Haor Regions- Importance, Problems, Strategy and Future Development

Kazi Ismat Jahan Suvra [1]

[1](Lecturer,Department of Economics,Sheikh Hasina University,Bangladesh.)(Hoq, 2021 #894)

Abstract:
Background: *The aim of this paper is to discuss and suggest ways to overcome the barriers hindering the Haor regions development of Bangladesh, including the steps the government has taken and is taking for a better future. The paper also examines the problems of specific sector in the Haor regions and describes the different strategies that have taken by different organizations (Government and Non-government). The paper provides a deep insight that the Haor is being degraded rapidly due to the inefficiency government policies, systems, mismanagement and destructive activities. But the government should formulate appropriate policy and laws implement these for the protection of the valuable resource and adapt an integrated joint management plan involving the local people. The paper also presents some table including importance and future development of Haor regions.*
Conclusion: *An integrated management plan and proper strategies are needed that includes utilization of wood and non-wood products, agriculture, fisheries and conservation of biodiversity for future development of Haor regions in Bangladesh.*
Key Word: *Importance, problems, strategy, future development of Haor regions, Bangladesh.*

I.   Introduction

Haors are technically depressed and marshy lands that are nearly circular in form. The term "Haor" was originally derived from the Sanskrit word "Shagor," which means "sea." The key trait of Haors is that they flood every year during the rainy season. A Haor is a wetland habitat in Bangladesh's north-eastern region that is geographically a shallow depression in the form of a bowl or saucer, also known as a back swamp, with an area of about 1.99 million ha and a population of about 19.37 million inhabitants (M. M. Islam, Bhuiyan, & Harun, 2012; MoW, 2005; Mustafa et al., 2019; Muzaffar, 2004). In the districts of Sunamgonj, Sylhet, Habigonj, Maulavibazar, Netrokona, Kishoregonj, and Brahmanbaria, there are 373 Haor/wetland. These 373 Haors occupy nearly 859000 Haors, or about 43% of the overall region of the Haor disticts (Ahmed, 2013; Alam, Quayum, & Islam, 2010). Despite being one of the country's main economic production areas, the Haor region is still under construction due to its physical and hydrological conditions. Agriculture and fishing are the mainstays of the region's rich economic capital. This region has a total of 0.71 million ha of net cultivable property, which generates more than 5.25 million tonnes of paddy per year. Despite the zone's economic significance, inhabitants of the Haor region are poorer than those in other areas of Bangladesh. More than 28% of the overall Haor population resides in poverty (LPL)(Ayers & Forsyth, 2009).

Table No 1: Haor regions in Bangladesh

District	Total area in ha	Haor area in ha	No. of Haors
Sunamgonj	367,000	268,531	95
Sylhet	349,000	189,909	105
Habigonj	263,700	109,514	14
Maulvibazar	279,900	47,602	3
Netrokona	274,400	79,345	52
Kishoregonj	273,100	133,943	97
Brahmanbaria	192,700	29,616	7
Total	1,999,800	858,460	373

II.   Importance of different Haors

There are many Haors are like Hakaluki Haor, Tanguar Haor, Gurmar Haor, Hail Haor, Kawadighi Haor, Balai Haor, Bara Haor, Maijeil Haor, Dekher Haor, Panger Haor,Kanamaiya Haor etc are the prominent Haors in Bangladesh(Aziz, Hasan, Mondol, Alam, & Haque, 2021). The demographic details of these Haors are as follows:

Hakaluki Haor:

Hakaluki Haor is a broad marsh wetlands biological environment in North-Eastern Bangladesh, and one of the largest in Asia. This Haor is based in the districts of Moulvibazar and Syllet. The Kushiara River flows across it. There are over 238 interconnecting beels, including mini, medium, and big ones. Amphibians, reptiles, birds, and humans all add to the region's biodiversity(BENNETT et al., 2007; Bhuiyan et al., 2020). Freshwater turtles and tortoises, otters, capped langurs, pallas's, sea eagles, dolphins, frogs, and several other species are among them. [The presence of birds of numerous species breathes fresh life into this Haor. There are 417 species of aves present here, 26 of which are completely extinct, two of which are fragile, and ten of which are endangered (14 of which are critically endangered). Around the Haor, around 20000 people work. For their livelihoods, they are all reliant on the Haor's wealth. In 1999, the Bangladesh government named Hakaluki Haor as an Ecologically Sensitive Region ECA(Byomkesh, Nakagoshi, & Shahedur, 2009; Cell, 2009).

Tanguar Haor:

Tanguar Haor is a nationally important wetland environment that has received international recognition. It is situated in Sunamganj district and covers ten mauzas in the district's dharma pasha and tahirpur upazilas(Choudhury, Paul, & Paul, 2004). The Haor is a major fishery source. There are more than 140 freshwater fish types to pick from. Air, gang magur, baim, tara baim, gutam, gulsha, tengra, titan, garia, beti, kakia, and other notables are among them. The Haor is an outstanding location for migratory birds. Any winter, around 200 different species of migratory birds migrate to this region to create a temporary home. This Haor has karach, nalkhagra, hijal, gulli, balua, bantulsi, and other significant endangered freshwater wetland tree species (Ferdushi, Ismail, & Kamil, 2019; Goodbred Jr & Kuehl, 2000).

Pashua beel, Gurmar Haor:

In the extreme southeast portion of Gurmar Haor, adjacent to the Patnai gang, the Pashua beel site consists of a single big beel with two smaller beels nearby. The beels are surrounded on all sides by higher terrain with thick grasses, brush, and pongamia forest, covering a region of around 400 hectares. A submersible embankment has recently been installed across Gurmar Haor to shield it from flash floods(Haque & Basak, 2017; Hassan, Aziz, Rahman, & Talukder, 2011). The meaning of pashua beel in the background of the region is immense. It offers a safe refuge for a large number of cormorants, heons, and egrets, as well as a number of species that are rare or local elsewhere in the area, such as the purple heron, black-headed ibis, spot-billed duch, and purple swamphen(Hoq, Raha, & Hossain, 2021).

Hail Haor:

The significance of hail for nature protection derives largely from its special role in the area as the region's only shallow, permanent lake. The lake supports a diverse aquatic plant population, which in turn supports a diverse range of resident bird species, including some that are uncommon or only found in this region (yellow bittern, purple heron watercock, purple swamphen and black breasted weaver)(Hossain, Nayeem, & Majumder, 2017; Huda, 2004). If it weren't for the high amounts of disruption generated by fishing operations, the lake will certainly be really important for wintering waterfowl(Hussain & Salam, 2007).

Kawadighi Haor:

Kawadighi Haor is based in Maulvibazer's Fatehpur union. Consider the improvements that may have happened to these wetlands after the development of the manu river project in the 1960s, Kawadighi Haor remains very relevant for a large variety of waterfowl (1976-83)(Irfanullah, Azad, Kamruzzaman, & Wahed, 2011; M. Islam, Khandoker, & Choudhury, 2019). Shore birds and many groups of herons and egrets were attracted to the shallow beels with wide fields of rolling marine plants and exposed mud. The Haor is critical for breeding birds in early May, black-winged stilts, and nest building activity at Patang Beel. Fish is the most essential product of this Haor. This Haor provides almost all of the fish in the region(Irfanullah et al., 2011; M. Islam et al., 2019; M. M. Islam et al., 2012).

Balai Haor:

The Balai Haor site is situated in the extreme east of the project district, between the Surma and Kushiyara rivers. It is surrounded by extensively grazed grazing land and rice fields and consists of three major beels (Dubail, Jugni, and Khakra kuri)(S. Islam, 2003). According to observations made during the current surveys, the region is of specific interest due to its varied fauna and flora. During times of deep rainfall, the emergence of at least two endangered species (lesser adjutant and pallas's fish-eagle) as well as significant numbers of ducks. Because of its strategic role as the first or last major wetland that migrants meet on their path to and from the lowlands of the northeast country, the Haor can also be of great significance as a standing area

for passage migrants. However, even further study needs to be done until the site's importance for nature can be established (S. Islam, 2003; Jakariya et al., 2020; Jakariya & Islam, 2017).

Dekher Haor:
A variety of large and small beels, mainly shallow and surrounded by rice fields, with a fair amount of floating and emergent aquatic plants. Kuri beel is distinct than the others in that it is much smaller and has steep grassy banks surrounding it(S. Islam, 2003). The Haor is important for a large range of wintering waterfowl, as well as a limited number of resident species. The main sites Dekher Haor and Kuri beel were listed separately in the directory(Jakariya et al., 2020).

Panger Haor:
A community of four big beels and some smaller beels surrounded by rice fields with some emergent aquatic plants. A submersible embankment houses the framework. Ducks, brown-headed gulls, and whiskered turns use this Haor as a wintering site(S. Islam, 2003; Jakariya et al., 2020).

Bara Haor:
The best floodplain grassland ecosystem in the district, as well as some reed bog and swamp forest areas, can be found in Bara Haor. Bird species such as breeding cormorants and breeding herons have been seen in this Haor field(Jakariya & Islam, 2017).

Maijeil Haor:
Maijeil Haor contains two Haor, deep beels with little emergent vegetation surrounded by rice fields. This Haor is famous for wintering ducks which presumably feed in the surrounding rice fields(Kamruzzaman & Shaw, 2018).

Kanamaiya Haor:
On the Patnai gang, Kanamaiya Haor comprises two large unprotected beels with some emergent aquatic vegetation. The beels are isolated from nearby Gurmar and are important for wintering ducks and shorebirds, as well as a significant number of waterfowl. This Haor is also essential for bird breeding(Kamruzzaman & Shaw, 2018).

Table no 2: Summary of important Haors and their features

Important Haors	Special Features
Hakaluki Haor	Amphibians, Reptiles, Aves, Mammals, Birds, Fishes etc
Tanguar Haor	Fishes, Birds and Trees
Gurmar Haor	Birds species
Hail Haor	Birds species
Kawadighi Haor	Shore/breeding birds and species of herons and Egrets
Balai Haor	Rice and birds
Dekher Haor	Rice and small number of resident species
Panger Haor	Ducks, brown headed gulls and whiskered turns
Bara Haor	Breeding cormorants and breeding herons and birds species
Maijeil Haor	Wintering ducks and rice
Kanamaiya Haor	Wintering ducks, shore/breeding birds

III. Role of Haor in Bangladesh economy

Despite being one of the country's main economic development areas, the Haor region is still underdeveloped due to its physical and hydrological characteristics. Agriculture and fishing are the principal sources of the region's diverse economic wealth. The Haor regions' gas and mineral deposits, biodiversity and wetland, livestock, tourism, and other economic activities are all significant to Bangladesh(Khan & Haque, 2010). The following is a list of their different roles:

Gas and Mineral Resources:
This region has a higher proportion of gas and mineral resources than the rest of the world. The Haor districts generate approximately 90% of the country's overall gas output. The Surma Basin (SB), a depressed part of the Bengal Basin, covers the majority of the region. The Haor zone's geomorphology is made up of the Surma Kushiyara floodplain and the Meghna River Floodplain. In Sylhet's Haor fields, a dense stratigraphic

succession of mainly tertiary sediments occurs. Silt, sand, gravel, and clay, pebbly sandstone, sticky clay, sandstone, coarse quartz pebbles, petrified wood, clay stone with siltstone and sandstone, marine shale, basalt, volcanic ash, and coal are among the stratigraphic sequences found in Bangladesh(Khan & Haque, 2010). The geological environment and formations of Bangladesh's northeastern area promote the deposit of a broad variety of mineral and energy resources. Natural gas, crude oil, shale, white clay, glass sand, peat, tar, asphalt, and building sand are among the mineral resources found. The box illustrates the different types of mineral resources available in the Haor area(Kurukulasuriya & Rosenthal, 2013; Liong, Lim, Kojiri, & Hori, 2000).

Gas and Mineral Resources:
   This region has a higher proportion of gas and mineral resources than the rest of the world. The Haor districts generate approximately 90% of the country's overall gas output. The Surma Basin (SB), a depressed part of the Bengal Basin, covers the majority of the region. The Haor zone's geomorphology is made up of the Surma Kushiyara floodplain and the Meghna River Floodplain. In Sylhet's Haor fields, a dense stratigraphic succession of mainly tertiary sediments occurs(Miah, 2013; MoEF, 2012). Silt, sand, gravel, and clay, pebbly sandstone, sticky clay, sandstone, coarse quartz pebbles, petrified wood, clay stone with siltstone and sandstone, marine shale, basalt, volcanic ash, and coal are among the stratigraphic sequences found in Bangladesh. The geological environment and formations of Bangladesh's northeastern area promote the deposit of a broad variety of mineral and energy resources. Natural gas, crude oil, shale, white clay, glass sand, peat, tar, asphalt, and building sand are among the mineral resources found. The box illustrates the different types of mineral resources available in the Haor area(MoEF, 2012; Monwar et al., 2018).

Table no 3: Gas and mineral resources

Type	Brief description of Mineral Resources
Coal	The coal consists of 18.96-39.32% carbon,15-46.16% ash,0.62-1.44% moisture and 32.64-48.22% gaseous materials.
Crude oil	Small commercial oil discovered at Haripur, Sylhet was in operation for about 7years only
Glass sand	Glass sand is found in Habigonj, Shajibazar and Nowapara
Gravel	Gravel is composed of rock types like quartzite, granite, amphibolite, basalt, sandstone, conglomerate ,etc
Lime stone	Limestone is mainly found in subsurface at Boglibazar ,Lalghat, Takerghat and Bhangerghat of Taherpur upazila,Sunamganj district.
Natural Gas	Among the 23 natural gas fields,10 fields are located in the Haor region
Peat	Peat is available around Maulvibazar,Sunamgonj,Sylhet, Brahmanbaria and Habigonj districts
White Clay	White Clay deposit is found nearly surface to subsurface in Netrokona district.

Employment:
   The inclusion rate of the amount of economically engaged persons over the age of 15 is a popular indicator of job prospects. Currently, 61.84 percent of the Haor area's economically active workforce will function, which is better than the national average of 58.74 percent. As a consequence, the job situation in the Haor region is crucial to our economy(MoEF, 2012).

Biodiversity and Wetland:
   Haor wetlands have a diverse ecology. Hakaluki Haor, Tanguar Haor, Hail Haor, Matian Haor, Pasuar Beel Haor, Dekar Haor, Baro Haor, Gurmar Haor, Sonamorol Haor, Baram Haor, Kalni Haor, Kawadighi Haor, and Pagner Haor are the most significant wetlands. Rots, rodents, humans, and amphibians make up a large wildlife population in these wetlands. Wetland plants are also enhanced in most of the essential Haor areas due to lowland plantation. By conserving water, improving irrigation and fish development, and rendering the Haor a safe zone for birds and wildlife, several steps are being taken to conserve the natural environment and local heritage. Tanguar Haor is a significant bird-watching region in Bangladesh. Hakaluki Haor, Hail Haor, Pasuar, and Panna beel are the other bird regions. The Bangladesh National Herbarium (BNH) discovered 78 plant species in the region during a survey (Khan, 2001). There are 11 free-floating organisms, such as Pistiastratiotes (Topapana), Salvanianatans (Tetulpana), 38 anchored, underwater species, such as Potamogetoncrispus (keorali), Aponogetonechinatus (Ghechu), 5 suspended species, such as Utriculariaaurea (Chhotojanghi), Cerato-phyllumdemersum (also known as chhotojanghi), In Bangladesh, Haor habitats are the main habitat for birds and fish. Tanguar Haor is home to roughly 141 fish species, including several rare introduced species, accounting for more than half of the country's freshwater fish species, according to different reports (266 spp.)(Liong et al., 2000; Miah, 2013). Air, Gang Magur, Baim, Tara Baim, Gutum, Gulsha, Tengra, Titna,

Garia, Beti, Kakia, and others are notable animals. In the Haor field, there are 208 different bird species. As a consequence, these habitat and wetland upgrades are vital to our economic prosperity(Mustafa et al., 2019).

Table no 4: Species and Threatened

Wildlife Community	No.of species In Haor	No.of species In Bangladesh	Threatened In Haor	Threatened in Bangladesh
Amphibians	9	34	1	8
Birds	257	650	18	41
Mammals	29	120	13	40
Reptiles	40	154	24	58

Agriculture:

The seven Haor districts comprise a cumulative region of about 1.99 million hectares, with a net planted area of about 1.31 million hectares (Table 4). Bangladesh has a combined rice field of 11.35 million hectares, with the Haor zone responsible for 15.3 percent (1.74 million hectares)(Muzaffar, 2004; Oakkas, Islam, Jalil, Al-Agad, & Islam, 2015). The Haor area generates 5.25 million metric tonnes of rice, accounting for 16.5 percent of Bangladesh's overall rice production. Rice crops occupy approximately 90.2 percent of the total crop area. Non-rice harvested land accounts for around 9.8% of overall cropped land. The other main cereal crops, wheat and maize, account for around 0.7 percent of the total cropped region. Potatoes, like sweet potatoes, account for 1.2 percent of all cropped ground. Non-rice crops (pulses, oilseeds, vegetables, and so on) account for 6.7 percent of total cropped land. Jute is a large cash crop, accounting for around 1% of total cultivated land. Sugarcane often occupies a limited portion of the property. Tea is the most important agricultural crop, accounting for around 3.7 percent of the NCA, while fruits account for 0.42 percent(Poffenberger, 2000). We will see from the table below that agriculture in the Haor regions plays an important role in the growth of our economy.

Table No 5: Importance of agriculture in Haor basin

District	District NCA(ha)	Haor NCA(ha)	Haor NCA in %	Cropping intensity Haor	District wise Production ('000mt)	Haor wise Production ('ooomt)
Sunamganj	276,434	212,777	79	116	801	741
Habiganj	162,926	103,760	64	128	692	411
Netrokona	211,130	66,000	31	130	911	209
Kishoreganj	196,900	123,340	63	113	932	536
Sylhet	208,680	138,200	66	143	861	548
Maulvibazar	126,928	33,100	26	135	479	116
Brahamanbaria	150,381	23,420	16	122	571	87
Total	1333379	705,597			5248	2690

Fisheries:

The Haor area is home to a large number of fin fish, including 143 indigenous and 12 endemic species, as well as many freshwater prawn species. Large fish (major carp, large catfish, chital, Gangetic stingray, gazar, and shol) and small fish (chital, Gangetic stingray, gazar, and shol) are classified into two groups. The Haor region's total fish habitat area is about 967,000 ha. The fish ecosystems contain a total of 4.32 lakh tonnes of fish, with catch fishing accounting for 73.7 percent and culture fishing accounting for the remainder (Table 5.15). Sunamganj accounts for about 23.4 percent of overall fish output in the Haor districts, led by Netrakona (16.9%), Kishoreganj (16.2%), Sylhet (14.8%), Brahmanbaria (12.7%), Habiganj (8.1%), and Maulvibazar (8.1%). (7.9 percent) (Poffenberger, 2000 #885; Resources, 2005 #873). In the Haor region, culture fish ponds generate around 1.14 lakh tonne, or 26.3 percent of total output. The Haor basin generates approximately 20% of Bangladesh's total inland fish output, and this sector is important to the country's overall economy (Resources, 2005 #873). Bangladesh's fisheries industry accounts for about 22.2 percent of the country's agriculture GDP (DoF, 2011). Overall, the fisheries business contributes 3.74 percent of GDP, 2.7 percent of foreign exchange profits, and 58 percent of animal protein consumption (DoF, 2011). (DoF, 2011). The Haor basin contributes about 0.6 percent of the fisheries allocation to GDP, whilst the rest of the world contributes 3.14 percent. During the 2009-10 fiscal year, the Haor basin shipped 452 tonnes of cod (DoF,2011).

Table no 6: Importance of agriculture in Haor besin

District	Total Habitat Area(ha)	Production Capture(Ton)	Production Culture(Ton)	Total Production(Ton)	No of Species
Sunamganj	228,734	894	120	1014	48+
Habiganj	97,057	256	92	348	51+
Netrokona	149,129	519	212	731	54+
Kishoreganj	145,134	522	176	698	56+
Sylhet	180,490	503	138	641	63+
Maulvibazar	66,949	228	113	341	46+
Brahmanbaria	99,352	265	285	550	37+
Total	966,845	3187	1136	4323	

Livestock:

Livestock is an important part of Bangladesh's agricultural economy, serving a variety of purposes including food security, revenue, draught strength, manure, diesel, transportation, and foreign exchange savings. Animal protein comes from livestock products with around 44% of overall animal protein. Cattle, buffaloes, goats, sheep, chickens, and ducks are the most popular livestock in the Haor area. In the Haor farms, there are about 32.68 million head of livestock (cattle, goats, sheep, ducks, and poultry)(Alam et al., 2010; Aziz et al., 2021). They account for roughly 22% of the total cattle population in the world. Ducks and poultry are the most common livestock species here, with the Haor area accounting for more than a quarter of the country's total duck population.

Table no 7: Livestock population (2010-2011) in million

District	Cattle	Buffalo	Sheep	Duck	Goat	Poultry
Sunamganj	1.35	0.03	0.04	1.97	0.21	1.17
Habiganj	0.52	0.01	0.03	1.17	0.14	0.98
Netrokona	0.60	0.01	0.01	2.81	0.23	2.32
Kishoreganj	0.67	0.03	0.03	1.63	0.30	3.83
Sylhet	0.86	0.06	0.05	0.95	0.16	3.94
Maulvibazar	0.53	0.15	0.01	0.44	0.13	1.81
Brahmanbaria	0.48	0.01	0.02	0.78	0.11	2.11
Total in Haor region	5.01	0.28	0.21	9.75	1.29	16.15
National Total	22.9	1.26	2.78	39.84	21.56	212.47
% of Total in Country	22	22	7	24	6	8

Tourism:

Tourism leads to a region's or community's socioeconomic well-being. It's the extension of a company that provides a blend of geological, geographical, archaeological, scenic, and cultural attractions. Haor are one-of-a-kind wetlands with the ability to draw visitors (Bhuiyan et al., 2020; Ferdushi et al., 2019). Thousands of migratory birds migrate to the Haor and beels throughout the winter. Winter is a wonderful time to go bird hunting, but it's also when the Haor diminish in size and sacrifice a lot of their watery charm. A variety of locations in the Haor districts may be established as tourist attractions. The government plans to lift the tourism sector's existing GDP levels from 0.70 percent to 2% by 2015, and then to 5% by 2021. (OPP, 2010).

Table no 8: District wise tourist spots

District	Natural	Man-made
Sunamganj	2	8
Habiganj	10	22
Netrokona	4	15
Kishoreganj	1	14
Sylhet	6	18
Maulvibazar	13	13
Brahmanbaria	1	17
Total	37	107

IV. Problems in Haor regions:

Since there were no livelihood choices during the monsoons except fishing, river flooding, lack of road networks, and standing water bodies are major challenges to securing livelihood in Haor areas. Strong or excessive rainfall triggers flash flooding. Every year, flash flooding in the Haor basin lasts an average of six months. During the monsoon season, the whole area turns into a freshwater fishing paradise(Ferdushi et al.,

2019; Haque & Basak, 2017; Hoq et al., 2021). Because of the strong seasonality of the Haor-based economy, local citizens have been out of jobs for long periods of time, resulting in unemployment. It is the impediment to long-term survival. Disruption of traffic and daily life, disruption to buildings and facilities, degradation of vegetation and marine resources, and loss of revenue opportunities are all typical consequences of extensive and sustained floods and water logging(Hossain et al., 2017). The vulnerable community could become much more vulnerable as a consequence of the disturbance.

The major problems of specific sectors of Haors basin-

Water resources:
Flash floods, river bank and wave erosion, runoff, low navigability, and sedimentation are the key water-related issues in the Haor district. Pre-monsoon flash floods are one of the big hazards that engulf the primary production industry, placing the lives and livelihoods of the Haor's people in peril(Huda, 2004). The drainage issue here arises mostly in December, which is a significant month since it is when the Boro crop is planted. Sedimentation of rivers and a lack in contact with the Haors and rivers are the major sources of drainage concerns.

Agriculture:
Crop failure due to flooding, a shortage of seed supply, and a seed delivery system that is insufficient are all factors that concern agriculture. While other factors such as drainage congestion, hailstorms, cyclones, and pests can affect crops, flooding is the most common cause of damage, especially to rice crops(M. Islam et al., 2019). Based on existing data on crop flood damage from 1993 to 2010, it is calculated that more than 4% of the overall cropped region was completely affected on average(M. M. Islam et al., 2012).

Fisheries:
Loss of fisheries biodiversity is evident in the Haor area which is directly linked to the loss of habitats and fishing practices. There are not enough fish pass structures for roads, protecting fisheries resources from the adverse effects of flood control embankments and road etc(Vatsa & Joseph, 2003). The major causes of biodiversity loss or the major problems of the fisheries sub-sector have been identified as:
▪ Aggradation of habitats due to siltation
▪ Habitat alteration and fragmentation
▪ Over and indiscriminate fishing
▪ over exploitation of swamp forests
▪ Unplanned road construction
▪ Water pollution
▪ Unavailability of quality fish seed
▪ Increasing use of agricultural inputs
▪ Inadequacy in fisheries management
▪ Reluctance in obeying fisheries laws and regulations as well as weak enforcement of such laws
▪ Climate change implications
▪ Inadequate extension services

Pearl culture:
The key impediments to pearl culture opportunities are a lack of pearl culture preparation, extension work, and technological expertise among the poor people of the Haor area(Uddin, 2008; Van Nguyen & Ferrero, 2006; Vatsa & Joseph, 2003). The lack of well-established marketing outlets and local micro-entrepreneurs has hindered the introduction of pearl cultivation in the Haor region.

Livestock:
The main challenges in livestock rearing involve a scarcity of pasture space, insufficient care services, a lack of feeds and fodder, and a lack of modern technologies(Thomas et al., 2013). Furthermore, Lack of quality supplies, insufficient facilities and physical infrastructure, structural deficiencies such as a poor regulatory system and implementation, insufficient qualified manpower and capital, and insufficient scientific and technical innovation have all hindered livestock production.

Education:
The residents of the Haor area face significant challenges such as lack of knowledge, inadequate development measures, natural disasters, poverty, poor education, limited human capital, child labour, gender inequality, and malnutrition. The incidence of duplication in the Haor region is higher than the national average.

Primary school dropout rates total 44 percent (45 percent for students, 43 percent for girls), which is greater than the national average of 40 percent. Kishoreganj (46%), Brahmanbaria (53%), Sunamganj (44%), Sylhet (42%), and Habiganj (50%) have higher dropout rates than the national average. The secondary school dropout rate is 3.4 points greater than the primary school dropout rate (boys' 3.36 percent and girls 3.51 percent)(Rao & Rao, 2008).

Health:

Shortage of health service centres, drugs and medicines, shortages of doctor/nurses and other staffs, lack of emergency services, poor transportation and communication are the main problems of health services in this Haor area. Some of the other key problems and issues that have been highlighted included:
▪ impact of seasonal variation on disease and health services
▪ impact of economic impoverishment on people's access to health services
▪ undeveloped heath service facilities, specially at the grass root level
▪ dependency on informal/folk medicines
▪ natural disasters and health hazards compounding the existing problems of lack of hygienic sanitation facilities
▪ inaccessibility to safe drinking water
▪ lack of health awareness
▪ no Haor-incentives for doctors and other staff
▪ unavailability of ambulances and transportation services during emergency situation.

Supply of water and sanitation:

The Haor basin's main concerns involve a shortage of basic water delivery systems, a shortfall of clean water, and a lack of proper sanitation facilities(Raikes, Smith, Jacobson, & Baldwin, 2019; Rana, Kiminami, & Furuzawa, 2020). It has been a major contributor to health problems and significant environmental deterioration, especially during the flood season. Effluent dispersion into groundwater from latrines is a major contamination problem.

Forest:

The major problems of forestry are:
▪ Lack of community involvement
▪ Indiscriminate exploitation of natural resources
▪ No management plans for natural resources
▪ Land tenure problems
▪ Conflict of interest between the Ministry of Land and the Forest Department
▪ Very few NGOs working on natural resources and environment
▪ Widening gap of supply of and demand for forest products.

Transportation:

The transportation and communication systems in the Haor area face various challenges, including insufficient infrastructure, lower land elevation, seasonal vulnerability, a shortage of services, a lack of suitable modes, and unplanned transportation growth(M. H. Rahman, 2010). The key problems in the Haor basin are a shortage of basic water supply networks, a scarcity of safe water, and insufficient sanitation facilities. It has been a major contributor to health concerns and significant environmental destruction, especially during flood season. Latrine effluent dispersion into groundwater is a significant cause of pollution(Rabby, Alam, Mishra, Hoque, & Nair, 2011; K. M. Rahman, Hossain, & Rana, 2020; M. H. Rahman, 2010).

Tourism:

The key problems for visitors in the Haors region are a lack of coverage through the newspapers, a lack of lodging facilities such as a regular hotel/motel, a lack of proper protection, and inadequate transportation and connectivity. As a consequence of these concerns, visitors choose to reach Haor areas by launch only during the day and are afraid to spend the night(Poffenberger, 2000). The lack of government policies is the primary explanation for the underdevelopment of tourist attractions in this region. Other factors leading to the demise of tourism attractions include flash flooding and the leasing of Jalmohals to powerful individuals(Oakkas et al., 2015).

Mineral Resources:

During the production of natural gas, a number of concerns typically occur. Local residents, for example, destroy crops and property as a consequence of a gas field explosion and burning, and the ecosystem declines as a result. Similarly, quarrying for gravel and sand without adequate environmental protection has detrimental effects, resulting in environmentally deteriorated terrain. Sandstone, shale, and white clay are also important commodities that are being lost over time. As a consequence, programmes with growth potential must be undertaken in a coordinated way in order to minimise these forms of issues(Mustafa et al., 2019; Muzaffar, 2004).

V. Policies and strategies of Haors:

Bangabandhu Mujibur Rahman, the nation's lord, started to advocate Haor-oriented growth ideas. Sheikh Mujibur Rahman guided the establishment of the Haor Development Board in 1974 for the overall development of the citizens of Haor and marshy regions. Later, on February 22, 1977, the Haor Develpoment Board was created by ordinance. Unfortunately, on September 21, 1982, the board was disbanded. As a result, the production of Haor areas has reached a stalemate. Following the father of the country, the charismatic vision and purpose of Bangladesh's current honourable prime minister started to blast again, ushering in a new age of growth. Sheikh Hasina stressed the creation of Haor and marshy areas in a public gathering on the 3rd of October 1998 in Mithamain upazila of Kishorgonj district. As a result, on January 10, 2001, the "Bangladesh Haor & Marshy Land Creation Board" and "The working committee" of the Board were established via two notifications. Later, in order to add mass dynamism to the creation of Haor and marshy areas, the Haor and Marshy Land Development Board was formed as a directorate on November 17, 2014, as kindly directed by the honourable Prime Minister Sheikh Hasina(Oakkas et al., 2015). For the Haors areas, Bangladesh has established a variety of significant and specific national policies, initiatives, and plans. The below are some of the policies and strategies:

- National fisheries Policy,1998 that can be directed related Haors under the water sector for its sustainable development and development of fish culture.
- National Policy for Safe Water Supply and Sanitation,1998 that has been formulated with the objective of making water and sanitation services accessible to all.So this policy is also applicable to Haor regions.
- National Water Policy,1999 that has 17 sections dealing with policy directives for particular issue which can be linked to the Haor areas.
- National Agriculture Policy,1999 that was declared by the government which is also related to the water of the Haors region.
- National Rural Development Policy,2001 that several statements are directly linked to the Haor regions.
- National Jute Policy,2002 that is correlated with the development of jute production in the Haor areas.
- National Industrial Policy,2005 that covers some aspects with respect to the development of the industrial sector in the Haors region.
- National Land Transport Policy,2004 that major statements are related to Haors.
- National Jalmahal Management Policy,2009 that was formulated for increased production and biodiversity conservation of fisheries resources which is also related to Haors region.
- National Tourism Policy,2009 that clearly stresses the need for bringing the Haor area under tourism development.
- National Health Policy,2010 that covers some aspects with respect to the development of the industrial sector in the Haors area.
- Bangladesh Climate Change Strategy and Action Plan,2009 is a 10 years programme(2009-2018) which can be easily related to the navigational facilities possible to implement in the Haor area without must be use of fuel.
- Outline Perspective Plan,2011 that could be related to the Haors.
- A 20-years master plan (2012-2032) had been formulated for the overall development of the Haor regions.

VI. Future development of Haor regions:

Following the required measures, the region's agenda was briefly outlined, concentrating on the significant changes that would influence the Haor region over the next twenty years, from 2010 to 2030. The imaginary situation describes the real state with various resources. In order to make strategic decisions, it is important to understand the Haor region's future development background(Mustafa et al., 2019; Muzaffar, 2004; Oakkas et al., 2015). The aim was to generate a number of scenarios that represent how the Haor area would change in the future if such incidents, patterns, and technologies occurred. Administration of Intellectual Resources Since people's well-being is the highest concern, it's crucial to recognise the organization's complexity, structure, current capital endowment, and immediate future opportunities.

Population:

According to 2010 statistics, the seven Haor districts' total population is about 19.37 million people, with an average household size of 5.3 people. The population could hit 21.38 million and 22.92 million by 2020 and 2030, respectively. The total Haor area's population growth trend is smaller than the national average. It's likely that by 2030, it'll have fallen from 1.09 percent to 0.63 percent, while the average national growth rate would have declined from 1.31 percent to 0.84 percent(Rabby et al., 2011).

Table No 9: Projected population of Haor region (in million)

District	2010	2015	2020	2025	2030
Sunamganj	2.65	2.81	2.96	3.09	3.20
Habiganj	2.28	2.40	2.51	2.61	2.69
Netrokona	2.60	2.74	2.88	2.99	3.09
Kishoreganj	3.31	2.47	3.61	3.73	3.83
Sylhet	3.36	3.56	3.74	3.90	4.04
Maulvibazar	2.10	2.22	2.32	2.41	2.49
Brahmanbaria	3.07	3.22	3.36	3.48	3.58
Total	19.37	20.42	21.38	22.22	22.92

Population by Sex:

In the Haor districts, the sex (Female:Male) ratio is on average 100:99.27, suggesting that the male population is smaller than the female population. Except for Sylhet and Sunamganj, every Haor district has a similar scenario. The demographic ratio of these two districts means that the male population outnumbers the female population. The national female-to-male ratio is 100:105.

Table no 10: Sex ratio

District	2011	2020	2030
Sunamganj	102.06	101.02	100.22
Habiganj	98.18	96.74	95.62
Netrokona	100.87	99.79	98.95
Kishoreganj	98.43	96.81	95.55
Sylhet	102.53	101.76	101.15
Maulvibazar	98.55	96.84	95.51
Brahmanbaria	94.25	91.54	89.44
Haor	99.27	97.79	96.64

Urban and Rural Population:

The proportion of citizens residing in cities is projected to increase in the Haor area, hitting 12.62 percent in 2020 and 13.72 percent in 2030. The population of rural Haor areas will begin to rise rapidly until 2020, when it will stabilise.

Landless and Farm Population:

The growing pattern in all of the Haor districts indicates that farm holdings are being transferred to non-farm holdings. This pattern can be seen around the world, with approximately 50% representation in all forms of holdings by 2030. By 2030, non-farm holdings in Sylhet district would rise from 50% to 63 percent, and in Kishoreganj district, from 47% to 55%.

Table No 11: Distribution of Non-Farm and Farm land holdings

District	2010		2020		2030	
		FH	Non FH	FH	Non FH	FH
Sunamganj	47	53	50	50	52	48
Habiganj	42	58	44	56	45	55
Netrokona	38	62	39	61	39	61
Kishoreganj	48	52	51	49	53	47
Sylhet	50	50	57	43	63	37
Maulvibazar	42	58	44	56	45	55
Brahmanbaria	45	55	48	52	50	50
National	39	61	46	54	50	50

Literacy Rate:

If the Haor area is to expand, human capital growth is almost definitely the most critical aspect to resolve and financially help. If the existing literacy rate of 51 percent continues to climb, it will hit 63 percent and 75 percent by 2020 and 2030, respectively.

Gross Domestic Product (GDP) :

The Haor region has contributed about 2% of national GDP on average over the last decade, with an average value of BDT 37,740 million. The agricultural sector has contributed 25%, the manufacturing sector has contributed 31%, and the utility sector has contributed the remaining 7%. According to the OPP, the government has set a target of hitting double digits by 2015-2016. If this pattern proceeds in 2015-16, the Haor area's GDP could increase by tenfold, resulting in a net worth of BDT 3,62,574 million(MoW, 2005).

Agriculture :

For the duration 2011-2030, agricultural crop production has been forecast using a business-as-usual scenario. In the future, gross rice crop areas will rise by around 1,90,000 ha, with 70,000 ha, 70,000 ha, and 50,000 ha assigned to Aus, T Aman, and Boro, respectively. The overall area of non-rice crops is projected to expand by around 2,45,000 ha in the future. 6.55 million metric tonnes of rice will be produced in the future, which is around 25% greater than the present total rice output(Cell, 2009; Hassan et al., 2011; Hossain et al., 2017). Rice production will rise by about 1.3 million tonnes, with Aus, T Aman, and Boro responsible for about 14.6 percent, 30.0 percent, and 55.4 percent of total production, respectively. Non-rice crops would total 2.49 million metric tonnes, a 63 percent improvement over current total non-rice supply.

Fisheries:

Fish production has been calculated under the potential scenario for various years and clustered as 4.52, 4.56, 4.62, and 4.68 lakh tonnes for 2015-16, 2020-21, 2025-26, and 2030-31, respectively, by taking proper measures.

Livestock:

Bangladesh has one of the world's largest livestock densities. It has 145 wide ruminants per square kilometre, compared to 90 in India, 30 in Ethiopia, and 20 in Brazil. Milk output in all Haor districts was reported to be about 0.62 million M. tonne in 2010. By the year 2015, demand will have risen to about 0.93 million M. tonne, 1.32 million M. tonne by 2021, and 1.74 million M. tonne by 2030. Meat production in the Haor region was about 0.14 million M.ton in 2010, and it is projected to grow to 0.39 million M.ton by 2030. Meat production in the Haor region is projected to exceed 0.21 million M.ton in 2015 and 0.30 million M.ton in 2021, respectively(Kamruzzaman & Shaw, 2018). In sum, 989 million eggs were raised across all Haor districts. By 2015, 2021, and 2030, this volume would have risen to 1483,2096, and 2771 million units, respectively.

Mineral Resources:

Based on regular gas output (source: Petrobangla) and total remaining reserve of different wells in the Haor districts, a projection was made. The cumulative volume of gas produced from Haor wells to date is 8,095.60 BCF, with a surplus of 8,717.30 BCF. According to forecasts, the remaining balance in 2015 will be 6,139.04 BCF, 2,967.08 BCF in 2020, and 1,321.39 BCF in 2030(Hoq et al., 2021).

VII.   Recommended suggestions

The government may consider the following matters for the development of Haor areas-

- To protect the crops of the Haor people, the rivers, canals, ponds etc need to be excavated under the food for work program.
- On the both sides of the river, in the deserted high land of Haors water capable mass tree plantation can be done encircling the villages and forming woods thus the demands for firewood can be met. In the rainy seasons, fishes obviously will get good shelters in the woods and find abundant food. Birds will live there fearlessly and without any harm.
- Like the Hill District Board, the Haor Development Board should have to be empowered and strengthened from administrative, infrastructural, technical and economical points of views.
- The houses prone to the destruction of water waves need to be secured from.
- The farmers in the Haor areas will have to be made eager to multidimensional cultivation rather depending on paddy cultivation.
- The farmers will have to be given need-based training.
- Assessing the condition of Haor areas,made of nature, characteristics of infrastructures through permanent educational& health infrastructure and mobile or flooting medical centres, health services can be ensured.

- Haor fisheries and agricultural institute may be formulated.
- Technical education will have to be distributed in the Haor areas and in the Science & Technological Universities, faculties on biodiversity of Haor areas can be kept.
- Self-employment projects will have to be launched through the facility of loan & training.
- In the curriculum of the universities of the country, the problems & prospects of Haor areas can be incorporated opening the horizon of research and study.
- Tourism will be developed there emphasizing the real natural environment.
- As the high-quality stones, sand &cement are available, then the electric pole and ceramic factories may be established.
- Thousands of years history, tradition, culture, life-struggle etc of Haor areas will have to be preserved through establishing Haor museum there.
- Massive electrification can be ensured through solar cells there.
- Women there will have to be made work oriented.
- Fisheries research centre, several fisheries breeding grounds and in the rainy season the Haor water presented with boundaries may play a very important role to release and cultivate local fishes.When these fishes grow, these can be released in another free water body. Closed boundary method fish cultivation and vegetable cultivation can be planed in the free water bodies.
- In the dry seasons, fields are seen everywhere. Also, there are plenty of grasses. Milk farm, cow strengthening project and goat management projects can be built on the basis of these grasses & fields.
- The ways to make the deserted Haor lands productive in the dry seasons will have to be explored.
- Haor tourism shall have to be built focusing on the uniqueness of the areas.
- Chatok-Sunamgonj-Mohongonj railways need to be built.

It is a great hope for us that the present government by approving in the ECNEC, took massive programs for development of Haor areas, particularly establishing medical college hospital, TTC, BITAC & Nursing Institutes upgrading hospital to 250 beds, building 750 metres long Jodukata bridge &recently in a aggerated science & technology university(where a faculty on biodiversity of Haor areas may be kept) in Sunamgonj and launching the Dirai-Salla-Azmirigonj regional road project have made the in habitants of Haor areas flourished with realistic magnificent dream.

VIII. Conclusion

As we can see from the debate above, the Haor framework offers a broad variety of economic benefits to both locals and Bangladeshis. Benefits involve fish processing, rice production, cow and buffalo rearing, duck rearing, reed and grass collection, and aquatic and other plant collection. The Haor system also prevents the lower floodplains from flash flooding that occur in April and May, recharges the water levels, holds fish in other lower riparian water bodies fed, and offers shelter for migratory and local waterflow. This research emphasises the fact that Haor is a significant source of natural resources, offering strong economic and livelihood values to the surrounding community and the country as a whole. Bangladesh's population is rising at a faster pace than natural capital, but natural resources are not growing at the same rate. Poverty has a major effect on the climate, and it is approaching a crucial point in the study field, influencing local residents to begin depleting natural capital. For the future growth of Bangladesh's Haor regions, an integrated management plan and effective strategies are needed, which involve the usage of wood and non-wood goods, agriculture, fisheries, and biodiversity protection.

References
[1]. Ahmed, A. (2013). Bangladesh: Environmental and Climate Change Assessment. International Fund for Agricultural Development: Rome, Italy.
[2]. Ahmed, A. U. 2012. Bangladesh Environmental and Climate Change Assessment. Main report, prepared for IFAD's Country Strategic Opportunities Programme 2012-2018.
[3]. Alam, M. S., Quayum, M. A. and Islam, M. A. 2010. Crop Production in the Haor Areas of Bangladesh: Insights from Farm Level Survey. The Agriculturists, 8(2):88-97.
[4]. Alam, M. S., Quayum, M., & Islam, M. (2010). Crop production in the Haor areas of Bangladesh: insights from farm level survey. The Agriculturists, 8(2), 88-97.
[5]. Asiatic Society of Bangladesh. 2003. Banglapedia, Dhaka.
[6]. Ayers, J., & Forsyth, T. (2009). Community-based adaptation to climate change. Environment: science and policy for sustainable development, 51(4), 22-31.
[7]. Aziz, M. S. B., Hasan, N. A., Mondol, M. M. R., Alam, M. M., & Haque, M. M. (2021). Decline in fish species diversity due to climatic and anthropogenic factors in Hakaluki Haor, an ecologically critical wetland in northeast Bangladesh. Heliyon, 7(1), e05861.
[8]. Bangladesh Rice Research Institute (BRRI). 2004. Twentieth National Workshop on Rice Research and Extension in Bangladesh. Emerging Technologies for Sustainable Rice Production. Bangladesh Rice Research Institute, Gazipur-1701. 19- 21 April 2004.
[9]. BENNETT, D., SCOTT, D., Karim, A., Sobhan, I., Khan, A., & Rashid, S. (2007). Interpretive Description Of The Region's Wetlands. Wetland Resources Specialist Study, Northeast Regional Water Management Plan, Bangladesh Flood Action Plan, 6.

[10]. Bennett, S., Scott, D., Karim, A., Sobhan, I., Khan, A. and Rashid, S. M. A. 1995. Interpretive Description of the Region's Wetlands, Wetland Resources Specialist Study, Northeast Regional Water Management Plan, Bangladesh Flood Action Plan 6, Bangladesh Water Development Board.

[11]. Bhuiyan, M. A. H., Kowser, A., Islam, S. S., Islam, M. R., Mohid, M., Kakoly, S. A., . . . Khondker, M. (2020). Phytoplankton in relation to water quality of Tanguar haor ecosystem, Bangladesh: 2. Watch Tower station. Dhaka University Journal of Biological Sciences, 29(1), 9-18.

[12]. Byomkesh, T., Nakagoshi, N., & Shahedur, R. M. (2009). State and management of wetlands in Bangladesh. Landscape and Ecological Engineering, 5(1), 81-90.

[13]. Cell, C. C. (2009). Adaptive crop agriculture including innovative farming practices in the Coastal Zone of Bangladesh. DoE, MoEF, 1996-2003.

[14]. Center for Natural Resources Studies (CNRS). 2009. Adopting Early Warning System to Address Flash Flood in the Deeply Flooded Haor (Wetland) Basin in North-EastBangladesh. Non-Governmental Organization (NGO). Dhaka-1213, Bangladesh.

[15]. Choudhury, N. Y., Paul, A., & Paul, B. K. (2004). Impact of costal embankment on the flash flood in Bangladesh: a case study. Applied Geography, 24(3), 241-258.

[16]. Climate Change Cell (CCC). 2009. Adaptive Crop Agriculture Including Innovative Farming Practices in Haor Basin. Climate Change Cell, DoE, MoEF; Component 4b, CDMP, MoFDM. June 2009, Dhaka. ISBN: 984-300-003312-5.

[17]. Comprehensive Disaster Management Programme (CDMP ll). 2014. District Level Disaster Management Plan Development, District- Sunamganj. Ministry of Disaster Management and Relief. Government of the People's Republic of Bangladesh.

[18]. Department of Agricultural Extension (Fanggidae, Nursiani, & Bengngu). 2007. Department of Agricultural Extension, Field Crops Wing, Khamar Bari, Farmgate, Dhaka-1215.

[19]. Fanggidae, R. E., Nursiani, N. P., & Bengngu, A. (2019). The Influence of Reward on Organizational Commitment towards Spirituality Workplace as a Moderating Variable. GATR Journal of Management and Marketing Review. doi:10.35609/jmmr.2019.4.4(5)

[20]. Ferdushi, K. F., Ismail, M., & Kamil, A. A. (2019). Perceptions, Knowledge and Adaptation about Climate Change: A Study on Farmers of Haor Areas after a Flash Flood in Bangladesh. Climate, 7(7), 85.

[21]. Goodbred and Kuehl. 2000. Enormous Ganges-Brahmaputra Sediment Discharge during Strengthened Early Holocene Monsoon. Geology.

[22]. Goodbred Jr, S. L., & Kuehl, S. A. (2000). Enormous Ganges-Brahmaputra sediment discharge during strengthened early Holocene monsoon. Geology, 28(12), 1083-1086.

[23]. Haque, M. I., & Basak, R. (2017). Land cover change detection using GIS and remote sensing techniques: A spatio-temporal study on Tanguar Haor, Sunamganj, Bangladesh. The Egyptian Journal of Remote Sensing and Space Science, 20(2), 251-263.

[24]. Hassan, A. W. R., Aziz, M., Rahman, M. and Talukder, B. A. 2011. Report on Regional Workshop (Inception & Planning) in Four Climatic Vulnerable Regions of Bangladesh. Disaster and Climate Risk Management in Agriculture (DCRMA) Project (CDMP- II/DAE Part), Department of Agricultural Extension (Fanggidae et al.), Ministry of Agriculture (MoA), Government of the People's Republic of Bangladesh.

[25]. Hassan, A., Aziz, M., Rahman, M., & Talukder, B. (2011). Report on Regional Workshop (Inception & Planning) in Four Climatic Vulnerable Regions of Bangladesh. Disaster and Climate Risk Management in Agriculture (DCRMA) Project (CDMP- II/DAE Part), Department of Agricultural Extension (DAE), Ministry of Agriculture (MoA), Government of the People's Republic of Bangladesh.

[26]. HILIP. 2011. Bangladesh: Haor Infrastructure and Livelihood Improvement Project. Main Report, Volume I, Report No.: 2263-BD.

[27]. Hoq, M. S., Raha, S. K., & Hossain, M. I. (2021). Livelihood vulnerability to flood hazard: understanding from the flood-prone Haor Ecosystem of Bangladesh. Environmental management, 1-21.

[28]. Hossain, M. S., Nayeem, A., & Majumder, A. K. (2017). Impact of flash flood on agriculture land in Tanguar Haor Basin. International Journal of Research in Environmental Science, 3(4), 42-45.

[29]. Huda, M. (2004). Experience with modern and hybrid rice varieties in haor ecosystem: Emerging Technologies for Sustainable Rice Production. Paper presented at the Twentieth national workshop on rice research and extension in Bangladesh. Bangladesh Rice Research Institute. Gazipur-1701.

[30]. Huda, M. K. 2004. Experience with Modern and Hybrid Rice Varieties in Haor Ecosystem: Emerging Technologies for Sustainable Rice Production. Twentieth National Workshop on Rice Research and Extension in Bangladesh. Bangladesh Rice Research Institute. Gazipur-1701, 19- 21 April 2004.

[31]. Huq, S., Rahman, A. K. M. A., Ali, S. M. I., Moeller, P. and Gnoyke, P. 2012. Conference Proceedings on 1st National Conference, Community Based Adaptation to Climate Change in Bangladesh Community Based Adaptation to Climate Change in Bangladesh. Bangladesh Centre for Advanced Studies (BCAS), Dhaka, Bangladesh, 08-09 April 2012.

[32]. Hussain and Salam. 2007. Basic Service Delivery Advocacy: Review Report, Development Wheel (DEW), Dhaka.

[33]. Hussain, M., & Salam, M. (2007). Basic service delivery advocacy: Review report. Development Wheel (DEW), Dhaka.

[34]. Irfanullah, H. M., Azad, M. A. K., Kamruzzaman, M., & Wahed, M. A. (2011). Floating gardening in Bangladesh: a means to rebuild lives after devastating flood.

[35]. Irfanullah, M. H., Azad, M. A. K., Kamruzzaman, M. and Wahed, M.A. 2011. Floating Gardening in Bangladesh: A Means to Rebuild Life after Devastating Flood. Indian Journal of Traditional Knowledge, 10(1): 31-38.

[36]. Islam, M. A. 2010. Adaptive Crop Agriculture Including Innovative Practices in Haor Basin. Centre for Natural Resource Studies (CNRS), Bangladesh. Proceedings of the South Asia Regional Consultations on Strengthening Climate Resilience through a Climate Smart Disaster Risk Management Approach. Faridabad, Delhi NCR, India, 14 – 16 June, 2010.

[37]. Islam, M. M., Bhuiyan, M. N. K. and Harun, M. Y. 2012. Development of Value Chain: An Effective Way of Profitable Duck Farming in Haor Areas of Bangladesh. INFPD Good Practices of Family Poultry Production Note No 04.

[38]. Islam, M. M., Bhuiyan, M. N. K., & Harun, M. Y. (2012). Development of value chain: an effective way of profitable duck farming in haor areas of Bangladesh. INFPD Good Practices of Family Poultry Production Note No, 4.

[39]. Islam, M., Khandoker, M., & Choudhury, S. (2019). Constraints of floating farming in haor area of Bangladesh. Int. J. Agril. Sci, 9(9), 001-005.

[40]. Islam, S. (2003). Banglapedia: national encyclopedia of Bangladesh (Vol. 3): Asiatic society of Bangladesh.

[41]. Jakariya, M., & Islam, M. N. (2017). Evaluation of climate change induced vulnerability and adaptation strategies at Haor areas in Bangladesh by integrating GIS and DIVA model. Modeling Earth Systems and Environment, 3(4), 1303-1321.

[42]. Jakariya, M., Alam, M. S., Rahman, M. A., Ahmed, S., Elahi, M. L., Khan, A. M. S., . . . Sayem, S. M. (2020). Assessing climate-induced agricultural vulnerable coastal communities of Bangladesh using machine learning techniques. Science of the Total Environment, 742, 140255.

[43]. JNA. 2014. Pre-Disaster Secondary Data. The JNA Consolidation Project, Bangladesh.
[44]. Johnson and Alan. 1991. Sedimentation and Tectonics of the Sylhet Trough. Geological Society of America Bulletin.
[45]. Kamruzzaman, M., & Shaw, R. (2018). Flood and sustainable agriculture in the Haor basin of Bangladesh: A review paper. Universal Journal of Agricultural Research, 6(1), 40-49.
[46]. Karim, M. M. 2013. Crop Diversification and Intensificationin a Village of Dingaputa Haor. M.S. (Ag.Agron.) Thesis, Department of Agronomy, Bangladesh Agricultural University, Mymensingh.
[47]. Khan, S. M. M. H., & Haque, C. E. (2010). Wetland resource management in Bangladesh: implications for marginalization and vulnerability of local harvesters. Environmental Hazards, 9(1), 54-73.
[48]. Kurukulasuriya, P., & Rosenthal, S. (2013). Climate change and agriculture: A review of impacts and adaptations.
[49]. Liong, S. Y., Lim, W. H., Kojiri, T., & Hori, T. (2000). Advance flood forecasting for flood stricken Bangladesh with a fuzzy reasoning method. Hydrological processes, 14(3), 431-448.
[50]. Master Plan of Haor Area. 2012. Ministry of Water Resources, Government of the People's Republic of Bangladesh.
[51]. Miah, M. R. (2013). Enhancing food security through acclimatized species domestication in the haor region. ABC Journal of Advanced Research, 2(1), 49-65.
[52]. Miah, M. R. 2013. Enhancing Food Security through Acclimatized Species Domestication in the Haor Region. ABC Journal of Advanced Research, 2(1): 49-65.
[53]. Ministry of Environment and Forests (MoEF). 2012. Second National Communication of Bangladesh to the United Nations Framework Convention to the Climate Change. Government of the People's Republic of Bangladesh.
[54]. Ministry of Environment and Forests (MoEF). 2013. Climate Change and Agriculture in Bangladesh: Information Brief. Government of the People's Republic of Bangladesh
[55]. MoEF. (2012). Second National Communication of Bangladesh to the United Nations Framework Convention on Climate Change. In: Ministry of Environment and Forests (MoEF), Government of the People's ….
[56]. Monwar, M. M., Mustafa, M. G., Khan, N. A., Hossain, M. S., Hossain, M. M., Majumder, M. K., . . . Alam, M. S. (2018). Indigenous adaptation practices for the development of climate resilient ecosystems in the Hail Haor, Bangladesh. Global Social Welfare, 5(2), 125-136.
[57]. MoW. (2005). Government of the People's Republic of Bangladesh.
[58]. Mustafa, M. G., Sarker, G. C., Anwar, S. N., Ahsanuzzaman, M., Rahman, S., Azher, S., & Morshed, R. M. (2019). Analysis of pond fisheries in climate change scenario in the Haor region of Bangladesh. Advances in Research, 1-14.
[59]. Muzaffar, S. (2004). Diurnal time-activity budgets in wintering Ferruginous Pochard Aythya nyroca in Tanguar Haor, Bangladesh. Forktail, 20(2), 25-27.
[60]. NERP. 1995. Specialist Study Wetland Resources, Final Report; Northeast Regional Water Management Project, FAP-6, Flood Plan Coordination Organization, October, 1995.
[61]. Oakkas, M. A., Islam, M. F., Jalil, M. A., Al-Agad, M. A., & Islam, F. (2015). Fish, Fishing and Fishermen: A Case of Hakaluki Haor, Bangladesh.
[62]. Poffenberger, M. (2000). Communities and forest management in South Asia: a regional profile of the Working Group on Community Involvement in Forest Management. Communities and forest management in South Asia: a regional profile of the Working Group on Community Involvement in Forest Management.
[63]. Rabby, T. G., Alam, G. M., Mishra, P. K., Hoque, K. E., & Nair, S. (2011). Different economic and policy perspectives in micro population for sustainable development: A study of the Haor livelihood in Bangladesh. African Journal of Business Management, 5(6), 2475-2492.
[64]. Rabby, T. G., Alam, G. M., Mishra, P. K., Hoque, K. E., Nair, S. 2011. Different Economic and Policy Perspectives in Micro Population for Sustainable Development: A Study of the Haor Livelihood in Bangladesh. Afr. J. Bus. Manage, 5(6):2475-2492.
[65]. Rahman, K. M., Hossain, M. J., & Rana, M. S. (2020). Livestock and poultry rearing by smallholder farmers in haor areas in Bangladesh: Impact on food security and poverty alleviation. The Bangladesh Journal of Agricultural Economics, 41(1), 73-86.
[66]. Rahman, M. H. (2010). Ultra poor'households' flood coping strategies toward food security in two flood prone regions. Dhaka: USAID.
[67]. Rahman, M. H. 2010. Ultra Poor Households' Flood Coping Strategies towards Food Security in Two Flood Prone Regions. National Food Policy Capacity Strengthening Programme, Final Report CF # 5/08.
[68]. Raikes, J., Smith, T. F., Jacobson, C., & Baldwin, C. (2019). Pre-disaster planning and preparedness for floods and droughts: A systematic review. International Journal of Disaster Risk Reduction, 38, 101207.
[69]. Rana, S., Kiminami, L., & Furuzawa, S. (2020). Analysis on the factors affecting farmers' performance in disaster risk management at community level: focusing on a Haor locality in Bangladesh. Asia-Pacific Journal of Regional Science, 4(3), 737-757.
[70]. Rao, K. H., & Rao, P. S. S. (2008). Disaster management: Serials Publications.
[71]. Sikder, M. A. I. 2013. Climate Change and Bangladesh Agriculture: Country Profile. Submitted as country paper in the Workshop on Developing Farming Systems for Climate Change Mitigation, 26-30 August 2013, Colombo, Sri Lanka.
[72]. The World Conservation Union (IUCN). 2007. Communities and Forest Management in South Asia; page 32; ISBN 2-8317-0554-1.
[73]. Thomas, T. S., Mainuddin, K., Chiang, C., Rahman, A., Haque, A., Islam, N., . . . Sun, Y. (2013). Agriculture and adaptation in Bangladesh: Current and projected impacts of climate change (Vol. 1281): Intl Food Policy Res Inst.
[74]. Uddin, M. N. (2008). Agricultural extension services in Bangladesh: A review study. Department of Agricultural Extension Education, Bangladesh Agricultural University, Bangladesh.
[75]. Van Nguyen, N., & Ferrero, A. (2006). Meeting the challenges of global rice production. In: Springer.
[76]. Vatsa, K. S., & Joseph, J. (2003). Disaster management plan for the state of Maharashtra, India: evolutionary process. Natural Hazards Review, 4(4), 206-212.