

Ecosystem Service Preference of Forest People: A Study in Madhupur Sal Forest of Bangladesh

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ABSTRACT

This study investigated the ecosystem service preference of forest people in Madhupur Sal forest and the factors contributing to their preference towards those services. Data were collected through a personal interview with 230 respondents with four focus group discussions. Majority of the respondents comprised ethnic people (the Garo) of the region. Findings revealed that the majority of the respondents (89.8%) possessed moderate to high knowledge regarding ecosystem service. They identified 16 ecosystem services where 'Forest identity', 'Crop cultivation', and 'Maintenance of social relation' were perceived as the top services. The ecosystem service preference differed among respondents of different locations of the forest where people living inside the forest and living 1-2 km of forest appreciated cultural service most. The variation observed in service preference among different ethnic groups and Garo Sangsharek community's preference towards ecosystem service was much higher than the other two communities (Garo Christian and Bengali). Results of multiple regression analysis showed that respondents' age, ecosystem service knowledge, residence distance from forest, and forest dependency were the contributing factors that influenced their preference towards ecosystem services. The research results offer relevant information that is helpful for ecosystem-related studies in Bangladesh.

Keywords: Bangladesh, Ecosystem, Forest, Madhupur, Preference.

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I. INTRODUCTION

Forest ecosystems are considered one of the most important sources of biodiversity and ecosystem services. Rural people are much dependent on them for their daily requirements and more psychological and abstract reasons. Food, fuelwood, fiber, freshwater supply, and other benefits that people gain from these ecosystems are recognized as ecosystem services [1]. These ecosystem services are essential for underprivileged rural people's livings, mainly those in developing countries. Despite that, today's modern economy influences forest modification and agricultural intensification ultimately threatens the sustainable supply of these ecosystem-based services. This phenomenon is remarkably common in developing countries like Bangladesh. During the past few decades, the country's forest area diminished from almost 20 to 9% [2], [3].

Bangladesh was enriched with forest resources even several decades ago; population pressure leads to the rapid degeneration of forest reserves. Sal forest of Bangladesh, widely distributed in Dhaka, Tangail, Mymensingh,

Dinajpur, Rangpur is experiencing such degradation [4]–[6]. This forest covers a land area of 124,500 ha, which is 0.81% of the country's total land and 7.80% of the country's forest area. Unfortunately, 38% of this Sal Forest has already encroached, and poor-quality stands are remaining [4]. Such human interferences result in biodiversity loss from the forest with consequent effects on their structure, ecological functions, and services provision. Climate change, biodiversity degradation, and pollution are diminishing forest's ability to supply services that ensure human needs and food security. While deriving economic benefits or adjusting to environmental changes human societies are altering ecosystems [7], [8].

Madhupur Sal forest which is considered the third largest forest in Bangladesh was once home to countless species including medicinal plants, fruit trees, uncultivated vegetables, herbs, and creepers. Now it has been altered into gardens of rubber and fuelwood, banana, pineapple, turmeric, and papaya. Over the last two and a half decades, the forest land has undergone massive changes that were environmentally detrimental. The natural forest has been vanished along with its rich biodiversity, causing

immeasurable and possibly permanent loss to the environment. The invasive and exotic species, particularly eucalyptus and acacia were sown by the Forest Department cutting away thousands of Sal coppices [2]. According to Millennium Ecosystem Assessment (MEA) [9], the destruction of forest negatively affects the availability of ecosystem services, which has an adverse impact on humans' livelihood [10].

The loss of the natural forest has also devastated the life and livelihood of the Madhupur forest's ethnic people (the Garo). The 'Garo' have been thought of as the earliest residents of the Madhupur forest originally immigrated from Tibet. Sangsharek is the traditional religion of the Garo people, but because of their insecurity and economic hardship, the majority have converted to Christianity, and very few have adopted Islam. Women play a crucial role as primary wage earners in the matriarchal Garo society by exploiting forest's natural resources. But the degradation of the natural Sal Forest, which has become severe after the liberation war of Bangladesh, has made their task difficult [11]–[14]. Though different scientific studies have focused Madhupur Sal forest from ecological or conservation perspectives, there are no studies that linked the ecosystem services and local people's preference towards those services. These studies neglected forest residents' knowledge of those services and the aspects that influenced their service preferences. Bearing the above situation in mind, the study was conducted to explore the ecosystem service preference of the forest people, and the factors contributing to their preference towards those services.

II. METHODOLOGY

A. Study Site

The research was carried out in forest regions of Madhupur Upazila in Dhaka Division (Fig. 1). The location was selected purposively due to the abundance of Sal forest cover.

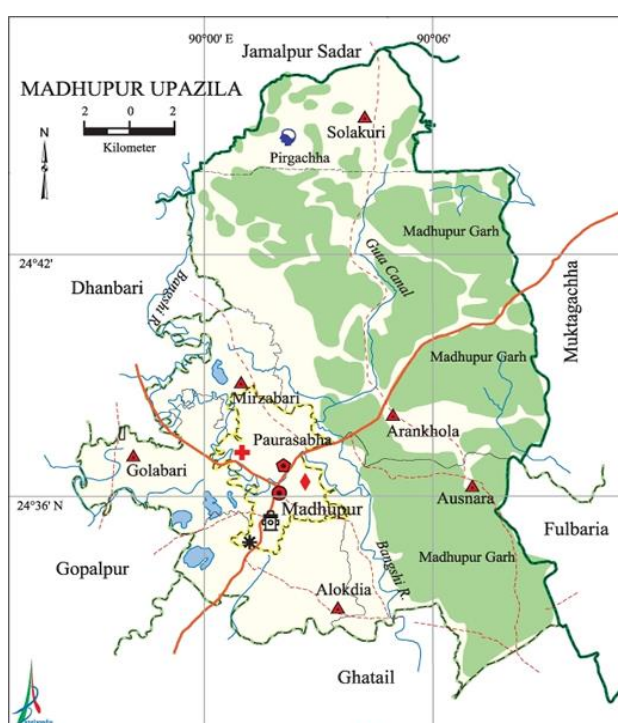


Fig. 1. Map of Madhupur Upazila (Study site).

B. Research Design

The survey-based, descriptive-diagnostic research design was applied. Existing ecosystem services were explored with the aid of three Focus Group Discussions (FGD). Both ethnic and non-ethnic inhabitants of the forest were selected as participants with an average of 8-10 people for each group. The data from the respondents were gathered through an in-person interview approach using a semi-structured interview schedule. All the people directly or indirectly depended on the Madhupur Sal forest were the population of the present study. A sample of 230 respondents was chosen using a proportionate random sampling procedure from the neighboring villages of the forest area.

C. Measurement of Dependent Variable

The preference (satisfaction) of the respondents towards ecosystem services was the dependent variable of this study. Following focus group discussions to determine the ecosystem services, prominent ecosystem services were identified based on the respondents' extent of perceived satisfaction towards those services using a four-point scale. Score 4, 3, 2, and 1 were assigned for not at all (NA), slightly satisfied (SS), moderately satisfied (MS), and very satisfied (VS) satisfaction levels, respectively. Based on the extent of satisfaction, the services were ranked. A Satisfaction Index (SI) was calculated by using the following formula [15]:

$$\text{Satisfaction Index (SI)} = \text{NA} \times 1 + \text{SS} \times 2 + \text{MS} \times 3 + \text{VS} \times 4 \quad (1)$$

D. Measurement of Independent Variables

The independent variables of the present study were age, education, ecosystem service knowledge, residence distance from the forest, access to the forest, and forest dependency.

A respondent's age was calculated in years based on the actual age of his life. The number of classes completed was used to measure educational status. To calculate the knowledge score, a number of ten (10) questions related to ecosystem service were asked to respondents, for each question, score two (2) was assigned for a correct answer, one (1) for a partial answer, and zero (0) for incorrect answer. Similar types of calculation systems were also adopted by other researchers, like Mahamud *et al.* [16] and Hasan *et al.* [17]. Weight for responses to the ten questions of a respondent was added together to get his knowledge score which could range from 0 to 20. Based on the knowledge score, the respondents were classified (Mean±SD) as slightly knowledgeable (<3.81), moderately knowledgeable (3.82–8.82), and highly knowledgeable (>8.82). Respondents' residence distance from the forest was measured in km. For measuring access to the forest, scores 1, 2, and 3 were assigned for no access, occasional access, and living inside the forest where the score increases with their increasing access to the forest. Similarly, in the case of forest dependency, scores 1, 2, and 3 were assigned for not dependent, slightly dependent, and completely dependent where the score increases with their increasing dependency on the forest.

E. Factors Contributing to Respondents' Ecosystem Service Preference

To determine the attributes influencing the respondents' ecosystem service preference, all the independent variables were subjected to full-model regression analysis by the following equation:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k + \dots + \varepsilon \quad (2)$$

where, y is the probability of ecosystem service preference: $X_1, X_2, \dots, X_n$ indicate the independent variables such as age, level of education, ecosystem service knowledge, residence distance from the forest, access to the forest, and forest dependency, while $\beta_1, \beta_2, \dots, \beta_n$ are regression coefficients of the independent variables. β_0 is constant.

The Statistical Package for Social Science (SPSS) was used to analyze the data, and statistical tests such as frequency count, percentage, and mean were conducted. The relationship between the dependent and independent variables was examined using 0.10, 0.05, and 0.01 level probability.

III. RESULTS AND DISCUSSION

Data presented in Table I revealed that most percentage of the respondents (77.8%) of the study area were male while the remaining were female. The Garo Christian community constituted the highest proportion (80%) of the respondents. The more than 50 years of age category constituted the highest proportion of the respondents (33.3%) followed by the 31 to 40 years of age category with an average of 48.60 years. Through their study, [10] found similar types of findings, that is, the average age of the respondents was 46.22. Furthermore, another study in Bangladesh concluded that the younger farmers usually had more social and mass media contact and that they had a broader viewpoint [18]. The highest proportion of the respondents (44.4%) had no education followed by respondents with secondary-level education. The study location is located in a far-off region of the district Tangail with poor infrastructure and most of the respondents were local 'Garo' community are ethnic minority community. This region's general educational environment and infrastructure were different from those in other regions. Hence, the educational level of the general people was not up to the mark. [19] also found similar types of results regarding education when they conducted their research in the tribal area of Bangladesh. Most percentage (67.6%) of them denoted farming as their main occupation followed by business. Though a significant portion of them (70%) resided inside the forest, more than half of the respondents (53.7%) did not rely on the forest for income. Most percentages of the respondents (52%) had occasional access to the forest with slight dependence (63%). The majority of the respondents (89.8%) possessed slightly to moderately favorable knowledge regarding the ecosystem services of Sal forest.

A. Ecosystem Service Knowledge of the Respondents

Ten questions were utilized to judge respondents' knowledge score on ecosystem services that are presented with their rank order in Table II.

TABLE I: INDIVIDUAL CHARACTERISTICS OF THE RESPONDENTS

Characteristics	Categories	Frequency	%	Mean
Gender	Male	179	77.8	
	Female	51	22.2	
Ethnicity	Garo Christian	184	80	
	Garo	14	6	
	Sangsharek	32	14	
	Bengali	23	10.2	
Age	21-30	23	10.2	48.60
	31-40	75	32.4	
	41-50	55	24.1	
	>50	77	33.3	
Education	No education	101	44	
	Primary	41	18	
	Secondary	71	31	
	SSC and above	16	7	
Occupation	Farming	153	67.6	
	Business	34	14.8	
	Service	5	1.9	
	Student	2	0.9	
	Homemaker	26	11.1	
	Day labor	5	1.9	
	Unemployed	5	1.9	
Source of income	Other than forest	124	53.7	
	Forest centered	83	36.1	
	Both	23	10.2	
Residence distance from forest	Inside forest	160	69.4	
	1-2 km	40	17.6	
	3-5 km	21	9.3	
	6-8 km	9	3.7	
Frequency of access to forest	No access	45	19.4	
	Occasional access	120	51.9	
	Frequent access	66	28.7	
Dependency on forest	Not dependent	64	27.8	
	Slightly dependent	144	63.0	
	Completely dependent	21	9.3	
Ecosystem service knowledge	Slightly knowledgeable	23	10.2	6.32
	Moderately knowledgeable	154	66.7	
	Highly knowledgeable	53	23.1	

Table II indicated that respondents' top-ranked knowledge measuring question was 'Mention four reasons behind forest destruction' (Score=144) followed by "Name four existing plant species available in the forest" (score=133) and "Mention four services of the forest" (Score=129).

Knowledge scores of a respondent regarding ecosystem service ranged from 0 to 20, with an average of 6.32. Based on knowledge scores, the respondents were classified into three categories as shown in Table III.

It is seen from Table III that the highest proportion (66.7%) of the respondents were moderately knowledgeable followed by highly (23.1%) and slightly knowledgeable (10.2%). The majority of the respondents (89.8%) possessed a moderate to a high level of knowledge regarding ecosystem service. It was due to the majority of the respondents were forest inhabitants, so they possessed considerable knowledge regarding forest services. Similar types of findings were also obtained in several studies in Bangladesh by [17]. A greater understanding and knowledge of ecosystem services can help a person feel more capable of combating environmental deterioration. Another Bangladeshi study by [20] emphasized

that knowledge usually assisted to expand one's responsiveness and mental alertness.

TABLE II: DISTRIBUTION OF THE KNOWLEDGE QUESTIONS
ACCORDING TO RANK ORDER

Questions	Score	Rank
1. Mention four reasons behind forest destruction.	144	1
2. Name four existing plant species available in forest.	133	2
3. Mention four services of the forest.	129	3
4. Mention four existing animal species of the forest.	67	4
5. Name two disappeared plant species available in forest.	52	5
6. Mention two disappeared animal species of the forest.	45	6
7. What do you mean by forest co-managements?	41	7
8. What do you mean by Ecosystem Service?	38	8
9. What do you mean by Ecosystem?	23	8
10. What do you mean by eco-tourism?	19	8

TABLE III: DISTRIBUTION OF THE RESPONDENTS ACCORDING TO THEIR
KNOWLEDGE LEVEL

Categories	Frequency	Percent	Mean	SD
Slightly knowledgeable	23	10.2		
Moderately knowledgeable	154	66.7	6.32	2.5
Highly knowledgeable	53	23.1		
Total	230	100.0		

B. Ranking of Identified Ecosystem Services

To identify the top services, respondents were interviewed individually. They were asked to express their extent of preference for those services. Based on their extent of preference, ecosystem services were ranked as presented in Table IV.

Table IV showed that forest identity was the most satisfying ecosystem service which ranked first scoring 807 followed by crop cultivation (2nd), maintenance of social relations (3rd), maintenance of traditional culture (4th), and edible plant (5th). On the whole religious belief, business, and tourism ranked 14th, 15th, and 16th with a minimum score.

These findings revealed that cultural and provisioning services were prominent in the study area, and respondents were mostly satisfied with those services. In Assam, India, [21] observed almost similar types of findings. They found that the respondents of the study area were mostly satisfied with provisioning and supporting services.

The preference for ecosystem service differed among respondents of different locations of forest (Fig. 2.). This figure showed that cultural service was the most appreciated (preferred by more than half of the respondents) ecosystem service category between inside forest and 1–2 km group. However, regulating was the most satisfying category between 2–5 km (46.25%) and 6–8 km (37.50%) respondent groups. From the figure, it is obvious that preference towards ecosystem service was gradually decreasing with increasing distance to the forest.

The variation observed in service preference among different ethnic groups presented in Fig. 3. Findings revealed that all categories of the services were most preferred by 'Garo Sangsharek' community followed by Garo Christian. Exception found in regulating service where Bengali

community (46.67%) preferred regulating service slightly more than Garo Christian people.

TABLE IV: PREFERENCE BASED RANKING OF ECOSYSTEM SERVICES

Ecosystem Services	Score	Rank
Forest identity	807	1
Crop cultivation	711	2
Maintenance of social relation	679	3
Maintenance of traditional culture	609	4
Edible plant	466	5
Fuelwood collection	454	6
Mental peace	449	7
Maintenance of soil fertility	443	8
Pollution free environment	424	9
Forest beauty	394	10
Wildlife habitat	383	11
Medicinal plant	371	12
Livestock ranching	341	13
Religious belief	298	14
Business	241	15
Tourism	230	16

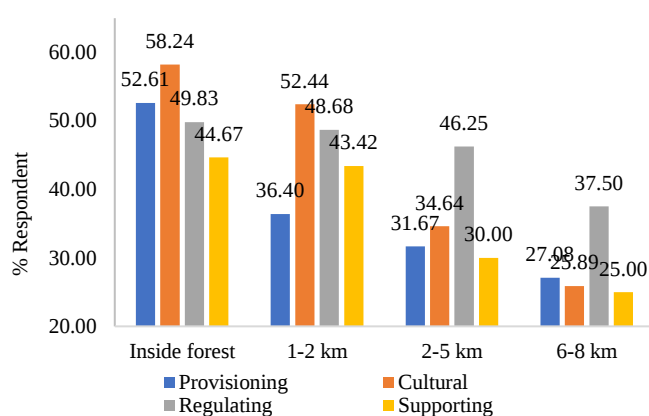


Fig. 2. Variation of ecosystem service preference based on location.

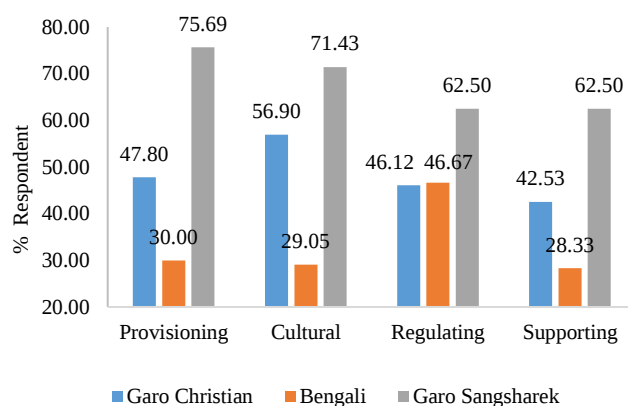


Fig. 3. Preference given to ecosystem service by different ethnic group.

As the 'Sangsharek' community was the main inhabitants of Sal forest and most of them lived inside the forest, it was easier for them to get access to the forest services. So, their preference towards ecosystem service was much higher than the other two communities. Garo Christian were also forest people but in recent decades, they were getting detached from the forest due to the advancement of technology, less attachment to their traditional lifestyle by a new generation, and better livelihood opportunities in urban areas. In contrast, Bengali community had less access to and attachment to the forest, they hardly perceived the importance of ecosystem services of the forest.

C. Factors Influencing Respondents' Preference towards Ecosystem Services

To determine the factors influencing the respondents' preference towards ecosystem services, six independent variables were subjected to regression analysis. Regression results in Table V indicated that a number of four out of six characteristics- age, ecosystem service knowledge, residence distance from forest, and forest dependency showed a significant contribution towards ecosystem services preference.

TABLE V: RELATIONSHIP BETWEEN INDIVIDUAL CHARACTERISTICS OF THE RESPONDENTS AND THEIR PREFERENCE TOWARDS ECOSYSTEM SERVICES

Characteristics of the respondents	Coefficient β	t value	p (significant)
1. Age	0.122*	1.788	0.077
2. Education	0.035	0.483	0.630
3. Ecosystem services knowledge	0.163**	2.193	0.031
4. Residence distance from forest	-0.476***	-5.509	0.000
5. Access to the forest	0.051	0.558	0.578
6. Forest dependency	0.241***	2.620	0.010

R=0.782, R²=0.61, Adjusted R²=0.59, Value of F=26.541 *p<0.1 **p<0.05, and ***p<0.01.

The model seems to have good fitness as indicated by R-square. R² value was 0.61, which revealed 61.0% of the variation in the preference towards ecosystem services. The adjusted R² (which is the measure of goodness of fit of the estimated regression model) value of 0.59 indicated a good fitting of the model.

The multiple regression analysis (Table V) results explained that age showed a positive and significant contribution toward ecosystem services preference. This characteristic was significant at the 10% level. The regression coefficient 'b=0.122' showed that one unit increase in age would increase respondents' preference towards ecosystem services by 0.122 units. That means if the age of the respondents increased it would positively change their preference. A study in Bangladesh [22] also found a similar type of contribution of age on the respective variables.

Ecosystem services knowledge showed a positive and significant contribution toward service preference. This characteristic was significant at the 5% level. The regression coefficient 'b=0.163' showed that one unit increase in the knowledge would increase respondents' preference towards ecosystem services by 0.163 units. That means if the knowledge of ecosystem services of the respondents increased it would positively change their preference. A study in Bangladesh conducted by [23] also found that knowledge had a significant contribution to their respective variables.

Residence distance from the forest showed a negative and significant contribution towards ecosystem services preference. This characteristic was significant at the 1% level. The regression coefficient 'b=-0.476' showed that one unit increase in the distance would decrease respondents' preference towards ecosystem services by 0.476 units. That means the higher the distance from the forest the lesser the preference towards ecosystem services.

The respondents' forest dependency showed a positive and significant contribution toward their ecosystem services

preference. This characteristic was significant at 1% level. The regression coefficient 'b=0.241' showed that one unit increase in dependency would increase respondents' preference towards ecosystem services by 0.241 units. That means the higher the dependency on forests the higher the preference towards ecosystem service.

IV. CONCLUSION

A total number of 16 ecosystem services were identified in Madhupur Sal forest. Forest identity was the most preferred ecosystem service followed by crop cultivation (2nd) and maintenance of social relation (3rd). The preference of the respondents towards ecosystem service was gradually decreasing with their residence distance to the forest. Variation was observed in service preference among different ethnic groups and Garo Sangsahrek community's preference towards ecosystem service was much higher than the other two communities (Garo Christian and Bengali). Results of multiple regression analysis indicated that respondents' age, ecosystem service knowledge, residence distance from forest, and forest dependency were the contributing factors that influenced their preference towards ecosystem services.

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CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

REFERENCES

- [1] Ahammad R, Stacey N, Sunderland TCH. Use and perceived importance of forest ecosystem services in rural livelihoods of Chittagong Hill Tracts, Bangladesh. *Ecosystem Services*. 2019; 35: 87–98.
- [2] Islam MS, Roy S, Khanom S, Islam M. Deforestation and biodiversity degradation in Madhupur Sal forest at Tangail region. *Khulna University Studies*. 2013; 11(1): 219–223.
- [3] Muhamad D, Okubo S, Harashina K, Gunawan B, Takeuchi K. Living close to forests enhances people's perception of ecosystem services in a forest-agricultural landscape of West Java, Indonesia. *Ecosystem Services*. 2014; 8: 197–206.
- [4] Alam, M, Furukawa Y, Harada K. Agroforestry as a sustainable land use option in degraded tropical forests: A study from Bangladesh. *Environment, Development and Sustainability*. 2010; 12(2): 147–158, 2010.
- [5] Kibria MG, Saha N. Analysis of existing agroforestry practices in Madhupur Sal forest: an assessment based on ecological and economic perspectives. *Journal of Forestry Research*. 2011; 22(4): 533–542.
- [6] Abdullah, HM, Golam M, Mezanur MR, Ahmed T. Monitoring Natural Sal Forest Cover in Modhupur, Bangladesh using Temporal Landsat Imagery during 1972-2015. *International Journal of Environment*. 2015; 5(1): 1–7.
- [7] Gouwakinnou GN, Biao S, Vodouhe FG, Tovihessi MS, Awessou BK, Biao HS. Local perceptions and factors determining ecosystem services identification around two forest reserves in Northern Benin. *Journal of Ethnobiology and Ethnomedicine*. 2019; 15(1): 1–12.
- [8] Hasan MK, Huda N, Akter R, Islam MT. Effects of human disturbances on vegetation parameters and soil nutrient status in the Madhupur Sal

- forest of Bangladesh. *Journal of Agriculture and Rural Development*. 2018; 10(2): 43–55.
- [9] MEA, Ecosystems and Human Well-Being: Synthesis, Washington, DC: Island Press, 2005.
- [10] Saha S, Hasan SS, Haque ME, Ahamed T. Perception Based Assessment of Ecosystem Services of Madhupur Sal Forest in Bangladesh. *European Journal of Agriculture and Food Sciences*. 2021; 3(1): 39–44.
- [11] Dey S. Deforestation and the Garo Women of Modhupur Garh, Bangladesh. *Asian Women*. 2008; 24(3): 57–81.
- [12] Muhammed N, Chakma S, Masum MF, Hossain MM, Oesten G. A Case Study on the Garo Ethnic People of the Sal (*Shorea robusta*) Forests in Bangladesh. *International Journal of Social Forestry*. 2011; 4(2): 197–211.
- [13] Jalil MA, Oakkas MA. The Family Structure and Cultural Practices of Garo Community in Bangladesh: An Overview. *Himalayan Journal of Sociology & Anthropology*. 2012; 5: 95–100.
- [14] Islam KK, Hyakumura K. Forestland concession, land rights, and livelihood changes of ethnic minorities: The case of the Madhupur Sal forest, Bangladesh. *Forests*. 2019; 10(3): 1–21.
- [15] Uddin M, Bokelmann W, Entsminger JS. Factors affecting farmers' adaptation strategies to environmental degradation and climate change effects: A farm level study in Bangladesh. *Climate*, 2014; 2(4): 223–241.
- [16] Mahamud TA, Hasan SS, Ghosh MK, Chakma P. Assessing farmers' awareness towards climate change in the middle part of Bangladesh. *Malaysian Journal of Society and Space*. 2022; 18(1): 1–14.
- [17] Hasan SS, Hossain M, Sultana S, Ghosh MK. Women's Involvement in Income Generating Activities and Their Opinion About Its Contribution: A Study of Gazipur District, Bangladesh. *Science Innovation*. 2015; 3(6): 72–80.
- [18] Hasan SS, Mohammad A, Ghosh MK, Khalil MI. Assessing of Farmers' Opinion towards Floating Agriculture as a Means of Cleaner Production: A Case of Barisal District, Bangladesh. *British Journal of Applied Science & Technology*. 2017; 20(6): 1–14.
- [19] Chakma P, Hasan SS, Rafiquzzaman SM, Alam MJ. Farmers' attitude towards ponds and creeks use in some selected hilly areas of Bangladesh. *European Journal of Agriculture and Food Science*. 2021; 3(5): 16–22.
- [20] Ghosh MK, Hasan SS, Haque ME, Uddin MJ. Knowledge of farmers to sustainable agriculture practices: A case study in Southwestern region of Bangladesh. *Scholars Journal of Agriculture and Veterinary Sciences*, 2020; 7(1): 5–12.
- [21] Deka S, Tripathi OP, Paul A. Perception-based assessment of ecosystem services of Ghagra Pahar forest of Assam, Northeast India. *Geology, Ecology, and Landscapes*. 2018; 3(3): 197–209.
- [22] Ghosh MK, Hasan SS, Fariha R, Bari M, Parvin MA. Women Empowerment through Agriculture in Chapainawabganj, Bangladesh. *European Journal of Agriculture and Food Sciences*. 2021; 3(1): 153–160.
- [23] Hasan SS, Roy S, Saha S, Hoque MZ. Assessment of the Farmers' Perception on Vermicompost as Waste Management Practice and Economic Return in Some Areas of Bangladesh. *European Journal of Agriculture and Food Sciences*. 2021; 3(3): 14–20.