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Research Article

RELATIONSHIP OF PLANT DIVERSITY AND LIVELIHOOD OF HOMESTEAD FARMERS IN RANGAMATI SADAR UPAZILA OF BANGLADESH

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Abstract

Bangladesh's economy heavily relies on homestead agroforestry. In Sadar upazila of Rangamati in Bangladesh, the study was conducted to ascertain the effect of homestead agroforestry on the respondents' standard of living. It also identifies how the selected variables, like age, education, family size, farm size, homestead size, annual revenue, expenditures, and knowledge of homestead farmers, relate to the diversity of plant species in the study area. Data was collected using structured interviewing, and a correlation test was carried out to determine the relationship between the relevant dependent and independent variables of the study. Education, Farm size, Homestead size, Annual income, Expenditure, and Savings of the respondents revealed significant positive relationships with the plant species diversity, whereas no such relationship was observed with Age, Family size, Knowledge of Homestead Agroforestry and Socio-economic conditions of those respondents. Male were the highest decision makers for housing with 37.5% while female were highest decision makers for tree plantations, Schooling, Savings and Expenditure, and Participation in training program, Uses of agroforestry product and Agronomic crop with 35%, 41.67%, 36.67%, 44.17% and 35.83%, respectively. In the case of family planning, decisions were equally made by males, females, and both males and females combined, accounting for 33.33%. . Therefore, there is a huge opportunity to increase the farmers' income and their livelihood through increasing plant diversity in the present homestead areas of Bangladesh.

Introduction

The agroforestry system is the first among the types of managed land-use systems. By directly integrating trees into the agricultural system, agroforestry creates more entangled, distinctive, productive, profitable, healthy, and sustainable land-use systems (Ahmed and Rahman, 2004). In Bangladesh, where nearly 50% of rural households lack access to land, homestead agro-production is especially important (Januzi and Peach, 1977). For the supply of fuelwood, timber, fruits, and fodder, homesteads are essential. From Bangladeshi home gardens, data of the country's requirements for 70% of timber, 90% of fuelwood, 48% of sawn and veneer logs, and over 90% of bamboo are accessible (Uddin et al., 2002). In Bangladesh, less than 10% of the country is covered by homestead agroforests, which are managed by at least 20 million people and provide the majority of the supply of timber and non-timber products (Kabir and Webb, 2008). According to Leusehner and Khaleque (1987), the homestead agroforestry system is crucial to Bangladesh's economy. The homestead is always at the forefront when the phrase "agroforestry" is used, and in a nation like Bangladesh, simply focusing on homestead regions would cover more than a fourth of all issues related to agroforestry in general.

Cite This Articale

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Homestead agroforestry accounts for roughly 22% of the average yearly household income of Taka 49,055, which was reported by Akter et al. (1997) in a sample hamlet in the Chittagong district. They also reported that in the study area, 1341 individuals representing fewer than 37 distinct tree species, including bamboo. According to Awal et al. (2000), homestead fruit and vegetable techniques generated significant income for all respondent categories. In terms of making decisions for the household, women participated more. The proof would be more dramatic in areas like family planning, child education, poultry rearing, fruit and vegetable planting, and sons' and daughters' marriages. With more farmers participating in economic activities, homestead farming is becoming more and more important as a means of spending little money and making a lot of money. Homestead agroforestry may help improve the farmers' socioeconomic situation, provide them with fuel wood, protect them from dangers, grow their own food, and provide other advantages. Rangamati, part of the Chittagong Hill Tracts (CHT), differs from other regions of Bangladesh in geography, climate, and farming practices. Traditional homestead farming in CHT incorporates agroforestry, shifting cultivation, and indigenous knowledge, distinct from plain land agriculture. The region is home to indigenous groups like the Chakma, Marma, and Tripura, each with unique farming traditions. Understanding plant diversity in this context provides insights into indigenous knowledge, conservation, and sustainable livelihoods, which have been understudied in previous research. As Rangamati Sadar Upazila in Bangladesh lagging behind in exploring the relationship of plant diversity in the homesteads and also respondents' socio-economic condition, hence the studied was undertaken.

Materials and Methods

Study Area

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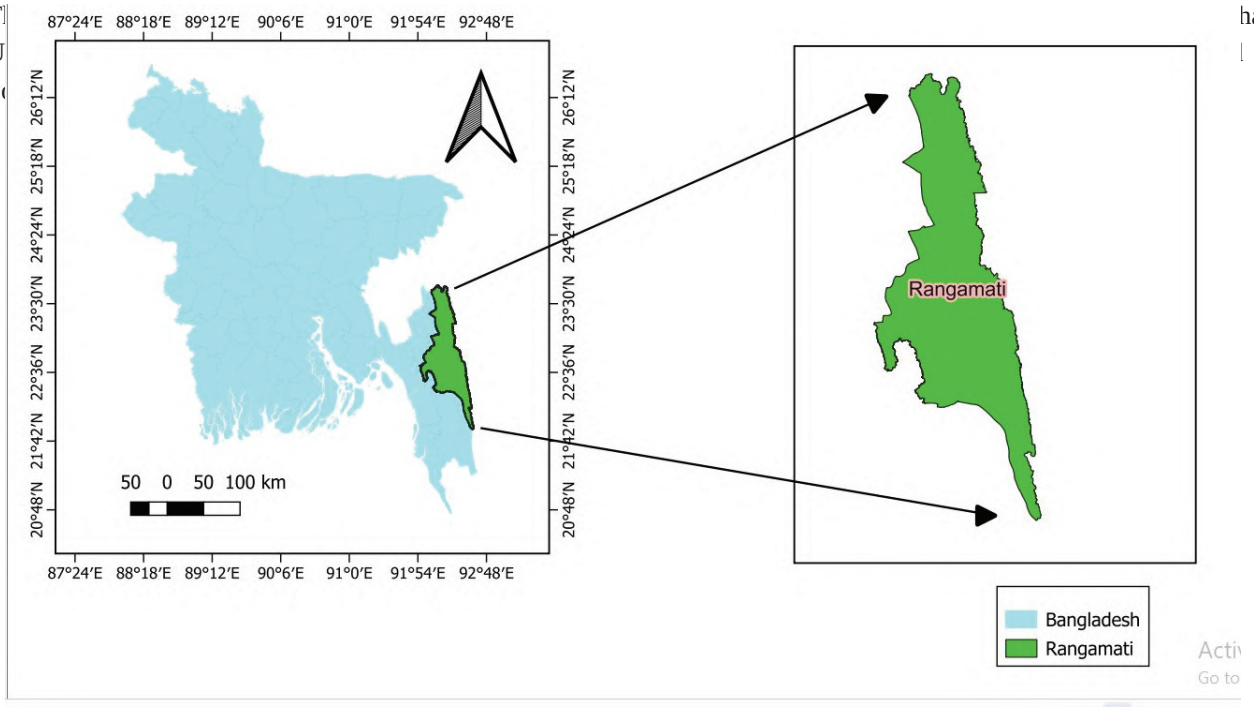

Figure 1. Study Area

Method of investigation

To collect relevant information from the respondents a set of preliminary survey schedules was used. The questionnaire was carefully designed keeping the objective of the study in mind. The questionnaire contained both open and closed form questions. Very easy simple, direct questions and different scales were used to obtain information.

Data processing and analysis

Data were collected from a total of 120 (60 from Pouroshova and 10 from each union) randomly selected respondents. Age, Education, Family size, Farm size, Homestead size, Annual revenue, Expenditure, Knowledge of homestead agroforestry and Socio-economic conditions of the respondents were selected as independent variables while Number of diversified plant species was the dependent variables. Age of respondents is defined as the number of years between the respondent's birth date and the interview. Each year of his age received a score of (1). According to the respondents' reports, it was measured in full years. The capacity to read and write, as well as formal education gained up to a given degree, are both considered to be elements of education. A respondent's education was evaluated based on the classes he had successfully completed at a formal educational institution. The total number of family members belonging to a responder served as a proxy for family size. The respondent's own family, as well as his spouse, kids, and other dependents, were all included. The family size score assigned to a responder was based on the total number of family members. A respondent's farm size was calculated in terms of hectares by using the formula of Begum *et al.*, 2012. This refers to the overall income that a respondent's entire family receives through farming, rearing livestock, fishing, and other sources. Every thousand taka received a score of one (1). Farmers who correctly responded to a question received the full score, while those who gave incorrect or no responses received a score of "0 (Zero)," which denoted that the respondent had no knowledge of traditional agroforestry. Annual income refered to the combined annual income from farming, rearing livestock, fishing, and other sources of all respondents' family members. For each thousand taka, a score of one (1) was given. The dominant plant species (fruit, timber, vegetable, medicinal, and others) found in the study area was computed and expressed in number. After all of the interview schedules' data had been collected, they were coded, assembled, tabulated, and analyzed in accordance with the study's objectives.

Results and Discussion

Characteristics of the respondents

Age of the respondents of Sadar upazila of Rangamati Hill district was ranged from 20 to 75 with an average of 43.20 years and standard deviation of 12.49. On the basis of their age, respondents were classified into three categories. Categorization of respondent according to their age showed that highest proportion of 41.67 percent were in the middle category, 20 percent were in young and 38.33 percent were in old category. In this study 13.33 percent of respondents had higher level of education whereas 22.5 percent had primary, 41.67 percent had secondary, 10 percent had college level education and 12.5 percent of them were illiterate. Family size scores of the respondents ranged from 2 to 11 with an average of 4.66 and standard deviation 1.83. Most of the respondents (55.83 percent) had small families compared to 35.83 percent medium families and 8.33 percent large families. In this study the respondents' farm size were categorized into three categories with the mean of 2.18 hectare and standard deviation of 4.76. The highest proportion of the respondents were in landless category (71.66%) compared to 20% for large and 3.33% were for marginal and medium categories, respectively. Average homestead size of the respondent of Sadar upazila of Rangamati district is 0.745 hectares with a standard deviation of 2.068. Highest proportions of respondent were in landless and marginal category (70.83%) compared to large, and small categories, respectively (25.83%, 3.33%) (Table 1a).

Most of the respondents (85.83%) of the study area had higher income according to their annual income compared to 11.67% and 2.5% had medium and low income respectively with standard deviation of 173.8 (Table 1b). The knowledge on agroforestry of the respondents ranged from 0 – 20 with 11.16 and standard deviation of 4.49, i.e, they had the medium level of knowledge on agroforestry. Socio-economic condition of the respondents was high in the studied area. Average score ranged from 7-80 with an average of 25.45 and standard deviation of 14.57. After spending from their income most of the respondents had low savings (79.17%) compare to medium (13.33%) and high savings (7.5%) per annum (Table 1b).

Relationship between the selected characteristics of the respondents with numbers of diversified plant species

This part deals with the relationship between ten selected characteristics of the respondents and the numbers of diversified plant species observed in homestead agroforestry system. The variables were age, education, family size, farm size,

homestead size, cultivable land size, annual income, expenditure, savings, knowledge on homestead agroforestry, and socio-economic conditions of the respondents.

Relationship between respondents' age and numbers of diversified plant species

The relationship between age of the respondents and numbers of diversified plant species was presented in Table 2. The result indicated that the computed r value for the diversified tree species was 0.072. It was concluded that the age of the respondents had no significant relationship with the numbers of diversified plant species. Similarly, Uddin *et al* (2021) and Rejuan *et al*. (2011) found the relationship between age of the respondents and diversified tree species which were -0.116 and 0.054 and showed statistically insignificant relationship.

Table 1a. Description of respondents' characteristics used as the study's independent variables (N=120)

Characteristics	Category	Respondent (%)	Measuring system	Observed range	Average	Standard deviation
Age	Young age (up to 30)	20.00	Years	20 - 75	43.20	12.49
	Middle age (31 to 45)	41.67				
	Old age (above 45)	38.33				
Education	Illiterate (0)	12.50	Level of Schooling	0-13	4.79	3.66
	Primary (Class I-V)	22.50				
	Secondary (Class VI-X)	41.67				
	College (Class XI-XII)	10.00				
	Above class XII	13.33				
Family size	Small family (up to 4)	55.83	Numbers	2-11	4.66	1.83
	Medium family (5 to 7)	35.83				
	Large family (8 and above)	8.33				
Farm size	Landless (<0.20 ha)	71.66	Hectare	0.0121-10.469	2.18	4.76
	Marginal (0.20-0.50 ha)	3.33				
	Small (0.50-1.00 ha)	1.67				
	Medium (1.00-3.00 ha)	3.33				
	Large (>3.01 ha)	20.00				
Homestead size	Landless and Marginal (Up to 0.02 ha)	70.83	Hectare	0.0072-2.0686	0.745	2.068
	Small (0.03 to 0.05 ha)	3.33				
	Medium (0.06 to 0.09 ha)	0.00				
	Large Above 0.09 ha	25.83				

Table 1b. Description of respondents' characteristics used as the study's independent variables (N=120)

Characteristics	Category	Respondent (%)	Measuring system	Observed range	Average	Standard deviation
Annual income	Low income (Up to 80 thousand)	2.50	Thousands taka	75.67-338.06	304.94	173.8
	Medium income (81 to 120 thousand)	11.67				
	High income	85.83				
Expenditure	Low expenditure (Up to 80 thousand)	4.17	Thousands taka	75-307.3	263.93	149.25
	Medium expenditure (81 to 120 thousand)	16.67				
	High expenditure (Above 120 thousand)	79.17				
Savings	Low expenditure (Up to 60 thousand)	4.17	Thousands taka		45.43	76.2
	Low saving (Up to 60 thousand)	79.17				
	Medium saving (61 to 120 thousand)	13.30				
	High saving (Above120 thousands)	7.50				
Knowledge on Homestead agroforestry	Low (Up to 8)	42.50	Scale score	0-20	11.13	4.49
	Medium (9-16)	47.50				
	High (Above 16)	10.00				
Socio-economic conditions	Low condition (Up to 12)	20.30	Scale score	7-80	25.47	14.57
	Medium condition (13-20)	23.33				
	High condition (Above 20)	55.83				

Relationship between education and numbers of diversified plant species

The relationship between level of education of the respondents and the numbers of diversified plant species shows that the computed value of 'r' for the diversified plant species was 0.228 indicates the significant positive correlation between education and numbers of diversified plant species (Table 2). Uddin *et al*. (2021) and Rashid *et al*. (2007) found the significant positive relationship between level of education of the respondents and diversified tree species.

Table 2. Pearson's Product Moment Co-efficient of Correlation between the dependent variable (numbers of diversified plant species) and independent variable

	Respondents' characteristics	Computed value of 'r'
Numbers of diversified plant species Vs	Age	0.072^{NS}
	Education	0.228^{*}
	Family size	-0.028^{NS}
	Farm size	0.800^{**}
	Homestead size	0.530^{**}
	Annual income	0.238^{**}
	Expenditure	0.190^{*}
	Saving	0.192^{*}
	Knowledge on homestead agroforestry	0.173^{NS}
	Socio-economic conditions of the respondents	0.155^{NS}

* Significant at 0.05 level; ** Significant at 0.01 level; NS-Non significant

***Relationship between family size and numbers of diversified plant* species**

The relationship between family size of the respondents and diversified plant species presented in Table 2 which revealed that the computed r value for family size diversified tree species was -0.028. There was negative relationship between family size of the respondents and their numbers of diversified plant species observed in homestead agroforestry. Larger families may require more space for housing, reducing the land available for agroforestry and plant diversity, while increased resource consumption may lead to a prioritization of staple crops over diverse plant species. Uddin *et al*. (2021) in Kamalganj upazila of Moulvibazar district and Begum *et al*. (2012) in Gopalpur of Tangail district also found insignificant negative relationship between family size of the respondents and diversified tree species which were -0.340 and -0.220 respectively.

Relationship between farm size and numbers of diversified plant species

The relationship between farm size of the respondents and numbers of diversified plant species regarding in homestead agroforestry presented in Table 2. It revealed that computed r values for the farm size and diversified tree species aspects was 0.80. Therefore, it was concluded that the farm land size of the respondents had a significant positive relationship with the numbers of diversified plant species. Larger farms provide more physical space for planting a greater variety of tree and plant species and can allocate specific areas for agroforestry, increasing plant diversity. Uddin *et al.* (2021) in Kamalganj of Moulvibazar district and Shabuj *et al*. (2010) in Natore district found statistically significant positive relationship between farm size of the respondents and diversified tree species which strongly support the present findings.

Relationship between homestead size and numbers of diversified plant species

The relationship between homestead size of the respondents and numbers of diversified plant species of homestead agroforestry revealed that computed r value was 0.530. Therefore, it was concluded that the homestead size of the respondents had a significant positive relationship with the numbers of diversified plant species (Table 2). This indicates that the number of plant species in a respondent's agroforestry system tends to rise dramatically in tandem with the size of their homestead. The present findings corroborated with Uddin *et al*. (2021) and Rejuan *et al*. (2011) who found significant positive relationship between homestead size of the respondents and diversified tree species.

Relationship between annual income and numbers of diversified plant species

The relationship between annual income of the respondents and numbers of diversified plant species of homestead agroforestry presented in Table 2 shows that the computed r values for the numbers of diversified tree species was 0.238. Therefore, it was concluded that family income of the respondents had a significant relationship with the numbers of diversified plant species. This implies that, although the association is not very strong, plant species variety tends to rise as family wealth does. Plant diversity may increase as a result of better income families' ability to afford seeds, saplings, fertilizer, and irrigation systems. Similarly, Uddin *et al*. (2021) and Rashid *et al*. (2007) found the relationship between income of the respondents and diversified tree species that was statistically significant positive relationship.

Relationship between Expenditure and numbers of diversified plant species

The relationship between expenditure of the respondents and numbers of diversified plant species of homestead agroforestry was examined and presented in Table 2 showed computed r values for the numbers of diversified plant species and family expenditure was 0.190. Therefore, it was concluded that the expenditure of the respondents had a significant positive relationship with the numbers of diversified plant species. Higher-income families are frequently better able to invest in fertilizers, a variety of plant species, and improved farming methods since they have more money. Expenditure often correlates with income—higher-income households typically have higher spending capacity. Since income also shows a positive relationship with plant diversity (though weak), expenditure similarly influences agroforestry diversity.

Relationship between Savings and numbers of diversified plant species

The relationship between savings of the respondents and numbers of diversified plant species presented in Table 2. The result revealed that computed r values for the numbers of diversified plant species was and savings of the family 0.192 means savings of the respondents had a significant positive relationship with the numbers of diversified plant species. Instead of focusing just on short-term agricultural crops, households with stable savings are more likely to adopt long-term agroforestry methods, such as planting fruit trees, medicinal plants, and timber species. The present findings corroborated to Uddin *et al*. (2021) who found significant positive relationship between annual savings of the respondents and diversified tree species.

Relationship between Knowledge on homestead agroforestry and numbers of diversified plant species

The relationship between knowledge on homestead agroforestry of the respondents and diversified plant species showed that the computed r values for the numbers of diversified plant species was 0.173 means knowledge on homestead agroforestry of the respondents had an insignificant positive relationship with the numbers of diversified plant species (Table 2). This suggests that other factors are more important, even when a greater awareness of agroforestry leads to a minor increase in plant species diversity. Uddin *et al*. (2021) in Kamalganj of Moulvibazar district and Rejuan *et al*. (2011) in Nakla of Sherpur district found statistically significant positive relationship between knowledge on homestead agroforestry of the respondents and diversified tree species.

Relationship between Socio-economic conditions of the respondents and numbers of diversified plant species

The relationship between socio-economic conditions of the respondents and numbers of diversified plant species of homestead agroforestry presented in Table 2 represented that the computed r values for the numbers of diversified plant species and socio-economic condition was 0.155 means socio-economic conditions of the respondents had an insignificant relationship with numbers of diversified plant species. Plant diversity may be significantly impacted by resource availability, farming knowledge, and farm size than by socioeconomic status. However, Uddin *et al*. (2021) and Sultana (2003) found statistically significant positive relationship between socio-economic conditions of the respondents and diversified tree species.

Gender participation in decision making

The percentage of male and female on decision makings in various topics such as Tree plantation, Housing, Family planning, Schooling, Saving and Expenditure, Participation in training program, Uses of agroforestry product and Agronomic crop presented in Figure 2. It revealed that males were the highest decision makers in the topic of Housing with 37.5% while female were the highest decision makers in the topics of Tree plantation, Schooling, Savings and Expenditure, Participation in training program, Uses of agroforestry product and Agronomic crop with 35%, 41.67%, 44.17%, 36.67%, 38.33% and 35.83%, respectively. The present findings corroborated the results of Singha *et al*. (2019) who reported that males were dominated for their decision on tree plantation, housing and schooling of their children in Kamalganj upazila of Moulvibazar district. In case of family planning, male, female and both male and female together made equal decision with 33.33%. Male (37.5%). were the dominant as decision makers for housing followed by female (33.33%). The findings highlight gender differences in decision-making across various household and agricultural activities in homestead agroforestry. The data suggests that men dominate decision-making in housing, whereas women have more influence over schooling, savings, expenditure, agroforestry use, and agronomic crop selection. Awal *et al*. (2000) reported the women were involved in the household decision-making process to a greater extent. The evidence would be more spectacular in aspects like family planning, education of children, poultry rearing, plantation of fruits and vegetables and marriages of sons and daughters.

Figure 2. Gender Participation on decision making in family aspects

Conclusion

There are six different characteristics of the respondents: education, farm size, homestead size, annual income, and expenditure and savings of the respondents showed significant positive correlations with the numbers and variability of plant species, but non-significant relationships were observed with age, family size, knowledge of homestead agroforestry, and socioeconomic conditions. Therefore, there is a lot of scope to improve the current traditional homestead agroforestry introducing modern plant species in order to maximize farmers' socio-economic conditions. On agroforestry production systems, the majority of respondents had a moderate to high degree of education. Therefore, it can be advised that the government and nongovernment extension service providers can make an effort to provide education, incentive programs, and efficient technology to boost homestead production. For efficient use of the homestead land with an appropriate advanced agroforestry system to maximize domestic productivity and family income, knowledge of homestead agroforestry needs to be increased.

Declaration

There is no conflict of interest among the authors of the manuscript.

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