

Ecosystem of East Calcutta Wetlands As An Example Of Environmental Protection in India.

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Wetlands have been described as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. The importance of wetlands lie in the fact that it maintains the food chain, ecological balance and absorb pollution, treat sewage and fulfills the requirement of fishes.

Situation of the East Calcutta Wetland system

The wetlands to the east of Calcutta (22° 27' N 88° 27' E) comprises a large number of water bodies distributed across the districts of South and North 24 Parganas. The multifunctional wetland ecosystem is spread over 12,500 hectares. It has, along with the wetlands, 264 sewage-fed fisheries, agriculture and solid waste farms and some built up areas. The resource recovery system developed by the local people over many years using waste water from the city is the largest and the only one of its kind in the world. It also helps in water treatment and is home to waterfowl and a large biodiversity. In August, 2002, 12,500 hectares of the East Calcutta Wetland area was included in the 'Ramsar-List' making it a wetland of International Importance. The Ramsar Bureau List was established under Article 8 of the Ramsar Convention.¹

Historical aspects of ECW.

The earliest known accounts (year 1748) of the wetlands picture it as marshy Salt Lakes teeming with fish and birds. The Lakes were spread over a vast area, stretching from the vicinity of River Hooghly to about 5-6 km. to the east. According to these early accounts, the circumference of the lakes was much, much bigger than it is at present. From the late 18th century, the edge of the lakes receded about one and a half kilometers. The loss of head water feed from the river Hooghly, the gradual deterioration of the River Bidyadhari (within the wetland area), the ever expanding city of Calcutta with its increasing demands for drainage and waste disposal led to rapid silting and reclamation of

the East Calcutta Wetlands. Human interventions have played a decisive role in the shrinking of the East Calcutta Wetland to their present size.

The East Calcutta Wetlands have an interesting hydrological history. The area had been a brackish water lagoon swamp but as fresh drainage water came out of Calcutta it became suitable for raising fish. Local farmers stocked some of the ponds and then dug more. Currently, there are 300 or so large fish farms and ponds cover a total area of 3,500 hectares, some individual ponds extend to 70ha. Landlords, many of them absentee, let the majority of ponds to commercial managers, some others are managed by the government and some have been given to fishermen's groups and cooperatives. Vegetable production is a household activity with people renting small plots or sub-letting smaller plots for their own household sustenance and income. Apart from those people actually raising fish (about 8,000) or growing vegetables, there are porters, auctioneers, traders, retailers and people raising fish seed, making nets, maintaining drainage canals and reinforcing the banks. A great many people, many of them poor, depend on the Wetlands for their livelihoods. Many more, in Calcutta city, depend on the fish and vegetables produced; 13,000 tonnes of fish are produced annually in ponds managed for wastewater aquaculture and 150 tonnes vegetables per day are harvested from small-scale horticultural plots irrigated with wastewater. But there are a number of problems. The salt lake to the East of Calcutta have been for the abundance of fish fauna, which up to few years ago consisted mainly of brackish water forms (Gupta 1908)³. *Latex calcifer* (Bloch) which is commonly known as "Bhetki" and *Mughal persii* (Ham) known as "perse".

Hilisa hilisa (Ham) was also known not uncommon when the lakes were fed by water from the tidal river Bidyadhari which of late has silted up; there is at present no ingress of saline water into the salt Lake from this source.² Sewell (1934) in studying the fauna of the Salt Lake also remarked on the rapid deterioration of the river Bidyadhari owing to deposition of salt during the flood tides. The natural process of delta formation and the consequent change in the river system, as also engineering construction, such as bridges and canals, have also been instrumental in bringing the present moribund condition of the river.⁴ Several fish culture ponds have been started in the villages bordering in the Salt Lake, and the Lakes themselves are being more and more banded up into small reservoirs or "bheris" as time passes (Gupta 1908)³.

Farmers around Calcutta developed a technique of using domestic sewage for fish culture almost a century ago. This technique is widely used to meet the growing demand for fish in this thickly populated city.

The technique is considered to be unique and is the largest operational system in the world to convert waste to consumable products.

The large scale usage of sewage for fish culture began in 1930s. early success of fish culture in stabilized sewage ponds, which were used as a source of water for growing vegetables provided stimulus for the large scale expansion of sewage fed fish culture system. The area under this unique system of culture peaked at 12,000 hectare, but in recent years there has been a steep decline in the area due to the increasing pressure of urbanization.

What the Wetlands offer :

Fish: The city of Calcutta gets its huge volumes of daily sewage treated at no expense and gets in addition a substantial daily supply of highly edible freshwater fish (a very essential protein supplement in their daily food). In fact, Calcutta City receives about one third of its daily requirement of fish from the sewage-fed fisheries (about 11,000 metric tones annually.)

Garbage: Calcutta generates roughly 2,500 metric tons of garbage (solid waste) a day which is collected and dumped at designated sites in the wetlands. The garbage filled areas are extensively used to raise a variety of vegetables. The city receives roughly 150 metric tons of vegetable everyday from its garbage farms.

Foodgrains: The paddy fields in the wetlands (many of which are irrigated by the effluent water of the fisheries) produce 15,000 metric tons of paddy annually.

Air purification: It is claimed by environmentalists that these wastewater bodies and fisheries act as a carbon-dioxide sink and help to improve the quality of air of Kolkata and its environs. Any loss of the wetlands, therefore, will have a negative impact on the overall environmental condition of the area. So, the role and importance of the wetland in relation to its surroundings cannot be undermined.

The East Calcutta Wetlands Serves to :

(a) absorb and treat in the most efficient, economical and natural way the huge volume of sewage and wastewater and urban solid and air wastes generated by Calcutta at no cost to the city;

(b) fulfill substantially the requirement of fish, vegetables and food-grains in the city;

- (c) absorb the pollution from, and purify the air that citizens breathe;
- (d) absorb and pass to downstream creeks and the sea the flood waters that the monsoon brings to the city;
- (e) provide a habitat for a variety of flora and fauna and living organisms endemic to wetlands;
- (f) provide the food chain and waste-to-wealth recycling so unique and essential to this city;
- (g) maintain the micro-climatic condition of the region;
- (h) maintain the delicate ecological balance in a fragile environment and eco-system;
- (i) provide livelihood support for thousands of local villagers who also have the unique skill of using wastewater to grow fish and vegetable and thereby help sustain a stable urban fringe.

The objectives of the study are to :

- 1) Identify the livelihood options in and around East Calcutta Wetlands based on use of urban wastewater.
- 2) Estimate the value of direct benefits derived from the use of Urban Waste water by the stakeholders in ECW.
- 3) Estimate the environmental impact of East Calcutta Wetlands on Stakeholders. In order to assess the livelihood, environment and health impacts of wastewater/sewage generated from Calcutta residing in ECW on the people residing in and around East Calcutta Wetland, we developed a questionnaire through repeated pilot study.

Table 1: The East Calcutta Wetlands consists of 264 operating fish farms or bheris arms which are given below :

P.S.	Bheris
Bidhannagar(s)	46
Bhangar	37
Sonarpur	104
Tiljala	77
Total :	264

The following data, presented in the form of a number of tables, were obtained by conducting a personal survey among the workers.

Table 2: Religion & monthly expenditure according to different types of occupation

Primary Expenditure(Rs) Occupation	Religion			Monthly Family		
	Hindu	Muslim	Others	0-1000	1001-5000	5001-10,000
No good Produced	38	8	0	3	34	9
Rice	74	11	0	1	64	18
Vegetable	60	1	0	4	50	7
Fish	263	2	1	5	230	27
Garbage	34	7	1	2	34	6

Table 3 :Literacy level(Years of School:0-illiterate; 2-can read &write; primary;10-Madhyamik/classX;12-Higher Education).

Class	Frequency	Percentage
0-1.0	40	8
1.1-2.0	50	10
2.1-3.0	71	14.2
3.1-5.0	184	36.8
5.1-8.0	113	22.6
8.1-10.0	28	5.6
10.1-12.0	14	2.8

Table 4:Distribution by occupation

Related occupation or good Produced	Households	
	No.of households	Percentage
No good produced (other activities)	46	9.2
Rice (using wastewater)	85	17.0

Vegetables (using wastewater)	61	12.2
Fish (using wastewater)	266	53.2
Garbage	42	8.4

Table 5: Combination options of production

Primary Occupation (commodity Produced)	Secondary Occupation				Total
	No Commodity Produced	Rice	Vegetables	Fish	
No Commodity produced	270	8	11	0	46
Rice	750	1	6	3	85
Vegetables	591	0	0	1	61
Fish	2550	5	6	0	266
Garbage	380	0	3	1	42
Total	4541	14	26	5	500

Table 6: Secondary Occupation

Commodity production related to	No. Household	Of
No Commodity Produced	454	
Rice (using Wastewater)	14	
Vegetables (using Wastewater)	26	
Fish (using Wastewater)	5	
Garbage	1	

Table 7: Average Productivity using wastewater :

Produce	Average productivity, Per month (kg/acre)
Fish	104.10
Paddy	1359.18

Vegetables	1021.30
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Table 8: Profit per unit of produce using waste water :

Produce	Profit per kg.
Fish	Rs. 8.82
Paddy	Rs. 6.08
Vegetables	Rs. 2.30

Table 9: Value Addition per Hectare per year using wastewater :

Produce	Value Addition/hectare/month (Rs.)	Value Addition/hectare/year (Rs.)
Fish	2754.486	33,053,832
Paddy	24791.443	1,48,748,658
Vegetables	7046.97	84,563.64

Table 10: Per capita monthly availability of food :

Food	Per capita monthly Availability (kg)
Fish	1,948
Rice	8.58
Vegetables	7.30
Pulses	0.755

Table 11: Incidence of Diseases :

Table 11.1: Total incidence of disease

Disease	No. Incidents	Of
Indigestion	430	
Cholera, diarrhea	96	
Typhoid, Paratyphoid	14	
Jaundice	21	
Skin Diseases	41	
Other (fever, cancer)	429	

Table 11.2:Age-wise and gender-wise incidence of disease.

Disease	Child(0-12yrs)		Mid-age(13-60)		Old age(61 & above)	
	Male	Female	Male	Female	Male	Female
<u>Female</u>						
Indigestion	45	42	172	148	14	9
Cholera,	15	11	34	30	2	4
<u>Diarrhea</u>						
Typhoid,	3	1	4	6	0	0
<u>Paratyphoid</u>						
Jaundice	8	1	8	3	1	0
Skin	6	1	21	12	1	0
<u>Diseases</u>						
Other	80	49	144	116	21	19
Total	157	105	383	315	39	32

The East Calcutta Wetlands face several problems or threats from different quarters, namely:

1) Threats of encroachment from real estate developers:

The East Calcutta Wetlands represent vast areas of shallow filled land in the fringe areas of the bustling metropolis of Calcutta which are easily reclaimable by filled up and act as magnet for “land sharks”. Before the current realization of the importance of the wetlands several “development” schemes also made in-roads in the area, leading to a gradual shrinkage in the total area of the wetlands.

Solution : legal measures

The conservation area boundary for the East Calcutta Wetlands and waste-recycling region was mapped in 1985 by the State Planning Board, Government of West Bengal. This wetland area is protected by order of the Calcutta High Court in 1992, which prohibits change in land use. High Court directed the State Government to take recourse to statutory cover, if required, to prevent any private alienation of land. Recently, the Director of land and Land Records, Govt. of West Bengal has issued a fresh order prohibiting any conversion of land use within the conservation area boundary and declaring all such conversions, that have taken place since 1992, as void. Filling up of water bodies in this area is not permissible under West Bengal Town and Country (Planning and Development) Act, 1979 as well as under the West Bengal Inland Fisheries Act, 1984 (with amendment in 1993).

2) Metal deposition

Metal deposition in the canal sludge rendering the waste water incapable of ensuring the edible quality of the fish and vegetable grown in the wetland is another recent threat. Indiscriminate dumping of untreated solids and hazardous industrial wastes like heavy metals, without ascertaining the assimilative capacity of the wetland, may lead to severe pollution of the wetlands and adverse health impact to local population.

Some unscrupulous businessmen do not run effluent treatment plants efficiently and directly discharge untreated effluents from factories and sewage into the East Calcutta Wetlands through Bagjola, Bhangar and Tiljola Canals. The water of these canals gets further mixed with water from the Dhapa dump yard through leaching.

Heavy metals released from effluents after reaching Wetland Water are transferred to vegetables and fishes and finally to human beings through food chain.

Solution :

1. Tougher enforcement of environmental laws.
2. Use of water hyacinths which accumulate heavy metals in their body. By applying water hyacinths and benthos in polluted water it is observed that heavy metallic pollution decreased unto 8-10%. Water hyacinths accumulate heavy metals in their body.

3) Workers' Problems:

A. Loss of Income during non crop seasons;

Solution:

- a) Handicraft training for women
- b) Setting up of co-operatives
- c) Development of Eco tourism/amusement parks in or around the bheris

B. Lack of proper education

From the analysis of the literacy rates and the educational attainments of the main income earners, we find that the literacy level is not impressive in this area. Most of the women folks are illiterate. Scope of higher education is also very limited.

Solution: Government initiatives could be taken to set up schools both at primary as well as secondary level. These schools must be set up in locations from where they are easily accessible to the students. Care must be taken to motivate the students and their family members to pursue education in order to reduce the drop out rates. To accomplish this income level of the family members must be increased so that they do not stop their child's education due to crunch for money.

C. Indebtedness of labourers

A serious issue that must be given adequate attention is the indebtedness of the labourers, especially those working for recycling

firms. Many bheri workers also become indebted to the bheri owners. As a result they reach the status of bonded labourers.

Solution: Measures must be taken to relieve them from this bonded ness. Micro finance and micro credit schemes can be developed so that they can save small amounts and borrow from the banks at low rates. Several NGOs active in these areas pursue micro finance schemes and have helped many families, to earn a steady source of income. The women and families who work as garbage pickers have shown good response to such schemes. But with the help of the government, this scheme can be strengthened.

D. Health Hazard

Though the fishermen working for long hours rarely develop any disease related to wastewater, their household members do complain of diaohrrea, dysentery and other waterborne diseases.

Garbage picking for the recycling and compost production also adds to the health hazards of the workers.

Solution 1) provision for better sanitation facilities including better quality of drinking water;

2) better access to medical facilities;

3) better protective area and awareness.

CONCLUSION:

East Calcutta wetlands serve as one of the best examples to the world on concepts of integrated resource recovery systems and water recycling using peripheral wetlands around cities. It is the largest ensemble of sewage for fish ponds in one place in the world. But it is being lost due to the urban expansion without consideration of the ecological, environmental and economic benefits of the sewage-fed aquaculture system. There is necessity to understand the science behind the management practices evolved by fishermen themselves. Costanza et al (1997), when estimating the value of the world's ecosystem services, estimated that wetlands are 75% more valuable than lakes and rivers, 15 times more valuable than forests, and 64 times more valuable than grasslands and rangelands.⁵

Steps must be taken to protect the East Calcutta Wetlands and to improve the living standards of the people residing in most interior parts of the wetland. Focused and directed developmental programmes must be evolved. Areas and target groups must be decided, specific needs must be chalked out according to priorities before any developmental funds are allocated for these areas with stakeholders participation in the programmes.

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Notes and References

1. In order to recognize the importance of wetlands and protect them world convention took place in Ramsar, Iran 1971 for wise use of wetlands. The main aim was to halt the world-wide loss of wetlands. The convention was known as the convention on wetlands of International importance especially as waterfowl Habitat (Ramsar,1971). This is a sustainable utilization of the benefit of the mankind in a way compatible with the maintenance of natural properties of ecosystem. The Ramsar convention had 138 contracting parties and identified 1370 wetland site. East Kolkata wetlands was declared as a Ramsar site in November 2002 as per Ramsar guidelines. It is the largest sewage-fed aquaculture in the world.
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