanthal	*Artocarpus heterophyllus*	87	Sharifa	*A. squamosa*
73	Tal	*Borassus flabellifer*	88	Leamon	*Citrus limon*
74	Khejur	*Phoenix sylvestris*	89	Guava	*Carica papaya*
75	Coconut	*Cocos nucifera*	90	Boroi	*Ziziphus mauritiana*
76	Jalpai	*Elaeocarpus Floribundus*	91	Amra	*Zamia furfuracea*
77	Jarul	*Leagerstromia specieosa*	92	Tentul	*Tamarindus indica*
78	Litchi	*Litchi chinensis*	93	Jambura	*Citrus grandis*
79	Chalta	*Dillenia indica*	94	Karamcha	*Carissa Carandas*
80	Sofeda	*Achras sapota*	95	Kamranga	*A. Carambola*
81	Dalim	*Punica granatum*	96	Bilatiamra	*Spondias dulce*
82	Star Apple	*Chrysophyllum cainito*	97	Deshiamra	*Spondias dulce*
83	Amloki	*Phyllanthus embelica*			

Medicinal species

98	Pineapple	*Ananus sativa*	116	Akond	*Colotropic procera*
99	Bohera	*Terminalia bellerica*	117	Arhar	*Cajanus cajan*
100	Neem	*Azadirachta indica*	118	Bandar lathi	*Cassia fistula*
101	Kathbel	*Feronia elephantum*	119	Tejpata	*Cinnamomum tamala*
102	Horitoki	*Terminalia chubela*	120	Dhanya	*Coriandrum sativum*
103	Arjun	*Terminalia arjuna*	121	Ata	*Anona squamosa*
104	Olatkambal	*Abroma augusta*	122	Turmeric	*Curcuma longa*
105	Khoir	*Acacia catechu*	123	Dhutora	*Datura sp.*
106	Babla	*Acacia nilotica*	124	Mehedi	*Lawsonia inermis*
107	Basak	*Adhatoda vasica*	125	Ghoraneem	*Melia azedarach*
108	Bel	*Aegle marmelos*	126	Pudina	*Mentha spicata*
109	Onion	*Allium cepa*	127	Sajna	*Moringa oleifera*
110	Garlic	*Allium sativum*	128	Tulsi	*Ocimum americanum*
111	Kaju Badam	*Anacardium occidentale*	129	Sarpagandha	*Rauwolfia serpentina*
112	Agar	*Agailaria agolocha*	130	Castor oil plant	*Ricimus communis*
113	Supari	*Areca catechu*	131	Nishinda	*Vitex negundo*
114	Simul	*Bombax ceiba*	132	Harjora	*Vitex guadrangularis*
115	Palas	*Butea monosperma*	133	Dhaiphul	*Woodfordia*

Vegetable species diversity: The study area is vegetated by different types of vegetables. A total of 36 vegetable species were recorded in the homestead of the study areas. Out of 36 vegetable spices the dominant spices are Turmeric, Papaya, Hyacinth bean, Banana and Aroids were found upto 75% respondent homestead area. Similar type of vegetable species diversity was observed by Belali (2011) in Narayangonj and he observed total 11 vegetable spices diversity rich in study area.

Species density: Species density means number of tree species per unit area. In this study, species density was measured by number of tree species per 50m^2 homestead area. Among the 133 species, average of 27 species per family was found in Gopalpur upazila. This indicates species density in Gopalpur was dense. It was found that, tree density per 50m^2 areas of Jhaoail, Hadira, and Nagda Shimla union under Gopalpur upazila was 2.45, 1.73 & 2.69, respectively. The average species density of Gopalpur upzila was 2.29 species per 50m^2 homestead area. This results also indicate the higher species diversity in Gopalpur upzila of Tangail. The reasons for the higher species in this area may be the people of this area are well aware about tree, the soil of this area is more fertile, land topography almost plain and the this

area never affected by flood. Similar type species density and similar also observe by Moontasir (2009) in Comilla district and Belali (2011) in Narayanganj district.

Tree density: Tree density means the number trees per unit area. Here, plant density was also measured by number of plant per $50m^2$ homestead areas (Table 3). It was found that, tree density per $50m^2$ homestead areas of Jhaoail, Hadira, and Nagda

Shimla union under Gopalpur upazila was 6.36, 4.89, & 6.53, respectively (Table 3). Average of tree density per $50m^2$ area was 5.92 which are much higher than species density ($2.29/50m^2$ areas). This indicates that people of this area planted several trees of any single species in their homestead. The reasons for the higher tree density may be the availability of seed, sufficient homestead area, favorable environment and fertile soil.

Table 3. Tree density found in three union of Gopalpur Upazila

Sl No.	Location (Union)	Average no. of plant/Homestead	Average Homestead area (m^2)	No of plant/$50m^2$
1	Jhaoail	70.0	550	6.36
2	Hadira	65.0	664	4.89
3	Nagda Shimla	68.0	520	6.53
	Average	67.6	578	5.92

Existing Agroforestry Practices: The diversity of trees and vegetables in this study area found as rich condition. As a result there is a combination or mixed association of tree-vegetable was found in this area. Each combination treated as a separate agroforestry practices. This type of combination was critically observed in the study area and total fifteen different combinations were recorded as different agroforestry practices. They are- 1) Banana – Turmeric, 2) Bean - Mango –Jackfruit, 3) Bean- Banana-Jackfruit, 4) Coconut- Jackfruit- Betelnut-Papaya- Spinach, 5) Papaya- Bean- Potato, 6)Turmeric-Data, 7) Papaya-Bean- Potato, 8) Papaya- Mango- Betelnut - Onion, 9) Potol- Papaya- Mango, 10) Jackfruit –Sweet gourd, 11) Eucalyptus- Sissoo- Bottle gourd- Raddish, 12) Eucalyptus- Raddish, 13) Sissoo- Sweetgourd- Raddish, 14) Akashmoni- Rice, 15) Banana- Papaya- Turmeric.

Relationship between the selected characteristics of the respondents with tree diversification: This section deals with the relationship between 7 selected characteristics of the farmers and the diversified tree species observed in homestead agroforsetry system. The variables were age, education, family size, farm size, homestead size, cultivable land size, and annual income. Pearson's product moment co-efficient of correlation (r) has been used with the description of the meaning of 'r'. The summary of the results of the correlation co-efficient regarding relationship between the different characteristics of the farmers and tree species diversity were as follows: (Table 4).

Table 4. Correlation between the dependent and independent variable

Farmer's characteristics	Computed value of 'r'
Age	-0.105 (NS)
Education	0.616[**]
Family size	-0.220[*]
Farm size	0.701[**]
Homestead size	0.815[**]
Cultivable land size	0.449[**]
Annual income	0.822[**]

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

References

ADB (Asian Development Bank) 1993. Master Plan. Forest Production. Govt. Bangladesh, Ministry Env. Forest, Dhaka. p. 66.

Bangladesh Bureau of Statistics (BBS) 2010. Population and housing census 2011. Preliminary results, July 2011., Ministry Of Planning, Govt. People's Republic Bangladesh.

Bangladesh Bureau of Statistics (BBS). Population Census, National Volume-1, 2001. Retrieved 2012 August 12 from www.bbs.gov.bd/webtestaplication/.../PHC2011Preliminary %20Result.pdf

Bangladesh Economic Survey 2012. Retrieved 2012 August 12 from www.thefinancialexpress-bd.com/more.php

Banglapedia 2003, National Encyclopedia of Bangladesh, Banglapedia Trust, Asiatic Society of Bangladesh January 2003.

BBS (Bangladesh Bureau of Statistics). 2010. Statistical Yearbook of Bangladesh. Bangladesh Bur. Stat. Divn., Minist. Plan. Govt. People's Repub. Bangladesh, Dhaka.

Belali, M.H. 2011. Study on homestead agroforestry and species composition in Sonargaon upazila of Narayangonj district. Unpublished M.S. thesis, Department of Agroforestry, BAU, Mymensingh.

Bhuiyan, A.A. 1994. Forestland Agroforestry: the north Bengal experience. BARC-Winrock Int., Dhaka, Bangladesh. p.63.

BRAC, 1989, Annual Report: Research and Evaluation Division (RED). Dhaka: Bangladesh Rural Advancement Committee.

Byron, R.N. 1984. People's forstry a novel prospective of forestry in Bangladesh. ADAB News, 11.28-42.

Douglas, J.J. 1982. Consumption and Supply of Wood and Bamboo in Bangladesh. ADB Comm. Forestry Project. FAO-UNDP-BGD/78/010. Planning Commn., Dhaka.

FRA 2000. Forest resources of Bangladesh - Country report of FAO. Retrieved 2012 Septemer 01 from www.fao.org/ docrep /007/ ad104e/ AD104E06. htm

Leuschner, W.A. and Khakeque, K. 1987. Homestead Agroforestry in Bangladesh. Agroforestry System. 5:139-51

Sadaat, M.N. 2007. A study on the homestead agroforestry of three selected unions of Gobindagonj upazila in Gaibandha district. Unpublished M.S. thesis Department of Agroforestry BAU, Mymensingh.

Shabuj, M.B.H., Wadud M.A., Sharif M.O., Khan T.A. and Mandol M.A. 2010. Homestead Agroforestry Systems practiced by the farmers of Natore district J. Agrofor. Environ., 4 (2) 133-136

Torquaebiae, E. 1990. The concept of Agroforestry. Lect.Notes. 2nd ed. ICRAF. Nairobi, Kenya.

Yasmin, R., M.A. Wadud, M.M.A. Mandol and M.O. Sharif (2010). Tree diversity in the homestead and cropland areas of Madhupur Upazila Under Tangail District. J. Agrofor.Environ., 4(1):89-92.