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Homestead agroforestry systems practiced by the farmers of Natore district

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Abstract: This study was performed in six upzilas (Natore sadar, Singra, Gurudaspur, Lalpur, Bagatipara and Boraigram) of Natore district with a view to identify the tree diversity, homestead agroforestry practices, vertical stratification and to explore their relationships with the selected characteristics of the farmers of the study area. Information collected from a total of 100 households ranging from marginal, small, medium and large categories. An interview schedule with simple technique and visual observation was used to determine the selected parameters. The respondents were selected randomly and data were collected during the period from 26 August to 12 September 2010. Pearson's Product Moment Correlation Co-efficient (r) was used for statistical analysis along with the usual descriptive statistical parameters. A total of 32 different tree species was recorded in the homestead of the study area of which Jackfruit, Eucalyptus, Ipil-ipil, Mango, Neem, Mehogoni were dominant species. On an average 21.25 tree species were found in homestead. Ten different agroforestry practices were identified from the study area within four different layers. Selected characteristics of the farmers namely age, family size, farm size, and homestead size showed significant positive relationships with the diversity of tree species, while no such relationship was observed with education of the farmers.
Key words: Tree diversity, homestead and cropland agroforestry.

Introduction

Bangladesh is mainly agricultural based country and agriculture play a great role in the national economy of the country. About 23.50% of the GDP come from the agriculture and it creates 62% employment opportunity of the country (BBS, 2006). The population of Bangladesh in 2003 was estimated by the United Nations at 146,736,000, which placed it as number 7 in population among the 193 nations of the world. According to the UN, the annual population growth rate for 2000–2005 is 2.02%, with the projected population for the year 2015 at 181,428,000.

Like agriculture, another important resources i.e., forest which has important role in ecological balance and socio-economic upliftment of the rural people. The accepted standard according to the experts of environmental science is that a country has at least 25 percent of its total land area covered with trees or forests (Huda and Roy, 1999). Once covered by dense forests, Bangladesh is now almost devoid of forest land, except in few selected areas of the country (Giri and Shrestha, 1996). In terms of per capita forest land, Bangladesh ranks the lowest in the world, which is about 0.02 ha per person (UNEP, 2002). According to the Forestry Master plan (FMP) total 7,69,000 hectares or 6 percent of the country's land mass have actual tree cover (Huda and Roy, 2001).

Agroforestry practices specially in the homestead area will be and appropriate alternate land management option to overcome the situation. Agroforestry is the combination of forestry and agriculture with the attributes of productivity, sustainability and adoptability. Agroforestry can provide sound ecological basis for increased crop and animal productivity, more dependable economic returns and greater diversity in social benefits on sustained basis. According to Nair (1993) the term homestead agroforestry means anything for growing vegetables behind house to complex multistoried systems. They defined it as a land use practices involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and invariably livestock within the compounds of individual houses, and the whole crop tree-animal unit are being intensively managed by family labor.

A homestead is a unique combination of trees, shrubs, vegetables, livestock, animals, fishponds and human beings functioning as an ecosystem and maintaining the diversity of the life as well as the biological wealth. So a rich homestead production system with plantations and other production enterprises provide immediate cash benefits as well as long term benefits for the farm families and thereby for the rural communities. In the view of proper utilization of homesteads, the homestead agroforestry systems of Natore district was studied to observe the diversity of tree species in the homestead and to observe the different agroforestry practices with vertical stratification in homestead area.

Materials and Methods

The study was conducted on the area of Bangladesh located at Natore district of Rajshahi division. The data were collected from six upzilas (Natore sadar, Singra, Gurudaspur, Boraigram, Lalpur, Bagatipara). The study areas were frequently visited during the period from 26 August to 12 September 2010.

Geological Location of the Study Area: Natore is the eastern district of Rajshahi division. It is located 24.41N and 88.93 E.

Methods of data collection: The study was based on field level primary data and researcher himself collected data for the study. According to Dillon and Hardaker (1993) there are three main methods by which farm survey data can be gathered. These are: (1) direct observation; (2) interviewing farmers; and (3) record kept by farmers. In this study "interviewing farmers" method i.e., farm survey method was used for data collection.

Variable of the study: Independent variables of study area were (i) Age, (ii) Education, (iii) Family size, (iv) Farm size, (v) Homestead area and (vi) Number of tree species in homestead. Dependent variable of study area was tree species diversity.

Measurement of independent variables: Age of farmers refers to the period of time from his birth to the time of interview. A score of (1) was assigned for each year of his age. It was measured in complete years as reported by a farmer. Education is defined as the ability of an individual to read and write, or formal education received up to

ascertain standard. Education of a respondent was measured on the basis of classes he had passed in formal educational institution. For example, if a respondent passed class five, his education score was five. If a respondent not knowing reading and writing given a score of zero (0), and a score of 0.5 was assigned to these respondents who can sign only. The family size was measured by the total number of members in the family of a farmer. The family members included the farmer himself, spouse, children and other dependents. The information was obtained by farmers to item number 3 of interview schedule. The total number of family members was considered as the family size score of a farmer.

Farm size of a respondent was measured in terms of hectares by using the following formula:

Farm size = $A_1 + A_2 + \frac{1}{2}(A_3 + A_4) + A_5$ Where, A_1 = Homestead area, A_2 = Own land under own cultivation, A_3 = Land taken from and /or given to other on borga, A_4 = Land taken from and /or given to other on lease, A_5 = others (pond, fruit garden etc).

Homestead size was measured by the area of the raised land in which the household has its entire living room, livestock and poultry shed, yard under vegetables, fruit and timber trees, backyard, bushes, bamboo bunches, pond etc. It was express in hectare. Number of tree species in home stead was measured by number of tree species which were grown on the home yard area. Timber, fruits and fuel wood trees considered here. It was express by numbers.

Measurement of dependent variable: Number of diversified tree species observed in homestead agroforestry system was the main focus of the study. On the basis of this main aspect the researcher gained knowledge by visiting the study area and discussing with farmers before collection of data. Tree species are the important components of homestead flora. Predominating plant species (fruits, timber, palms, crops, vegetables and others) observed in the study area was calculated in homestead and it was express by numbers.

After completion of field survey data were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. Pearson's Product Moment Co-efficient of Correlation (r) was used in order to explore the relationship between the concerned variables.

Results and Discussion

Independent variables are presented in the Table 1. Age of the respondents ranged from 18 to 68 years with an average of 40.52 years and standard decimation of 3.91. On the basis of their age, the respondents were classified into three categories. Data presented that the highest proportion of 59 percent of the farmers was in the middle age, 12 percent old and only 29 percent was in young stage category.

Table 1. Basic statistical values of the selected characteristics of the farmers in the study area (N= 100)

Characteristics	Measuring	Observed range	Mean	Standard deviation
Age	Years	18-68	40.52	9.74
Education	Level of schooling	0-16	5.53	3.91
Family size	Numbers	2-12	5.27	1.48
Farm size	Hectare	0.09-6.45	1.21	0.37
Home stead size	Hectare	0.01-0.43	0.12	9.01
Number of trees species in homestead	Numbers	6.0-32.0	21.25	11.09

□ Grow up to 12 tree species   ■ Grow up to 13-20 tree species
□ Grow 21-30 tree species   ■ Grow above 30 tree species
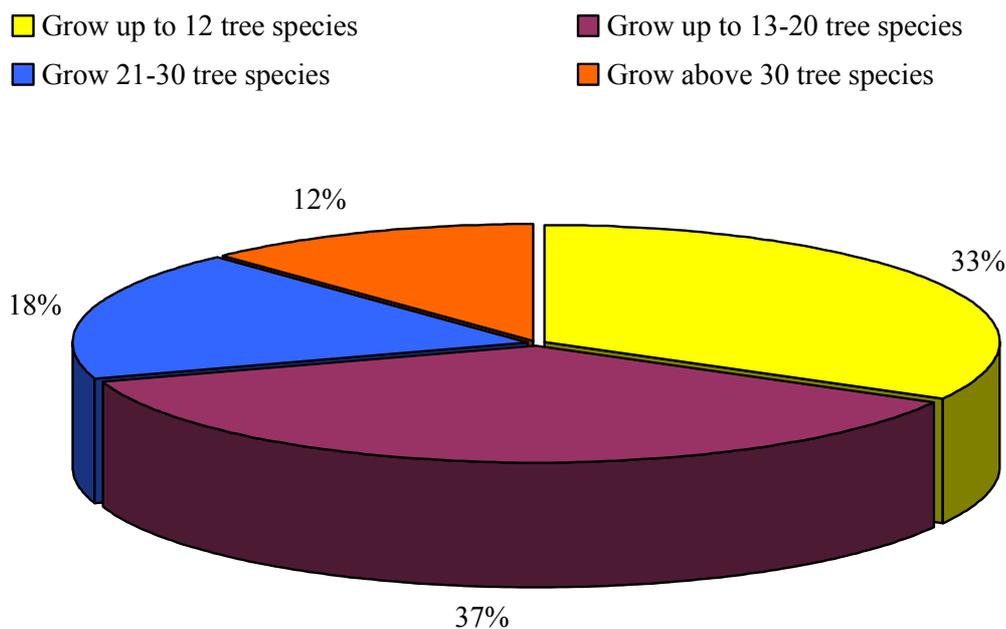

Fig. 1. Pie graph showing percentage of the farmers growing different tree species in their homesteads

Table 2. Tree species observed in homestead area

SI. No	Local name	Scientific name	No. of Homestead
1	Jackfruit	*Artocarpus heterophyllus*	75
2	Eucalyptus	*Eucalyptus camaldulensis*	63
4	Kalokoroi	*Albizia lebbeck*	40
5	Tal	*Borassus flabellifer*	42
6	Raintree	*Albizia saman*	41
7	Ipil-ipil	*Leucaena leucocephala*	70
8	Mander	*Erythrina orientalis*	25
9	Tentul	*Tamarindus indica*	43
10	Arjun	*Terminalia arjuna*	25
11	Mango	*Mangifera indica*	92
12	Amloki	*Phyllanthus emblica*	25
13	Kalo Jam	*Syzygium cumini*	45
14	Neem	*Azadirachta indica*	63
15	Bokain	*Melia sempervirens*	66
16	Supari	*Areca catechu*	56
17	Narikel	*Cocos nucifera*	63
18	Krishnachura	*Delonix regia*	6
19	Litchi	*Litchi chinensis*	67
20	Boroi/Kul	*Ziziyphys mauritiana*	55
21	Lebu	*Citrus limon*	43
22	Peyara	*Psidium guajava*	65
23	Ataphal	*Annona reticulata*	20
24	Mehogoni	*Swietenia grandis*	82
25	Krishnachura	*Delonix regia*	32
26	Kadham	*Anthocephalus chinensis*	25
27	Sajna	*Moringa oleifera*	45
28	Bamboo	*Bambusa sp*	32
29	Bot	*Ficus bengalensis*	23
30	Simul	*Bombax ceiba*	27
31	Jalpai	*Elaeocarpus floribundus*	26
32	Jiga	*Garuga pinnata*	23

The education level of the farmers ranged from 0- 16 with an average of 5.53 and standard deviation of 3.91 of schooling. In this study 32 percent of the farmers had secondary level education whereas 18 percent of them were illiterate, 8 percent of them were primary level and 42 percent was higher secondary level education (Table 1). The family size scores of the farmers ranged from 2-12 with an average of 5.27 and standard deviation 1.48. Most of farmers (45 percent) had medium families compared to 33 Percent small and 22 percent large families (Table 1).

In the study area the farm size of the farmer ranged from 0.09-6.45 hectares with an average of 1.21 hectare with the standard deviation of 0.37. Among the farmers, 47 percent was land less and marginal, 10 percent was medium, 40 percent was small and 3 percent was large farm holder (Table 1). The homestead of the farmer ranged from 0.01-0.43 hectare with an average of 0.12 hectare and standard deviation of 9.01 amongst the farmers, 15 percent had small, 11 percent had medium and only 14 percent had large homesteads and while lastly landless and marginal was 60 percent (Table 1).

Number of tree species in homestead: Number of tree species in homestead ranged from 6 to 32 (Table 2) with an average value of 21.50 and standard deviation of 11.10. Out of 32 tree species Jackfruit, Eucalyptus, Ipil-ipil, Mango, Neem, Mahogoni were dominant in the homestead. The conducted study showed that 33 percent of the respondents grew up to 12 tree species, 37 percent grew 13 to 20 tree species, 18 percent respondents grew 21 to 30 trees species and 12 percent of the respondents grew above 30 number of tree species (Fig. 1).

Agroforestry Practices in the Homestead area: The vertical structure of the homegarden over time is not static. It is perpetually changing and being renewed by the interplay of floristic and structural factors. It can, therefore, termed as dynamic. The homegarden have a multistoried canopy configuration. Basher (1999) identified four vertical canopy strata (with in 1 m, 2-5 m, 5-10 m and > 10 m) and Millat-e-Mustafa (1997) identified six vertical canopy strata (< 1m, 1-3 m, 3-5m, 5-7 m, 7-9 m and > 10 m). This study identifies four vertical strata (Table 3).

Within these four layers ten (10) different agroforestry systems viz. Mango- country bean based agroforestry system, Litchi -chili based agroforestry system, Date palm- Brinjal –Litchi based agroforestry system, Jujube-Turmeric based agroforestry system, Date palm-Turmeic based agroforestry system, Mango-Banana based agroforestry system, Mehogoni-Litchi based agroforestry system, Eucalyptus-Banana-Chilli based agroforestry system, Mango-Papaya based agroforestry system and Brinjal-Litchi based agroforestry system, were identified.

Relationship between independent variables such as age, education, family size, farm size and homestead size and tree diversity were estimated. Except education all independent variables showed significant positive correlation with tree diversity (Table 4).

Table 3. Vertical layer`s in the homesteads of study area

Layer	Height (m)	Examples
L_1	0-1.5	Country bean, Chilli, Brinjal, Turmeric etc.
L_2	1.5-3.5	Banana, Papaya etc.
L_3	3.5-7.0	Litchi, Jujube etc.
L_4	> 7.0	Mango, Date palm, Mahogoni, Eucalyptus etc.

Table 4. Relationship between independent variables and tree diversification

Farmers characteristics	Computed value of 'r'	Tabulated value of 'r' a 98 degrees of freedom		
		5%	1%	0.1%
Age	0.266**			
Education	-0.042^{NS}			
Family size	0.235*			
Farm size	0.719***	0.187	0.247	0.425
Homestead size	0.575***			

From this study it appears that the homesteads contained important fruit and timber species of high economic value. However, there is scope to develop the homesteads with appropriate agroforestry systems for higher economic returns.

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