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Developing Strategies for Wetland Resources Management-A Policy Implication for a South-western Coastal Wetland in Bangladesh

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Abstract

Because of increasing population pressures on Chanda Beel, a south-western coastal wetland in Bangladesh, the resources of the wetland are overexploited resulting in local extinction and varity of many important and environmentally significant resources of the beel. Therefore, an effort in this study was made to develop strategies for better management of the coastal wetland resources. The study has developed strategies such as, no fishing in the beel area during a specific period, stopping of the fishing of fingerlings and brood \$shes, conservation of vulnerable fish species in the canals during the dry season, prohibition of the collection of snails, prohibition of bird hunting for at least five years, increasing the use of organic manures and reduction of dependency on chemical fertilizers and pesticides etc. The study also reveals that the developed strategies for the beel resources management are socially acceptable. Finally, the study concludes that a better socio-economic and environmental outcome can be achieved by adopting those strategies in the wetland area. So, not only do the wetland management strategies reflect the social acceptance but adopting the developed strategies can improve the human welfare of the coastal people considerably.

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1.0 Introduction

Coastal wetlands are the wetlands which occupy the transition zone where the natural distribution of fresh, brackish and saline water exists. In coastal areas, the interaction between the sea and the land processes governs the functions and services of the coastal wetlands. Coastal wetlands are the most productive ecosystems because of the multiple benefits that they provide to the society in the form of services and products. The most important services of the coastal wetland ecosystems involve shoreline protection, organic decomposition, carbon sequestration, flood control, nutrient cycling, water quality improvement, habitat for migratory and resident animals, and regulation of fluxes of nutrients, water, particles and organisms between land, rivers and the ocean (Levin *et* al., 2001). Those environmental services of the coastal wetland are often undervalued because they are not traded in formal markets and usually treated as public goods. But values of the wetland ecosystem services must be incorporated into environmental policies for coastal wetland resources management because the estimated monetary value of the wetland ecosystem scrviccs can provide an insight for proper understanding of the economic welfare to the society from resources management of the coastal wetland.

Bangladesh has an extensive area of wetlands including freshwater lakes and marshes, haors, baors, beels, water storage reservoirs and estuarine systems with extensive mangrove swamps. It is estimated that Bangladesh possesses seven to eight million hectares of wetlands in the form of permanent rivers and streams (480,000 hectares), estuarine and mangrove swamps (610,000 hectares), shallow lakes and marshes (120,000-290,000 ha), large reservoirs (90,000 ha), small ponds and tanks (150,000-180,000 ha), shrimp ponds (90,000-115,000 ha) and seasonally flooded flood plains (5,770,000 hectares) (Nishat, 1993). Among the wetlands of Bangladesh, beels are small saucer-like depressions of a marshy character which are chiefly fed by surface runoff and flood water during monsoon. There are about 1000 freshwater depressions (i.e., beels) of different sizes in the country (Khan, 1993). The coastal wetland of the country is of great importance because they support

livelihoods of the poor coastal people and thus is the key to the Bangladesh economy (Billah, 2003; Khan, 1993). But in recent years the coastal wetland resources of the country are extensively exploited and thus depleted. Therefore, the overexploitation and depletion of coastal wetland resources of the country have become a great concern over the last few decades. The main reason of the overexploitation and degradation of the coastal wetland resources of the country is the rural poverty and consideration of the direct economic profits from the coastal wetlands irrespective of taking into account all the ecosystem services and products provided by the coastal wetlands of the country (Billah, 2003). Moreover, the degradation of the coastal wetlands of the country is also due to the expansion of agricultural land with an excessive application of chemical fertilizers and pesticides (Nishat, 1993).

However, among the coastal wetlands of Bangladesh, Gopalganj-Khulna beels are under the threat of extensive resource degradation and Chanda Beel, being a south-western coastal freshwater wetland in Gopalganj district of the country, experiences such type of threats (Zaman, 1993). The coastal people living in and around the Chanda Beel area utilize animal and plant resources of the beel freely and indiscriminately resulting in local extinction and rarity of many important and environmentally significant resources of the beel (Ali, 1998). Before the year 1960, agricultural practices in the Chanda Beel area were traditional and were also almost similar until the year 1975. But after the introduction of modem varieties and technologies in agricultural sectors (i.e., cultivation of high yielding variety crops and use of chemical fertilizer with pesticides), in recent years agricultural yields have become more than double in the Chanda Beel area at the cost of the functions and services of the Chanda Beel freshwater wetland without considering all of its ecosystem service values (BCAS and CDI, 2006). Moreover, Ghosh and Mondal (2013) extensively studied the non-use values of Chanda Beel and the results of the study showed a substantial monetary value of US$ 0.48 million annually from the beel wetland. But considerations of such functions, services and products of the coastal fresh water wetland including economic values are crucial for its resources management in a

sustainable way. So, given all the functions, services and products provided by the coastal fresh water wetland like Chanda Beel, it is imperative to develop strategies for better management of the coastal wetland resources in the long term.

2.0 Objective of the Study

Generally, coastal wetlands are one of the most productive lands of the world that provide food, aquatic resources and maintain ecological balance. Chanda Beel is also a coastal wetland in Bangladesh and thus, supports livelihoods of the community people in and around the beel area by providing different harvestable goods, such as fish, frogs, snails, wild vegetables, fodders etc. Therefore, the main objectives of the study were:

- To identify wetland resources and resource user groups for gaining insights about the wetland and finally
- To develop strategies for better management of the resources of a coastal wetland (Chanda beel) in Bangladesh.

3.0 Methodology

Study Area

Gopalganj district of Bangladesh is geographically located in the coastal area of the south-western hydrological region at about 120 km south of Dhaka, the capital of the country (LGED, 2007). The district has five upazilas, namely Gopalganj Sadar, Muksudpur, Kotalipara, Kashiani and Tungipara.

Chanda Beel is a south-westem coastal fresh water wetland in Gopalganj district of the country (Fig. 1). Chanda Beel is also the largest beel in Gopalganj district and located between 23°8 to 23°15 N and 89°54 to 90°01 E in the Madhumati river floodplain of the country (BCAS, 1997). The beel is bounded by the Madaripur Beel Route Canal to the east, by Diasur-Hatiara-Dhopakandi road to the west, by Jalirpar-Nanikhir-Dhopakandi road to the north and by Diasur-Mianjirkandi road to the south

(BCAS, 1997; BCAS and CDI, 2006). Chanda Beel covers a total area of 10,890 ha of which about 60% of the total area is under Muksudpur upazila, 30% under Kashiani upazila and the remaining 10% under Gopalganj Sadar upazila (BCAS, 1997; Hussain *et al.*, 2005; BCAS and CDT, 2006).

The land forms of the Chanda Beel area are very young and there is a lack of geological structures. The study area consists of late Holocene to Recent alluvium of the Ganges deltaic plain in the north and tidal plain in the south and is mainly composed of sand, silt and clay in various proportions with small amount of coarse sand (Reimann, 1993). In addition, the Chanda Beel is occupied by thick deposits of peat along with clay and calcareous silty sediments (Brammer, 1996). Moreover, the Madaripur Beel Route Canal and tributaries of the Kumar River contribute water to Chanda Beel. The beel is connected to the adjacent Madaripur Beel Route Canal and the Kumar River by sixteen canals. Both the route canal and the Kumar River receive flood water from the Ganges river system of the country. Generally the inundation of Chanda Beel starts from the middle of May and during the monsoon, Chanda Beel remains completely inundated with the monsoonal water (BCAS, 1997; Hussain *et al.*, 2005).

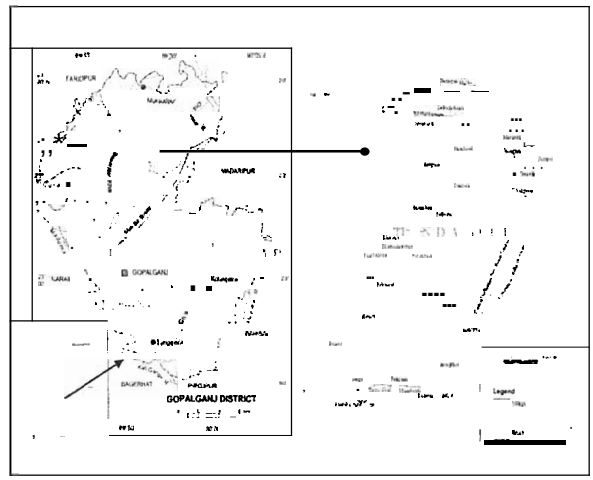

Figure 1: Location of Chanda Beel in the south-western coastal Bangladesh

Survey Design

Both primary and secondary information and data were used to develop strategies for the resources management of Chanda Beel. For this sake, key informant interviews (KII) and focus group discussions (FGD) were conducted in and around the Chanda Beel area.

Key informant interview (KII) is a powerful survey instrument that can help to develop strategies for better management of the rcsourccs of thc becl wetland by evolving information and data about the use and non-use attributes of the beel. The key infonnant interviews were only conducted with those coastal people who were directly and/or indirectly dependent on the beel resources, or had interest in conserving the coastal wetland resources. Key informant interviews were conducted in and around the Chanda Beel area with farmers, fisher folks, water lily collectors, snail collectors, frog collectors, baira makers, bird hunters, boatmen, peat collectors, wild vegetable collectors, fuel wood collectors, fisheries experts, livestock experts and agriculture officials. More than 50 KIIs were done including NGO officials, social scientists and experts in related fields. The perception and opinion of the coastal pcoplc about the present, past and trends of becl resources were found from the key informant interviews.

Moreover, focus group discussions (FGDs) were also employed in and around the beel area. The focus group discussions were conducted with different livelihood groups which involved farmers, fisher folks, water lily collectors, snail collectors, frog collectors, baira makers, bird hunters, boatmen, peat collectors, wild vegetable collectors and fuel wood collectors. A total of 13 livelihood groups were identified. For each livelihood group at least three FGDs were done and these three FGD was selected through Purposive Random Sampling. Thus total 39 FGD had been conducted. Each FGD was started with asking very general and greeting questions. Technical terms which were not clear to them, were avoided during the conduction of FGD. People were clearly explained thc purpose of discussion during conducting FGD.

Vague, confusing questions, cultural and religious belief attacking questions were avoided. The focus group discussants consisted of adult men and women (age belongs to 18 or above) considering gender issues in different locations of the study area. Each FGD took about one and a half hours to two hours. Each FGD consisted of at least 6-8 persons with homogeneous mixture. Thus, For 39 FGDs more than 250 persons were engaged. After developing the strategies for better management of the Chanda Beel resources, FGDs were conducted again with those livelihood groups to finally identify the strategies and to get people's opinions on acceptability about those. In addition, different literature including the reports of the Ministry of Environment and Forest, Local Government Engineering Department, Bangladesh Centre for Advanced Studies, Centre for Natural Resource Studies, IUCN-Bangladesh, Asian Development Bank and U. S. Agency for International Development were also reviewed to develop the strategies.

4.0 Results and Discussion

(a) Findings from Key Informant Interviews (KII)

Key informant interviews were conducted with different livelihood groups to explore the present and past conditions of the Chanda Beel in terms of resources and physical characteristics.

Most of the key informants from farmer, fisher folk, water lily collector, snail collector, frog collector, baira maker, bird hunter, boatmen, peat collector, wild vegetable collector and fuel wood collector groups perceived that the unplanned construction of water management interventions in the beel area over the years has accelerated reduction of the water coverage area of the beel and is responsible for the degradation of the Chanda Beel. Moreover, lack of maintenance of sluice gates has also caused the reduction of the water coverage area of Chanda Beel.

Most of the key informants from different livelihood groups said that the beel supports a rich habitat for floral resources. Important floral resources like Nol Khagra (*Phragmites karka*), Dholkalmi

(Ipmoea *fistulosa*) are usually utilized as vegetables, while wild vegetables like Kalmi (Ipomoea *aquatica*), Helencha (*Enhydra fluctuans*) and stem of Shapla (Nymphaea nouchali) are also consumed in the beel area.

The key informants opined that Chanda Beel also supports a rich diversity of fauna resources. Most of them categorized the fauna resources of the beel into broadly two groups such as fisheries resources and wildlife resources. According to them, the fish production is declining because of over exploitation, pesticide use, loss of water bodies and converting the water bodies to agri-lands etc.

The fisherman key informants said that freshwater prawns and crabs are the important and available fauna resources in the beel area. The key informants of the fishermen livelihood group identified some rare species of the beel, such as Tatkini/Bata (Cirrhinus reba), Kalibaus/Kalia (Labeo callbasu), Pabda (Ompok *bimaculatus*), Boal (*Wallago* attu) etc. Moreover, some extinct fish species of the beel were also identified by the fishermen key informants such as, Rup Chanda, Selenda, Koral, Kamini etc. However, almost all of them agreed that every resource has been dccrcased and currently showing the same trend.

(b) Findings from Focus Group Discussions (FGDs)

Focus group discussions with the farmers in and around the Chanda Beel area revealed that once upon a time, vegetables, pulses and wheat were grown in addition to rice in the beel area, but at present rice has become the main staple crops in the beel area and no other crops are found to be grown in the beel apart from jute. People of the beel area grow different types of rice such as BRRI Dhan 3, BRRI Dhan 29 and BRRI Dhan 26 as boro rice during the dry season, whereas aman rice is grown in very small portion of the land during the monsoon. The crop calendar was formulated during the group discussion as shown in Table.1. However, most of the farmers gave preference for reducing the use

of chemical fertilizers and pesticides during HYV-boro rice cultivation in the beel area and they opined that if they are given training on how to use organic manure in agricultural land properly with its advantage, a large number of farmers would adopt it.

Table 1: Plantation and harvesting period of different crops in Chanda Beel

Crops	Plantation period	Harvesting period
Boro rice	January-February	April-May
Aman rice	April-May	October-November
Jute	April-May	July-August

Discussions with fishermen revealed that in Chanda Beel area generally two categories of fishermen are found such as, full time fishermen and part time fishermen (also called non-fishermen or seasonal fishermen). Fishes in the beel are found to be available during the rainy season from June to October and fishermen of the beel area usually use nets, bamboo traps and spears as fishing gears for fishing. Most of the fishermen opined to **excavate** the silted up canals in the beel area and conserve vulnerable fish species in the canals during the dry season, but they gave importance for their alternative income generating sources in case of stopping the fishing from the beel area for a certain period of the year.

Focus group discussions with snail collectors revealed that the breeding season of the snails is from May to July. Harvesting of snails is started from June and continued up to November in the Chanda Beel area and the peak of the harvesting is found in September. The group discussion explored that there is a snail marketing network over the area. Usually, snails are collected in the morning and the late afternoon (3-5 pm) from the beel area. Snails are caught by using snail nets. The people who directly collect snails from the beel area are called snail collectors. They sell their snails to local dealers (also called small traders). Then local dealers take their collected snails to an assembling centre

(called gala) and sell it to large traders. Snail large traders of the area mainly sell snails to the Bagerhat and Khulna region, where the soft body of snails is separated to use it as fish feed and the shell is used to produce lime which is usually used by the shrimp farmers in the region. However, snail collectors gave importance for their alternative income generating sources in case of stopping the snail collection from the beel area.

Discussions with bird hunters revealed that Chanda Beel supports migratory birds including aquatic birds. Birds from the Chanda Beel area are usually hunted from December to February and hunters usually can catch 8 birds per day on an average. For the beel wetland management they urged to create alternative income generating sources considering their livelihoods.

So, the discussions conducted with different groups such as, farmers, fisher folks, water lily collectors, snail collectors, frog collectors, bird hunters, peat collectors revealed that all the livelihood groups mainly emphasized the alternative income generating sources. If alternative income generating source is provided in the Chanda Beel area, over-exploitation of the beel resources can be minimized significantly.

(c) Strategies for Coastal Wetland Resources Management

On the basis of secondary literature reviews, experts' opinion (14 persons) and social acceptability, the strategies are developed in order to better manage the resources of Chanda Beel in the long term. The developed strategies for better management of Chanda Beel resources are given in Table 2. It is found from the table that the developed strategies reveal a proposed use pattern of the beel by which we can achieve a better economic and social benefit in the long term. The study identified the most important strategies that can be adopted in the beel area such as, no fishing in the beel area from 1 April to 30 June, stopping the fishing of fingerlings and brood fishes from the beel area, excavating the silted up canals in the beel area and conservation of vulnerable fish species in the

canals during the dry season, implementing the fish conservation act in the beel area, prohibition of the collection of snails from the beel area, prohibition of bird hunting for at least five years from the beel area, banning of frog collection from the beel area, increasing uses of green or organic manure in agricultural field and reducing dependency on chemical fertilizers and pesticides by adopting the integrated pest management (IPM) farming technique. It is mentionable and evident from a demonstration plot in the Chanda Beel area that the IPM farming techniques generally do not decrease agricultural production. The farmers of the Chanda Beel area think that if any incentive regarding the use of organic manure and IPM farming practices are given to them, they will adopt it in the future. Moreover, alternative income generating works for the direct resource extractors from Chanda Beel especially for fishermen, snail collectors, water lily collectors and bird hunters must be provided and urgent needs for better wetland resources management in the area. The people identified the possible alternative works such as, construction works, earthen works etc. But most livelihood group argued to set up textile mills or cottage industries on a small or large scale as their alternative income generating sources in the area.

Table 2: Strategies for better management of the resources of Chanda Beel

Resource/area	Key issue (s)	Strategic regulations/actions
Monsoonal fishing	Decline in fish production	• Banning the use of current and fine-meshed nets • No blocking of the fish migration routes • Alternative income generating works for fishermen of the Chanda Beel area can be provided for resource users such as construction works, earthen works. Mills/cottage industry can be set up in the area for providing alternative income of the coastal people who depend on the harvested resources of the beel during the monsoon • Excavating the silted up canals in the beel area and conservation of vulnerable fish species in the canals during the dry season
	Over fishing and harvesting of small fish fries and brood fish	• No fishing in the beel area from 1 April to 30 June • Stopping the fishing of fingerlings and brood fishes • Impact and extent of over fishing on population of different fish and prawn species should be assessed and thereby, regulatory measures are to be enforced • Implementing the fish conservation act in the bcel area
		• Banning the digging of shallow ditches by landowners (locally called 'kua')

Collection of snails	Decrease of snail production	• Collection of snails can be restricted • But snail collection can be unrestricted to the extent which will have no impact on overall production of snails of the beel and that extent is to be worked out by the relevant experts • Alternative income generating works for snail collectors of the Chanda Beel area can be provided as mentioned before
Collection of aquatic plant (water lily)	Decrease of water lily production	• Harvesting of water lily can be allowed to that extent which will not exceed its natural re-growth • Alternative income generating works for water lily collectors of the Chanda Beel area can be provided as mentioned before
Bird hunting and trapping	Decline of bird population	• Banning the bird hunting from the beel area for at least five years to allow the bird species to re-establish in the beel area • After five years, restriction may be lifted for few species which are not protected by law and hunting extent should be fixed by the concerned authority to the limit which will have no severe impact on the wetland ecosystem • After all, alternative income sources for bird hunters of the Chanda Beel area can be provided

Frog hunting	Decline of frog population	• Banning the use of frogs as bait for fishing or any other purposes
Agriculture	Loss of agricultural land fertility due to excessive use of agro-chemicals in the form of fertilizers and pesticides	• Reducing the use of chemical fertilizers and pesticides during HYV-boro rice cultivation • Encouraging the use of green/organic manure among the farmers of the Chanda Beel area • Adopting the integrated pest management (IPM) technique • Promoting baira farming practice in the Chanda Beel area
	Negative impact on fisheries and other available resources of Chanda Beel	
Peat collection	Decrease of peat stocks in the beel area	• Controlling the collection of peat from the Chanda Beel area by developing rules • Introducing fuel efficient stoves • Motivating local people for cultivating aman rice, jute, dhaincha/sola apart from HYV-boro rice
Monitoring and evaluation	Loss of wetland resources	• Forming a regional and local community level monitoring cell by integrating all local and regional stakeholders • Organizing different local communities under various wetland conservation groups • Monitoring fish, frog, bird and other resources of the beel which are under serious threats • Evaluation to be made after monitoring and thereby actions to be incorporated in the program

5.0 Policy Implication for Wetland Resources Management

Coastal wetland ecosystems are characterized by the use and non-use attributes and these attributes are responsible for their multiple benefits that they provide to human welfare. These multiple benefits are the result of the interaction between the land and sea processes occurring in the coastal area and making the coastal wetlands more diversified and productive. If all these multiple benefits are economically valued in a common framework, we will better understand the economic welfare that can be achieved from conserving the coastal wetlands. Development projects or policies require incorporating such wetland values for wetland resources management in a sustainable way. Failing to incorporate such values considering all the wetland ecosystem services and products will make the development project and policy unsustainable in the future. The identification of ecological-economic linkages of the coastal wetland can help us realize the hidden value of wetland ecosystem functions and services. However, the developed strategies in the present study can help policy makers integrate those strategies into decision making while implementing any development projects or policies in the Chanda Beel area. The study also reflects the people's attitude towards conservation of the wetland resources. Finally, the study can help planners and policy makers develop a socially acceptable, economically feasible and environmentally sound strategy for management of the Chanda Beel wetland resources.

6.0 Conclusion

The study reveals that Chanda Beel as a coastal fresh water wetland plays a vital role in the area by providing multiple benefits to the coastal people and thus most of the people stated their attitude towards conserving the resources of the beel. The study has developed important wetland management strategies which are the urgent needs in the area for conserving the resources of the beel and hence, the policy makers should pay a special attention to the wetland issues. Finally it can be concluded that if the developed wetland management strategies are adopted in the area, a better socio-economic and environmental outcome will result from the resources management of the beel in the future.

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