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RESEARCH ARTICLE

RIVER EMBANKMENT AND RECESSION OF WETLAND: A STUDY ON BARUL BEEL IN LOWER AJOY BASIN

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ABSTRACT

River floods play an important role in keeping the vitality of the adjacent wetlands. In Lower Ajoy Basin, embankments have been constructed to prevent the flood and thereby to avoid the flood damages. It has put a barrier for water and materials exchanges in between the river and the wetlands as it prevents the frequent river spill on the floodplain. As a result the wetlands are losing their characters and suffering from the scarcity of water. In the present study, emphasis has been given to find out the relationship between embankment and recession of Barul beel (wetland).

INTRODUCTION

River and wetland are the important part of the hydrological cycle, like 'artery and lymph'. Normally these two are the part of physical set up of a region. Wetlands are very much important in the riparian environment because they regulate floods, maintain flows during lean period and exchange ground water. It is the landscape that underlies many of the large-scale factors and fundamental forces that are essential to the formation and long-term maintenance of ecosystems (Brinson, 1993). In the absence of exchange of water between river and wetland, the river level may rise and fall rapidly, causing stress in the aquatic ecosystem. Embankment constructed on the right bank of the Ajoy river has put a barrier between the river and the Barul *beel*. As a result the total coverage of the wetland (Barul *beel*) has been receded to a significant extent from 1972 to 2010.

MATERIALS AND METHODS

Barul *beel* is located on the right bank of the Ajoy river in Ausgram-II block of Burdwan district, West Bengal. Geographical extension of the *beel* is from $23^0$24'36'' N. to $23^0$36'36'' N. latitudes and from $87^0$31'02'' E. to $87^0$33'07'' E. longitudes. Total area of the wetland is about 200 acres or 600 bighas. Survey of India's toposheet bearing the index no. 73 $^M/_{10}$ and satellite imagery (LISS-III) have been consulted thoroughly for detecting the change of areal coverage of the Barul *beel*. Field surveys have been conducted to find out the ground reality of the wetland at present situation. Apart from these, some secondary data have been collected from panchayet and block development offices. GIS software (Map Info, Arc GIS) have been applied to prepare the maps.

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RESULTS AND DISCUSSION

Formation of Marshes

Marshes are a type of wetlands subject to frequent or continuous flood. Typically the water is shallow and features grasses, rushes, reeds, typhas, sedges and other herbaceous plants grow in the marshes. Existences of marshy lands are more dominant in the lower reaches of Ajoy river basin. Marshy areas are mostly found in the eastern part of the basin, particularly below 20 metres contour. The construction of embankments along Lower Ajoy river prevents the natural drainage from the protected areas into the river. It causes water logging in the surrounding areas leading to formation of marshy lands. Though, some portion of the water can be drained into the river through the pre-determined drainage sluices provided in the embankment. But of course, the total capacity of the drainage sluices cannot be made equal to the pre-embanked water available for natural drainage of the countryside into the river. According to the opinion of local people, before reconstruction of Ajoy embankments in 1980s, the surrounding areas of *Barul Beel*, *Chhora Beel*, in Ausgram block, *Abarkhala Beel*, *Khandar Beel*, *Doura Beel* in Nanur block, *Mollickpur Beel*, *Kankora Beel*, in Mongolkot block and *Jatinpur Beel*, *Chhota Beel*, *Bara Beel* in Katwa block had frequently been flooded. Another fact is that at the confluence point of Ajoy with the river Bhagirathi, remains three meters higher than the level of Ajoy during rainy season. Therefore, the excess water of Ajoy cannot enter into the Bhagirathi. It creates 'back push' effect in the water of Ajoy river. Consequently the overflow takes place in the low-lying banks of the Ajoy creating large areas under perennial marshes. It has been estimated that about 13128.12 hectares of marshy area present in Lower Ajoy River Basin (Mukherjee, 2002). Marshy lands are predominantly found in the areas of Ketugram, Panchundi, interfluves area of Kunur river, near Mongolkot,

Nutanhat, Mollickpur, Somaipur in Burdwan district and in south-eastern part of Nanur in Birbhum district. In Lower Ajoy River Basin, the marsh or backswamp is locally called as '*Beel*'. The '*Beels'* or marshes are very much affected by human encroachment. Dumping of soil on the '*Beels*' for procurement of land is very common in the basin area and sporadic agriculture is also practiced in the newly reclaimed lands. All these factors have turned many marshy areas into very shallow water bodies, which are characterized by periodical inundation and dryness. During rainy season, over-flooding of areas adjoining the '*beels*' become common features (Molla, 2010). Many of the marshes are either totally full of vegetation and reeds or converted into agricultural lands and they certainly do not deserve to be called as '*Beels*'.

Drying-up of the Wetlands

During-up of the adjacent wetlands of the river is very common in Lower Ajoy Basin. Surveys conducted on the wetlands of Lower Ajoy Basin, reveal the fact that due to absence of spill of river Ajoy, the surrounding wetlands are gradually drying-up. The agricultural land is gradually expanding towards the fringe area of the wetlands. Table-1 shows that the standing water bodies of Barul *beel* (local name of wetland) is gradually shrinking since 1972. The total area of Barul *beel* is about 7.30 sq.km. out of which in 1972, the standing water body of the wetland was about 4.76 sq.km. (65.21%) and cultivable land was about 1.52 sq.km. (20.82%) while in 2000, the standing water body of the wetland was about 3.33 sq.km (45.62%) and cultivable land was about 2.57 sq.km. (35.20%). But in 2010, the area of standing water body was about 3.08 sq.km. (42.19%) and the cultivable land was about 2.69 sq.km. (36.85%). So it is clear from the table that human encroachment (especially agriculture) to the *beel* is gradually increasing and consequently, the standing water body is decreasing. According to the opinion of the aged people of the area, before reinforcement of embankment in 1978, the river Ajoy used to spill frequently and the adjacent wetlands were recharged by the flood water. Further, the wetlands used to act as 'buffer zone' to reduce the severity of flood. But after strengthening and increasing height of the embankment, the frequent flooding of the floodplain is prevented and the recharge of wetlands is deferred. Therefore, the wetlands are gradually drying-up and losing their characters.

Ecological disturbance

Construction of embankment along Ajoy river exerts significant impacts on the floodplain ecology. The most notable positive ecological impacts include the changes in the bio-mass through increased rice production and reduced recurrent flood damage to the field crops. Before construction of embankment, frequent flooding of the floodplain was very common and wetlands situated in the floodplain had been recharged by the floods. Spilling of flood water was very important for keeping the vitality of river ecosystem as well as the ecosystem of the adjoining wetlands. But now, the embankment acts as a wall between river and the floodplain. It has restricted the frequent flooding of the adjoining wetlands which locally called as '*beels'*. These '*beels'* were the habitat of numerous indigenous species. But due to absence of frequent flooding, spatial coverage of the wetlands has gradually been reduced and land has been reclaimed for agriculture. As a result a large number of the aquatic and amphibian species have been extincted (table-2) while the number of some others species have been decreased significantly and their name have been in the 'Red Data Book'. The most significant negative ecological impact in Lower Ajoy Basin is associated with the reduction of standing perennial and seasonal water bodies. Consequently the breeding grounds of fisheries have been lost and migration routes have been disturbed. As the size and status of wetlands changes, the connections to the drainage and floodplain network are broken and the recharge of water and nutrients is considerably hampered (ESCAP, 2003) Submerged aquatic vegetation is less prevalent as a source of organic matters as the wetlands decline. The contributions of biological organisms and organic matter which arrive in the flood water do have vital linkages to the fertility and vitality of the floodplain eco-system.

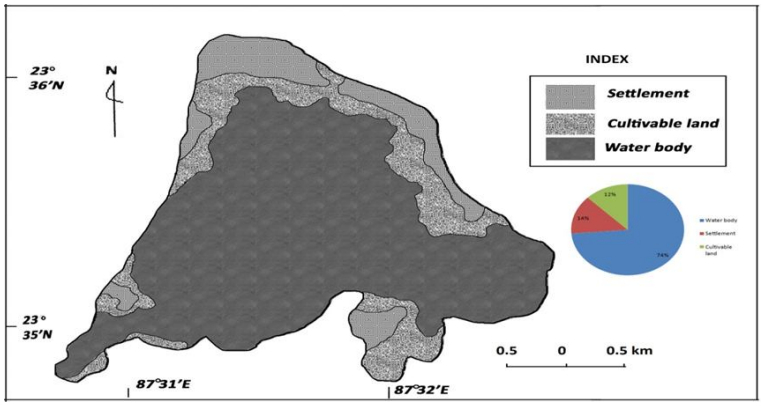
Table 1. Changing status of wetland in Lower Ajoy Basin (Barul beel): 1972- 2012

Land use type	1972		2000		2010	
	Area (sq.km.)	% of total area	Area (sq.km.)	% of total area	Area (sq.km.)	% of total area
Settlement area	1.02	13.97	1.40	19.18	1.53	20.96
Standing water body	4.76	65.21	3.33	45.62	3.08	42.19
Agricultural land	1.52	20.82	2.57	35.20	2.69	36.85
Total	7.30	100	7.30	100	7.30	100

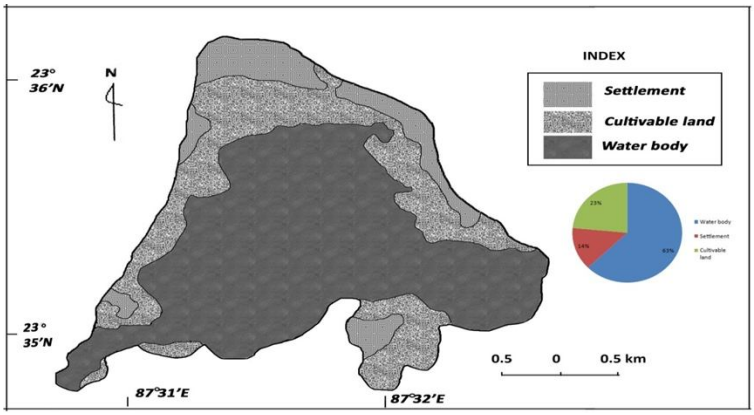
Source: Toposheet and satellite image (LISS-III)

Table 2. List of extinct and endangered species in Lower Ajoy Basin

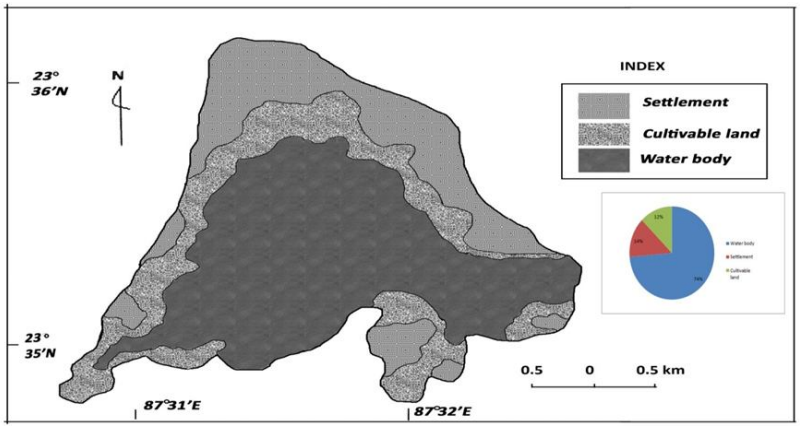
Sl.No.	Name of the species	Scientific name of the species
1	River Terrapin	*Batagur baska*
2	Otter	*Lutra lutra*
3	Spoon billed Sand piper	*Eurynorhynchus pygmeus*
4	Golden frog	*Rana tigrina*
5	Long tailed Duck	*Clangula hyemalis*
6	Siberian Crane	*Grus leucogeranus*
7	Pink headed Duck	*Rhodonessa caryophyllacea*
8	Frog fish	*Antennarius striatus*
9	Eel	*Arguilla rostrata*
10	Floating fish	*Parexocoetus branchypterus*



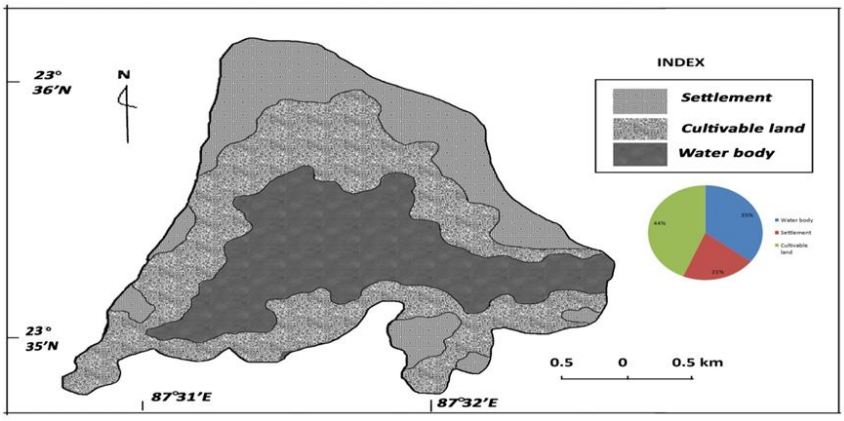
Land use pattern of Barul *beel* in monsoon period-1972 Figure-1. (a)



Land use pattern of Barul *beel* in pre-monsoon period-1972 Figure-1. (b)



Land use pattern of Barul *beel* in monsoon period-2010 Figure-2. (a)



Land use pattern of Barul *beel* in pre-monsoon period-2010 Figure-2. (b)

Therefore, prevention of annual flooding can rapidly changes the physical quality of the soil in the embankment protected areas.

Conclusion

Embankment is a quite common structural measure of flood control but in Lower Ajoy Basin, it results drying up of the surrounding wetland as it has found in case of Barul *beel*. In the absence of wetlands the floodplain becomes unable to contain water and all the rainwater come into the river. It increases the magnitude of flood. The ecological systems of the floodplain also undergo great changes as the embankment hampers the water and material exchanges in between the river and the wetland. Though the embankment is given due weightage as a flood control measure, but restoration of wetland is also essential so far as the floodplain ecology is concerned. The importance of maintaining the historic diversity of wetlands across a landscape requires that the geomorphology and hydrologic regime of a restored wetland match that present historically (Wilcox and Whillans 1999). Regarding the performance evaluation of the embankment as a flood control measure, the Kosi embankment breach in 2008, Ajoy embankment breach in 2000, Brahmaputra embankment breach in 2012 have shown that embankment provides a 'false sense of security' to the bank dwellers. Therefore, question arises regarding the efficacy and necessity of the embankment as a flood control measure.

In this juncture point the right bank embankment of Ajoy river may be cursed for the recession of the Barul *beel*, which once has provided as rich ecological spot is now deteriorating as the embankment has been constructed along the Ajoy river. Therefore, the policy makers should rethink the role of embankment as a flood control measure and momentum should be given to the non-structural measures of flood control like floodplain zoning, flood proofing measures and insurance schemes.

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