Farmers’ Perception towards Forest Ecosystem Services and Human Well-being


ABSTRACT

Bandaran hill district is one of the main hilly areas of Bangladesh which is surrounded by forests and enriched with ecological resources and biodiversity. Ecosystems sustain, generate for, regulate, and offer cultural services that are essential to human well-being. Hence, it is important to recognize the current situation of forests’ ecosystem services available in the Bandaran hill district with the local farmers’ realization of the well-being they receive from those ecosystem services. Through the present study, it was investigated the available ecosystem resources in some two hilly upazilas of Bandaran district, the farmers’ perception towards those ecosystem services and human well-being and also farmers’ socioeconomic characteristics which influence their perception. To investigate these, 80 respondents were interviewed through the help of a semi structured interview schedule. The findings of the study suggested that 28 ecosystem services were identified and six out of these were showing increasing trend including crop and vegetable cultivation and other 22 were following decreased. The respondents received improve to moderate services from those 28 ecosystem services which were exhibited through their perception as 68% of them had moderate to improve perception towards ecosystem services. According to the study’s findings, respondents who had higher levels of education, family income, agricultural training, residential distance from forests, and income from ecosystem services had better perceptions of ecosystem services and human well-being. Because the residents’ perceptions would make them aware of the need to conserve the forest environment, policymakers should base future decisions on the findings of this study.

Keywords: Ecosystem services, farmers’ perception, forest, human well-being.

I. INTRODUCTION

The human being receives different services from the earth’s ecosystem which is also known as ecosystem services and they are entirely reliant on these ecosystems [1]. Low-income rural households are more reliant on ecosystem services than ordinary households are in practically all contexts [2], [3]. In addition to being crucial for preserving natural harmony, ecosystem services also have a significant positive economic impact on human society [4], [5]. Rural residents, especially those in countries that are developing, rely heavily on the resources and services that natural ecosystems contribute to the environment [6], [7]. The various services that people receive from the forest environment are referred to as forest ecosystem services. Despite this, the ability of local and global humans to live is seriously endangered by the degradation of ecosystems caused by humans, including that of forests, wetlands, and agricultural areas. According to the Millennium Ecosystem Assessment, human well-being includes the essentials of a good life (livelihood, food, shelter, clothing, and access to goods), as well as physical and mental health, harmonious social relationships (social cohesion, mutual respect, and the capacity to help others), security (access to resources, personal safety, and security from disasters), and freedom of choice (the ability to pursue personal goals) [8]. Access to manufactured, human, and social capital acts as a mediator in the link between ecosystem services and human well-being. Ecosystem services are important for human well-being, but it also depends on the availability and caliber of social capital, institutions, and technology. These elements, which are still debatable and poorly understood, mediate the connection between ecosystem services and human well-being. Human well-being and ecosystem services have a nonlinear relationship.

Forest resource conservation is essential to for continuing good ecosystem services as currently, forest ecosystem services is found to deteriorating because of human activities that have affected on the Earth’s environment [9]. It is exhibited [10] that, implementing community participation has been viewed as a direct conservation strategy to restore degraded natural ecosystems and environments. According to scholars like, [11], it is impossible to protect natural systems without acknowledging or taking into account the perceptions and attitudes that people have about the environment. Hence, to (re)design more sustainable farming systems, it is crucial to take into account the perceptions of farmers. Farmers manage their systems as a whole and have extensive and

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priceless experimental information about them. On the other hand, scientists still view ES as distinct entities [12], [13]. The research on the ES framework [1] has focused mostly on supplying services and the monetary valuation of these services. The social-cultural valuation of ES, which is particularly important for the numerous supporting, regulating, and cultural ES [14]-[16], has, however, received relatively little investigation. According to [17], local people's perceptions of ecosystem services are crucial for both assessing the socio-cultural aspect of ecosystem services and ensuring behavioral compliance with management and policies. It can be helpful to understand these perceptions and attitudes in order to make effective conservation and management strategies more long-term sustainable and sensitive to the human well-being [18], [19]. Humans have complex moral and social values underlying their attitudes toward the environment, and as a result, these values shape (at least some of) their environmental concerns. Decision-making can also be significantly influenced by perceptions of the environment.

The Bandarban district is a part of Bangladesh's Chattogram Hill Tracts (CHT), a region with a variety of topography in the country's southeast [20]. The forest is crucial to the economy of the indigenous people living in the CHT since it supports their religious, cultural, and economic practices [21]. Deforestation and land degradation brought on by agriculture and other activities are the two main threats to hilly areas. This circumstance contributes to the emergence of socioeconomic issues and a vulnerable hillside environment including loss of ecosystem services [22]. Due to changes in land use and cover, the natural resource base of CHT has gotten worse [23], [24].

Farmers’ understanding of ecosystems is valuable for the management of farming system and the provision of ecosystems [25]. Some of the previous studies (like, [12], [26] have recognized that there is a lack of studies available which address farmers’ perception and management of ecosystem services. In order to continue changing their management, farmers also look back and reflect on the ES provided to ascertain their perception of it. There is a dearth of research on the farmers’ perception towards ecosystem services and human well-being in the CHT areas of Bangladesh. Therefore, we conducted this specific research for figuring out different ecosystem services as well as the farmers’ perception towards those ecosystem services in the Bandarban district of Bangladesh and also to trace the existing situation of those ecosystem services. Moreover, we also determine the socio-demographic characteristics of the farmers and the contribution of those characteristics on the perception of ecosystem services and human well-being.

II. METHODOLOGY

A. Study Location

Ruma upazila of Bandarban district is a distinct and inaccessible area of Bangladesh and its total area is 493 km². Ruma is surrounded by Rowangchari upazila at North side, Thanchi upazila at South side, Bilaichari upazila at east side and Bandarban Sadar and Lama upazila at west side. Sangu is the only rive which is seen in this area. While Thanchi is another hilly area, and its total area is 1021 km². Thanchi is surrounded by Ruma and Bilachari upazila at northern part, Mynamar at Eastern and Southern part, Ruma and Rwangchari upazila at Western part and Lama and Alikadam upazila at Western part. Like Ruma, Sangu is the only river of this upazila. A map shows the study location (Fig. 1) below.

We selected two unions from each upazila. These were Remacri union of Thanchi upazila, and Paindu union of Ruma upazila of Bandarban district. We conducted survey for collecting data from the respondents from these unions.

B. Research Design and Sampling

While understanding the perception of the local farmers towards forest ecosystem services and human well-being some selected areas of the Bandarban district, we deployed descriptive survey research design. We also selected the farmers of those unions who performed their agricultural activities in the forest area to collect data and a list of all those farmers were collected from the local upazila Department of Agricultural Extension (DAE) office. Total number of such farmers were around 410 in those two unions who were considered as the population of this study. Out of these 410 farmers, a total number of 80 farmers (20% of total population) were selected as the sample of this study following proportionate random sampling technique. Then we administered personal face-to-face interview by utilizing a pre-structured interview schedule.

C. Selection of Independent Variables and Their Measurement Technique

After reviewing previous literatures, we choose a total number of ten independent variables and these were respondents’ age, educational attainment, family size, total land holding, family annual income, agricultural training received, respondents’ home distance from forest, forest distance from nearby highways, ecosystem products sell price, and earnings from ecosystems. We measured those independent variables based on their nature. Based on the actual age of the respondent's life, the respondent's age was determined in years. Education level was determined by the number of classes taken. The total number of people in the family, including the respondent's spouse, kids, and

Fig. 1. Map showing the study areas (a. Ruma upazila; b. Thanchi upazila).
additional family members who shared a residence, was used to calculate the size of the family. A respondent's total land area includes their homestead, farmland, leased land, mortgaged land, hilly land, etc. Acres were used to express these land areas. The total annual family income of a respondent in the research area was calculated using his earnings from all businesses, services, and other sources. The total number of agriculture-related training sessions a respondent attended from various organizations served as a measure of the training. The respondents' homes' actual distance in kilometers from the forest and the distance of the woodland from surrounding roadways were measured. The respondents gathered various things from the forest ecosystems, used some of them, and then offered others for sale. As a result, the sell price of ecosystem products and ecosystem earnings were determined in actual BDT earned.

D. Selection of Dependent Variables and Its Measurement Technique

The dependent variable for this study was "farmers' perceptions toward ecosystem services and human well-being." To ascertain this, we asked the local farmers to respond to 21 statements about ecosystem services and human well-being. The perceptions of the respondents were therefore rated on a 5-point Likert scale (strongly agree, agree, uncertain, disagree, and strongly disagree) as follows: strongly agree (5), agree (4), uncertain (3), disagree (2), and strongly disagree (1). Similar types of measurement techniques were used by some other Bangladeshi researchers, like, [27]-[29].

E. Measurement Technique of the Respondents’ Perception towards Ecosystem Services and Human Well-being

We followed a simple two-step method and designed an ecosystem services and human well-being perception index (ESHI) according to the following (1):

\[ \text{ESHI} = \sum_{j=1}^{21} \sum_{m=0}^{1} \sum_{q=0}^{1} E_j R_{m} W_{q} \]  

(1)

The sample respondents read a total of 21 perception statements about ecosystem services and human well-being, and their opinions were solicited \((E)\). Then, for each perception that was acknowledged, we assigned a value of 01; otherwise, we assigned 0. The respondents were given a score of 05 for each strongly agreeing opinion and a score of 01 for each strongly disagreeing opinion when they asked to express their opinions on a five-point scale \((R_m)\) in the second phase. These ranks were then transformed into a weighted score \((W_q)\). Then, 01 was given the highest rank of 05 and 02 was given the lowest rank of 1. While the weighted score was added up to determine the ESHI for each responder. Some other studies also used this formulation and equation like, [30], [31].

F. Multiple Linear Regression Procedure

To identify the variables influencing respondents’ perceptions of ecosystem services and human being, we used full-model regression analysis on nine independent variables (respondents’ age, educational attainment, family size, total land holding, family annual income, agricultural training received, respondents’ home distance from forest, forest distance from nearby highways, and earnings from ecosystems). Due to the nature of the dependent variable, we proceeded to apply the linear regression model. Consequently, the latent equation (Equation 2) employed in this study was:

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \ldots + \beta_6 x_9 + \varepsilon \]  

(2)

where, \(y\) was the dependent variable, \(\beta_0\) was the intercept, \(\beta_1-9\) was the coefficient, and \(x_1-9\) was the independent variables.

The independent variables that influenced the respondents’ perceptions of the ecosystem services and human well-being were:

- \(X_1 = \) Age of the respondents;
- \(X_2 = \) Educational attainment of the respnd.;
- \(X_3 = \) Family size of the respondents;
- \(X_4 = \) Respondents’ total land holdings;
- \(X_5 = \) Family annual income of the respnd.;
- \(X_6 = \) Respondents’ agril. training received;
- \(X_7 = \) Respondents’ home distance from forest;
- \(X_8 = \) Forest distance from nearby highways;
- \(X_9 = \) Earnings from ecosystems;

All of these statistical analyses were done by SPSS software.

III. RESULTS AND DISCUSSION

A. Identification and Current Situation of the Ecosystem Services in the Study Area

We conducted two focus group discussions (FGDs) in the two upazila, i.e., Thanchi and Ruma at the community level with ten participants each for identifying the forest ecosystem services present in those areas and recognized a total number of 28 ecosystem services (Fig. 2).

Both tribal and non-tribal farmers were present in those two FGDs. Out of these 28 services, 14 services were in provisioning services, 07 in cultural services, 04 in regulating services and the rest of 03 in supporting services.
B. Current Situation of Forest Ecosystem Services

We also figured out the trends of change of these ecosystem services. Data furnished in Fig. 3 exhibited that out of 28 ecosystem services, a total number of only 06 services were found to have an increasing trend and the other 22 services followed decreasing trend.

The ecosystem services which followed the increasing trend were crop cultivation, vegetables production, opportunities for education-research, tourism, religious belief, and agriculture and forest related business. Population of those areas are increasing and for supplying different demands of these increasing population can exert pressure on the existing ecosystem services. Saha et al. [17] conducted a study in the Madhupur Sal forest in Bangladesh and concluded that speedy population growth, industrialization, increasing pollution and also practicing monocropping was responsible for decreasing ecosystem services in the Madhupur Sal forest.

C. Respondents’ Perception towards Ecosystem Services and Human Well-being

As it was mentioned earlier that for measuring the respondents’ perception towards ecosystem services and human well-being, we utilized 21 statements related to ecosystem services and human well-being and then we combined the individual scores for each of these 21 statements. The perception score was therefore scored from 21 to 105, with 21 denoting "very low perception" and 105 denoting "very high perception". Although, the observed perception score was varied from 60 to 100 with a mean and standard deviation as a “rule of thumb” and calculated the respondents’ perception towards ecosystem services and human well-being into three categories, namely, lower perception, moderate perception and improve perception. We observed that several authors, like, [32], [33] used similar method of classification of perception in their respective studies. The findings are depicted in Fig. 4.

Data furnished in Fig. 4 exhibited that 53% respondents had improve perception towards ecosystem services and human well-being, while 32% of them had lower perception. Whereas, 15% respondents had moderate perception ecosystem services and human well-being. Hence, it is shown that 68% respondents had moderate to improve perception towards ecosystem services and human well-being.

Through their study in Madhupur Sal forest, Bangladesh, [17] concluded that the ‘Garo’ respondents of that area were living in the forest for a long time. Due to their extended stay in the forest, they were able to build an intense connection with the environment, which contributed to shape their distinctive social and cultural structure. Over time, those forest dwellers had a more favorable perception of ecosystem services than people in other places.

D. Socioeconomic Characteristics of the Respondents

Data presented in Table 1 showed that 52.5% respondents’ age were less than 30 years while 40% of them were in between 31-40 years of age. Yet, the average age of the respondents 31.23 years which suggested that they were somewhat younger in age. In a study in Bangladesh, [34] discovered that younger farmers have more social exposure and possess a broader perspective. Concerning the educational attainment of the respondents, we see that, 80% of them were secondary to SSC level educated, while, 17.5% of them were more than SSC level educated.
The findings also indicated that cent percent of the respondents were educated which exhibited a good sign of education level of the country. The highest percentage (62.5%) of family size of the respondents was 4 to 5 and average family size of the respondents was 5.02 which indicated a higher average family size than the national average of 4.06 [35]. About 97.5% of the respondents had marginal to medium sized land (0.05-7.41 acres), although, the average land size of them was 2.19 acres. Most percentage (52.5%) of the farmers family annual income were 50000-100000 BDT and their average income was 94675 BDT. This indicated that out of nine independent variables, educational attainment, family size, total land holding, family annual income, agricultural training received, respondents’ home distance from forest, forest distance from nearby highways, and earnings from ecosystems). The computed regression results exhibited in Table II indicated that out of nine independent variables, educational attainment, family annual income, agricultural training received, home distance from forest, and earnings from ecosystems were to have significant contribution towards perception. The R2 value of 0.745, which demonstrated that 74.5% of the variation in the perception of ecosystem services with human well-being, suggested that the model appears to have good fitness. Following is a discussion of Table II that details the contributions of the selected factors on the respondents’ perception.
mean that if the respondents’ home was far from the forest, their concern towards ecosystem services was lower. Through a study in Bangladesh, Saha et al. [44] also found that residence distance from the forest area had negatively significant contribution towards ecosystem service preferences of the respondents. Accordingly, earnings from ecosystem services of the respondents were found to have significant positive influence on the perception towards ecosystem services and human well-being. The β value was 0.328 which was significant at 01% level. The findings indicated that if the respondents received more earnings from the ecosystem services, then, ultimately, their perception towards ecosystem services and human well-being would be improved.

IV. CONCLUSION

On the basis of the previous discussions, the following conclusions were drawn:

1. Through this investigation 28 different ecosystem services in total were found. Out of them, it was discovered that 06 services had an increasing tendency while the other 22 had a declining trend. A key aspect in the declining trend of these services was the rising demand brought on by the growing population in the study area. Although 32% of farmers had a lower assessment of how forests contribute to human well-being and ecological services, 68% of farmers had a moderate to improve perception. Farmers who had lived close to forests for a long time had a better perception of ecosystem services than those who had moved to more remote locations.

2. The average age of farmers was roughly 32 years, and more than half of them (52.5%) were under 30. Eighty percent of them had completed secondary to SSC level schooling, and their typical family size was five. They had farms that were 2.19 acres in size on average, and 80 percent of them had taken one to five agricultural training courses. Approximately 88% of farmers lived within 1 to 5 km of a forest, and the average distance between a forest and the closest highway was 5.50 km. The business associated to agriculture and forest service had discovered to follow a growing trend since the respondents received an average of 40609 BDT each year from various ecosystem services. These could produce a favorable view of ecosystem services and human well-being among the respondents in the study area.

3. The results of the regression analysis suggested that the main variables influencing the farmers’ perceptions of ecosystem services and human well-being were their educational level, family annual income, agricultural training received, home distance from forests, and income from ecosystem services. This implies that people perceive ecosystem services more favorably the higher these traits are.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare that are relevant to the content of this article. All the authors have consented to the publication.

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