Studies on tree diversity of homestead Agroforestry systems in three union of Nakla upazila of Sherpur district

A.L.M. Rejuan, M.A. Mondol and M.A. Wadud

Department of Agroforestry, Bangladesh Agricultural University, Mymensingh -2202

Abstract: The study was conducted in three union viz., Chandrakona, Pathkata and Baneswardi under Nakla upazila of Sherpur district to observe the tree diversity in the homestead area and to explore the relationships with the different characteristics of the farmers. A structured personal questionnaire was used for collecting data during the period from 15 July to 15 September, 2011. Ninety farmers were selected randomly for the study area for data collection. A total of 52 tree species, 14 vegetable species, 9 agroforestry practices and 5 different vertical layers were recorded in the homestead of the study area. The different categories of trees as 15 timber species 19 fruit species, 6 fodder species, 6 medicinal species, 4 ornamental & 2 other species were recorded. Among the trees species, Supari, Jackfruit, Akashmoni, Raintree Mango, Mahogoni, Coconut, Guava and Jamrul were dominant species. Average of 24.33 plant species were recorded in each homestead and species density was 4.27 per 100 m^2 in the homestead area. Average tree population density was 61 per homestead and tree population density was 10.60 per 100 m^2 in the homestead area. A total of nine different combinations were recorded as different Agroforestry practices. Among the nine agroforestry practices Mahogoni-Halud, Litchi-Banana-Halud and Mahogoni-Akashmoni-Halud was the dominant practices in the study area and others practices were found sporadically. Vertically different layer or strata was observed in this area. In this study total five layer was identified as L_0 (> 1 m), L_1 (2-3m), L_2 (3-5m), L_3 (5-7m), and L_4 (>7m). Five selected characteristics of the farmers namely, farm size, homestead size, cultivable land size, annual income and knowledge about trees showed significant positive relationships with the diversity of tree species, while no such relationship was observed with age, education, family size, knowledge about agroforestry.
Key words: Homestead, Species diversity, Tree density, Species density, Agroforestry.

Introduction

Bangladesh is one of the most densely populated countries of the world. Having about 142.3 million people in its 1,47,570 km^2 of area (BBS, 2010). If the current population growth rate (1.34%) continues, population will increase to 180 million by the year 2020 and the country will face enormous problems for nursing her population. The country has a total area of 14.4 million hectares of which land covers 13.62 million hectares and river 0.78 million hectares. There are 7.62 million hectare of cultivable land and about 2.5 million hectares of forests in Bangladesh (BBS, 2010). About 70% of the population live in the rural areas in 25.35 million households spread over 87316 villages (BBS, 2010).There are only 808254 ha of homestead land (about 10.63 percent of total cultivable land) having 0.03 ha per household.

Since the population growth is increasing at a rate of 1.34, it requires more residential area and more food. For this, agricultural land is decreasing and at the same time forestland is also decreasing to great more homesteads and more agricultural land. While forest is important natural resources of a country requiring 25% forestland of the total area of a country for its socio-economic upliftment and maintenance of environmental equilibrium. But Bangladesh has only 9% forestland of the total area as officially recorded where trees cover only 5.5% of the total area which is decreasing day by day. A substantial depletion of forest resources has occurred in the last few decades, and not it is reduced to less than 0.02 ha per person, one of the lowest ratios of the world. This is a great challenge against the socio-economic and environmental development of the country.

Agroforestry practices help overcome this deteriorating environment of the traditional agriculture. As the expansion of classified forest is almost impossible because of high population pressure, growing trees in crop field may serve as the best option to balance ecosystem. From the time immemorial, farmers grow a considerable number of various tree species in the crop field. In Agroforestry system, interaction between trees and crops are the heart because sharing of the common resources by different species is the common phenomenon. However, these interactions should take place with respect to how the component of Agroforestry utilize and share the resources of the environment and how the growth and development of any of the components will influence the others (Torquaebiae, 1990).

Homestead Agroforestry plays 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 plant diversified condition is desirable for sound environment. Considering the above facts present study observe the plant diversity along with Agroforestry in Nakla upazilla of Sherpur district.

Materials and Methods

Location of study area: The study was conducted for Nakla upazila of Sherpur district. The geographical co-ordinates of the study area are from 25°18' to 24°52' north latitude and 90°18' to 89° 52 east longitudes. It is bounded on the north by Nalitabari upazila of Sherpur district, on the south by sadar upazila of Jamalpur district, on the east by Phulpur upazila of Mymensingh district and on the west by Sherpur Sadar upazila.

Preparation of survey schedule: The questionnaire was carefully designed in such a way that all factors associated with the economic organization and performance of the farm business could be included. Simple questions and/or statements regarding their basic factors were included in the questionnaire. The draft questionnaire was pre-tested

by interviewing some sample farmers of the Upazila by the researcher herself. Thus, some parts of the draft questionnaire were improved, rearranged and modified in the light of the actual and practical experiences gained by the researcher from the pre-testing. Thus, the final survey schedule "-as prepared in a simple manner maintaining logical sequences and necessary adjustments.

Period of data collection: To get valid and pertinent information, the researcher made all possible effort to explain the purpose of the study to the respondents. The researcher administered the interview schedule personally to the respondents. Rapport was established with the respondents through informal discussion regarding objectives of the interview. Co-operation was obtained from respondents during data collection. Data were collected from 15 July to 30 September 2011.

Method of data collection: Data were collected through several repeated field visits in the study area and personal interviewing with the sample farmers. Interviews were normally conducted in farmers' house in their leisure time and even in the field when they worked in the plots. They provided information from their memory. In order to minimize the response error, questions were asked in simple Bengali. After completion of each interview, each interview schedule was checked.

Variables of the study: Two types of variables are observed in this study viz., independent and dependent variables. Independent variables were farmer characteristics represent the independent variable in this study. Total nine characteristics of farmers selected for this study as independent variable which are as: Age, Education, Family size, Farm size, Homestead area, Cultivable land size, Annual income, Knowledge about tree and Knowledge about Agroforestry. Dependent variable is tree species diversity treated as dependent variable of the study

Data processing and analysis: After completion of field survey data from all the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all the respondents in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. For describing the different characteristics and their constraint facing, the respondents were classified into several categories. These 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 which were the independent variables of the study were investigated viz age, education, family size, farm size, homestead size, cultivable land size, annual income, knowledge about trees 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	Observed range	Mean	Standard deviation
Age	Years	19-70	42.38	14.68
Education	Level of schooling	0-15	6.2	4.24
Family size	Numbers	3-10	5.8	1.86
Farm size	Hectare	0.13-1.6	0.52	0.32
Homestead size	Hectare	0.02-0.33	0.057	0.035
Cultivable land size	Hectare	0.1-0.70	0.3	0.17
Annul income	Taka	25000-210000	84689	43564
Knowledge about trees	Scale score	15-45	29.8	7.42

Tree species diversity

Different tree species were observed in the homestead area as diversified condition. Total 52 tree species were recorded from the study area of which 15 timber species, 19 fruit species, 6 medicinal species, 6 fodder species, 4 ornamental species and 2 others species. Among these 52 different plant species Supari, Mahogoni, Akashmoni, Raintree and coconut were found as dominant tree in the Nakla upazila (Fig.1). Out of 15 timber species Mahogoni, Akashmoni and Raintree 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, fodder, ornamental and other species. Similar type of timber species diversity was observed by Saadat (2007) in Gaibandha and he observed total 21 timber species in his study area.
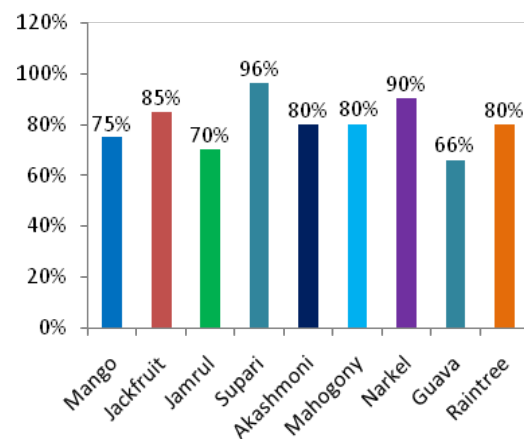

Fig 1. Major Tree species in homestead area

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 100m^2 homestead area. Among the 52 species, average of 24.33 species per family was found in Nakla upazila. This indicates species density in Nakla was dense. It was found that, tree density per 100m^2 areas of Chandrakona, Pathkata, and Baneshwardi union under Nakla upazila was 3.91, 4.0 & 4.90, respectively (Table 2). The average species density of Nakla upzila was 4.27 species per 100m^2 homestead area. This results also incate the higher species diversity in Nakla upzila of Sherpur. 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 also observe by Moontasir (2009) in Comilla district and Jahanh (2010) in Narayanganj district.

Table 2. Species density found in three union of Nakla Upazila

Sl. No.	Location (Union)	Average no. of species/ homestead	Average Homestead area (m^2)	No of species/100m^2
1	Chandrakona	26	664	3.91
2	Pathkata	22	550	4.0
3	Baneshwardi	25	510	4.90
	Average	24.33	575	4.27

Tree density: Tree density means the number trees per unit area. Here, plant density was also measured by number of plant per 100m^2 homestead areas (Table 4). It was found that, tree density per 100m^2 homestead areas of Chandrakona, Pathkata, and Baneshwardi union under Nakla upazila was 9.33, 10.54, & 12.35, respectively (Table 3). Average of tree density per 100 m^2 area was 10.60 which are much higher than species density (4.27/100m^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 Nakla Upazila

Sl. no.	Location (Union)	Average no. of plant/homestead	Average Homestead area (m^2)	No of plant/100m^2
1	Chandrakona	62	664	9.33
2	Pathkata	58	550	10.54
3	Baneshwardi	63	510	12.35
	Average	61	575	10.74

Vegetable species diversity : The study area is vegetated by different types of vegetables. A total of 14 vegetable species were recorded in the homestead of the study areas. Out of 14 vegetable species the dominant species are Halud, pui shak, papaya, Chili & Aroids were found upto 75% respondent homestead area (Fig.2). Similar type of vegetable species diversity was observed by Belali (2011) in Narayangonj and he observed total 11 vegetable species in his study area. This indicates vegetable species diversity rich in my study area.

Fig 2. Major vegetable species in homestead area

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 nine different combinations were recorded as different Agroforestry practices. These nine practices were as: 1. Segun-Halud, 2. Mahogoni-Akashmoni-Halud, 3. Akashmoni-Boroi-Kachu, 4. Mahogoni- Mustard, 5. Mahogoni-Halud, 6. Litchi-Banana-Halud, 7. Mahogoni-Papaye-Halud, 8. Mahogoni-Banana-halud and 9. Akashmoni-Rice.
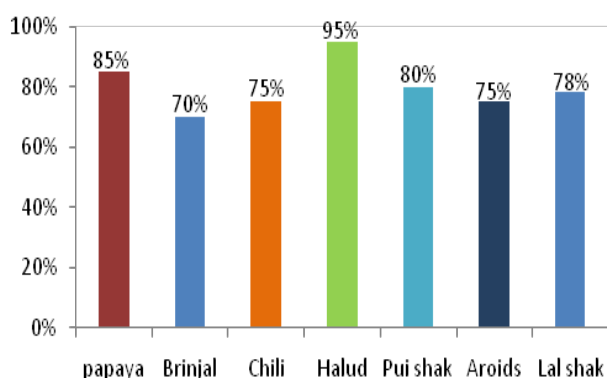
Vertical Species Composition: The vertical structure of the homestead overtime is not static. The home garden has a multistoried canopy configuration. In the study area, 52 tree species and 14 vegetable species were recorded i.e. the vegetation of this area is diversified and complex. Vertically different layer or strata was observed in this area (Table 4). Total five layer was identified as L_0 (> 1 m), L_1 (2-3m), L_2 (3-5m), L_3 (5-7m), and L_4 (>7m) in this study area. Similarly, Basher (1999) identified four vertical canopy strata (1m, 2-5m, 5-10m, and >10m in Rangpur district; Millat-e-Mustafa (1997) identified six vertical canopy structure (<1m, 1-3m, 3-5m, 5-7m, 7-9m

and >10m) surveying the whole Bangladesh and Shabuj *et al*. (2010) identified four vertical canopy strata(0-1.5m, 1.5-3.50m, 3.52-7.0m, and >7.0m) in Natore district.

Table 4. Vertical layer's in the homesteads of the study area

Layer	Hight(m)	Examples
L_0	>1.00	Halud, Brinjal, Chili, Indian Spinach, Sweet gourd,Shosa,etc
L_1	2-3	Papaya, Banana, Guava etc.
L_2	3-5	Litchi, Jujube, Payara, Gab, Golapjam,etc.
L_3	5-7	Mango, Jackfruit, Ipil-Ipil, Jamrul, Jam,etc
L_4	>7	Mahogany, Eucalyptus, Rain tree, Sisso, Tal,etc

Table 5. Correlation between the dependent and independent variable

Farmer's characteristics	Computed value of 'r'	Tabulated value of 'r' with 88 df	
		5% level	1% level
Age	0.054 NS		
Education	0.201 NS		
Family size	0.189 NS		
Farm size	0.511**		
Homestead size	0.495**	0.319	0.412
Cultivable land size	0.448**		
Annul income	0.508**		
Knowledge about trees	0.352*		
Knowledge about Agroforestry	0.227 NS		

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

Relationship between the selected characteristics of the respondents with their diversified tree species: Relationship between 9 different characteristics of farmers and the diversified tree species was measured using the Pearson's product moment co-efficient of correlation (r). Five characteristics of the farmers namely; farm size, homestead size, cultivable land size ,Annual income & knowledge about trees, showed significant positive relationships with the diversity of tree species, while no such relationship was observed with age, education, family size & knowledge about Agroforestry.

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