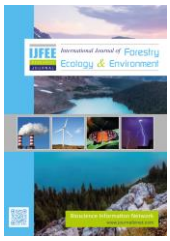
Published with Open Access at Journal BiNET
Vol. 05, Issue 01: 195-201
International Journal of Forestry, Ecology and Environment
Journal Home: https://www.journalbinet.com/ijfee-journal.html



Homestead agroforestry practices and livelihood status of farmers in Domar Upazila, Nilphamari, Bangladesh

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Article received: 15.04.21; Revised: 30.08.21; First published online: 15 September, 2021.

ABSTRACT

The study was conducted for three months from October to December, 2020 at Domar Upazila of Nilphamari District, Bangladesh, to observe the socio-economic characteristics of the farmers in the study area and explore the relationships among the selected farmers and plant species diversity. Data were collected by face-to-face interviews to know the independent and dependent variables. The independent variables were age, education, family member, total land size, homestead size, cultivable land size, fallow land size, annual income, knowledge about trees and knowledge of agroforestry, while the dependent variables of the study were plant diversity and existing agroforestry practices. The average age of farmers was about 45 years and it ranged from 19 to 70 years. A few people have education in this area and their education level ranged from 0-14 with an average of almost 05. The family size of the respondents ranged from 02-22, with an average of about 06. The farmer's farm sizes were from 03 to 990 decimals. The average homestead size was almost 18 decimals regarding ranged from 01-115 decimals. The rank of fallow land size was from 01-50 decimals, including average number of about 01 decimal. The farmer's annual income was from 24000 to 400000 Tk. while considering average no. 110430 Tk. Total 22 plant species were demonstrated in the study area, of which 03 timbers, 15 fruits, 03 medicinal, 01 non-timber were counted. Farmers recently, i.e. cultivate crops/vegetables in association with different tree species. The result concludes that there is a great scope for improving farmer's livelihood enormously by practising the agroforestry system. Agroforestry practices with proper tree-crop combinations also increase species diversity and ensure economic return.

Key Words: *Diversity, Area, Species, Practice and Systems*

Cite Article: Rana, M. S., Alam, M. M. and Sarker, M. A. (2021). Homestead agroforestry practices and livelihood status of farmers in Domar Upazila, Nilphamari, Bangladesh. International Journal of Forestry, Ecology and Environment, 05(01), 195-201.
Crossref: https://doi.org/10.18801/ijfee.050121.22

I. Introduction

Bangladesh mostly depends on agriculture and it is playing the main role to magnify the country's national economy. Almost 13.02 % of GDP comes from the agriculture sector (Bangladesh Economy

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Survey, 2019-2020). According to the BBS report, there were 165.57 million people in Bangladesh in 2019. The density of the population was 1116 per square km in the same year. The cultivable land has reduced 0.14 % and 0.73 % from 1976 to 2000 and 2000 to 2010. This type of trend may worsen in the future (Hasan et al., 2013). The contribution of agriculture is declining to the GDP. Because of the increasing population, the natural resources of the country are also depleting. According to the expert of environment science, the accepted standard is that each country should have at least 25 % of its total land area covered with forests or trees (Huda and Roy, 1990). In addition, it is not possible to satisfy the need of the community people living in the rural area because they use their land traditionally with discrete allocation for agriculture and forestry (Hanif and Bari, 2013).

Nowadays, agroforestry practices are being popular to the farmers in Bangladesh to plant trees within agricultural cultivation for a long period for getting products and developing their livelihoods. The most diversity of plants is seen at the homestead in Bangladesh. This diversity helps to control not only ecological balance but also the ecological system. The agroforestry based on horticultural trees is more common in Bangladesh than timber yielding trees (forest trees) (Hasanuzzaman and Hossain, 2015). Researching in southern Bangladesh reported that agroforestry develops the socio-economic condition of the farmers (Chakraborty et al., 2015) and their livelihood (Rahman et al., 2012) as well as ensures the different environmental services in degraded ecosystems such as sandbars (Ibrahim et al., 2011). Agroforestry practices simultaneously involve producing annual crops and perennial trees in cropland (Yasmin et al., 2010). It fulfils the socio-economic demands of the people (Sharmin and Rabbi, 2016; Chakraborty et al., 2015). Harvesting products (tree resources and food crops) from agroforestry satisfies the multidimensional demands of the rural people (Rahman et al., 2012). Trees are planted along, leaving alleyways in lines or cropland boundaries in a scattered way for annual crops (Hanif et al., 2018). Fast-growing, nitrogen fixing, small crowned and deciduous trees are often selected for planting as agroforestry species (Miah et al., 2002). Cash crops, vegetables, cereal crops, pulses and spices are cultivated in agroforestry (Chowdhury, 1997).

Agroforestry practices can improve soil fertility and water quality, control soil erosion and promote biodiversity (Garrity, 2004). It also mitigates poverty by enhancing income and employs women in the activities of production (Rahman et al., 2017; Leakey and Simons, 1998). Through carbon sequestration, it can also decrease the negative effect of climate change (Hanif et al., 2015; Nair et al., 2009). Concerning the present deficiency of fuelwood and extreme deforestation in Bangladesh, the system of homestead agroforestry is imperative to be strengthened (Leuschner and Khaleque, 1987). The northern part of Bangladesh has huge opportunities to increase agroforestry practice. For this, the present study observed the farmers' socio-economic characters, the existing agroforestry system and plant diversity as well as the effect of agroforestry on the livelihood status and to explore the correlation among the selected characteristics of the farmers and plant species diversity.

II. Materials and Methods

Location of the study area

The study was done in 2 unions (Boragari and Pangamotukpur union) of Domar Upazila in Nilphamari district (Figure 01). The area of Nilphamari district (Rangpur Division) is 1580.85 sq. km, located in between 25°44' and 26°19' north latitudes and in between 88°44' and 89°12' east longitudes. The area of Domar Upazila is 250.84 sq. km, located in between 26°02' and 26°19' north latitudes and in between 88°46' and 88°54' east longitudes. It is bounded by West Bengal of India on the north, Nilphamari Sadar Upazila on the south, Dimla and Jaldhaka Upazilas on the east, Debiganj Upazila on the west. The Upazila consists of one municipality, 10 Union Parishads, 47 Mouzas and 47 villages. The main rivers are Jamuneshwari, BuriTista and Deonai. There is coarse sand (Domar Sand) in this Upazila. The main sources of income are agriculture (68.04%), non-agricultural labourer (4.69%), industry (0.38%), commerce (12.38%), transport and communication (3.78%), service (4.28%), construction (0.97%), religious service (0.25%), rent and remittance (0.19%) and others (5.04%) (Banglapedia, 2014).

Physiography

Non-calcareous brown sandy loams to clay loams are seen in the old Himalayan piedmont plain, Tista and old Brahmaputra floodplains and locally in the old Ganges River floodplains. Soils are slight to strongly acid in reaction (BBS, 2019).

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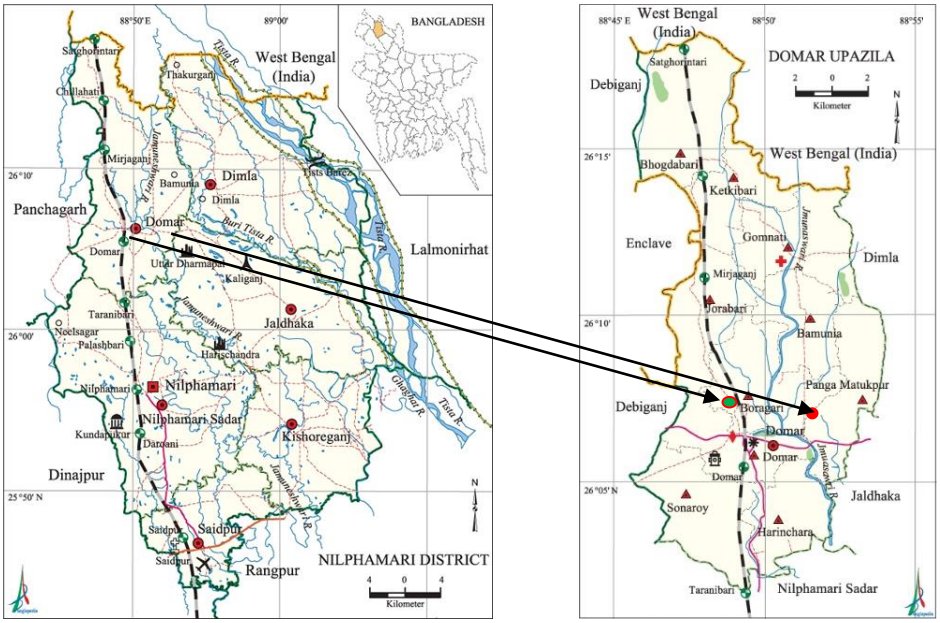

Figure 01. Location of the study area (Boragari ; Pangamotukpur **)**

Sampling procedure and Survey schedule

A simple questionnaire was asked for collecting information through a set of preliminary survey schedules from the study area. A set of preliminary survey schedules has been planned based on the main objectives of the study. Data collections were done from the selected 100 farmers during October to December, 2020. The draft schedules were pre-tested by interviewing some sample farmers by the researchers. Thus, the final survey schedule was prepared in conformity with logical sequences and necessary adjustments.

Variables of the study

Two types of variables were shown in this study area viz., dependent and independent variables. The independent variables were age, education, family member, total land size, homestead size, cultivable land size, fallow land size, annual income, knowledge about trees and agroforestry knowledge. The dependent variables of the study were plants (plant diversity) and existing agroforestry practices. The plant diversity of homestead agroforestry was found by calculating the number of tree species. As the number of tree species observed in homestead agroforestry was the main focus of the study, the researchers acquired it by visiting the study area and discussing it with farmers. Predominating observed tree species (fruits, timbers, crops, vegetables and others) was counted in homestead area and numbers expressed it.

Data processing and analysis

After data collection, the entire interview schedules data such as range, number and percentage, mean, standard deviation and rank order were used to view the objectives of the study whenever possible. Pearson's Product Moment Coefficient of Correlation (r) was also used to determine the relationship between the concerned variables. The computed values of the Correlation Coefficient (r) were compared with relevant table values. All the data analysis was done by using IBM SPSS statistical software.

III. Results and Discussion

Characteristics of the respondents

11 (eleven) characteristics were investigated viz age, education, family size, total land size, homestead size, cultivable land size, fallow land size, annual income, type of plant, knowledge about trees and knowledge about Agroforestry. Among the 100 homesteads, the age of the farmers ranged from 19 to 70, whereas the mean was about 45 (Table 01). The education average was above 05, with minimum no education (value 0) to maximum post-graduation (value 14). Regarding family size, the mean number was about 05, followed by 22 with a large family and 02 with a small family. The average total land size was almost 155 decimals, with the lowest of 03 decimals and the highest of 990 decimals.

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The mean homestead size was about 18 decimals, while the lowest land was 01 decimal and the highest land was 115 decimals following different combinations of plants. The mean cultivable size was almost 135 decimals while the lowest value was 0 and the highest value was 957 decimals with different cultivation all the year. Similarly, the average fallow land size was about 01 decimal with the lowest value of 0 and the highest value of 50 decimals without cultivation. On the other hand, the mean type of plant was almost 07, followed by 15 with the highest combination of plant variety and 02 with the lowest combination of the plant variety. The average knowledge about agroforestry was about 29 while the lowest value was 05 with a few practices of agroforestry and the highest value was 60 with a large amount practice of agroforestry. The measuring system of each characteristic, their observed range, mean and standard deviation are as follows (Table 01).

Table 01. Farmer's characteristics i.e., independent variables at Domar Upazila of Nilphamari (N = 100)

Characteristics	Measuring system	Observed range	Mean	Standard deviation
Age	Years	19-70	44.63	11.34
Education	Level of schooling	0-14	5.36	3.76
Family size	Numbers	2-22	5.66	3.24
Total land size	Decimal	3-990	155.02	185.25
Homestead size	Decimal	1-115	18.30	15.30
Cultivable size	Decimal	0-957	134.80	178.41
Fallow land size	Decimal	0-50	1.33	6.48
Annual income	Thousand	24-400	110.43	70.14
Type of plant	Number	2-15	6.94	2.18
Knowledge about tree	Score	5-55	29.45	11.99
Knowledge about agroforestry	Score	5-60	28.90	12.72

Tree species diversity

The number of tree species ranged from 2 to 15 (Table 02), with an average value of about 07 and a standard deviation of almost 02 in the homestead. Out of 22 tree species, Jackfruit, Bamboo, Betelnut, Guava, Mahogany, Eucalyptus were dominant in the homestead. The study showed that 24 percent of the respondents grew up to 5 tree species, 68 percent grew 6 to 10 tree species and 8 percent of respondents grew 11 to 15 tree species (Figure 02). Generally, farmers did not want to plant trees in their crop field for its broad canopy. Total 03 (three) timber (Eucalyptus, Mahogany, Gamar) and 03 (three) medicinal (Tentul, Neem, Simul) species were found in this study area. The 15 (fifteen) different fruit species were counted, of which Jackfruit, Betelnut and Guava were more dominant than other species. Moreover, bamboo grove was found in 68 homesteads due to early cash income.

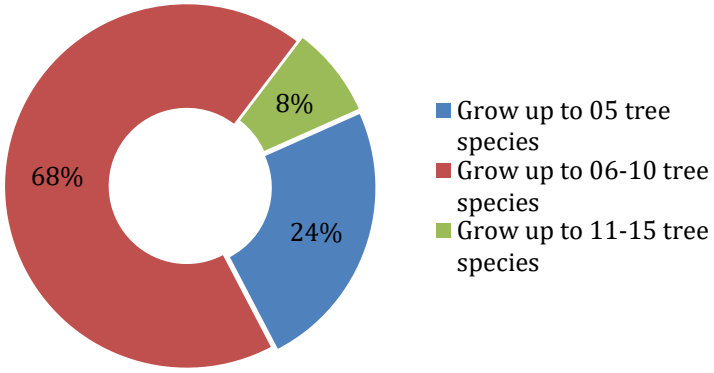

Figure 02. Percent of farmers growing different tree species in their homesteads

A similar type of research work was also done by Hanif et al. (2018) in Thakurgaon district, Begum et al. (2013) in Tangail district, Ibrahim et al. (2011) in Mymensingh district and Shabuj et al. (2010) in Natore district. Hanif et al. (2018) showed fruit (40%), fuelwood (31%) and timber (21%) percentages of different species grown by the farmers based on their usage in Thakurgaon district. Begum et al. (2013) showed 133 tree species, of which 68 timber, 28 fruit and 35 medicinal species in Tangail district. Ibrahim et al. (2011) found 45 tree species, of which nine timbers, seven medicinal, nine fuel

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or fodder and 20 fruit species. Shabuj et al. (2010) also showed 32 tree species, whereas Jackfruit, Eucalyptus, Ipil-ipil, Mango were dominant in the homestead.

Table 02. Tree species were observed in the study area

Local name	Scientific name	No. of Homestead	Uses
Eucalyptus	*Eucalyptus camelduleusis*	25	
Mahogoni	*Swetenia mahogoni*	31	Timber
Gamar	*Gmelina arborea*	02	
Tentul	*Tamarindus indica*	01	
Neem	*Azadirachta indica*	21	Medicinal
Simul	*Bombax ceiba*	02	
Mango	*Mangifera indica*	12	
Jam	*Syzygium cumini*	17	
Jackfruit	*Articarpus heterophyllus*	79	
Litchi	*Litchi chinensis*	21	
Guava	*Psidium guajava*	33	
Coconut	*Cocos nucifera*	09	
Jambura	*Citrus grandis*	22	
Papaya	*Carica papaya*	09	Fruit
Jujube	*Zizyphus jujube*	13	
Olive	*Elaocarpus floribundus*	12	
Amra	*Sponolias pinnata*	01	
Lotkon	*Baccaurea motleyana*	01	
Dalim	*Punica granatum*	01	
Betelnut	*Areca catechu*	47	
Apple	*Malus domestica*	01	
Bamboo grove	*Bambusa sp*	68	Non-timber

Agroforestry practices in the study area

The cultivation of crops/vegetables associated with different tree species was found as the rich condition in this area. Each association was used as a separate agroforestry system. Total 11 (eleven) different agroforestry systems were recorded such as (1) Eucalyptus - Chilli – Napa shak - Pat (jute) shak- Onion- Garlic based agroforestry system, (2) Betelnut - Papaya - Lau - Sweet gourd based agroforestry system, (3) Betelnut - Maize – Banana based agroforestry system, (4) Eucalyptus - Chilli – Cabbage – Cauliflower based agroforestry system, (5) Coconut- Potato - Cabbage – Cauliflower based agroforestry system, (6) Mahogoni - Napier grass - Lau - Bean – Jinga based agroforestry system, (7) Eucalyptus – Sunflower based agroforestry system, (8) Jackfruit -Lau – Turmeric – Ginger - Data shak based agroforestry system, (9) Mango – Litchi - Onion- Garlic based agroforestry system, (10) Papaya - Chilli - Carrot – Tomato based agroforestry system (11) Jambura - Kochu – Pat shak- Data – Napa shak based agroforestry system. Although farmers suffered some problems for planting tree seedling/sapling such as lack of planting materials, seedling damage by animals, specific pest infestation/infection, the high price of insecticide/pesticide, drought, lack of irrigation system, poverty etc, they are very much interested to cultivate crops/vegetables with timber or fruit tree species for greater access to food security and livelihood capitals.

Relationship between dependent and independent variables

This section was used to compare the relationship between 10 (ten) selected characteristics of the farmers and the type of plant (tree species diversity) observed in the homestead agroforestry system. The variables were age, education, family size, total land size, homestead size, cultivable land size, fallow land size, annual income, knowledge about trees and knowledge about agroforestry. Pearson's Product-Moment Coefficient of Correlation (r) was used to regard the relationship between the different characteristics of the farmers and tree species diversity. In this case, the result that there was a significant difference among total land size, homestead size, cultivable land size, fallow land size, knowledge about tree, knowledge about agroforestry with tree species diversity while no significant difference was among age, education, family size, annual income with tree species diversity. The results were as follows (Table 03).

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Table 03. Correlation between the independent and dependent variables.

Farmer's characteristics	Computed value of 'r'
Age	0.175 NS
Education	0.040 NS
Family size	0.115 NS
Total land size	0.249*
Homestead size	0.463**
Cultivable land size	0.217*
Fallow land size	0.302**
Annual income	0.162 NS
Knowledge about tree	0.358**
Knowledge about agroforestry	0.381**

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

IV. Conclusion

Agroforestry practices work as a source of fruit, medicine, timber, fuelwood, crop and vegetable and act as a medium of preventing the homesteads against all climatic conditions. The findings of the study suggest that the biodiversity of home gardens is mostly dependent on the farmers' preferences for a particular use. Moreover, now the structure and function of home gardens are gradually changing due to population growth and increasing dependency on homesteads. The farmers engaged in agroforestry have small farms; they increase food security, case income and improved livelihood status. For this, the farmers should be aware and trained with diverse vegetation practices of the home gardens. Good quality planting materials and providing small loans should also be available to the farmers to develop homestead vegetation.

Acknowledgments

We are grateful to the Regional Bamboo Research and Training Center, Bangladesh Forest Research Institute, Nilphamari for their cooperation in executing the field research activities.

References

[1]. Bangladesh Economic Survey, (2019-2020). http://www.bbs.gov.bd/Gross-Domestic-Product-(GDP)
[2]. Banglapedia, (2014). National Encyclopedia of Bangladesh. https://en.banglapedia.org/index.php/Domar_Upazila
[3]. BBS (2019). Statistical Yearbook of Bangladesh- 2019. 39th edition, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Govt. People's Republic of Bangladesh.
[4]. Begum, M., Haque, M. A., Karim, M. R., Akter, M. and Wadud, M. A. (2013). Study on Agroforestry and plant diversity in Gopalpur Upazila of Tangail district. Journal of Agroforestry and Environment, 7(1), 135-138.
[5]. Chakraborty, M., Haider, M. Z. and Rahaman, M. M. (2015). Socio-economic impact of cropland agroforestry: evidence from Jessore District of Bangladesh. International Journal of Research in Agriculture and Forestry, 22, 11–20.
[6]. Chowdhury, M. K. (1997). Agroforestry in homesteads and croplands: existing practices and potentials. In: M. K. Alam, F. U. Ahmed, S. M. R. Amin (eds.), Agroforestry: Bangladesh perspectives. Bangladesh Agricultural Research Council, Dhaka, pp. 68–84.
[7]. Garrity, D. P. (2004). Agroforestry and the achievement to the millennium development goals. Agroforestry Systems, 61, 5–17. https://doi.org/10.1023/B:AGFO.0000028986.37502.7c
[8]. Hanif, M. A., Bari, M. S. (2013). Potentiality of potato-based agri-silvicultural land-use system in the northern part of Bangladesh. Science Secure Journal Biotechnology, 2, 61–65.
[9]. Hanif, M. A., Bari, M. S. and Rahman, A. (2015). Potentiality of carbon sequestration by agroforestry species in Bangladesh. Res Crops, 16, 562–567. https://doi.org/10.5958/2348-7542.2015.00080.7
[10]. Hanif, M. A., Roy, R. M., Bari, M. S., Ray, P. C., Rahman, M. S. and Hasan, M. F. (2018). Livelihood Improvements Through Agroforestry: Evidence from Northern Bangladesh. Small-scale Forestry, Dordrecht, Netherlands, 17(4), 505-522. https://doi.org/10.1007/s11842-018-9400-y
[11]. Hasan, M. N., Hossain, M. S., Bari, M. A. and Islam, M. R. (2013). Agricultural land availability in Bangladesh. Soil Resources Development Institute, Dhaka, Bangladesh. p. 17.

Published with open access at journalbinet.com.
EISSN: 2708-5430, © 2021 The Authors, Research paper.

[12]. Hasanuzzaman, M. and Hossain, M. (2015). Leaf litter decomposition and nutrient dynamics associated with common cropland agroforest timber tree species of Bangladesh. International journal of Forestry Research, 61, 125–139. https://doi.org/10.1155/2014/805940
[13]. Huda, N. and Roy, M. K. (1999). State of the Forest. In: Q.I. Chowdhury (ed.) Bangladesh State of Environment report 1999. Forum of Environmental Journalists of Bangladesh (FEJB), Dhaka, pp. 95-100.
[14]. Ibrahim, K., Wadud, M. A., Mondol, M. A., Alam, Z. and Rahman, G. M. M. (2011). Impact of agroforestry practices on livelihood improvement of the farmers of char Kalibari area of Mymensingh. Journal of Agroforestry and Environment, 5(2), 77–80.
[15]. Leakey, R. R. and Simons, A. J. (1998). The domestication and commercialization of indigenous trees in agroforestry for the alleviation of poverty. Agroforestry Systems, 38, 165–176. https://doi.org/10.1023/A:1005912729225
[16]. Leuschner, W. A. and Khakeque, K. (1987). Homestead Agroforestry in Bangladesh. Agroforestry System, 5(2), 139-151. https://doi.org/10.1007/BF00047518
[17]. Miah, M. G., Ahmed, F. U., Ahmed, M. M., Alam, M. N., Choudhury, N. H., and Hamid, M. A. (2002). Agroforestry in Bangladesh: potentials and opportunities, Paper presented in South Asia Regional Agroforestry Consultation workshop held on 23–25 November, 2002 at New Delhi, India.
[18]. Nair, P., Kumar, K. R. and Nair, V. D. (2009). Agroforestry as a strategy for carbon sequestration. Journal of Plant Nutrition and Soil Science, 172 (1), 10–23. https://doi.org/10.1002/jpln.200800030
[19]. Rahman, M. A., Tani, M., Asahiro, K. and Ullah, S. A. (2017). Species composition, diversity and productivity of homesteads in south eastern Bangladesh. Small-Scale Forestry, 16(3), 295–309. https://doi.org/10.1007/s11842-016-9356-8
[20]. Rahman, S.A., Imam, M.H., Snelder, D.J., Sunderland, T. (2012). Agroforestry for livelihood security in Agrarian landscapes of the Padma floodplain in Bangladesh. Small-Scale Forestry, 11(4), 529–538. https://doi.org/10.1007/s11842-012-9198-y
[21]. 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. Journal of Agroforestry and Environment, 4(2), 133-136.
[22]. Sharmin, A. and Rabbi, S. A. (2016). Assessment of farmers' perception of agroforestry practices in Jhenaidah District of Bangladesh. Journal of Agriculture and Ecology Research International, 6(4), 1-10. https://doi.org/10.9734/JAERI/2016/21760
[23]. Yasmin, R., Wadud, M. A., Mandol, M. M. A. and Sharif, M. O. (2010). Tree diversity in the homestead and cropland areas of Madhupur Upazila under Tangail District. Journal of Agroforestry and Environment, 4(1), 89–92.

HOW TO CITE THIS ARTICLE?

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Rana, M. S. et al, "Homestead agroforestry practices and livelihood status of farmers in Domar Upazila, Nilphamari, Bangladesh". International Journal of Forestry, Ecology and Environment, 05(01) (2021): 195-201.

APA
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