J. Sylhet Agril. Univ. 11(1): 83-96, 2024 *https://doi.org/10.3329/jsau.v11i1.82688*

ISSN: 2308-1597

Journal of the Sylhet Agricultural University

Journal home page: http://www.jsau.sau.ac.bd

Research Article

CLIMATE CHANGE PERCEPTION, PROBLEM AND ADAPTATION STRATEGEY OF THE COMMUNITY PEOPLE ADJACENT TO RATARGUL SWAMP FOREST IN GOWAINGHAT UPAZILA OF BANGLADESH

T Afroz[1]*, F Islam[1], MO Sharif[1], M Das[1] and MR Mim[1]

[1]*Department of Agroforestry and Environmental Science, Sylhet Agricultural University, Sylhet-3100, Bangladesh*

Article info

Article history

Received: 25.03.2024

Accepted: 22.05.2024

Published: 30.06.2024

Keywords

Adaptation, Climate change, Community Perceptions, Livelihood, Strategies

Corresponding author

Tahmina Afroz

E-mail: tahmina.smriti@gmail.com

Abstract

Climate change has gradually affected forest ecosystems globally and it has also happened at the adjacent areas of Ratargul Swamp Forest at Gowainghat Upazila in Bangladesh. This study documented climatic alterations and community-initiated adaption measures on climate change. Ratargul, the sole freshwater swamp forest in Bangladesh, is an essential life line for local ecology and also livelihoods of the local community. The study was accomplished through a survey of 65 randomly selected local people and employed meteorological data and people perception in respect of changing of climatic parameters. Results indicated that the demographic profile of the most people were middle-aged (47.7%), about 42% had medium income and 31% had only primary-level education. The majority of individuals near the forest work in the business sector (40%) followed by agriculture (29%). Meteorological data showed a steady rise in maximum and minimum temperatures over time, where increment rate per year of maximum and minimum temperatures were 0.0194°C and 0.0832°C, respectively. An increase in rainfall at the rate of 54.12 mm was also estimated. People perception and meteorological data together draw a scenario of climate change and the livelihood of the inhabitants living near the forest area. Around 49.2% respondents agreed that Akashmoni (*Acacia auriculiformis*) plantation increased at Ratargul Swamp Forest while some tree species like Bot (*Ficus benghalensis*) decreased in the forest according to 24.6% of the respondents but overall tree species decreased due to increasing population and its major influence was in the reduction of tree species in forest reported by 46.20% respondents. Rice (80%) is the principal crop; however, cropping practices have changed due to some climate induced factor. Increase in insect and pest attack (40%) and flooding (38.50%) were the major reasons of changes in cropping in the study area. People have already adopted several adaptation measures like new tree introduction (84.60%) and vegetable crop cultivation (36.90%) and these were some of the adoptive strategies. Major problems faced by the community people were poverty according to 73.8% of the residents, with 69.2% reporting insufficient transportation. Around 86.2% of the respondents reported that poverty can be tackled effectively by increasing employment opportunities in eco-tourism which is again can be possible by increasing transportation facility (83%) in the study area. Finding of this study can be used for policy making, environmental conservation and proper strategies to manage the climate change.

Introduction

Climate change is one of the major challenges of our time and adds considerable stress to our societies as well as the environment. The consequences of climate change can be seen not only in particular area of a country but all over the world (Adedeji, 2014). It exerted enormous consequences on living nature as well as the forest ecosystem. Even a small rise in mean annual temperature can have a major impact on a region's ecology and biological diversity (Pounds & Puschendorf, 2004) in the forest ecosystem. According to the Third Assessment Report of IPCC, South Asia is the most vulnerable region of the world to climate change impacts (Wang et al., 2017).

Cite This Articale

Afroz T, Islam F, Sharif MO, Das M and Mim MR. 2024. Climate Change Perception, Problem and Adaptation Strategey of the Community People Adjacent to Ratargul Swamp Forest in Gowainghat Upazila of Bangladesh. J. Sylhet Agril. Univ. 11(1): 83-96, 2024. https://doi.org./.....

The international community also recognizes that Bangladesh ranks high in the list of most vulnerable countries on earth (Dasgupta *et al*., 2010). The strong trends in climate change already evident, which have long term effect on livelihood and the forest ecosystem of Bangladesh.

Ratargul Swamp Forest is the only freshwater swamp forest, located in the northwestern area of Sylhet in Bangladesh. This forest is a tropical wetland habitat with considerable potential for biodiversity and other intangible benefits (Biswas *et al*., 2004). Swamp forests perform a variety of significant hydrological supporting functions, such as providing water storage space, controlling and protecting food peaks, maintaining subsurface water levels, recharging runoff, absorbing pollutant degradation, and purifying the quality of water (Xu & Chunjing, 2015). These forests have the potential for sustainable development by conserving and managing their biodiversity and water resources. However, the local populations exclusively depends on this forest for fuel wood and livelihood (Islam *et al*., 2016). Recent research has demonstrated that this unique forest is presently under multiple anthropogenic and environmental threats that are affecting its ecosystem and biodiversity (Siddika *et al*., 2020). This marshland region produces a considerable quantity of rice, fodder, and fuel. From this forest, many people gather Patipata (*Schumannianthus dichotoma*), which is used to make thatching materials, handicrafts, and other items. Ratargul Swamp Forests offer numerous advantages; yet, they are being endangered by erroneous anthropogenic interventions and climate change-related incidents, including extreme weather events and variability. The increasing scale of potential climate impacts on livelihood specially crop agriculture and forest resources call for immediate addresses for agricultural adaptation more coherently (Howden *et al*., 2007) the likelihood of further changes occurring, and the increasing scale of potential climate impacts give urgency to addressing agricultural adaptation more coherently. There are many potential adaptation options available for marginal change of existing agricultural systems, often variations of existing climate risk management. We show that implementation of these options is likely to have substantial benefits under moderate climate change for some cropping systems. However, there are limits to their effectiveness under more severe climate changes. Hence, more systemic changes in resource allocation need to be considered, such as targeted diversification of production systems and livelihoods. We argue that achieving increased adaptation action will necessitate integration of climate change-related issues with other risk factors, such as climate variability and market risk, and with other policy domains, such as sustainable development. Dealing with the many barriers to effective adaptation will require a comprehensive and dynamic policy approach covering a range of scales and issues, for example, from the understanding by farmers of change in risk profiles to the establishment of efficient markets that facilitate response strategies. Science, too, has to adapt. Multidisciplinary problems require multidisciplinary solutions, i.e., a focus on integrated rather than disciplinary science and a strengthening of the interface with decision makers. A crucial component of this approach is the implementation of adaptation assessment frameworks that are relevant, robust, and easily operated by all stakeholders, practitioners, policymakers, and scientists.","container-title":"Proceedings of the National Academy of Sciences","DOI":"10.1073/pnas.0701890104","ISSN":"0027-8424, 1091-6490","issue":"50","journalAbbreviation":"Proc. Natl. Acad. Sci. U.S.A.","language":"en","page":"19691-19696","source":"DOI.org (Crossref.).

Although there are extensive researches on the Ratargul Swamp Forest, focusing mainly on forest degradation caused by tourism and deforestation but there are a few studies specifically addressing how nearby communities are adapting to climate change and man-made cause. Many old similar research references are available but these are lack of fresh data on the community's adaptive strategies. So, the present study aims at understanding the community perception and adaptation strategies of people living adjacent to the forest area.

Methodology

Study Area

The study was carried out at adjacent areas of Ratargul Swamp Forest situated in Gowainghat Upazila of Sylhet district, Bangladesh (Fig. 1). The Swamp Forest is located at 25°00.025′N latitude and 91°58.180′E longitude of Bangladesh. The total area of swamp forest about 204 ha. Approximately 118.50 hectare was declared as a reserve forest (Biswas *et al*., 2004).

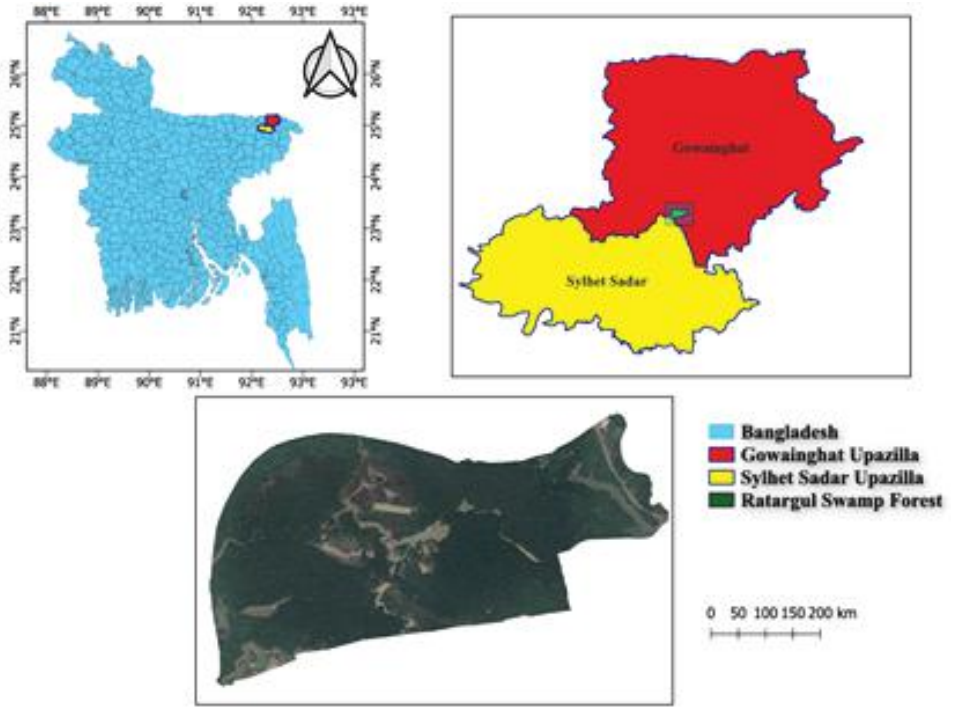

Figure 1. Location of the study area in Bangladesh

Data collection

Stratified random sampling was done from the selected areas. Total 65 respondents were selected for the household survey. The target population was the local inhabitants living in the village near Ratargul Swamp Forest. The survey semi structured questionnaire method was followed to achieve the objectives of the study. Face to face interview was carried out having both open ended and close ended questions. In addition to the survey, several Focus Group Discussions (FGDs) were held to verify the information and to discuss the important issues. FGDs were conducted in order to gain an understanding of the attitudes of the general community concerning management and conservation of the Ratargul Swamp Forest and changing of climatic parameters. All the findings were documented and analyzed through spread sheet MS Excel. Meteorological data were obtained from Bangladesh Bureau of Statistic (BBS 2017).

Results and Discussion

Demographic Characteristics

The age of the respondents of study area ranged 25 to 80 years (Table 1). The investigation revealed that over half of the villagers (47.70%) in the Ratargul area were middle-aged (36 to 50). Around 31.0% of the respondents had completed their primary school, followed by 29.0 % were illiterate, and 23.00 % who had completed their secondary education. Among the different occupations of the people in the study area, business sector ranked first (40%) in position followed by agriculture 29% and day laborers 22%. Majority of the respondents fell in medium family size (54.0%) followed by large families (35.0%) and small families (11%) (Table 1). According to the Bangladesh Bureau of Statistics (2017), the average family size in Bangladesh is 4.06, which is lower than the data presented in Table 1. The majority of the respondents in the research region (42.0%) had an annual income that fell within the medium range. This is in contrast to the 23.0% and 35.0% of respondents who had low income and high income (Table 1).

Table 1. Socio-economic and demographic profile of the respondents

Character	Category	Frequency	Percentage
Age	Young aged (up to 35)	16	24.6
	Middle aged (36-50)	31	47.7
	Old aged (>50)	18	27.7
Education	Illiterate (0)	19	29
	Primary (Class I-V)	20	31
	Secondary (Class VI - X)	15	23
	College (Class XI - XII)	6	9.3
	Above Class XII	5	7.7
Occupation	Business	26	40
	Agriculture	19	29
	Day laborer	14	22
	Public Service	4	6
	Private Service	2	3
Family size (Number)	Small (1-4)	7	11
	Medium (5-8)	35	54
	Large (≥ 9)	23	35
Annual income	Low income (Up to Tk 60 thousand)	15	23
	Medium income (Tk 61 to 120 thousand)	27	42
	High income (Above Tk 120 thousand)	23	35

Climate change: People perception and trend

Ratargul Swamp Forest has an important position in the tourists' minds and thus many people visit there throughout the year. So, the surrounding ecology, environment and climatic conditions of Ratargul Swamp Forest had become an important concern for all. Present study attempted to unfold the climatic change over time by discussing with the local respondents. During the survey, 10 climatic parameters were taken into consideration. The results showed that most of the parameters were in increasing trend except for dew intensity and severity, and cold spell intensity and severity during March-April and September-October (Table 2).

Table 2. Climate change perception of respondents

Climatic parameters	Respondents' Perception			
	Increased	(%)	Decreased	(%)
Temperature (Summer season)	34	52.3	10	15.4
Temperature (Winter season)	26	40	16	24.6
Rainfall intensity	29	44.6	12	18.5
Rainfall frequency	27	41.5	17	26.2
Drought length and severity	26	40	12	18.5
Drought frequency	23	35.4	18	27.7
Hailstorm amount and severity	41	62.1	4	6.15
Frost/Dew intensity and severity	17	26.2	21	32.3
Cold spell intensity and severity (March- April)	12	18.5	31	47.7
Cold spell intensity and severity (Sept- Oct)	13	20	28	43.1

Trend of temperature

Temperature analysis included both maximum and minimum average temperatures from 2009 to 2023. The data indicated a considerable upward trend in maximum temperatures over time which indicting warming conditions that may correspond to the common experience of rising heat in recent years. The increase in minimum temperature was more distinct than maximum temperature, while the increment rate of maximum and minimum temperatures per year was 0.0194 (Fig. 2) and 0.0832°C (Fig. 3), respectively. These changes might have influenced the pest and disease infestation, as well as productivity of vegetation, both trees and crops of the locality (Neelima *et al*., 2020).

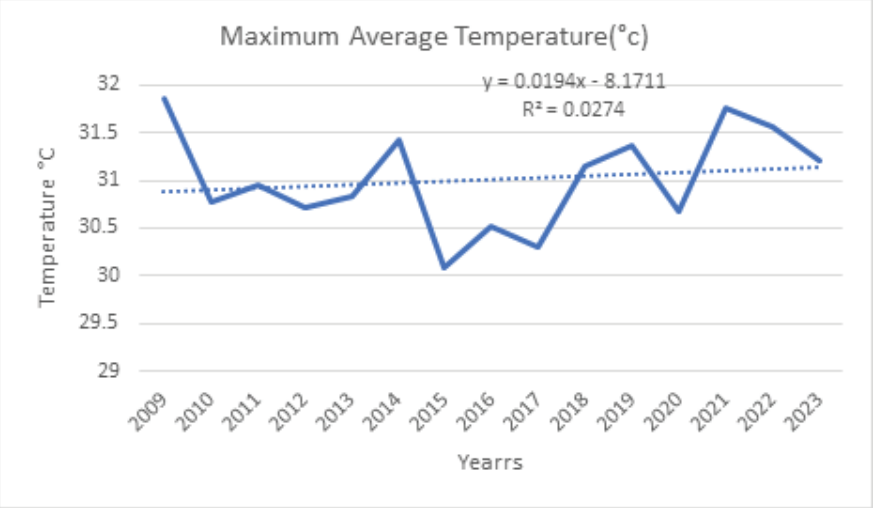

Figure 2. Maximum temperature trend in study area from 2009-23

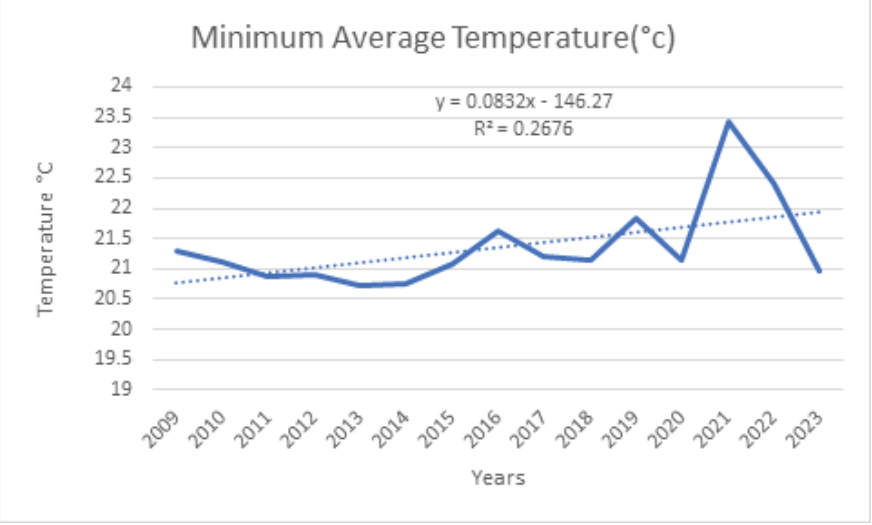

Figure 3. Minimum temperature trend in study area from 2009-2023

Trend of rainfall

Over the period, the total rainfall data in millimeters showed a great trend of change. Data indeed showed a non-stable tendency of rainfall over the years that may support the public view on the change in the amount of rain. The trend of total annual rainfall indicated an increasing pattern with an increment rate of 54.12 mm from 2009 to 2023 (Fig. 4). Due to inconsistent rainfall, several studies predicted that the flash flood depth would increase in the haor region in future (Choi *et al*., 2021)climate, high population density, and limited adaptation capacity. Mounting evidence suggests that the country is already suffering from the effects of climate change which may get worse without aggressive action. Here, we use an ensemble of high-resolution (10 km.

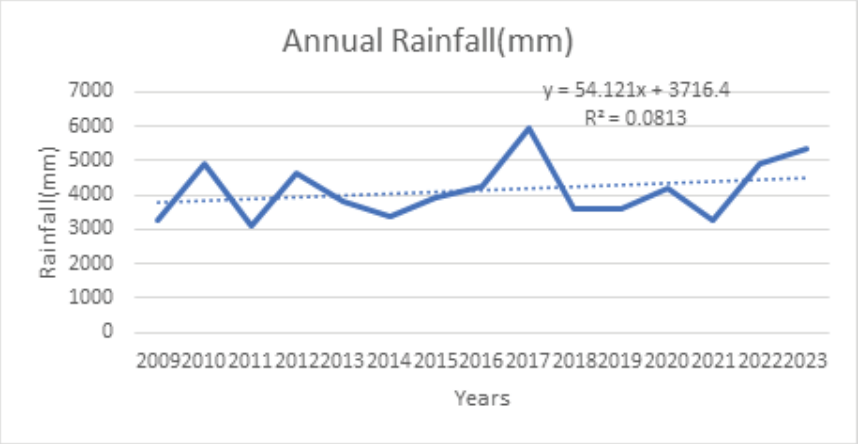

Figure 4. Annual total rainfall trends in study area from 2009-2023

Changes in forest resources

The study in Ratargul Swamp Forest depicted the following variation in tree species composition. The study found great variations in tree species. Among the respondents about 49.2% reported that Akashmoni (*Acacia auriculiformis*) tree species increased. The second most important response was Hizal (*Barringtonia acutangular*), which increasd according to 32.3% of the total respondents. It was followed by Koroch (*Dalbergiaren iformis*) species (30.8%) rise. The three species exhibited more significant increase in this forest during the specified period, as illustrated in Table 3.

Although it was observed that some species of trees increased but the survey also showed that several tree species had decreased. The degradation of swamp forest ecosystem was due to the adverse effects of climate change that had already been observed (Akter *et al*., 2024). For example, Jarul (*Lagerstroemia speciosa*) was recorded to decrease by 24.6% of the respondents. There were also 23.1% who mentioned that Bot (*Ficus benghalensis*) trees were reduced. It was interesting to see that orange and pineapple (*Ananas comosus*) plants ceased to exist in the forest according to observations made by 20% of the respondents (Table 3). These declines have been attributed to changes in hydrological patterns, human activities, or other environmental pressures within the swamp forest.

Table 3. Increased and decreased tree species in Ratargul Swamp Forest

Increasing Species (Local / English name)	**Scientific name**	**Respondents (%)**	**Decreasing Species (Local / English name)**	**Scientific name**	**Respondents (%)**
Akashmoni	*Acacia auriculiformis*	49.2	Jarul	*Lagerstroemia speciosa*	24.6
Hizal	*Barringtonia acutangula*	32.3	Bot	*Ficus benghalensis*	23.1
Koroch	*Pongamia pinnata*	30.8	Jam	*Syzygium cumini*	21.5
Murta	*Schumannianthus dichotomus*	27.7	Mango	*Mangifera indica*	21.5
Mangium	*Acacia mangium*	24.6	Orange	*Citrus sinensis*	20.0
Kodom	*Neolamarckia cadamba*	23.1	Pineapple	*Ananas comosus*	20.0
Jam	*Syzygium cumini*	21.5	Kodom	*Neolamarckia cadamba*	18.5
Jalibet	*Calamus tenuis*	21.5	Katal	*Artocarpus heterophyllus*	16.9
Bamboo	*Bambusa vulgaris*	21.5	Horitoki	*Terminalia chebula*	15.4
Raintree	*Samanea saman*	21.5	Litchu	*Litchi chinensis*	15.4
Katal	*Artocarpus heterophyllus*	21.5	Lemon	*Citrus limon*	15.4

Kala Akashi	*Acacia melanoxylon*	20.0	Narikel	*Cocos nucifera*	15.4
Bot	*Ficus benghalensis*	20.0	Hizal	*Barringtonia acutangula*	15.4
Mango	*Mangifera indica*	18.5	Koroch	*Pongammia pinnata*	15.4
Litchu	*Litchi chinensis*	18.5	Murta	*Schumannianthus dichotomus*	15.4
Teak	*Tectona grandis*	15.4	Borun	*Cratevar eligiosa*	15.4
Garjan	*Dipterocarpus turbinatus*	15.4	Kuma	*Lepisanthes senegalensis*	15.4
Koroi	*Albizia lebbeck*	15.4	Guava	*Psidium guajava*	15.4
Borun	*Crateva religiosa*	15.4	Rata	*Metrosideros robusta*	15.4
Arjun	*Terminalia arjuna*	15.4	Akashmoni	*Acacia auriculiformis*	15.4
Shirish	*Albizia lebbeck*	15.4	Akashmoni	*Acacia auriculiformis*	15.4
Jarul	*Lagerstroemia speciosa*	15.4			
Guava	*Psidium guajava*	15.4			
Pumelo	*Citrus maxima*	15.4			
Bamboo	*Bambusa vulgaris*	15.4			
Orange	*Citrus sinensis*	15.4			

The Table 4 showed so many forests and fruit trees are in the verge of declining. There were many reasons behind the decrease of trees in the study area. Increasing population adjacent to the forest was the most important factor which was observed by 46.2% of respondents while 40% of respondents opined that increasing population need fuel wood and thus trees are getting reduced. Another reason was water logging condition in the study area. Increasing infrastructure for living, deforestation for fuelwood need, natural disaster, ecosystem destroying etc. imparted detrimental effects on Akashmoni (*Acacia auriculiformis*) tree and boat making by Kuma (*Sasaveitchii*) trees were the causes of decreasing these trees in the study area as indicated by 36.9% of respondents (Table 4). According to Global Forest Resources Assessment 2015, between 1990 and 2015, Bangladesh loses 2600 hectares of prime forest annually. Primary forest land gradually fell from 1.494 million hectares in 1990 to 1.429 million hectares by 2015 (FRA, 2015).

Table 4. People's perception behind decreasing trees in Ratargul Swamp Forest Area

Reasons	Respondents' No.	Respondents (%)
Increasing population	30	46.2
Water logging	26	40.0
Collection of Fuel wood	26	40.0
Less interest or benefit	24	36.9
Deforestation	24	36.9
Natural disaster	24	36.9
Kuma - boat making	24	36.9
Akashmoni increasing	24	36.9
Ecosystem hampered	24	36.9
Increasing infrastructure	24	36.9
Increasing demand	22	33.9
Lack of education	22	33.9
Less tree plantation habit	20	30.8
Weather change	20	30.8
Normal plant dying	20	30.8

Flood	20	30.8
Selling of plants	20	30.8
Land fragmentation	20	30.8
Low rainfall	20	30.8
Low own land	20	30.8
Lack of improved conservation technique	20	30.8
No new plantation initiative	18	27.7
Stealing	18	27.7
Lack of protection of forest	18	27.7
Low growth and development	18	27.7

Changes in cropping in study area

Ratargul Swamp Forest is a marshy area. It can be noticed from the list of crops that different types of crops were grown at present and also before 10 years before in the study area. Highest percentage of respondents (80%) identified that rice *(Oryza sativa)* was the main crop at present. 69.2% of the respondents opined that tomatoes (*Solanum lycopersicum*) were the second most grown crop. Beans (*Phaseolus vulgaris)* ranked third in the list of grown crops, with 55.4% of the respondents reporting that beans were produced in the study area (Table 5).

But the scenario was changed from 10 years before. Among the surveyed farmers 61.5% respondents stated that rice was the primary crop as it was stable food crop while 53.8% reported that bottle gourd (*Lagenaria siceraria*) was grown, and 52.3% of surveyed farmers practiced cultivation of potato (*Solanum tuberosum*) crops in 10 years back (Table 5).

Table 5. Description of the crops cultivated near to Ratargul Swamp Forest area at present and 10 years before.

Present growing crops (Local/English name)	**Scientific name**	**Respondents (%)**	**Crops grown before 10 years (Local /English name**	**Scientific name**	**Respondents (%)**
Rice	*Oryza sativa*	80.0	Rice	*Oryza sativa*	61.5
Tomato	*Solanum lycopersicum*	69.2	Bottle gourd	*Lagenaria siceraria*	53.8
Bean	*Phaseolus vulgaris*	55.4	Potato	*Solanum tuberosum*	52.3
Potato	*Solanum tuberosum*	53.8	Tomato	*Solanum lycopersicum*	41.5
Bottle gourd	*Lagenaria siceraria*	43.1	Mustard	*Brassica juncea*	40.0
Red amaranth	*Amaranthus cruentus*	43.1	Bean	*Phaseolus vulgaris*	40.0
Amaranth	*Amaranthus tuberculatus*	36.9	Chilli	*Capsicum annuum*	38.5
Chilli	*Capsicum annuum*	36.9	Potato	*Solanum tuberosum*	35.4
Brinjal	*Solanum melongena*	35.4	Jute	*Corchorus olitorius*	33.8
Cauliflower	*Brassica oleracea var. botrytis*	32.3	Okra	*Abelmoschus esculentus*	33.8
Cabbage	*Brassica oleracea var. capitata*	32.3	Jhinga	*Luffa acutangula*	33.8
Raddish	*Raphanus sativus*	32.3	Raddish	*Raphanus sativus*	33.8
Ladies finger – Okra	*Abelmoschus esculentus*	32.3	Cucumber	*Cucumis sativus*	33.8

Jhinga	*Luffa acutangula*	30.8	Brinjal	*Solanum melongena*	33.8
Cucumber	*Cucumis sativus*	30.8	Snake gourd	*Trichosanthes cucumerina*	33.8
Spinach (Palongshak)	*Spinacia oleracea*	30.8	Korola	*Momordica charantia*	32.3
Mustard	*Brassica juncea*	29.2	Jute	*Corchorus olitorius*	32.3
String Bean (Borboti)	*Vigna unguiculata*	27.7	Puishak	*Basella alba*	32.3
Sweet gourd	*Momordicacochin chinensis*	27.7	Shatkora	*Citrus macroptera*	32.3
Jute	*Corchorusolitorius*	27.7	Bean	*Phaseolus vulgaris*	32.3
Chinese spinach (Puishak)	*Basella alba*	26.2	Pumpkin	*Cucurbita pepo*	32.3
Carrot	*Daucus carota*	26.2	Wheat	*Triticum aestivum*	32.3
Snake gourd	*Trichosanthes cucumerina*	26.2	Sponge Gourd	*Luffa aegyptiaca*	32.3
Pumpkin	*Cucurbita pepo*	26.2	Ribbed gourd	*Luffa acutangula*	32.3
Nagamorich	*Capsicum chinense*	26.2	Shalgom	*Brassica rapa*	30.8
Kakrol	*Momordica dioica*	26.2	Wax gourd	*Benincasa hispida*	29.2
Sesame	*Sesamum indicum*	26.2			
Dal	*Lens culinaris*	24.6			
Onion	*Allium cepa*	24.6			

There were many reasons behind the changes in cropping near the area of Ratargul Swamp Forest. About 40 percent of respondents opined that the increasing insect and pest attack were the most prominent reasons for the changing in cropping diversity in this area. Temperature rise played the pivotal role in insect population dynamics (Karuppaiah and Sujayanad, 2012). Flooding was another reason for the changes in crops in the study area which was the opinion of 38.5% respondents. There were some other reasons for changing cropping like land fragmentation, decreasing crop land due to population increase as mentioned by 35.4% of respondents (Table 6).

Table 6. Reasons behind the changes of cropping near to Ratargul Swamp Forest

Reasons	**Respondents' Opinion**	**Respondents (%)**
Increase in insect and pest attack	26	40.0
Flooding	25	38.5
Land fragmentation	23	35.4
Decrease of cropping land	23	35.4
Increasing of population	23	35.4
Govt taking khas land	22	33.8
Decreasing of agricultural land	22	33.8
Unavailability of water	22	33.8
Sandy soil	22	33.8
Short duration hybrid high yielding varieties of crops	21	32.3
Shortage of bullocks and agricultural equipments	21	32.3
Construction of houses	21	32.3
unavailability of new agricultural technology	21	32.3
Less production of local variety	20	30.8
Sudden death	20	30.8
Weather and climate unstable conditions	20	30.8
High return of vegetables over cereal crops	20	30.8
Introduction of foreign or alien species	20	30.8
Using of chemical fertilizer	20	30.8
Low rainfall	20	30.8
Uneven crop land	20	30.8
Increase in frequency of hailstorm	18	27.7

Adaptation practices

Presently, the biodiversity of the Ratargul Swamp Forest is under serious threat. Therefore, different adaptation strategies should be pursued to save the forest resources. The majority of respondents (67.7%) reported that they had already formed Community-based organizations (CBOs), which would help reduce the loss of biodiversity. On the other hand, 46.2% of the respondents mentioned that tree plantation especially Murta (*Schumannianthus dichotomus*) and Bet (*Beta vulgaris L.*) species would be useful for boundary structures and could be a good adaptation strategy (Table 7). Bangladesh's forest resources are under the custody of Bangladesh Forest Department (BDF) and they also could take some adapting measures (Akter *et al*., 2024). Participatory techniques of governance and planning (also known as Participatory or Community-based forest management, integrated resource management, joint forest management, and adaptive co-management) have been recognized as effective and acceptable in many areas in recent decades (Mendoza *et al*., 2003) and which could be applied for Ratargul Swamp Forest.

Table 7. Adaptation measures for forest management in Ratargul Swamp Forest

Measures	Respondents' opinion	Respondents (%)
New tree introduction	55	84.60
Formation of local organization	44	67.70
Plantation of Murta and Bet plant	30	46.20
Impose of restriction on open entry to the forest	24	36.90
Conserving plant and animal resources	22	33.80
Plantation of fruit trees	20	30.80
Roadside plantation	20	30.80

Due to adverse climatic conditions, many things had been changed by the local people in Ratargul Swamp Forest area as mitigation and adaptation measures. Fish culture and also species already decreased in the study area. Now the local community started to cultivate vegetables and it was opined by 36.9% of respondents. Around 33.8% respondents said that they have to excavate ponds in their fallow land to practice fishing and mitigate fish scarcity problem (Table 8).

Table 8. Adaptation measures taken by the community in relation of agriculture/crop production near to Ratargul Swamp Forest

Adaptation measures taken by the community	Respondents' Opinion	Respondents (%)
Vegetable cultivation	24	36.9
Fish farming	22	33.8
Reduction of fertilizer use	22	33.8
Limited use of insecticide and pesticide	22	33.8
Crop cultivation according to the advice of Agricultural extension (AE) officer	21	32.3
Taking consideration of advance warning of natural calamity given by the authority	21	32.3
Homestead plantation	21	32.3
Cultivation of HYV	20	30.8
Utilization of fallow land by lending to farmers for growing others crops	19	29.2

Problems and suggestions

The community surrounding the Ratargul Swamp Forest had faced a lot of problems and had to withstand a number of significant challenges for their livelihood. A major proportion of the people in the study area belongs to below the poverty line because of huge lack of basic needs and requirements. About 73.8 percent of the respondents reported that poverty is one of the major issues affecting them along with other socio-economic factors. It must be mentioned that Ratargul Swamp Forest is one of the most popular and highly visited tourist spots in the Sylhet area. Thousands of tourists visit this place every year because of its natural beauty and rare ecological variables. There are a lot of challenges that act not only as an obstacle for the

tourism sector but also for the local people residing in these regions. There are number of reasons for it but approximately 69.2 percent respondents said that transportation facilities were highly inadequate and underdeveloped. In addition, it was observed that the study area was not well-equipped with proper utilities regarding gas and electricity, which was indicated by 61.5 percent and 58.5 percent of respondents, respectively. It was also recognized that flash flood was another major and identifiable problem in the study area and it was mentioned by 55.4 percent of the surveyed respondents (Table 9).

Table 9. Major problems faced by the community to maintain their livelihood near the Ratargul Swamp Forest

Problem	Respondents' No.	Respondents (%)	Rank
Poverty	48	73.8	1
Transportation facilities low	45	69.2	2
No Gas	40	61.5	3
No electricity	38	58.5	4
Flash Flood	36	55.4	5
Unemployment	32	49.2	6
Lack of school	30	46.2	7
Less marketing facilities	28	43.1	8
Lack of medical treatment	28	43	9
Lack of modern agricultural knowledge	26	40	10
Lacking of fuel wood	26	40	10
Hail storm	24	36.9	11
Sandy soil	24	36.9	11
Fishing unavailability	24	36.9	11
Less wage	24	36.9	11
Over population	24	36.9	11
Lack of business facility	22	33.8	12
Pesticide and seed unavailability	22	33.8	12
Excess rainfall	22	33.8	12
Lack of capital	20	30.8	13
Crop field are not using properly	20	30.8	13
Less land for fisheries	20	30.8	13
Lack of Tubewell	20	30.8	13
Increasing product price	20	30.8	13
Lack of business facility	20	30.8	13
Low employment opportunity	20	30.8	13
Thunderstorm	18	27.7	14

A number of problems, potential suggestions and solutions were identified by discussing with the people living adjacent to the Ratargul forest area. An overwhelming majority (86.2%) of the respondents reported that poverty is an important problem and it can be tackled and reduced effectively by increasing and developing employment opportunities in the study area. They suggested that improvement of transportation facilities round the year is the most crucial for the visiting tourists in the area which would benefit them a lot. It was also vital for transportation of essential products' ad for better marketing process. The study area was highly lacking in medical facilities and when any local people face a medical emergency or health problem, they would have no alternative but to go a long distance to the Sylhet city for the needed treatment. This why about 73.8% of the total respondents opined that the study area needs an increase in medical facilities. They (about 67.7 percent) stated that a provision of monthly allowance especially for elderly people will help them. About 61.5 percent respondents demanded that supplying fertilizer by the government may help the farmers (Table 10). The study of Sharmin and Chowdhury (2016) observed that if Ecosystem of Ratargul Forest is properly managed/preserved it could provide various services to tourists by the local people and thus generate income for them and uplift their living condition.

Table 10. Suggestions from the community to solve the problems related to living in Ratargul Swamp Forest

Suggestion	Respondents' No.	Respondents (%)
Creation of employment opportunity	56	86.2
Increasing transportation facilities	54	83
Increasing medical facilities	48	73.8
Provision for monthly allowance to elder people	44	67.7
Government initiative for fertilizer supply	40	61.5
Ensuring proper gas supply	36	55.4
Making agricultural commodity accessible	36	55.4
Establishment of hospital and school	34	52.3
Development of marketing facilities	32	49.2
Enhancement of cultivation input facilities	32	49.2
Creation scope for handicraft business	32	49.2
Ensure electricity supply	30	46.2
Provide training on marketing	30	46.2
Restriction on use of vehicle in the forest	30	46.2
Providing capita for business	30	46.2
Increase agricultural extension activities	30	46.2
Initiative to use hill for production purpose	30	46.2
Improvement of drainage system	30	46.2
Providing fishing facilities for a certain period	28	43.1
Initiative to plant fruit trees	28	43.1
Make aware people about sudden flood	28	43.1

Conclusion

This study identified the socio-economic and demographic status of the surrounding community of the Ratargul Swamp Forest in Bangladesh. The changing trend of climate along with anthropogenic activities might have impacted profoundly to the decrease in forest resources and livelihood options of the community. Community perceptions showed that climate-induced changes occurred in case of increase in average maximum and minimum temperature and changes in weather patterns resulted in erratic rainfall cycles which in turn impacted traditional agriculture. Crops grown in the village near the forest area also changed over the year and changes have been observed in the attacks of pests and others also. Tree species were decreased in Ratargul Swamp Forest due to increasing population. This study also found issues related to present adaption practices, specifically sustainability and climate change. It is also found that suggestions/ideas of local community people must be accommodated in policy measures for community-based adaptation. Long-term efficacy and scaling up of these adaption strategies for other sensitive ecosystems in the region need further study.

References

Adedeji O. 2014. Global climate change. Journal of Geoscience and Environment Protection. 2(2): 114.

Akter S, Mozahid MN and Iqbal H. 2024. Valuation of Ratargul swamp forest conservation: Does climate knowledge matter? Trees, Forests and People. 17, 100638.

Bangladesh Bureau of Statistics. 2017. Retrieved November 11, 2024, from https://www.google.com/search?q=Bangladesh+Bureau+of+Statistics+(2017&oq=Bangladesh+Bureau+of+Statistics+(2017&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIHCAEQIRigATIHCAIQIRiPAtIBCTE2NTFqMGoxNagCCLACAQ&sourceid=chrome&ie=UTF-8.

Biswas SR, Choudhury JK, Islam MS, Rahman O and Uddin SN. 2004. Biodiversity of Ratargul swamp forest, Sylhet. IUCN: International Union for Conservation of Nature. IUCN Bangladesh. Retrieved from https://coilink.org/20.500.12592/m3pw2t on 27 Nov 2024. COI: 20.500.12592/m3pw2t.

Choi YW, Campbell DJ, Aldridge JC and Eltahir EAB. 2021. Near-term regional climate change over Bangladesh. Climate Dynamics. 57(11): 3055–3073.

Dasgupta S, Huq M, Khan ZH, Ahmed MMZ, Mukherjee N, Khan M and Pandey KD. 2010. Vulnerability of Bangladesh to cyclones in a changing climate: Potential damages and adaptation cost. World Bank Policy Research Working Paper, 5280. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1596490

FRA. 2015. Global Forest Resources Assessments. Food and Agriculture Organization of the United Nations. Retrieved November 11, 2024, from https://www.fao.org/forest-resources-assessment/past-assessments/fra-2015/en/

Howden SM, Soussana JF, Tubiello FN, Chhetri N, Dunlop M and Meinke H. 2007. Adapting agriculture to climate change. Proceedings of the National Academy of Sciences. 104(50): 19691–19696.

Islam MA, Islam MJ, Arefin S, Rashid A and Barman SK. 2016. Factors affecting the fisheries of Ratargul swamp forest of Sylhet district, Bangladesh. IOSR Journal of Environmental Science, Toxicology and Food Technology. 10(1): 60–65.

Karuppaiah V and Sujayanad GK. 2012. Impact of climate change on population dynamics of insect pests. World Journal of Agricultural Sciences. 8(3): 240–246.

Mendoza GA, Prabhu R, Nyirenda R, Standa-Gunda W and Mutimukuru T. 2003. A community-driven multi-criteria approach to developing indicators of sustainable resource management. https://www.sidalc.net/search/Record/dig-cgspace-10568-18901/Description

Neelima T, Reddy M, Ramana K, Ramulu V and Uma Devi M. 2020. Yield Gap Analysis of Rice Under Priyadarshini Jurala Command Area Using RS and GIS. Agro economist. 7(2):1-12.

Pounds JA and Puschendorf R. 2004. Clouded futures. Nature. 427(6970): 107–109.

Sharmin M, Dey S and Chowdhury S. 2016. Relationship between diversity and productivity at Ratargul fresh water swamp forest in Bangladesh. Journal of forest and environmental science. 32(3): 291-301.

Siddika T, Azad MAK, Sujan MH and Hasan MM. 2020. Assessment of present environmental status of the Ratargul swamp forest Sylhet. Journal of Bio-Science. 28: 51–57.

Wang SW, Lee WK and Son Y. 2017. An assessment of climate change impacts and adaptation in South Asian agriculture. International Journal of Climate Change Strategies and Management. 9(4): 517–534.

Xu Y and Chunjing Z. 2015. Hydrological research progress in forest marsh ecosystem. International Conference on Agricultural, Ecological and Medical Sciences (AEMS-2015), Thailand. https://iicbe.org/upload/8002C0415002.pdf