THE ROLE OF VEGETATION TO PROTECT BIODIVERSITY OF CHAR LAND FROM DISASTER: A REVIEW

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ABSTRACT

Bangladesh's chars are primarily generated by silt deposits generate from river erosion from three rivers Padma, Meghna and Jamuna. The overall Charlands area in Bangladesh is 1722 km^2, which makes up 1.7% of the country's total land area. Every year a new charland of 45 km^2 is raised from sediment deposition in the Meghna river estuary (lower Meghna floodplain and coastal plain), whereas 25 km^2 of occupied charland is lost to the river bed. As a result, despite a net charland gain of 20 km^2 each year in the Meghna estuary, there is a major loss of settlement and agricultural land. The charlands are the home to the poor people of Bangladesh. Charland is home to around 5% of Bangladesh's total population. This amounts to approximately 6.5 million. The char people rely primarily on agriculture and related activities. Charlands consists of very good fertile soil, which makes a wide variety of plants and vegetables grow there. The fertile soil on charland also supports agriculture, making it an important source of food for the local communities. The charlands of Bangladesh are being affected by natural disasters such as floods, river erosion and cyclones. Natural calamities such as floods, river erosion, and cyclones are wreaking frequently on Bangladesh's char regions. The biodiversity, vegetation, flora and fauna of the island char area have been extremely damaged as a result of this natural disaster. Many vegetation (flora) that was formerly common on the island char has been extinct as a result of river erosion. Many fruit plants and animals (fauna) are disappearing and being washed away in waterways. The catkin is useful vegetation that is the most abundant species in charland ecosystem. Its dense root system helps to stabilize the soil and prevent erosion, while its ability to accelerate silt deposition improves the fertility of the charland. Catkin has multipurpose uses, the Chars people make major use of it as thatching material for their homes. It is also a source of income for those who sell the catkin as thatching material in nearby mainland marketplaces. Catkin also provides shelter and nesting sites for various bird species. It plays a crucial role in protecting biodiversity from natural disasters.

Keywords: *Charlands, island char, vegetation, catkin, flood*

1. INTRODUCTION

Bangladesh is famous for having the world's largest delta. The delta is formed by the confluence of three major rivers: the Ganges, Brahmaputra, and Meghna (GBM). These rivers convey sediment from the Himalayas catchment to the Bay of Bengal. The GBM River System transports almost 2 billion tons of silt each year. This massive amount of silt deposition contributes to the continuous formation and shifting of charland, which in turn increases the risk of flooding and river erosion in Bangladesh. Bangladeshi rivers flow 1.72 million km² of water yearly, which is roughly 12 times the size of the country (Sarker, 2003). The extensive flow of water from Bangladeshi rivers not only carries sediments but also serves as a vital source of freshwater for irrigation, drinking and groundwater aquifer recharge purposes.

Bangladesh is situated at the meeting point of the Indian, Burmese, and Tibetan (Eurasia) plates. The junction of the three plates covers an area of approximately 200,000 km^2. Bangladesh occupies one-quarter of the total land area (Goodbred et al., 2014). The Eastern Himalayas are in southern Bangladesh, and the Indo-Barman range is in eastern Bangladesh. This organic silt flows via the GBM River System, where it is deposited and the world's largest delta is formed. Tectonic Plate, Sediment Supply, and GBM River System are significant factors in the formation of great deltas (Alam & Curry, 2003). The Ganges River flows from the southern Himalayan slopes into Bangladesh through the Rajshahi area. The Ganges River flows through Bangladesh's southeast and enters the Brahmaputra River at Goalanda Ghat (Ahmed, 1968; Haque and Jakariya, 2021). The Brahmaputra River originates in the Chinese Himalayas and flows south via Tibet and India into northern Bangladesh. The Jamuna River is named for its meeting with the Teesta River in North Bengal (Rashid, 1978; Sarma, 2004). The Meghna River flows from the Shillong Plateau in Assam, the rainiest region in the world, to the Padma River at Chandpur (Zaman & Alam, 2021).

Bangladesh's chars are primarily generated by silt deposits or river erosion from three rivers. In braided rivers, such as the Jamuna, medial bars appear as islands within the river channel. Point bars appear as land linked to riverbanks in both braided and meandering rivers. In Bangladesh, these rising lands are known as chars, and they provide potential for human settlement and agricultural activity (Sarker, 2003).

The charlands are the home to the poor people of Bangladesh. The island chars are not well connected to the mainland and are prone to severe erosion and floods, making the residents feel unprotected. Despite these physical issues, a sizable population lives there, enduring arduous and unstable conditions (Rahman et al., 2005; Islam and Nurullah, 2021). Char regions are especially vulnerable to the consequences of recurrent climate shocks (floods, droughts, and cyclones), which exacerbate the insecurity of poor people's lives by destroying their assets and forcing them further into poverty (Bender, 1999; Tasnuva et. al 2022; Al Mamun et al., 2023). Char regions in southwest coastal belt have extreme shortage of drinking water including cyclones and tidal storm surges (Bari & Sayeed 2022; Mondal & Bari 2022; Bari et. al. 2022).

The char people rely primarily on agriculture, fishing and related activities. There are few opportunities for off-farm activity. Because of river erosion, cultivable land, crops, and dwellings are frequently ruined or destroyed by rivers. Strategies for a livelihood related to fluctuations and changes in the environment are to be applied (Anderson, 1995; Mahmud, 2020; Kamal, 2011). The biodiversity of the char is continuously changing as a result of river erosion and other natural calamities. Many plant and animal species are present on the mainland but the same species are absent from charland (Sarker, 2003).

Various studies have been done at different times on the formation of charlands, the livelihood of charlands, the water crisis & sanitation (Ahmad et. al. 2014; Mondal et. al. 2023), the biodiversity of charlands and natural disasters. However, no research has been found on the biodiversity of charlands or the role of catkin in preventing river erosion and conserving the biodiversity of unprotected

charlands. The objective of this study is to evaluate the contribution of catkin from available literature for the safeguarding of unprotected charlands.

2. METHODOLOGY

This is a review paper. To achieve the main objective of this research, all the primary data have been collected from various secondary sources. The collected data is taken from various research papers, scientific journals, conference papers and reports of various Government and NGOs. All the data was collected based on four categories such as the formation of charland, biodiversity, vegetation and natural disasters of charland.

Through the literature review, we found two types of charlands in Bangladesh, as well as knowing the existing biodiversity in these charlands such as flora and fauna, existing vegetation and natural disasters in charlands. A graphical presentation of the methodology is shown below in Figure 1.

In this figure, we can see that the four categories described above were analyzed to achieve our targeted review and we obtained targeted findings such as fast-growing plants in charlands that protect charlands soils and the diverse applications of some plants and their importance in biodiversity conservation. In this paper, the local names for the flora, fauna and fruits are used for the targeted Bangladeshi readers.

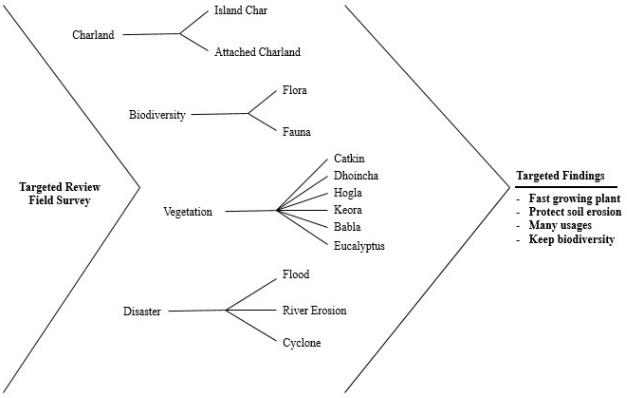

Figure 1: Graphical presentation of methodology

3. FORMATION OF CHARLAND

Bangladesh is a country bordered by rivers. There are around 300 rivers, both large and small. This has formed a net around Bangladesh. Padma, Meghna, and Jamuna are the country's three major rivers. Bangladesh is one of the countries with the highest concentrations of sand carried by the GBM River System. Char refers to land that is surrounded by rivers or seas as a result of river dynamics. The overall Char land area in Bangladesh is 1722 km^2, which makes up 1.7% of the country's total land area (Haque and Jakariya, 2021). Chars are classified into two types. The first is island char, which refers to a charland that is surrounded by water. This charlands lies between 2 and 10 km from the mainland. Boats are primarily utilized vehicles to access this char region. The second is attached charland, which is attached to the mainland (Rasheed, 2008).

Haque and Jakariya (2021) conducted a research and found that as the charland surface is not much higher than the river water level, these chars are readily inundated by floods. Charland can be classified into two categories based on its stability. (1) Old Charland is referred to as permanent char. The old chars are most probably several centuries old, with developed soils and fresh groundwater. (2) Young Charland is referred to as newly accrete or temporary char. The recently settled chars contain

salinity and poorly developed soils that make them unsuited for development or agriculture. Young char is prone to river erosion and may lost in the river bed. Large islands in Bangladesh such as Sandwip, Ramgati, Bhola, and Hatiya have evolved during the past few thousand years in the dynamic delta basin that covers across the majority of Bangladesh's coastal lowlands.

According to Ahmad (1968) and Haque (1997), due to the dynamism of the deltaic plain, its landform shifts frequently, making it extremely vulnerable with many current regimes. Every year during the monsoon, a significant portion of the land is submerged and new fertile soil formation from silt deposits is a vital part of deltaic processes, particularly in the Meghna-Tetulia-Shahbazpur distributary system. Brammer (2004) clarifies the formation and erosion of charland and states that 45 km^2 of new charland is raised from sediment deposition in the Meghna River basin (Lower Meghna) per year, whereas 25 km^2 of occupied charland is lost to the river bed. As a result, despite a total charland expansion of 20 km^2 each year in the Meghna basin, there is a major loss of settlement and agricultural land.

4. CHARLANDS OF BANGLADESH

According to Zaman and Alam (2021), Bangladesh's chars are classified into five sub-areas: the Jamuna river, the Ganges river, the Padma river, the upper and lower Meghna river.

Jamuna River: the braided Jamuna river contains a total of 282 chars. There are 226 little sandy and vegetation of few varieties chars and 56 large chars with all varieties of trees. The Jamuna chars are mostly island chars in between canals, especially in the Kazipur-Sirajganj area.

Ganges River: the Ganges river's char generation method differs significantly from that of other rivers. The Ganges is a spiral-shaped river with a more complicated char structure than other rivers. The Ganges river connects both chars, thus the island exists. The chars in this river are more steady.

Padma River: the Padma river has 31 charlands in all. There are 18 small and 13 large charlands. The Padma river has a larger incidence of attached chars, while the estuary contains more island chars. Some of the island chars are old and solidified, such as Char Janajat, which is located Ganges-Padma river channel.

Upper and Lower Mehgna River: upper Meghna chars are quite aged and solid, while lower Meghna chars along the Padma are larger and greater in width. Riverine chars found in the floodplains of the Ganges, Brahmaputra-Jamuna, and Meghna behave and are generated very differently from estuarine chars in the Bay of Bengal. Example of lower Meghna charlands are Bhola, Ramgati and Hatiya.

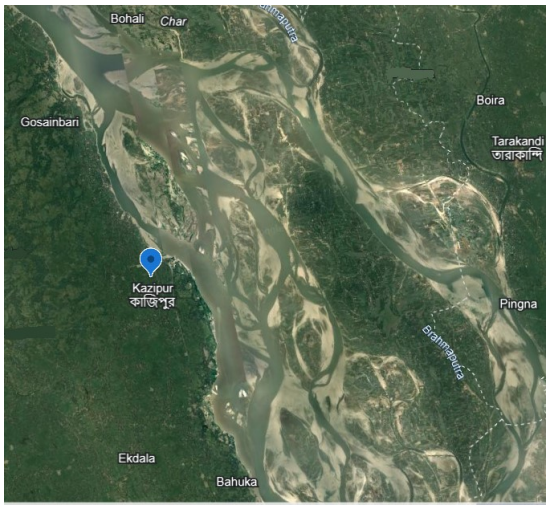

Figure 2: A pictorial view of charlands of river Jamuna at Kazipur

5. THE POPULATION OF CHARLAND

Charland is home to around 5% of Bangladesh's total population. This amounts to approximately 6.5 million. The majority of Bangladeshis live in poverty (Alam et al., 2018). Poor landless people live in charland, under vulnerable conditions because of natural disasters like- floods, river bank erosion and cyclones. Despite the risk, these landless individuals choose charland because the majority of their population has only received primary education. As a result, if they go elsewhere, they will not find a good job. Otherwise, Poor people choose the charland because it has common resources like cultivable areas, natural greenery, pastureland, a diverse indigenous tree population, open-water fish supplies, and livestock. The landless poor people are migrating from the mainland to charland because they lack land to live on. A large amount of rich land is accessible for grazing crops (Onneshan and Dhanomondi, 2008).

Mukerjee (1938) recognized that increased population in the decayed moribund floodplain as a cause influencing relocation into newly formed delta areas due to the presence of unusually productive alluvial soil and river prospects for transit and commerce. Nicholas' (1962) did a comparative study on the evolution of villages and stated that when there is no place for people to live in the old char or mainland. Then the poor people decide to live in the new char. Because they do not have the money to buy land elsewhere to live and cultivate.

Pritchard et al. (2015) state that only the poorest families were forced to migrate from the mainland to the charland by population congestion and landlessness. Even though the charlands were vulnerable, the communities have been drawn to migrate due to access to land and the possibility of finding new sources of income, even if the charlands are home to extremely poor people who are barely making ends meet.

6. LIVELIHOOD PATTERN OF CHARLAND PEOPLE

According to Alam et al., (2018); Saha et al., (2014); and Iftekhar & Takma (2008), the nature of the charland influences the livelihood of the people that live there. People staying in the attached and old charlands engage in a variety of activities such as business, employment, fishing, poultry, and agriculture. On the other hand, the majority of residents in island chars or young charlands work in agriculture for a living. Because the new charlands are readily flooded, they are 2 to 10 km away from the mainland, they are deprived of numerous benefits. The people that live in these charlands primarily work in agriculture, and when the males are no longer required to work on the charlands during rice planting and harvesting season, they relocate to the mainland where they sell their labor to

earn money. As a result, there is a significant level of food insecurity, as well as malnutrition and hunger. The people living in the island chars that are located in the Padma, upper and lower Meghna river earn money by fishing from the river and sea. The people living in these island chars especially catch hilsa fish. Hilsa fish is found in large quantities in the Meghna river during the monsoon season (July to October). Except of 22 days from 9 October in this island chars, fishermen catch hilsa fish (Mahmud, 2020).

7. BIODIVERSITY OF CHARLAND

A research was conducted by Rahman et al., (2018) who found that In Bangladesh, the biodiversity of the island and attached charlands differs. The Attached charlands have more ecosystems than island charlands. The physical features of the island chars are changing due to constant erosion and sand carpeting. Soils with seasonal flooding have clay-based silty and silty-to-silty forms, as well as a lack of organic content. Flora and fauna are more diverse in attached charlands than in island charlands. Many fruit kinds were available in the attached charland to the mainland, including Chalta, Jalpai, Dalim, Sharifa, Jam, Amloki and Latkan, but not in the island charland. Bamboo, Date palm, Palmyra palm, Coconut, Betnelnut, Gab, Dumur and other household plant kinds were rarely available, while only bananas are commonly grown on the island chars. The mainland was abundant in plants and bushes (such as Kata mehndi, Phani Mansa, Arhar, Satamuli, Gulancha, Kumarilata, Jangla shim, Pui, Orchid and Kochu, etc.), whereas the charland only contained Hogla and Dhoincha. Except of Eucalyptus and Babla, the various mainland timber production types are not present in the Charland, and the mainland common medicinal plants are unable to survive in the recently formed Charland. Due to habitat destruction, the Charland lacks the common animal fauna and birds of the continent. The mainland was home to an abundance of reptile and amphibian animals, many of which have since fallen extinct.

8. VEGETATION OF CHARLAND

Charland has good soil, which makes a wide variety of plants and vegetables grow there. The fertile soil on char land also supports agriculture, giving it a vital source of food for surrounding communities. Although relatively young charlands have little vegetation, older charlands include a diverse range of fruit and wood plants, including guava, jackfruit, mango, bamboo, juga and simul. Banana plants are commonly found in and around residences. The banana fruit is an important source of food and money, and the trunk is occasionally used to construct rafts, particularly during floods. People living in young charlands are not interested in slow-growing plants, because it takes time to grow. However, planting fast-growing plants that will grow fast and help them to prevent soil erosion (Kamal, 2011; Sarker et al., 2003).

According to Onneshan and Dhanomondi (2008), sweet potatoes, Aman paddy, Aush paddy, jute, and banana are some of the crops grown in charlands. These crops are well-suited to the Char area's climate and soil conditions, contributing to the local agricultural economy. The cultivation of these crops helps to ensure food security for the communities living in this region. Timber plants like Ipil-Ipil, Nim, Keora, Eucalyptus and Babla are fast-growing plants in the southern Char area. These fast-growing plants play a crucial stabilizing role in controlling the erosion of soil, which is particularly important in the face (interface to rivers) of frequent cyclones and tidal surges. Hogla, Dhoincha and Catkin are three homestead vegetation that can survive in the charland. The abundance of these plants provides a source of livelihood for many local communities, as they are used for various purposes such as fuel wood, construction materials, and handicrafts.

9. VULNERABILITY OF CHARLAND FROM NATURAL DISASTERS

Due to its critical geographic location and climate change, Bangladesh is one of the world's most vulnerable countries. Floods, riverbank erosion, and other climatic catastrophes, including drought, cyclones, salinity intrusion, water logging, and cold waves, commonly affect Charland communities

in upper and coastal regions, forcing many to lose their sources of livelihood and property consequently leaving them vulnerable (Islam and Nurullah, 2021; Sarker et al., 2003) to social and physical health issues (Moral et. al. 2019). Among the above natural disasters, the char areas are mostly affected by floods, river erosion and cyclones in lower Meghna river.

9.1 Flood

Floods play an important part in char formation, with younger chars having lower elevations and being more sensitive to flooding. All charlands in the Jamuna, Ganges, Padma, and upper Meghna rivers were submerged during the rainy season (June - September), with 68% of island chars submerged. During the same time, the lower Meghna river south of the junction was nearly 50% inundated. Some of the severe floods in Bangladesh such as the 1988 flood, severely affected the people living in the upper Meghna charlands. These charlands were inundated by water for approximately 40-60 days. Due to this terrible flood, the people living in the charlands lost their cultivable land and livestock. Due to floods, most of the lives are lost in the charlands located on the banks of the Jamuna River. Most char houses are vulnerable to flooding (Haque, 2020).

9.2 River Erosion

River erosion is a severe natural disaster for the people living in the charlands. Every year many people lose their homes, utensils and agricultural land due to river erosion. Around 60% of people living in the Jamuna charlands have to migrate more than once in six years. Some of the young charlands became eroded within 4 years due to river erosion. The charlands of the Ganges, Padma and lower Meghna rivers are quite stable compared to other rivers. In these rivers, approximately 40% of the char can not last more than six years. According to Hasan (2000), thousands of people living in charlands were forced to migrate due to river erosion. The biodiversity of charland is lost due to river bank erosion.

9.3 Cyclone

The unique geographical location of the charlands in the lower Meghna river makes them susceptible to frequent cyclones, which can have a disastrous impact on the lives and livelihoods of those who live in these places (Tasnuva et. al. 2022).

10. ROLE OF VEGETATION TO PROTECT BIODIVERSITY OF CHARLAND

Due to the river dynamic, silt is deposited and eroded in the char areas. Vegetation helps to accumulate this silt in the char areas, plants hold the soil through their roots, thereby preventing river erosion. It protects from the cyclone at the lower Meghna charlands. The people living in the charlands, earn money by selling some plants such as Catkin, Hogla etc. Some vegetation of charlands are given below-

Catkin is another type of perennial vegetation that plays a crucial role in the charland ecosystem. Its dense root system helps to stabilize the soil and prevent erosion, while its ability to accelerate silt deposition improves the fertility of the land. The decomposition of catkin adds organic matter to the soil, enhancing its nutrient content and promoting overall soil health.

In the lower Meghna river, houses are built low in height due to violent cyclones, and storm and wind protection is provided by catkin. Local sources for housing materials include catkin. The chars people make major use of it as roofing material for their homes. It also provides money to those who sell catkin as roofing material in mainland markets. Catkin's stems are often used to construct fences. In some char areas, dwellers cultivated a large amount of catkin to sell to betel leaf gardeners, who use it to cover the roofs of betel leaf enclosures. Catkin and its root are also commonly used as fuel. Because of the large quantity of catkin in chars, residents have a comparably better supply of fuel throughout the year. The small catkin grass is also utilized as animal feed. Cattle owners frequently build catkin mounds to raise their livestock above floodwaters when floodwaters inundate

homesteads. Catkin also provides shelter and nesting sites for various bird species. The dense growth of catkin creates a safe habitat for birds, contributing to the biodiversity of the charland ecosystem. This mutually beneficial relationship between catkin and birds further enhances the ecological balance and resilience of the area. The catkin also increases the natural beauty of the charland.

Eucalyptus and Babla are planted by charland dwellers because they grow faster in sandy soil than any other timber plants. Eucalyptus and Babla also have unique adaptability to extreme weather conditions in the region. While Eucalyptus can withstand highly flooded water during the monsoon season, Babla is known for its resilience in the hot summer months. This makes them even more valuable to charland dwellers, as they can rely on these trees to thrive in unpredictable environmental conditions.

In Nijhum island char, a Keora tree was planted for disposing of sand. The Keora tree is specifically chosen for its ability to prevent river erosion and aid in the expansion of the charland area. Its deep roots anchor the soil, preventing it from being washed away by the river. This strategic planting of Keora trees helps to protect the young charlands from erosion (Saha et al., 2014).

Hogla and Dhoincha are two homestead vegetation that can survive in the charland. These two types of vegetation, Hogla and Dhoincha are well-suited for the charland environment due to their ability to withstand hostile conditions such as flooding and high salinity. Their presence further contributes to the stability and growth of the charland ecosystem, providing additional protection against erosion and promoting biodiversity in the area (Rahman et al., 2018).

Catkin

Catkin is a kens grass plant. It scientific name is *Saccharum spontaneum*. It is usually up to 3 meters tall from the ground. It is seen in autumn (August-October) in Bangladesh. Catkin is usually grown in chars, wetlands, fallow lands and alluvial soil on the banks of rivers. The leaves of this flower are thin and the sides of the leaves are very sharp.

Figure 3: Catkin grass

Figure 4: Hogla

11. INVOLVEMENT OF DIFFERENT ORGANIZATION

In Bangladesh, government and non-government organizations work together to protect the people living in charlands from various natural disasters. The Government of Bangladesh (BEDB, FFWC and BFD) and various non-governmental organizations work to conserve the charlands that are connected to the mainlands. On the other hand, among the island chars the government and non-government organizations are also working to preserve Hatiya, Sandeep and Bhola. However, the government does not take many actions to conserve the new island chars where non-governmental organizations can increase their adaptive capacity. Activities of various organizations are given below-

11.1 Bangladesh Water Development Board

Bangladesh Water Development Board (BWDB) is responsible for a variety of duties related to river erosion and flooding. River restoration, canal dredging, river bank building, sluice gate, polders construction and maintenance are the responsibility of BWDB. They take these responsibilities to preserve crops and fisheries from floods and river erosion in the coastal, river bank and charland people.

11.2 Flood Forecast and Warning Center

Floods are most common in Bangladesh during the rainy season (June-September). Floods are triggered by heavy rainfall and water from the Himalayas. During floods, it inundates the areas along rivers, particularly the island chars and attached charlands. Flood predictions and warnings are discriminant 3 days in advance to protect the lives and property from severe flood damage (Annual Flood Report 2021, 2021).

11.3 Bangladesh Forest Department

Bangladesh Forest Department works for protected and unprotected forestry and conservation of existing biodiversity and rehabilitation of nearly extinct flora and fauna. The Bangladesh Forest Department works with tree plantations to conserve the soil and biodiversity of the island chars and attached charland (Rashid, 2013).

11.4 Polder Management

In 1960, the Government of Bangladesh and the Government of the Netherlands jointly constructed more than 100 polders in Bangladesh to increase agricultural production in the coastal and island chars. Due to the construction of these polders, the coastal and coastal island chars are protected from salinity growth and tidal surge from the destruction of existing agricultural crops (Nowreen et al., 2014).

11.5 Other Organizations

Various international organizations have provided financial assistance to Bangladesh in different ways. These organizations aid in the protection of Bangladesh's islands and coastal areas from river erosion, floods, and cyclones. These organizations include CARE, the Islamic Development Bank (IDB), the United Nations, UNICEF, World Food Programme, World Vision and Oxfam Australia. Some organizations provide small loans to helpless individuals in disaster-prone areas, both financially and morally. These organizations include Grameen Bank, Proshika, BRAC and ASA. It assists vulnerable people after natural catastrophes such as floods, river erosion, and cyclones by delivering aid and reconstructing their living conditions. Muslim Aid, SKS, and GUK are three of these organizations. UNDP is collaborating with the Government of Bangladesh to implement a number of disaster risk reduction techniques (Hossain, 2020).

12. SIGNIFICANCE OF THIS STUDY

This study found that charlands are being formed as a result of river dynamics, and that charland is being destroyed as a result of river erosion. According to a research (2004), 45 km^2 of charlands originate in the lower Meghna river each year, and 25 km^2 of charlands disappear into the river due to river erosion. Even after this breakup, there is still 20 km^2 of charland left. The majority of the destroyed charlands were land utilized for living or farming. It was also found that the Government or NGOs are implementing various constructive efforts (like river restoration, canal dredging, river bank building, construction of sluice gates and polders) to maintain the charlands, while some NGOs are increasing the adaptive capacity of the people who live in there. However, no research has been conducted on the significance of vegetation in protecting charlands from river erosion. Vegetation has a crucial role in avoiding river erosion. Keora, eucalyptus, Babra, Hogla, and Catkin are important in maintaining the lower Meghna river's island chars. Catkin is extremely useful for island char

conservation because it develops quickly and accumulates sand by using its roots and mat of island chars. As a result, the probability of river erosion diminishes.

Table 1: Observation of physical data and growth rate of Catkin under 3.048m^2 area

Field No.	Weight of stem (Kg) into 3.048m^2 area	Weight & density (kg/m^2)	Growth of Catkin		Rate (cm/day)
			Day	Height (cm)	
F-1	44.65	4.81	24	55.88	2.33
F-2	26.47	2.85	15	59.69	3.98
F-3	22.33	2.40	-	-	-

Analyzing the obtained data from the observation area, it has been seen that the density of catkin was 4.807 kg/m^2. A full-grown catkin's height was more than 304.4 cm. After cutting catkins and measuring the growth rate of catkins in the observation area, it has been found that catkins increase by about 3.98 cm per day. From this observation, we found that catkin is a fast-growing perennial plant that plays a crucial role in protecting the biodiversity of the charland and the prevention of river erosion.

13. CONCLUSION

After reviewing many research papers, it has been concluded that,

In Bangladesh, sediments carried by the three main rivers and the river dynamic lead to the formation and erosion of charlands through river erosion. Through this erosion and creation, in Bangladesh, 25 km^2 of new charlands are created every year downstream of the Meghna River.

The attached charlands to the mainland are less risky than the island chars. Island chars are between 2 to 10 km from the mainland and are much lower than the attached charlands. As a result, floods were inundated and crops, utensils, and houses were severely damaged.

Landless poor people live in charlands and work in charlands to earn their livelihood. There is a large amount of vacant fertile lands for cultivation in the char, due to poor people living there despite the risks.

The biodiversity of the island char has been greatly changing, due to natural disasters like river erosion. That is comparatively less in the attached charlands. All the flora and fauna that were on the island char have been extinct due to river erosion.

In some protected island chars such as Nijhum Dwip, keora trees are being planted to prevent soil erosion. However, the Keora tree can only be planted downstream of the Meghna River because the Keora tree cannot survive without brackish water. Therefore, it is not possible to prevent land erosion by planting Keora trees upstream of the Meghna, Padma and Jamuna Rivers. But it is possible to cultivate catkin in all these charlands and it is possible to reduce river erosion.

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