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Research Article

SOCIOECONOMIC STATUS AND INCOME DETERMINANTS FOR TRANSBOUNDARY SEMI-FILLED RIVERINE HABITANTS OF SUNAMGANJ, BANGLADESH

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ABSTRACT

The study was conducted to evaluate the socioeconomic status (SES) of Damalia semi-filled riverine residents in Biswambarpur Upazila, Sunamganj District, Bangladesh, who were affected by different disasters, especially drought in the dry season and flash flood in wet season. The information was gathered from secondary sources (government and non-governmental organizations) as well as primary sources (interviews, questionnaire surveys, and individual and group discussions) from July to December 2023 and analyzed using IBM Statistical Package for the Social Sciences software through descriptive statistics, frequency and percentage frequency, Chi-square test, and multiple linear regression models. According to the study, 33.33% of the habitants were illiterate, and the rest of them were primary to higher educated, as well as maximum inhabitants (93.8%) were Muslims and the rest of them were Hindus in religion. Around 50% of the respondents earned money from farming and the rest from business, jobs, fishing, and others; whereas 31.25% of households made semi-pucca houses, and 79.20% had sanitation facilities. The respondent's annual income, age, and land area on average were 17252.29 Tk, 40.25 years, and 1.12 acres, respectively, and their main drinking water source was tube well (84%). About 49.00% and 47.90% of the respondents were in medium to low social statuses, and the overall living opportunities score of 0.368 means that their SES was low in these areas. The respondent's number was decreasing significantly ($p \leq 0.05$) with increasing education level, income level, and social status. The income of the respondents increased significantly ($p \leq 0.05$) with an increase in education level, women's participation in the work, electricity, and drinking water availability. The study concludes that the overall SES was low, highlighting the need for government and institutional support to improve their access to education, healthcare, income, employment opportunities, infrastructure, and natural resources.

Keywords: Socioeconomic status, Riverine habitants, Income source, Living opportunity, Polluted water, Modern technique, Income determinants.

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INTRODUCTION

Economic development is facilitated by social development. The distribution and availability of freshwaters found in riverine systems have had a significant impact on socioeconomic and political development. A healthy river may support local livelihood activities such as fishing, tourism, and transportation and hold significant esthetic, cultural, and religious values (Alston and Mason 2008). This river is now dominated by upstream flow and anthropogenic activity and is subjected to continuous exposure to domestic effluents and waste disposal from riverside establishments. Riverbank erosion and environmental degradation are major issues in Bangladesh today, and they are becoming worse every day (Islam *et al*., 2017). There are about 700 rivers in Bangladesh (Ahmed *et al*., 2017). Out of 57 transboundary rivers, 54 share with India, and three share with Myanmar (Ahmed *et al*., 2017); and out of 54 transboundary rivers, four rivers present in Sunamganj district, such as Jadukata, Damalia, Nawagang, and Umium rivers. Among these four rivers, the Dhamalia river comes from Shillong, India. Within Bangladesh, this river is partially filled up by hilly erosion and siltation (Rahman *et al*., 2017); and it is completely dried in winter, but water flows in monsoons that cause flash floods and cause unfertile land for sand filtration, eroded riverbank houses, and damage to vegetables and crops as well. The people lost their fishing opportunity, communication, and irrigation facilities in the dry season and were hampered by flash floods in the wet season for river filled up by siltation (Islam, 2023). According to Williams (1988), rivers that "run dry" and intermittently cease-flow are seen to be more indicative of river systems across the world than those that flow continuously. Due to changes in land use, climate change, and increased human water extraction, these impermanent rivers are a worldwide phenomena (Larned *et al*., 2010) and are probably going to grow (Meehl *et al*., 2007; Palmer *et al*., 2008).

The quality of water in these rivers is changing and getting worse every day (Islam et al., 2017). Urbanization, the dumping of agricultural waste, and the increasing utilization of chemicals in soils, ponds, and agricultural fields all contribute to the degradation of river water quality, harming human health, the environment, and living things (Akhie and Dipta, 2018). Clogged riverbanks, obstacles to water movement, and solid waste from residential areas, animal waste, night soil, sewage systems, and household trash all affect the river's health. Unplanned urbanization, agrochemicals, household garbage, sewage systems, coal, and ash from brick fields have all had an adverse effect on the water quality of rivers, causing all living things to die and destroying the food chain (Akhie and Dipta, 2018). It turns into a serious illness that affects both human health and the environment (Wikipedia, 2019). Another problems of these rivers are affecting their livelihoods are the illiteracy rate, insufficient number of educational institutions and poor communications and transportation systems (Khanum, 2013). Poor healthcare facilities and the insufficient number of hospitals in the riverine regions make life more difficult for the riverine habitants (Ahmed et al., 2021). The most common natural disaster in these regions is flooding, which alters livelihood by upsetting agricultural productivity and ecosystems, increasing water pollution, and destroying local transportation networks, all of which seriously impair local economies and plans for reducing poverty (De Clerck et al., 2006). Therefore, the social sector, which includes sub-sectors such as access to education, medical and health care, housing, and water supply, is critical to their economic development. The overall problems highlighted the need for sustainable river's dredging and public awareness building by government and non-government organizations to improve socioeconomic status (SES).

SES refers to an individual's or family's position in society or country, based on their cultural possessions, income, and participation in

community activities, reflecting their overall social and economic status (Chapin, 1928). It addresses a wide range of human needs. The basic necessities of life, such as drinking water, reproduction, shelter, and warmth, may be considered human needs. According to Bhattacharya (Bhattacharja, 2014), socioeconomic condition is a comprehensive measure of an individual's or family's economic and social position, influenced by factors such as income, education, and occupation. The socioeconomic situation of the population in a given area is included in the standard of living. Understanding the local people's economic activity and variety requires an understanding of their socioeconomic situation (Islam, 2020). The economic status of fishers in Sunamganj is poor due to decreasing land, insufficient monthly income, and a socio-economic status that did not reflect the overall economic progress in Bangladesh (Hossain *et al*., 2020). Promoting health, education, employment, and infrastructure development are crucial for a reasonable living standard, which relies on access to suitable farming activities with qualified water and soil. Land and water degradations in extreme northeastern Bangladesh have persisted for a long time, but SES of households has not been scientifically observed. Hence, a scientific way for finding SES and earning determinants of household owners are important in the Damalia riverine areas of Sunamganj. Therefore, the research was undertaken to determine the SES and earnings determinants, where both social features and other pollution impacts will be used to find the living standard in these areas.

METHODS

Study area

The transboundary riverine areas of the Dhamalia river under Biswambarpur Upazila of Sunamgonj District of extreme northeastern Bangladesh were selected for assessing the SES of the habitants (Figs. 1 and 2); those were living in the riverbank areas.

Determination of sample size

The sample size was modified for a designated population (Kothari, 2004), after calculating it for an infinite population. The sample size for an infinite population was calculated by following equation:

$$n_0 = \frac{z^2_{\alpha/2} pq}{d^2} \quad (1)$$

The sample size for an infinite population, population proportion, margin of error, and z score was presented by no, p, d, and z in equation one. The population proportion was assumed to be 50%, margin of error usually 4–10% and Z score is estimated to be 1.96, depending on the confidence level (95%).

For Biswambarpur Upazila, the total households were 29336 (BBS, 2015); then, the sample size was calculated (96.67=97) from the finite population (29336) by following the equation:

$$n = \frac{n_0}{1 + (n_0 - 1)/N} \quad (2)$$

Finally, we determined the sample size for 29336 populations as 96 purposively along with the Damalia riverbank areas.

Study design

Ten villages near the Dhamalia river in Biswambarpur Upozila were purposively selected (Fig. 2). About 29,336 household heads (BBS, 2015) as the population, 96 household heads were randomly selected as a sample, and a reserve list of 15 was prepared for interviews in the absence of respondents of the original list. A semi-structured questionnaire was used for the interview, which includes various socioeconomic parameters. Farming activities questionnaire parts were designed with ten questions; whereas every main question has three to five sub-questions for judging SES. Similarly, thirty modern technique questions were used to judge the respondents about their living status. A preliminary questionnaire was developed and pretested with selected farmers, with some parts improved and rearranged, and then, the finalized questionnaire was logically arranged for easy response by respondents, ensuring a comprehensive understanding of the study's objectives. The interview schedule initially focused on local units, later adapted to national/international standards, and selected respondents were personally interviewed from July to December 2023 for reliable data. The study's objectives were explained to respondents with the help of local leaders before interviewing for getting their full cooperation without hesitation. The schedule was verified for accuracy, and new questioning methods such as focus group discussions and key informant interviews were explored as the interview progressed. Secondary data and related information were gathered from various sources, including the Department of Atomic Energy, fisheries and forest departments, literature, and study reports.

Estimation of the factors affecting the income of the respondents

In the multiple linear regression models, Y is a dependent variable, which takes the log of monthly income. This dependent variable was regressed by ten explanatory variables, including six dummy variables (i.e., fishing boat, participation of women in work, membership with local fishing or other organization, non-governmental organization (NGO) membership, electricity available, and drinking water available). The general multiple linear regression models can be written as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + u \quad (3)$$

Where, Y = Log of monthly income; β_0 = Intercept; X_1 = Age (years); X_2 = Level of education (year of schooling); X_3 = Fishing boat (0 = no, 1 = yes); X_4 = Family size (number); X_5 = Farm size (in acre);

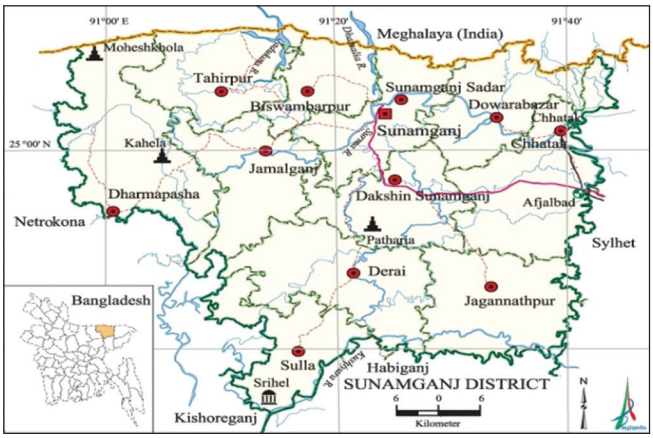

Fig. 1: Transboundary rivers at Sunamganj District, Bangladesh

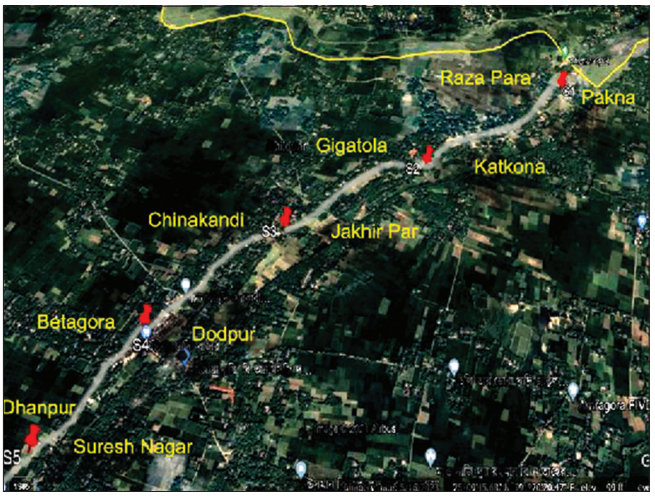

Fig. 2: Damalia riverbank areas for survey data

X_6 = Participation of women in work (0 = No, 1 = Yes); X_7 = Membership with local fishing or other organization (0 = no, 1 = yes); X_8 = NGO membership (0 = No, 1 = Yes); X_9 = Electricity available (0 = No, 1 = Yes); X_{10} = Drinking water available (0 = No, 1 = Yes); β_1 = Coefficients of independent variables; u = Error term.

Measuring respondent's SES

The questionnaire contains short-answer questions about personal and socioeconomic information such as name, education, age, address, income, and farming, which were measured using the ordinary method. Farming activities are focusing on crop cultivation, fishing, and other living opportunities, by asking ten questions with three to five sub-questions for judging SES. Farmer's responses were measured against ten statements, with a possible score range of 0–1, with 0 indicating zero living opportunity and 1 indicating full living opportunity. Respondents were assessed on their social status by answering thirty modern technique questions categorized into three categories. They were also measured, on their living status by their opinions on different techniques, with scores ranging from 0 to 30, indicating low to high status. Finally, the respondents were classified into three categories based on their living standard as low level (score below 11), medium level (score 11–20), and upper level (score above 20) of status.

Data analysis

The data were analyzed using IBM Statistical Package for the Social Sciences program (version 22). General descriptive statistics, frequency and percentage frequency, Chi-square test, and multiple linear regression models were used in this research. Arc GIS (version 10.4.1) and remote sensing techniques were also used. Pearson Chi-square test was used to find the categorical variations of socioeconomic characteristics. The relationships between two qualitative variables were found using Chi-square test (test of independence). Multiple linear regression models were used to find the income determinants of the respondents.

RESULTS

Socioeconomic situation of the respondents

The SES of transboundary Damalia riverine habitants with respect to different characteristics such as education, sex, religion, marital status, family size, household type, and latrine type were presented in Table 1. Households were divided into five categories to assess the educational status of riverine inhabitants (Dey, 2008). The study revealed that most transboundary Damalia riverine inhabitants were primary educated, with 33.33% being illiterate. Only 1.03% were highly educated, 13.54% were secondary level passed, and 5.20% were higher secondary level passed. Primary level access is now free, where 46.90% habitants were primary level passed. Most of the habitants (93.80%) were Muslim, and only 6.2% habitants were Hindus in this study. The study categorized families into three groups: 1–3, 4–5, and 5 members+. The majority (46.9%) belonged to the 5 members+group, followed by 37.5% to the 4–5 group and 15.6% to the 1–3 group. The study involved both male and female respondents, with 86.5% being male and 13.5% being female, for better results. The majority of the respondents were married, around 81.20%, but only 18.80% respondents were unmarried. The housing status was poor, with 41.66% Kucha houses made of tin and wood, 31.25% semi-pucca, and 27.08% made of straw, shon, and mud. Dissimilar result was found in the case of fish farmers (Siddiqua *et al*., 2019) that only 5% of the respondents have a kucha house. The majority of latrine facilities were open, around 45.80%, but only 33.3% of sanitary latrines, and 20.80% of households lacked latrine facilities. From Chi-square test (Goodness of fit test), it was found that categorical numbers were significantly ($p<0.001$) unequal in all socioeconomic characters with respect to the Damalia riverine inhabitants individually (Table 1).

Table 1: Characteristics of the household's respondents of riverbank areas

Characteristics of household's respondents	Damalia riverine habitants (n=96)	
	Number (%)	p-value
Education		
Illiterate	32 (33.33)	0.000[a]
Primary	45 (46.9)	
Secondary	13 (13.54)	
Higher secondary	5 (5.2)	
Higher	1 (1.0)	
Religion		
Muslim	90 (93.8)	0.000[a]
Hindus	6 (6.3)	
Others	00 (00)	
Family size		
1–3 members	15 (15.6)	0.001[a]
4–5 members	36 (37.5)	
More than 5 members	45 (46.9)	
Gender		
Male	83 (86.5)	0.000[a]
Female	13 (13.5)	
Marital status		
Married	78 (81.20)	0.000[a]
Unmarried	18 (18.80)	
Widow	00 (00)	
Divorce	00 (00)	
Household type		
Semi Pucca	30 (31.25)	0.010[a]
Kuccha with tin, wood, etc.	40 (41.66)	
Kuccha with straw, Shon mud, etc.	26 (27.08)	
Latrine type		
Open	44 (45.8)	0.011[a]
Sanitary	32 (33.3)	
Attached to biogas plant	00 (00)	
No latrine	20 (20.8)	

[a]Chi-square test (Pearson Chi-square test)

The Damalia riverine populations were categorized into low (0–80000 Tk/year), medium (80001–190000 Tk/year), and high (above 190,000 Tk/year) income categories, based on income-generating activities like larger l and ownership, business activities, and job services, despite limited land size and business facilities. The survey indicates that a significant percentage of respondents fell into the middle income category about 50.00%. The highest income earners were 15.63%, while the lowest were 34.38%. The average annual income was (147,252.29±94387.66) Tk. The majority of transboundary Damalia riverine inhabitants (46.9%) were middle-aged (30–45 years), with 18.8% being young (<30 years) and 34.4% being old (>45 years), with an average age of 40.25 years. In other research (Hossain *et al*., 2019), it was found that most of the fishermen at 31–40-year age group, which was more or less similar to the present one. Land ownership and housing conditions are crucial indicators of a society's wealth and poverty, affecting its living standard. Land is essential for building houses and producing crops. The study classified land ownership into small (<0.5 acre), medium (0.5–1.5 acres), and large sizes (>1.5 acres). Small landowners comprised 54.2%, while middle and large landowners were 25.0% and 20.8%, respectively. The average land area of inhabitants was 1.12 acres (Table 2).

Social status of the habitants

The study classified social status into low, medium, and high levels, with the majority of inhabitants falling into low (47.9%) to medium (49.0%) levels, with the minimum number of inhabitants in high (3.1%) levels (Table 3). The categories of social status were significantly ($p<0.001$) unequal in the Damalia riverine habitants individually.

Income versus education relationship of the habitants H

Table 4 presents the education levels of transboundary Damalia riverine inhabitants in relation to income categories. It showed that most of them were in low to medium income categories with illiterate and primary education levels, where higher and higher secondary educated

Table 2: Annual income, age, and land amount of the respondents of riverbank area

Characteristics of household's respondents	Damalia riverine habitants (n=96)	
	Number (%)	Mean±standard deviation
Income		
Low (0–80000)	33 (34.38)	147252.29±94387.66
Medium (80001–190000)	48 (50.00)	
High (above 190000)	15 (15.63)	
Age		
Young (<30)	18 (18.8)	40.25±10.62
Middle (30–45)	45 (46.9)	
Old (>45)	33 (34.4)	
Land area		
Small (<0.5 ace)	52 (54.2)	1.12±1.46
Medium (0.5–1.5 acres)	24 (25.0)	
Large(>1.5 acres)	20 (20.8)	

Table 3: Social status of the respondents of riverbank areas

Social statuses	Damalia riverine habitants (n=96)	
	Number (%)	p-value
Low (0–10)	46 (47.9)	0.000[a]
Medium (11–20)	47 (49.0)	
High (21–30)	3 (3.1)	

[a]Chi-square test (Pearson Chi-square test)

Table 4: Income versus education relationship of the respondents of riverbank areas

Education levels	Income categories of Damalia riverine habitants		
	Low	Medium	High
Illiterate	10	15	7
Primary	18	23	4
Secondary	3	8	2
Higher Secondary	2	2	1
Higher	0	0	1
Chi-square test (test of independence)	0.031[a]		

inhabitants in all income categories being comparatively low. In the Damalia riverine areas, low to medium income category habitants were high with primary education level and low (0) with higher education level. From this study, it was also found that the higher educated habitant with high income level was low in the Damalia riverine areas (Table 4); therefore, the relationship between income levels to education levels was significant (p≤0.031).

Social status versus education relationship of transboundary riverine habitants

Table 5 presents the relationship between social statuses and education levels in transboundary Damalia riverine habitants. Primary-educated inhabitants with low-to-medium social statuses were high, while higher and higher secondary levels educated inhabitants with high social status were low. The majority of illiterate and primary-educated inhabitants with low-to-medium social statuses were high in these areas. The respondent's numbers were increasing with decreasing social status and education level significantly (p≤0.001).

Social status versus income relationship of the respondents

The low-to-medium social statuses of the respondents with relation to income levels like low to medium were high in the Damalia transboundary riverine habitants shown in Table 6. The respondents of high social status with relation to different income levels were very low at the same habitants. Above 96% of respondents belonged to

Table 5: Social status versus education relationship of the respondents of riverbank areas

Education levels	Damalia riverine habitants (n=96)		
	Social statuses		
	Low	Medium	High
Illiterate	13	17	2
Primary	27	17	1
Secondary	2	11	0
Higher Secondary	3	2	0
Higher	1	0	0
Chi-square test (test of independence)	0.001[a]		

Table 6: Social status versus income relationship of the respondents of riverbank areas

Income categories	Damalia riverine habitants (n=96)		
	Social statuses		
	Low	Medium	High
Low (below 80000)	20	11	2
Medium (80001–190000)	18	29	1
High (above 190000)	8	7	0
Chi-square test (Test of Independence)	0.001[a]		

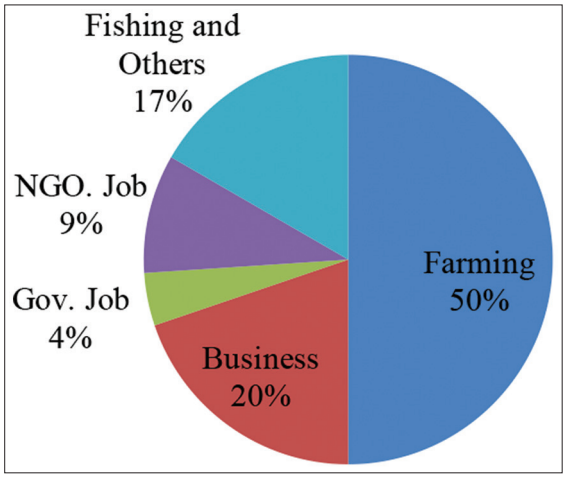

Fig. 3: Income sources of the respondents

low-to-medium social status with relation to different income levels in Damalia riverine habitants. The respondent's numbers were decreasing with increasing income level and social status significantly (p≤0.001).

Income sources of the habitants

In the study area, the respondents earned 50% of their money from farming activities, such as agriculture, poultry, and dairy. They also earned 17% of money from other activities such as fishing, car driving, helping, laboring, coal, wood, and sand collecting from the rivers and boat driving wages. Similarly, they earned 20% of money through business purposes. On the other hand, they got money 4% from the government jobs and 9% from non-government jobs (Fig. 3).

Drinking water sources of the respondents

The provision of clean and safe drinking water is considered to be the most valuable element in the society (Tellegen *et al*., 1996). Lack of drinking water hinders the development of a local economy and the removal of social marginality (Pasiak, 1995). The study revealed that 84% of respondents drank water from tube wells, while 1% collected

water from taps, 6% from protected wells, and 9% from unprotected wells and other sources (Fig. 4).

Respondent's activities related to polluted water for improving SES

The mean scores of respondent's activities related to polluted water are presented in Table 7. The improved environmental safety had the highest mean score (0.88), followed by decreased public wealth (0.19), income generating and saving (0.40), increased modern technology use (0.75), it makes family life painful (0.14), increased crop cultivation (0.52), physical aspects of the house (0.23), increased fish cultivation (0.00), increased waterborne diseases (0.17) and improved public health (0.41), respectively. The overall mean score of living opportunities was 0.368±0.175, which indicates that the SES was low in these areas.

Every main activity has 3–5 sub activities, where main activities mean score range will be 0–1.

Frequency distribution of the respondents for using modern technique

The respondent's percentages of those who used modern diurnal household techniques were presented in Table 8. Most of the respondents used an aluminum/plastic-made sieve, plastic bucket, frying pot, and plastic pot/small box. Among the respondents, at least 5.2% used hot pot in the Damalia riverine areas, followed by the use of aluminum- made pressure cooker, flux, and floor rug (7.3%). Table 9 shows the respondent's percentages for using transportation, regression, and furniture techniques. Around 83.3%, 67.7%, 53.1%, and 50.09% of the respondents used plastic tool/rack, wood that with mattress, electric fan, and television, respectively. Almost 4.25%, 5.2%, and 6.3% of the respondents used vehicles, cassette players, and cooking stoves. The respondent's percentages used health, environmental, and social techniques are presented in Table 10. Around 84% of the respondents used tube well water. Most of the respondents (74%, 70%, and 75%) used toilets with water cisterns and had memberships in cooperative societies and leadership of any society. Among the respondents, at least 3.1% used packaging materials/bagging.

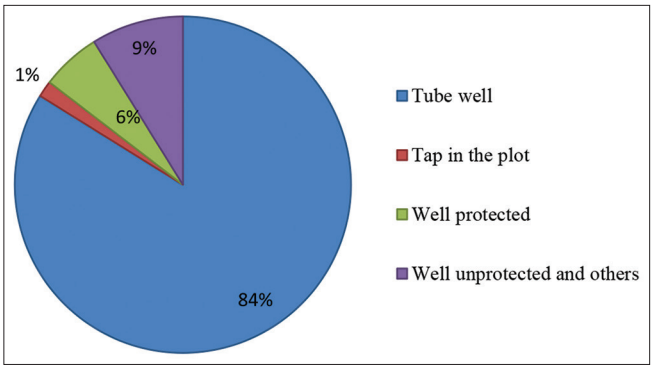

Fig. 4: Drinking water sources of the inhabitants

Table 7: Respondent's activities related to polluted water for improving socioeconomic status (n=96)

Activities of Damalia riverine habitants (living opportunities)	X±S
1. Income generating and saving	0.40±0.09
2. Increased water-borne diseases	0.17±0.07
3. Increased fish cultivation	00.00
4. Increased crop cultivation	0.52±0.23
5. Improved environmental safety	0.88±0.09
6. Increased modern technology use	0.75±0.19
7. Improved public health	0.41±0.43
8. Decreased public wealth	0.19±0.32
9. It makes family life painful	0.14±0.19
10. Physical aspects of the house	0.23±0.27
Overall	0.368±0.175

Factors affecting the income of transboundary riverine habitants

The income of the respondents can be influenced by various factors, such as the level of education, women participation in the work, electricity available, and drinking water available. To analyze these factors, a multiple linear regression model was carried out in this study, and a summary of the findings is presented in Table 11. The results revealed that the level of education of the respondents had a positive and significant effect on their income. Specifically, the income of the respondents increased by 0.9%, with 1 year increased in their level of education. It is also revealed that there was 6.3% increase in the income for every one woman participation increase in the work significantly

Table 8: Frequency distribution of the respondents using modern diurnal household techniques

Modern diurnal household techniques	Damalia riverine habitants (n=96)
	Frequency (%)
1. Use of aluminum/plastic-made sieve	73 (76)
2. Use of glass plates	60 (62.5)
3. Use of tray fryer	50 (52.1)
4. Use of milling or grinding machine	11 (11.5)
5. Use of flux	7 (7.3)
6. Use of hot pot	5 (5.2)
7. Use of plastic bucket	94 (97.9)
8. Use of plastic pot/small box	81 (84.4)
9. Use of aluminum-made pressure cooker	7 (7.3)
10. Use of iron-made frying pot	78 (81.3)
11. Use of floor rug	7 (7.3)

Score: Yes=1, No=0 and score range per respondents are 0–30 for 30 techniques

Table 9: Frequency distribution of the respondents using transportation, regression, and furniture techniques

Transportation, regression, and furniture techniques	Damalia riverine habitants (n=96)
	Frequency (%)
1. Use of plastic tool/rack	80 (83.3)
2. Use of vehicles	4 (4.2)
3. Use of bicycle	36 (37.5)
4. Use of dining table	24 (25)
5. Use of motorcycle	14 (14.6)
6. Use of ceiling/table/standing fan	51 (53.1)
7. Use of cooking stove	6 (6.3)
8. Use of television	48 (50.09)
9. Use of radio cassette player	5 (5.2)
10. Use of wood that with mattress	65 (67.7)
11. Use of refrigerator	13 (13.53)

Table 10: Frequency distribution of the respondents by using health, environment, and social activities techniques

Health, environment, and social activities techniques	Damalia riverine habitants (n=96)
	Frequency (%)
1. Use of iron machine for cloth ironing	6 (6.32)
2. Use of tube well water	81 (84.37)
3. Use of washing machine	0 (0)
4. Use of packaging material/Bagging	3 (3.1)
5. Use of upgraded cloth	26 (27.1)
6. Use of toilet with water cistern	71 (74)
7. Leader of any society or organization	72 (75)
8. Membership of cooperative society	67 (70)

Table 11: Determinants of the income for transboundary riverine habitants

Explanatory variables (dependent variable=Log of monthly income)	Damalia river
Age (years)	0.001 (0.412)
Level of education (year of schooling)	0.009 (0.020)*
Fishing boat (0=No, 1=Yes)	−0.057 (0.086)
Family size (number)	0.001 (0.938)
Farm size (in acre)	0.006 (0.607)
Women participation in the work (0=No, 1=Yes)	0.063 (0.009)**
Membership with local fishing or other organization (0=No, 1=Yes)	0.109 (0.093)
NGO membership (0=No, 1=Yes)	0.012 (0.717)
Electricity available (0=no, 1=yes)	0.166 (0.011)*
Drinking water available (0=no, 1=yes)	0.161 (0.024)*
Observations (n)	96
R^2	0.25

(p<0.01). Finally, available electricity and drinking water availability also influenced the income of the respondents, both positively and significantly (p<0.05). Respondent who had available electricity and drinking water availability had 16.6% and 16.1% higher income, respectively, than those who had no available electricity and drinking water availability.

DISCUSSION

SES is a very important factor in society's development. It was measured by socioeconomic characteristics, living opportunities, and modern technology use. The study revealed that most of the transboundary Damalia riverine inhabitants were primary educated (46.90%), with 33.33% being illiterate. The illiteracy rate is higher than the national average rate for 15 and above aged people in Bangladesh (UNESCO, 2018). In the northwestern region, 45% of fishermen were illiterate (Jahan *et al*., 2018). There were only 1.00% being highly educated and 13.54% having secondary education in this research area. Primary level access is now free for the Damalia riverine inhabitants. In the capital city of Bangladesh, the average schooling was 6.84 years, with 2.50% being illiterate in female garment workers (Sikdar *et al*., 2014). Economic status is a main cause for the lack of higher education, and NGOs are not providing support up to the primary level (Chen *et al*., 2020). The majority of the inhabitants in this research area were Muslim, with 93.8% being Muslims and 6.3% being Hindus. In another research, it was reported that Muslims are more dominant than Hindus at 85% in Dekar Haor, Sunamganj (Sufian *et al*., 2017). The study categorized the family size of inhabitants into three groups: 1–3, 4–5, and 5 members+. The majority (46.9%) belonged to the 5 members+ group, with 37.5% belonging to the 4–5 group and 15.6% to the 1–3 group. The average family size was 4.81, which is higher than the national average (4.1) (HIES, 2016), but lower than previous studies (6.56) (Morsheduzzaman *et al*., 2009; Hossain *et al*., 2009) The study interviewed both male and female residents for better results, revealing that 86.5% of the populations were male and 13.5% were female. According to other researchers (Das *et al*., 2015), 82% of male and 18% of female respondents in the southwest region of Bangladesh were actively involved in fishing. The majority of the inhabitants were farmers, with 50.0% engaged in agriculture. Only 4.00% were in government jobs, 20.00% in business, 9.00% in non-government jobs, and 17.00% in fishing and other activities. From other research (Paul *et al*., 2020), it was found that 54% of tribal people in Netrokona, Bangladesh, were engaged in agriculture, 10% in NGOs, 6% in government jobs, 8% in business, and 6% in other occupations. The study found that 81.20% of the inhabitants were married, while 18.80% were unmarried. This contrasts with a previous study in Kurung Kumey District, where 67.32% were married, 31.12% unmarried, and 1.55% widows (Tarh, 2014). The housing status was poor, with 41.66% of houses being kuccha made from tin and wood, 31.25% semi pucca, and 27.08% also kucha made from straw, shon, and mud. Nearly 50% of residences in Mymensingh Tarakanda Upazila were tin sheds, with 23% kuccha, 23% semi pucca, and 4% pucca (Ali *et al*., 2010). Similar housing conditions were observed in Gazipur Sadar Upazila (Alam, 2004) and Kaliakoir Upazila (Hossain, 2007). The study revealed that 45.80% of latrine facilities were open, with 33.30% being sanitary latrines, and 20.80% of households lacking latrine facilities. Similarly, it was revealed that 61% of households in the Democratic Republic of Congo have a private open pit latrine, 17% share an open pit latrine with neighbors, 9% own a private ventilated improved pit latrine, and 7% lack a toilet (Milliano *et al*., 2015). The categorical numbers are unequal significantly (p<0.001) in all socioeconomic characteristics with respect to Damalia riverine habitants individually (Table 1).

Most of the transboundary riverine habitants (46.9%) were middle- aged (30–45 years), where only 18.8% habitants were young-aged (<30 years) but 34.4% habitants were old-aged (>45 years) (Table 2), which is not similar to the finding of Sufian (Sufian et al., 2017) in Dekar haor, Sunamganj. Sufian data indicate that the majority of fishers (50%) were aged 31–45, while 35% were over 46, and 15% were under 30 years old. From this study, it was revealed that small-sized landowners were about 54.2% (<0.5 acre), whereas the middle and large-sized landowners were about 25.0% (0.5–1.5 acres) and 20.8% (>1.5 acres), respectively. The average land area of the transboundary riverine habitants was 1.12 acres (Table 2). Ahmed (1996) found that 94% of fishermen own their homes, while Mannu (1999) found 28% built houses on government-owned land outside the dam, 36% owned houses, 8% lived with their father-in-law, and 12% shared a house with their father. The annual income in this area was primarily derived from land ownership, business activities, and job services. The land size was small, and business and job facilities were limited. The majority of the respondents fell into the middle income category (80,001– 190,000 Tk/year), with 15.63% were earning above 190,000 Tk/year and 34.38% were earning below 80,001 Tk/year (Table 2), but their average annual income (147252.29 Tk) was below the national rate. Khanum (2013) reported that only 16% of fishers had higher annual income, and 31% had low incomes, whereas 53% of the fishers on moderate income in Hakaluki haor, which is not similar to the present findings. Overall income indicates that the studied respondents were poor, showing the real picture of Bangladesh from other communities (Siddiq et al., 2013; Hossain et al., 2014). The majority of the habitants had low (47.9%) to medium (49.0%) level social status, where the minimum numbers of habitants had a high (3.10%) level social status found in these areas. Other researchers (Pal et al., 2017) reported that the Manipuri community has standard social status than the Khasia community in Bangladesh. The overall living opportunities mean score 0.368 indicates that the SES was low in this area.

The majority of inhabitants in Damalia riverine areas were in low-to-medium income levels and social status, with illiterate to primary-educated individuals. Higher and higher secondary educated inhabitants were very low in all income levels and social status. According to the measure of SES by other researchers (Liao *et al*., 2004), it was found that education level and household income were substantially lower among minority communities. The respondent's relationship with social status versus education level, social status versus income level, and education versus income level was linear and respondents was decreasing with increasing social status versus education level and income significantly (p≤0.001), but the same trend was found in income level versus education level with significant (p≤0.031) (Table 4). Therefore, the overall education and income levels were lower in these areas. Focus must be given to the educational aspects to raise their future status (Dungdung and Pattanaik, 2020). The research by others (Das *et al*., 2015) found that 89% of the respondents in Cox's Bazar region drank water from tube wells, highlighting the significant impact of water on fisherman's health; whereas similar results (84%) were found in the Damalia riverine area. Income of transboundary Damalia riverine residents at Sunamganj was influenced by different factors like education level, women's work participation, electricity availability, and drinking water availability, with over one-third of respondents being

illiterate. Although it is not consistent with the national rate (BBS, 2020), they have a lack of higher education facilities in their locality. Respondents with electricity and drinking water had 16.6% and 16.1% higher incomes, respectively, due to their essential life needs, such as drinking, cleaning, cooking, firefighting, and manufacturing, which significantly improve quality of life (Tarr, 1996). The study found that 6.3% income was increased for every woman who increased their participation in work, as they typically managed household activities and took care of their children. Among thirty modern techniques, above 60% of the respondents used aluminum-made sieves, plastic bucket, plastic pot, and wood that with mattress, etc. and the rest of <40% of the respondents used floor rug, vehicle, cooking stoves, grinding machine, flux, etc. The discussion highlighted area's lacking in SES, including educational facilities, communication, health services, income sources, administrative help, infrastructure, and natural resources, which could be addressed through government and institutional assistance.

CONCLUSION

This study examined the SES of Damalia transboundary riverine residents in the extreme northeastern region of Bangladesh. The study revealed that 46.9% of the habitants were primary educated, with 33.33% being illiterate, but the rest of them were secondary to higher level educated. About income source, around 50.0%, 4.00%, 20.00%, 9.00%, and 17.00% habitants earn money from agriculture, government job, business, non-government job, and other activities, including fishing, and their average income was 147,252.29 Tk/year. Their housing status was not so good, sanitation facilities were not found in 20.80% of household, and their average land area was 1.12 acres per house (Table 2). The majority of the habitants had low (34.38%) to medium (50.00%) level social status, and the overall living opportunity score 0.368 means that the SES was low in these areas, whereas the respondents numbers were decreasing with increasing social status, income level, and education level significantly ($p \leq 0.05$). The lack of sustainable river's dredging, educational facilities, communication facilities, adequate health and co-operative services, adequate income sources, valuable assets, employment opportunities, institutional and administrative help, qualified infrastructures and extension services, and natural resources were identified as areas that could be overcome by government and institutional assistance to improve their SES.

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CONFLICTS OF INTEREST

There is no conflict of interest in the research declared by the authors.

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