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River System Climate Change in the Hatiya Islands and its Influence on the Island Environment

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Abstract: Islands are most vulnerable due to the impacts of climate change. An island of Bangladesh 'Hatiya' also affected by climate change. Present research conducted by primary and secondary data, based on qualitative and quantitative research with questionary survey and past record analysis. This study shows that Hatiya Island is influenced by natural disasters that are connected with the sea and river. Every year, due to climate change, cyclones are formed in rivers and seas. This study revealed that every year three to four storms are generated in the Bay of Bengal. The river environment is also responsible for landform changes in Hatiya Island; till now, 8 km have eroded. People change their living place because of river erosion. This study shows a 43.6 mm increase in precipitation, a 26% increase in cyclone intensity, and a temperature increase of 0.45 degrees Celsius. As a result, decrease crop and fish production. destroyed social bonding and historical heritage. Cultural, social, economic, and ecological environments are influenced by river systems. Most of the people are somehow affected by climate-related issues. Some areas are totally damaged for agriculture and home damage by soil salinity. The cause of environmental phenomena damaged cultural institutions as a result of human behavior and lifestyle influence. Health and economy are also affected by the change of river environment.

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I. INTRODUCTION

The human civilization was closely related to rivers (Hao Wang 2022). Human development is deeply connected with rivers (Qiang Zhang 2015). Climate change influences the sea and river ecosystem (Luc Hens 2018). Climate Change results in an impact on sea and river systems (Mohammad M. Rahman 2019). Flooding and fatalities as well as loss of livelihoods far from the coast, assuming that the strength of tropical cyclones and sea surface temperature are positively correlated (Ali 1996). The Meghna River influenced the circumstances of the ecosystem and local environment (Mohammad Yusuf Miah 2021). Ocean temperature was 0.88 (IPCC 2021). Global surface temperature in the first two decades of the 21st century (2001–2020) was 0.99°C (approximate) higher than in 1850–1900. (IPCC 2021). Global surface temperature was around 1.1 degrees in 1850 to 1900 and 1.09 in 2011 to 2020 (IPCC 2021).

Bangladesh is a country that is situated in a low-lying delta; topography makes it one of the most highly ranked in the world for vulnerability to climate change (P. M. Prof. Saleemul Huq 2024). This delta is the most densely populated. (Hanson 2020). Padma, Meghna, and Jamuna are also river systems of the delta (P. M. Prof. Saleemul Huq 2024). The GBM river system is one of the largest river systems under the Bay of Bengal. The Meghna River basin is the world's highest precipitation area, which is the cause of high floods and riverbank erosion (Rajib Kamal 2013). Bangladesh experienced different types of natural disasters every year because of climate change impacts. (P. M. Prof. Saleemul Huq 2024)

The coastal zone of Bangladesh had 35 million people, where all people were somehow affected by cyclones, storm surges, salinity intrusion, and floods. One-fourth of the total population of Bangladesh lived in coastal areas. The total island area of Bangladesh is 4,200 square km, where over 3 million people are extremely vulnerable (MOFDM 2010). The invariable threat of the bank erosion was contributed to a substantial disaster subculture in the riverine zones of Bangladesh (D. Hutton 2004). Around 30 million people are living in the coastal areas of Bangladesh, and they could become refugees because of climate change impacts (Biswas 2013).

In the Hatiya islands, the majority of people rely on agriculture and fish catching, which is highly influenced by climate change. Cyclones, sea level rise, and floods are major

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disasters in the Bay of Bengal region (Ahmed 2006). Hatiya Island is a valuable island of Bangladesh. Approximately 537,355 people lived here (BBS, Statistical Yearbook 2022). This island is highly influenced by cyclones, and the island's environment is also influenced by tidal surges, floods, salinity, and riverbank erosion. Cyclone Sidr and Aila are dangerous cyclone phenomena in recent times. Approximately 30% of households were affected by the cyclone. So many people become landless and extremely poor in this time. Huge losses Agriculture, fish, and livestock (Alam 2012).

This island is a geographically disaster-prone area. Cyclones, tidal surges, floods, and riverbank erosion are common phenomena of Hatiya Island. Islands are a phenomenon responsible for lofty, dense populations, poverty, and cultural divergence. River is an important role play to support the ecosystem. Hatiya Island is also situated beside the Meghna River. The Meghna River is also in the northwestern corner of the Bay of Bengal. The Bay of Bengal is the hottest zone for cyclones in the world (Mohammad Mahmudul Islam 2020). Climate change influenced the Meghna River's ecosystem (H. A. Rajalakshmi P.R 2021). This estuarial region is the most dangerous zone of climate change effects in the world for different calamities. Fishermen are economically affected, farmers are affected, and coastal communities are also affected by climate change (Mehedi Mahmudul Hasan 2021). Agriculture and fisheries are sensitive to climate change, rainfall, and temperature (Debajani Chakraborty 2021). Life and livelihoods are affected by the river environment. Tropical cyclones and sea level rise hit coastal communities that repeat every year.

Sea level rise affects coastal agriculture. Salinity intrusion degrades soil quality and decreases soil fertility. Human health is also affected by climate change in coastal areas. The cause of the natural disaster is the coastal poverty rate, which is higher than the national average (TNC 2018). A study conducted by a 14% rise in Meghna River flow when 10% rainfall increases annually (Haque, Climate Change Impacts on River System and Navigability in Bangladesh 2016).

Hatiya Island is extremely vulnerable to climate change. defined low-lying terrain and climate-related events. These include the erosion of riverbanks, the intensity of cyclones, coastal flooding, saltwater intrusion, and rainfall patterns (Md. Anisul Kabir 2020), (G.A.Parvin 2008).

II. LITERATURE REVIEW

River plays important role for create culture and civilization (Hao Wang 2022). Now a days river rapidly influenced climate change. (Qiang Zhang 2015) river affected high intense evaluation. Sea ecosystem and coastal area are affected by increasingly irreversible climate change (Mohammad Yusuf Miah 2021).

Table 1 Overall Temperature of Bangladesh

Year	Number of years	Temperature
1981-2010	30	25.8
2011-2023	13	26.2

Source: BBS and BMD.

Climate change responsible for hydrological changes. Climate changes Water related and river related crisis such as sea level rise, decrease of mean precipitation and ocean acidification (Mohammad Mehedi Hasan, Impact of climate change on hydropower generation in Rio Jubones Basin, 2018).

Bangladesh is the world largest delta that's highly vulnerable to climate change (P. M. Prof Saleemul Huq 2024). Rivers since the dawn of mankind influenced the economic, cultural, political development of human society river systems have experienced significant alterations as a result of climate change.Human societies and ecosystems are influenced by water as the main medium (P.Ray 2020).In last decade 90% destructive natural disaster influenced the water system that's mean sea surface changes and trend of precipitation play important role influenced water quality changes (GAR 2017). Changes of temperature affected the dissolved oxygen content, nutrient load, and pollutant toxicity of water. Meghna river and Bay of Bengal important role play for human society and natural environment here major climate related effect is flood, wave, health diseases (Alam 2012). Trend of temperature and precipitation responsible to rise up climatic event intensity (J. Caesara 2013).

Most of the people engaged with agricultural activities but agricultural sector also affected by climate change (Farhat Jahan Chowdhury 2019). Crop losses and water security also affected by climate change. Sea level rise's primary effects on water resources are the decline of freshwater availability due to saline intrusion. As sea levels rise, the salinity of the water and soil along the shore will rise as well, changing the typical properties of the coastal water and soil (AHMED 2012).

The occurrence of chars and the displacement of riverbanks by meters or kilometers are being caused by alterations in river flow, sediment accumulation, and flood patterns. (Rahman 2018). River's depth is reduced by siltation, raising the possibility of floods. This makes the effects of cyclones, heavy rain, higher tides, and larger tidal surges worse (SUZA 2023).

Because of the frequent coastal hazards and the potential effects of climate change, the coastal island of Hatiya is among the most susceptible places in the nation (Mohammad Abdul Kader 2013). Hatiya Island has five major vulnerabilities that have been discovered. These include saline intrusion, riverbank erosion, storm surges, floods, and cyclones (AHMED 2012).

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Hatiya has experienced an increase in cyclone strength, tidal surges, and riverbank erosion in particular. Additionally, a large portion of the coastal population is now more vulnerable due to income declines combined with a sharp rise in the cost of food and other essentials (Mehedi Mahmudul Hasan 2021) (SUZA 2023). An average 5 km land area have lost in northern part of hatiya (Md. Anisul Kabir 2020). whom are dependable on catching fish they are deeply feel the climatic event (SUZA 2023). Climate change also responsible for changes life cycle style and migration of hilsa. (EkattorTV 2024).

River banks become wet during the monsoon and progressively dry off during the dry season due to the 4-5meter change in water level as a result of this process, the banks may become unstable and collapse. The estuary of the Lower Meghna may be considered to the helisa and Shahhazpur rivers (Md. Royhanur Islam 2018). Extremely low flow has an impact on the ecology in New Zealand because summer temperatures are somewhat higher, which reduces the agricultural catchment area for low flow (B.S.Canso 2001).Climate change has affected river in several ways. (DECCMA 2017) (P. G. Whitehead 2015) (G.A.Parvin 2008).

Township affected by hatiya river system but no research has been done on the trend of climate change surroundings river and hatiya island impact of river system due to climate change.

➢ *Research Objectives*

- Trend of climate change analysis on river system of surroundings Hatiya.
- Analysis of Hatiya islands impacted by river system.

➢ *Research Questions*

- What are the changes in the river climate around Hatiya due to climate change?
- What is the impact of changes in river climate on Hatiya?

➢ *Research Hypothesis*

- Due to climate change, human health is affected by river flow.
- Due to climate change, the island economy is affected by the river.
- Island culture influenced by climate change of river.

III. RESEARCH METHOD

In this study, the response of the trend of climate change impact on Hatiya Island is a comprehensive methodology incorporating both qualitative and quantitative approaches. A model was developed to approximately analyze previous historical temperature and precipitation data on the surrounding river system over Hatiya and the impact of social and cultural changes on the island.

➢ *Sourch of Data*

This study related data collected both of data collection process that's primary and secondary sources.

- *Primary Data:*

primary data collected from Hatiya Island by questionnaire survey. There are 9 unions, which are different types of people.

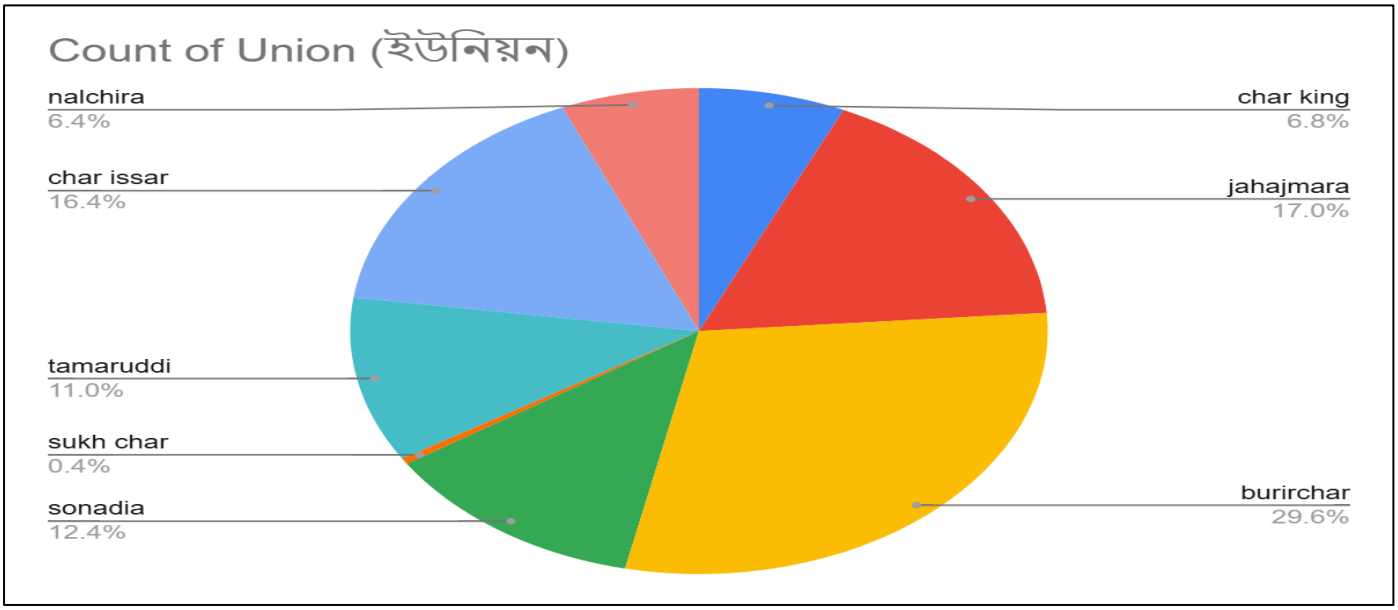

Fig 1 Union Based Data Sample of Hatiya Island

- *Secondary Data:*

secondary data collect from BBS, BMD, newspaper and previous study.

➢ *Data Collection Method*

Primary data collected by questioner survey there 500 respondent attends with this survey from hatiya island and field observation. Secondary data collected from government

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weather department which is BMD, BBS and some data collected from published journal and newspaper. Total sample size 501.

➢ *Data Analysis Method*

The following methods were adopted to carry out the study, both qualitative and quantitative data analysis methods. This study was conducted with 500 people with a questionnaire survey on the climate change impact on the island and an analysis of historical data, journal, and newspaper data for the trend of climate change on the Meghna River with historical data analysis.

➢ *Data Processing Method*

The observed temperature and precipitation data over the Hatiya Sorrundings River system, such as the Hatiya channel, Sahbazpur River, and the northern Bay of Bengal, developed my BMD and IMD. The data cover the years 1960 to 2020 climate change impact on Hatiya Island on social and cultural effects. observed river impact on island to climate change-related event.

IV. STUDY AREA

Hatiya Island is an upazila of Noakhali district. Here are 11 unions, but our study area is only Hatiya Island, which includes only 8 unions. (Field survey). The total area of Hatiya Island is about 371 sq km. According to the Population and Housing Census of Bangladesh conducted by BBS In 2011 (B.B.S. 2011), The total population of Hatiya Island is about 452,987 there. Male is about 50.73%, and female is about 49.27%. (BBS, Statistical Yearbook Bangladesh 2023). Total population of this island is 452,463. Total area of this island is 2100 sq km, Hatiya Thana. Hatiya island population 537355 by 2022 census (BBS., Statistical yearbook 2022). Our study area, the mainland of Hatiya, has a total population of 306,144, according to the Census 2011. (B.B.S. 2011).

➢ *River Environment of Hatiya*

This study area is bounded by the River Meghna, the Hatiya channel, and the Shahbazpur channel. Hatiya island environment influenced by river and sea. This island is situated at the mouth of the Meghna River. Bay of Bengal flown south of Hatiya Island. Hatiya Channel is on the north and east side of this island, and Shahbazpur Channel is on the west side. Shahbazpur Chanel is a flood zone. (Lalit Kumar 2012**).** The Meghna River is the largest river system in Bangladesh. This river's water quality is better than that of other rivers in Bangladesh, but in recent times, water quality is going to be bad**.** (Khandu 2016). millions of tons of sediment gather due to riverbank erosion. (Yong-Fei Zheng 2017). flood risk is high to Meghna estuary. (Md. Golam Mahabub Sarwar 2005**).** The Bay of Bengal is situated at the mouth of the Indian Ocean. The Bay of Bengal is one of the most terrible zones in the world; there are different types of natural disasters. The Northern Bay of Bengal is more than the other regions of the Bay of Bengal. This region is devastated by climate events, including cyclone intensity, sea level rise, floods, and riverbank erosion.

➢ *Climate Change of Hatiya Island*

- *Temperature:*

Globally sea surface temperature is increasing 0.2-0.3 degrees Celsius. (C. K. FOLLAND 1990) and according to the IPCC, the upper layer of the ocean has increased 0.6 degrees Celsius in the last 100 years. (IPCC, Climate Change 2007) Sea surface temperature over this era rose by 0.02 degrees Celsius per year. (World Bank 2024) That's much faster than previous decades. Researchers observed the Bay of Bengal is higher than other areas of the sea.

Hatiya island temperature is alarmingly increasing year by year. This island's 0.45-degree Celsius temperature differs from 1995 to 2023 (BMD). High temperature rising also influenced precipitation and riverbank erosion. salinity problem, flood, tidal surge, and other climate-related issues.

Table 2 Hatiya Island's Temperature (1995-2023)

Year	Temperature	Trend
1995-1998	26.15	--
1999-2003	25.82	-0.33
2004-2008	25.9	0.08
2009-2013	26.1	0.2
2014-2018	26.11	0.01
2019-2023	26.6	0.49

Source: BBS and BMD.

➢ *Precipitation Trend of Hatiya*

Bangladesh is the wettest country in the world. Meghna river basins received 34.39% more than normal month, another study said that 29.8% in a month. when 2 degrees Celsius temperature rise then 10 % increase precipitation (M.M.Q. Mirza 1997). Rainfall patterns in Hatiya range from 2668 to 4360 mm**.** precipitation intense impact on water resource (Khandu 2016).

Table 3 Precipitation Trend of Hatiya

YEAR	PRECIPITATION	TREND
1981-2010	3312mm	--
2011-2023	3355.6mm	43.6mm

Source: BBS And BMD

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Here is shown the precipitation trend of the Meghna estuary island of Hatiya. 1981 to 2010 precipitation mean 3312 mm and 2011 to 2023 precipitation mean 3355.6 mm; that's an increase of 43.6 mm (B.B.S. 2011., BBS., Statistical Yearbook Bangladesh 2023., BBS., Statistical Yearbook 2022., BMD).

➢ *Riverbank Erosion of Hatiya*

Hatiya Island faces riverbank erosion; the northern part is too much catastrophic compared to the other coastal part of Hatiya. 8 km eroded in 45 years. Here, the landward shifting rate is 285 m per year in Hatiya Island (Md. Anisul Kabir 2020). Our study shows that in the last 10 years, there has been 3 km of erosion in the northern part of Hatiya. Seaward shifting 2.5 km, then again eroding in the eastern northern part of Hatiya. Last week, 150 yards eroded in the northern part of Hatiya. Another person said that 20 m of erosion in 1 week (Field survey). Over the 21 years (1989–2010), Hatiya Island eroded 6476 hectares and a new land area of 9916 hectares rose (Manoj Kumer Ghose 2015).

➢ *Sea Level Rise in Hatiya*

Officially observed that 5.73 mm rising sea level in Char Changa (FinancialExp 2019). Another study has shown that the sea level rise trend is 6.0 mm/year, respectively (Md. Golam Mahabub Sarwar 2005). Char Chenga is an area of Hatiya Island. Sea level rise in Bangladesh ranges from 3.8 to 5.8 mm per year, which is higher than the global average (UNICEF 2016).

➢ *Flood in Hatiya*

Climate change impact responsible for flooding in Bangladesh and potential role play rising sea level and river flow (M. Shahjahan Mondal 2018). Climate change influenced river flow. When there is a 10% increase in precipitation, then there is a 14% increase in annual flow in the Meghna River (Haque, Climate Change Impacts on River System and Navigability in Bangladesh 2016). It was found that the peak flow may increase 4.5–39.1% in the monsoon, and the dry period low flows may drop by 4.1–26.9%, indicating high seasonality as a result of climate change (Rajib Kamal 2013). upstream freshwater flow higher increase in Meghna. Meghna river's water level also plays an important role in increasing river flow (Field survey).

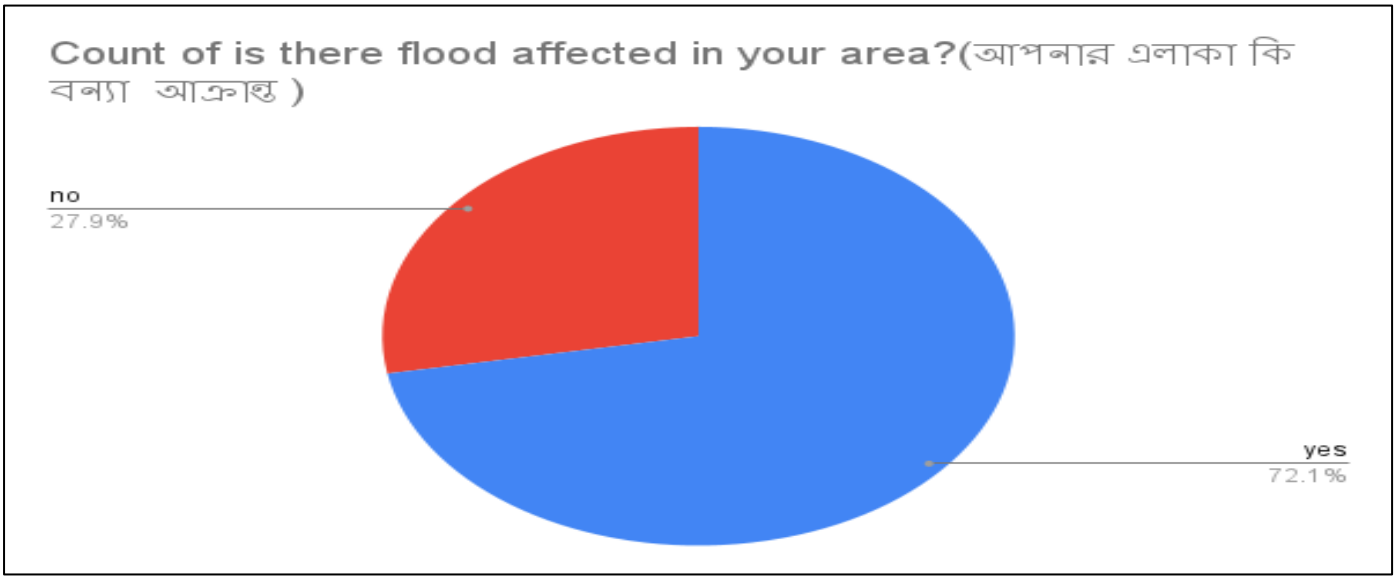

Fig 2 Flood Affected of Hatiya Island

Hatiya Island is also affected by lower river flow. 72% of land area affected by flood **(**field survey). cause of flood effect damage ecosystem social infrastructure livestock and human losses also. Sonadia, Charking, Tamaraddi, Nalchira, Sukhchar, and outside of the embankment area are too much affected by river flow and flood hazards.

➢ *Cyclone in Hatiya*

BOB is the hottest zone of tropical cyclone with an average of three to four storms annually (Md. Mahbub Alam 2003). A total of 539 tropical cyclones were formed on the coast of this region during the last 131 years, extending from 1877 to 2007. On average, 4.1 tropical cyclones in a year (Dewan Abdul Quadir 2008). Between 2000 and 2019, Bangladesh experienced more than 185 extreme events, making it the seventh most vulnerable country in the world. Tropical cyclone annually increased frequency 0.006 per year (Mohammad Mahmudul Islam 2020). Tropical cyclone Intensify by 10 to 20% when the temperature rises by 2-4 degrees Celsius (Haque, Climate Change Impacts on River System and Navigability in Bangladesh 2016). In the last 120 years, there has been a 26% increase in cyclone intensity in the Bay of Bengal (Daily Star 2010)

➢ *Tidal Surges in Hatiya*

A total of 59% of land area inundated by tidal surges in Hatiya Island. (Field survey). As a result, the salinity problem increases day by day. Cropland damage by tidal water and salinity. decreased crop harvest by tidal surges. Those people live in the riverine area every day affected by tidal surges. During monsoon surges, they devastate their living component.

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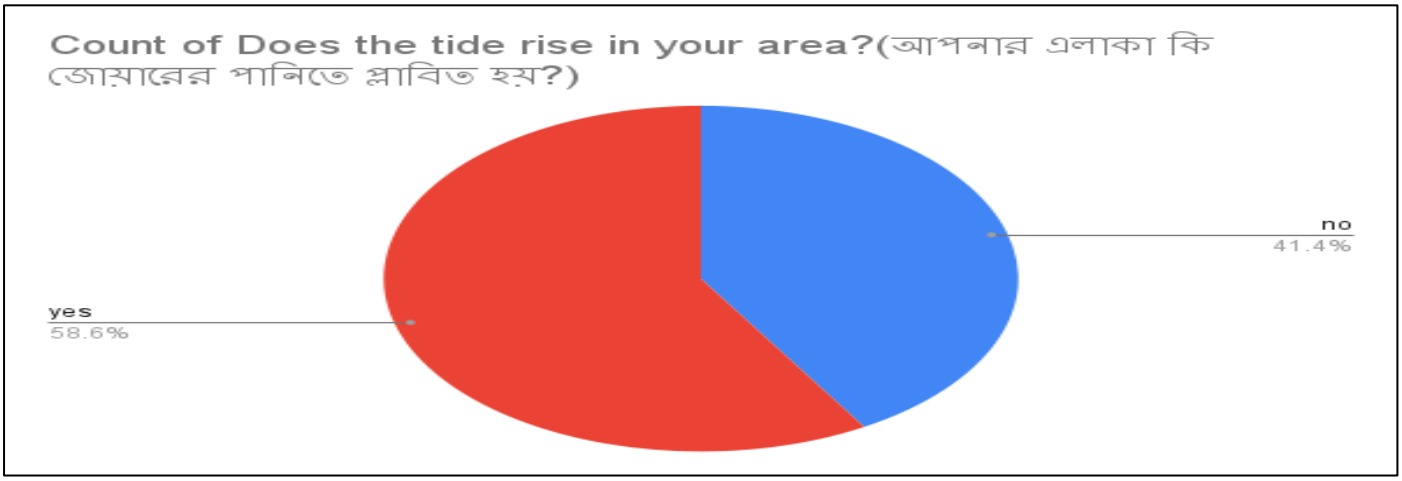

Fig 3 Tidal Area of Hatiya Island

Tidal surges affected crop fields, cultivated fish, and social environments. Tidal surges help to increase soil salinity on this island.

➢ *Salinity in Hatiya Island*

Rainfall patterns influenced water salinity (Debajani Chakraborty 2021). The TDS and salinity of The Meghna River water were found to be 101.4 and 0.4%, respectively. The EC values 202.8, the pH values of 6.8 (Shamima Sultana 2022).

V. DISCUSSION AND RESULT

➢ *Respondents Profile*

Our study area respondent profile is significant for understanding how to relate to the climatic problem there. This segment is designed on the basis of social and economic conditions. All our respondents lived on Hatiya Island. Noakhali district includes Hatiya Island; people have an average income of 180 USD (Tasfin Aziz 2021).

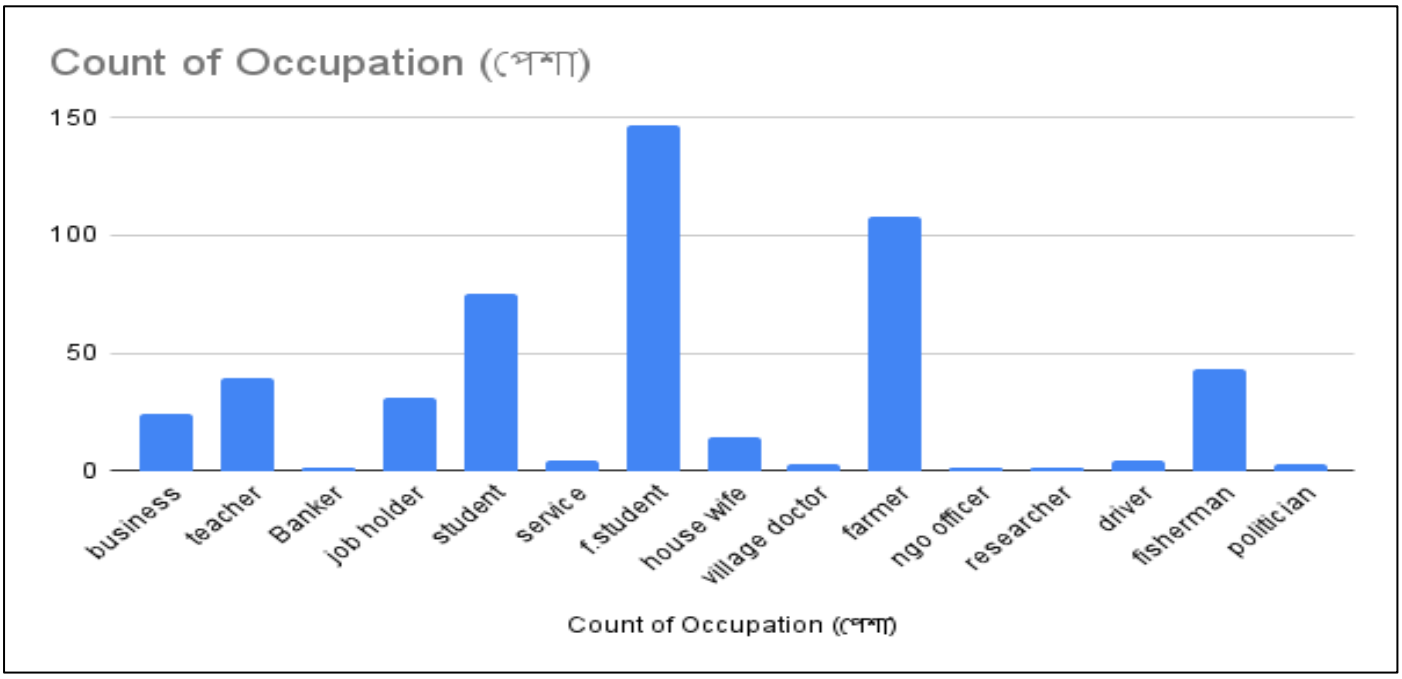

Fig 4 Occupation of Respondents

Here, farmers, fishermen, students, teachers, businessmen, and rickshaw pullers are different types of people in our study respondent. We covered the mainland of Hatiya, including the most vulnerable parts of Hatiya, such as the riverside area and sensitive occupied people, which are farmers, fishermen, daily laborers, services, bankers, job holders, housewives, village doctors, and researchers. Total literate people in Hatiya: 34.21%. A total of 10 + population 307955 and employment status 111446 according to census 2011. According to the 2011 census, the unemployment scenario is high rather than the employment status. Our study area has a 10+ population of 211,623. Total 10 + female population 157582, 4 ages child is 14.7% 5-9 is 17.2% in total population (census 2011).

14% peoples under 18 and others people between 18 to 60 years.60 above or senior citizen 7.2 %.

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Table 4 Age Ratio of Respondents

Age	percent
>18	14
19-30	34.8
31-40	12.4
41-50	15.6
51-60	16
61<	7.2

➢ *Social Effect*

Society structure and development depend on some standard parameters, which are a major problem for society development: climatic phenomena. Hatiya Island is dangerously affected by climatic hazards. Riverbank erosion damages social bonding. Floods and intense cyclones damaged Hatiya's socialization. Sea level rise and salinity ruin the economic structure of crop harvest as a result of the social economy. In Hatiya islands, most of the people engaged in fishing and agricultural activities (P. G. Whitehead 2015), but which sector is highly influenced? That is fishing and agriculture. Charking, and which area is very closely related to the river? Those are everyday affected by tidal surges and affected floods as a result of increased soil salinity. This area is not suitable for living; as a result, people migrate to other places for better lives. Low-lying land flooded anytime with any cases (Shardul Agrawala 2003). All social parameters bend by climatic problems. Soil structure is fully destroyed by the salinity problem. Some areas are completely in drought, and other areas are not enough for harvest. very affected charking, sukhchar, Nalchira, and affected areas Tamaraddi, Charissar, and Sonadia are moderate affected areas. The other area is Jahajmara, Burirchar, and the other union of Hatiya. But all union riverside areas are highly vulnerable to climatic problems. Crop, rice, and fish cultivation affected by climatic phenomena. Frequently climatic hazards such as floods and cyclones reduce agricultural income over the year (P. G. Whitehead 2015).

Riverbank erosion damaged hundreds of years of established socialization and family kinship. Cyclone intensity damages social infrastructure and property. Cause of climatic hazards: child deprivation of standard socialization and institutional teaching. Increase child labor; they were early engaged with work because of poverty, which helps to increase climatic phenomena. People cannot lead life with their expectations. The cause of riverbank erosion is the increase in trans-migrants; those people are not adapted to new places and new environments. Because of climatic hazards and erosion, a person lives under poverty to the richest person. Dwelling house damages, institution infrastructure damage, stopping educational activity for some time, and damaging embankments for cyclones and floods. Charking and sukhchar union most of the dwelling house damage by soil salinity. When damage to the embankment occurs, then stop contact with each other. Road infrastructure is completely destroyed. People in the Riverside area every year face climate-related hazards. See that some of the people feel fear, and they are not able to muster enough mental strength. Some of the people feel irritability and aggressive mode; as a result, they engaged in unsupportive work. Riverbank erosion directly influenced land use changes in Hatiya Island. people seeking new workspaces and trying to detect new work environments (P. G. Whitehead 2015). River flow impacted land use changes and water quality deposition (P. G. Whitehead 2015).

➢ *Cultural Effect*

River climate change impact on island culture. Hatiya Island is directly influenced by the river system, but the island culture is influenced by river characteristics that are manipulated by temperature and precipitation. Increasing cyclone and flood intensity is the cause of the trend in temperature. Increasing river erosion is the cause of river flow. That's why there is a low index to island culture development. World culture and civilization are influenced by river systems, but the cause of climate change impacts badly influences the established riverine culture and civilization development. Riverbank cyclones and floods are also responsible for riverine culture; that's the cause of riverbank erosion and the high index of dense population.

The island's traditional mosques, temples, bazaars, schools, and colleges are disappearing into the river. It has a serious effect on the human mind and brain, which is reflected in social life. Where human beings are seen living together, kinships are forced to break the bonds of kinship and move to other places, newly starting their lives. In some cases, there is social discrimination and listening to some bad talk. Due to overcrowding, children do not get enough space for cultural development. Frequent change of place and friendship hinders their intellectual development. Due to the natural disaster, the development of the society was disrupted. Child labor and child marriage are on the rise. The tendency to hide from society can be seen due to lack of finance. Having to live a poor life and having to depend on others due to not being able to make ends meet. Due to social poverty, social conflict increases. On the other hand, floods and cyclones hit at high speed every year, due to which people are losing their safe habitat. Due to climate change, people whose source of income in the river changed their profession and worked as laborers. People are failing to meet their basic needs due to frequent cyclones and floods. Due to frequent natural calamities, the regular functioning of the society is disrupted, social communication is disrupted, as a result of which the kinship ties are destroyed, and a very self-centered social system is emerging. Cultural development is not taking place, but thousands of years of tradition are about to be lost. People have to go through a life of poverty, unsafe housing, psychological pressure, and struggle.

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➢ *Economic Condition*

River line islands are influenced by the river environment, but when the river environment changes, then the economic condition changes. River erosion, cyclones, and floods influenced the island economy. Water quality decline in river cause of temperature rising. Crop fields flooded because of sea level rising. Although the water quality of the Meghna River is better than that of another river's water in Bangladesh. In this area, flood intensity is too much rising for sea level rise. It's destroying houses, livestock, cropland, shop products, cultivated fish, and land fertility. Because of too much flooding, an increase in soil salinity as a result of decreased harvesting, and less than seasonal crops. Like a bough, etc. Cyclone intensity is also responsible for floods that decline paddy production. The cause of the flood and river erosion gathered sediment. Sediment gathering is also responsible for flood intensity and declining fish catching. In Hatiya, the majority of people engaged in fish catching. The Hatiya economy is influenced by fish catching, but fish catching declines day by day as a result of the island economy affected by river impact. Because of fish catching, crop and paddy production declines as a result of the island market depending on imports. It's responsible for the price hike of regular goods. cause of river erosion People displaced their own property so they could live in another suitable place on the island as a result of increased density and declining fertile land. In island societies, people live under poverty. Lack of food and regular needs for flood effect. Increase labor and board personnel for decreased agricultural production and fish catching. Poverty is responsible for the increase in beggars and daily labor and jobless people also. Cyclone floods and river erosion have displaced too many and made them live under poverty on this island. Every year, cyclone and flood problems impact the economic structure in Hatiya Island individually per family, losing 30,000 to 5 lakhs, and every society loses 10 lakhs to 20 crores in damage from climatic hazard events. (field study 2024). Cause of climatic event losses: domestic animals (cow, goat, cock, hen, duck, etc.). Climate change is also responsible for soil fertility. Every year, local people are affected by the flood problem. Not only is this flood intensity increasing day by day. Salinity increases by flood as a result of soil fertility decrease. Seasonal crops and regularly harvested crops are also affected by climatic events. Harvested paddy, collected paddy and rice spoiled by cyclone and flood problems because of the lack of a safe house. Paddy tree and other crop growth affected by salinity. Salinity problems are also responsible for spreading animal disease, besides river shop products, and important family instrument damage by floods. Cyclones spoiled paddy trees because sometimes cyclones attack before crop harvest.

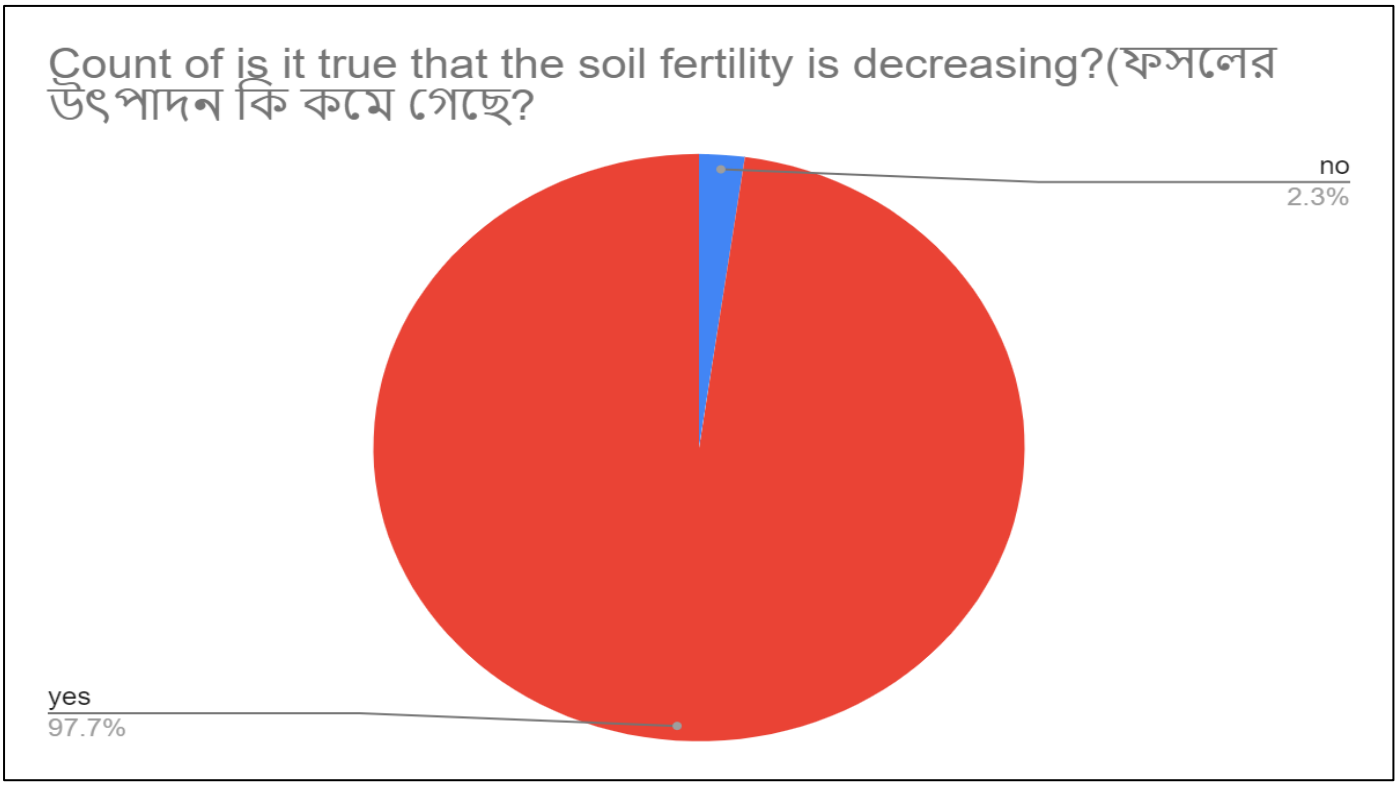

Fig 5 Respondents Opinion About Soil Fertility

Soil fertility decreased alarmingly; our study result is 97% of people agreed with us that soil fertility decreased.

Fish catching is one of the major sources of economic growth on the island (Tasfin Aziz 2021), but riverbank erosion increases river water salinity, and fish catching is affected, which impacts the social economy. According to researchers, 60% of hilsa decreased in the last few years in Meghna. There is a 10% reduction due to climate change (Mohammad Mahmudul Islam 2020).It's also alarming for national GDP. The cause of the less fish-catching economy growth affected the island. 95% of people said that the total amount of fish decreased because of climate change impact.

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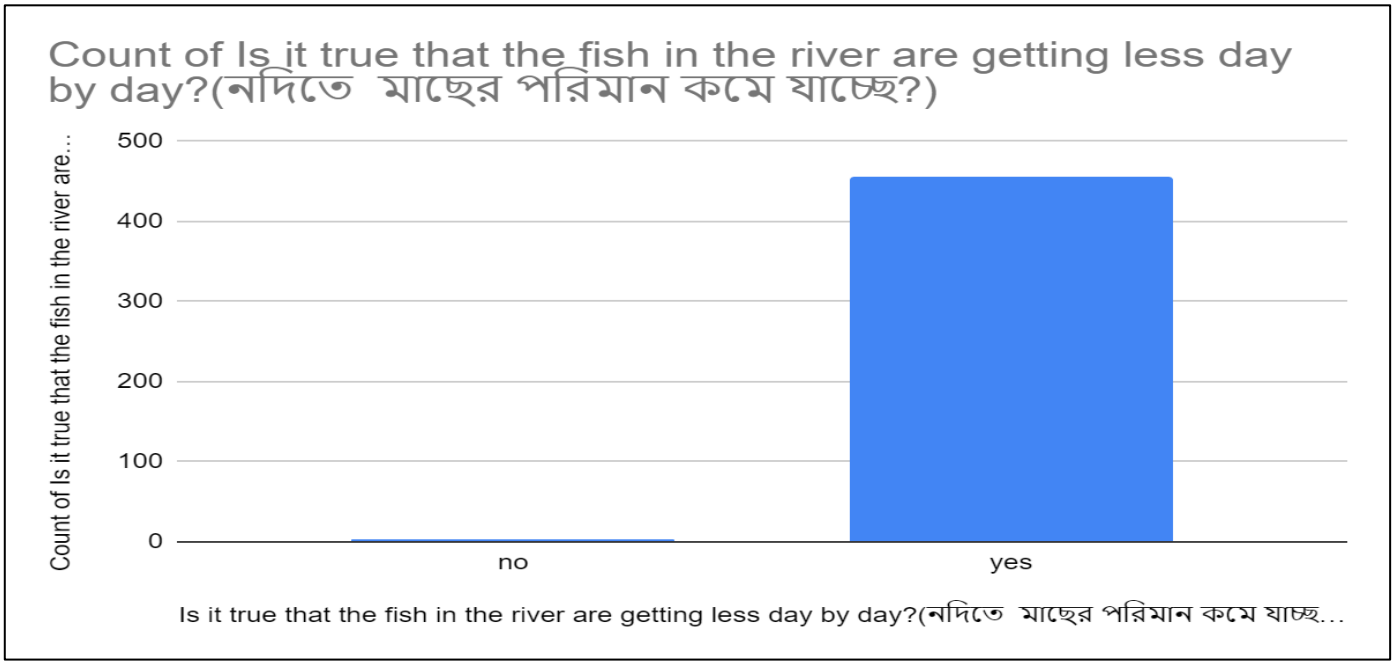

Fig 6 Fish Decreased in Hatiya Island

➢ *Ecological Effect*

Riverine islands are in disaster too much intense day by day due to climate change. That's why effected natural environment. Due to cyclone and flood intensity damage, the terrestrial region lost animal and bird species as a result. Decline the bird nest and deer accountability; it is too much decline. On the other hand, terrestrial regions are damaged due to river erosion. Due to floods and river erosion, millions of tons of sediment gather in the river. As a result, lost river ecosystems and damaged fish species. Cause of cyclone and flood: lost fish species and fish farms, lost forests, and damaged trees. Due to riverbank erosion, 795 ha of mangrove were converted to agricultural land (M. Main Uddin 2013).

➢ *Health Condition*

Due to climate change, the effect of the river on the island has harmful effects on the health of the people. Due to frequent floods, diarrhea, skin diseases, colds, coughs, and fevers are spreading. In addition, dysentery, typhoid, and jaundice are also spread. Due to river erosion, cyclone, and flood intensity, human suffering from malnutrition. Pneumonia, headache, breathing problems, influenza, depression, and hypertension. They are not able to have mental strength. Because of climate change, see that irritable behavior. Due to climate change, the river is badly impacted as a result of the river quality spoiled. That's a vital issue of illness increasing day by day. Our field survey results find out alarming data.

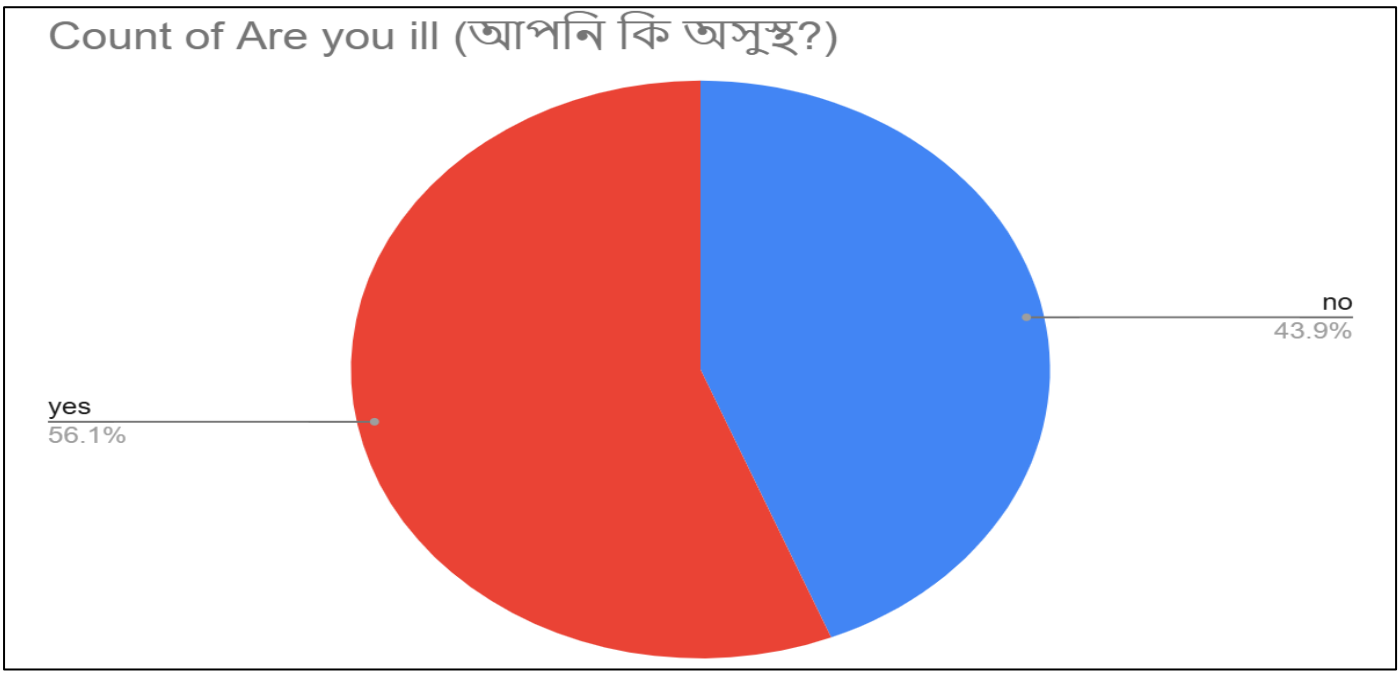

Fig 7 People's Disease Ratio

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Most of the people suffering any disease, our study results show, 56% of people suffer from any kind of disease. and 300 hundred people responded that any family member is sick from climate changes (field survey).

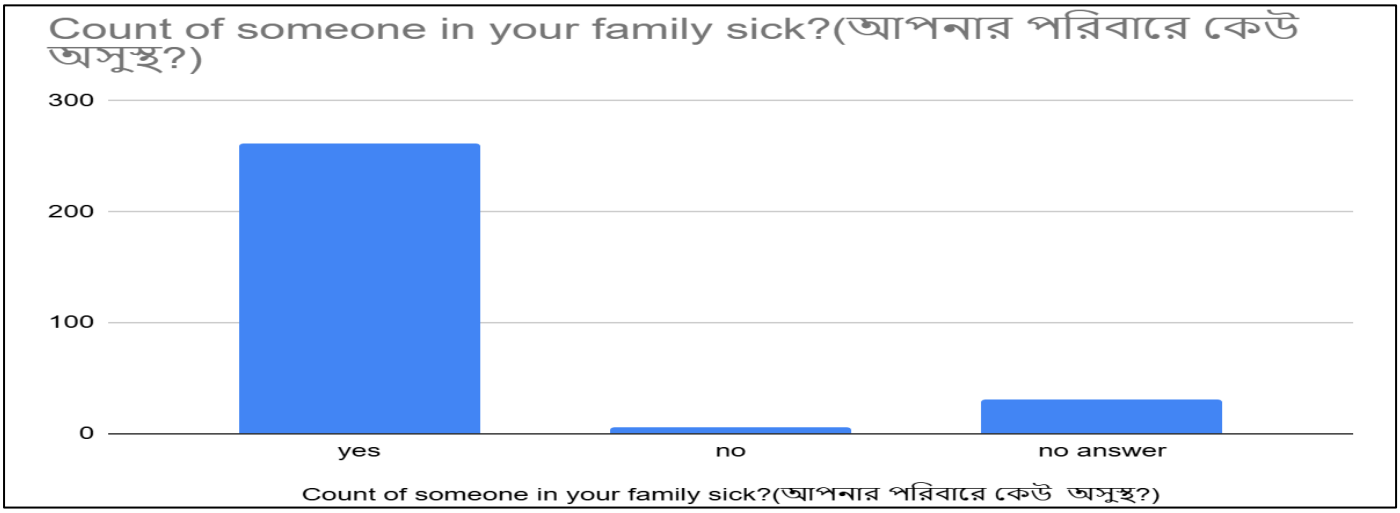

Fig 8 Family Members Sickness Ratio

Including jaundice (hepatitis), liver disease, asthma, influenza, viral fever and other viral complications, diabetes, heart attack, stroke, gastric ulcer, cancer, and so on (Babul Hossain 2021).

VI. CONCLUSION

Hatiya is one of the major vulnerable islands that's highly influenced by riverine climate. The Meghna River is impacted by climate change. This study basically shows the temperature and precipitation trend. Sea level rise. tidal surge, flood, salinity, and cyclone are major climatic hazards that influenced island environmental impact. The majority of people depend on fish and agricultural activities, but the cause of climatic hazards badly affected fish-catching and agriculture-related people. People are also affected socially, culturally, and economically by river climate change. Human health and ecological effects are highly influenced by river islands also. Riverbank erosion is a dangerous hazard on this island. The present study found that the temperature and precipitation trend is going to bad.

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