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Calcutta Wetlands
Towards a Sustainable Development

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1. Introduction

The practice of urban agriculture and fisheries in the wetland fringe of Calcutta has been a matter of considerable discussion in relation to the future development of the city. Conflicting views and legitimate settlement pressures have come to the surface. This has resulted in perfecting the knowledge of this ecosystem for the benefit of the city in particular and society in general. It is true that planning for urban agriculture and fisheries in the waste disposal wetlands is altogether a new kind of challenge to the regional planners. It is also true that we do not, as it is, have a proper directing principle to draw best out of these outstanding ecosystems for our future sustenance. Yet the basic frame of reference in relation to development alternatives in the wetland fringe of Calcutta has undergone a change and any effort in planning in this region over and above its obligation to accommodate extension of settlement should recognize that,

a. the wetland region to the east of Calcutta is no more a natural choice for housing and other built-environment projects for urban expansion;
b. ecologically indifferent planning can bring disastrous consequences;
c. immediate interest of a section of the society need not necessarily coincide with the welfare and survival of the city; and that
d. urban expansion in the wetland region will involve very high development cost.

The present papez aims at taking a balanced view of the pressures and pulls that have generated around the question of future development options in the wetland region to the east of Calcutta. It particularly in-

vestigates the problems and prospects of redeveloping urban agriculture and fisheries using city waste.

The technical barriers to the task of this redevelopment are divided into four sub-areas: problems of physical planning, engineering problems, problems associated with public health, and awareness gap and non-availability of information. The objective of this discussion is to introduce the issues for motivating further thinking and participation of those who matter in this sensitive task of regional planning.

2. Alternative Views and Ambitions

It is possible to distinguish four different perspectives in relation to the future options on the wetlands to the east of Calcutta. These are:

- private developers' perspective
- old-school perspective
- environmental perspective
- global perspective.

Private developers have the most advantageous position in having a suitable market that is working entirely in their favour. The method of working is fairly simple. The broker or land speculator negotiates with the intending seller, i.e. the owner of the fishery, for a price that is attractive to him relative to the sinking profitability of such fisheries. After the transfer of the title of the land a developer takes charge and completes the other works that are required for building a house on the land and then sells the land for anything between ten to twelve times the buying price. The margin of profit clearly indicates the strength of the private developers who are indeed in a favourable position to regulate the courses of history for this region and for that matter the whole city and even beyond that. This trend of surreptitious transfer is to be thwarted before it becomes a menace.

The old-school perspective represents the kind of thinking that considers the wetlands or the city's verge as the easiest choice of land for reclamation. A number of similar planning exercises have been attempted on the wetlands to the east of Calcutta. Such alternatives are listed as:

- truck terminus
- railway loop
- residential blocks.

The environmental perspective is being discussed since the middle of the last decade. In short, it upholds the significance of this region for following reasons:

- food from waste
- sanitation
- additional employment
- open space facility.

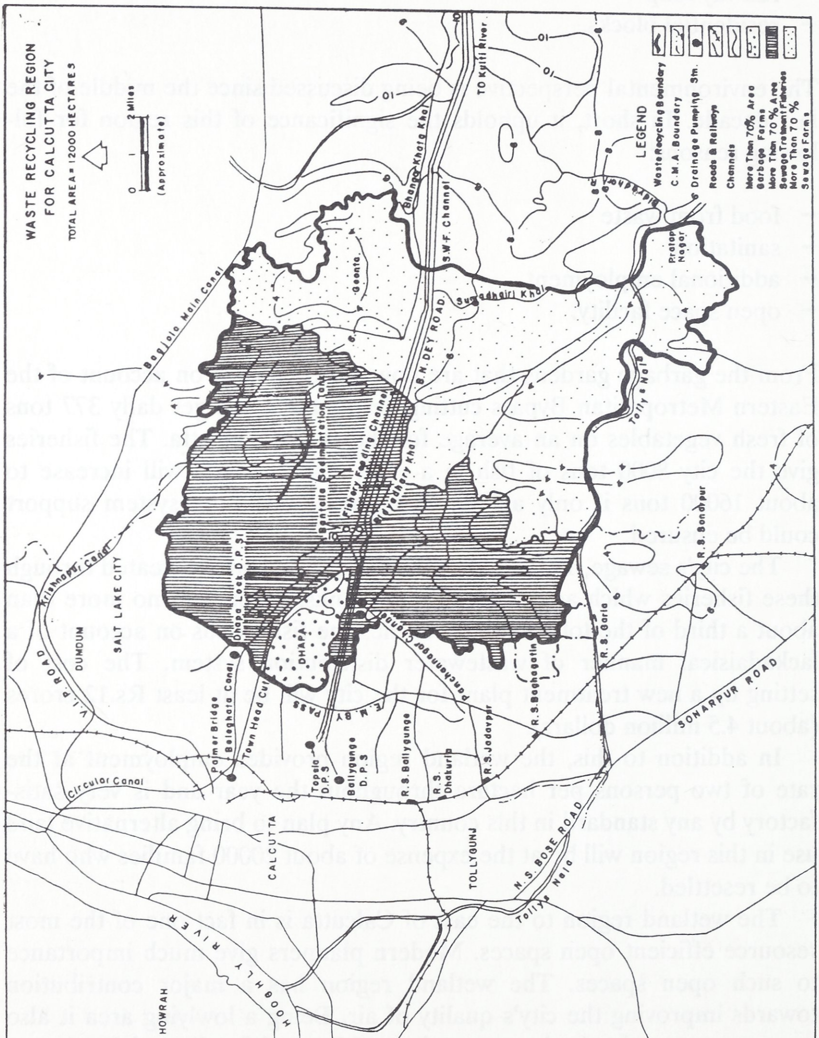
From the garbage gardens that are now more familiar on account of the Eastern Metropolitan Bypass cutting across them, we get daily 377 tons of fresh vegetables on an average for the city of Calcutta. The fisheries give the city 8000 tons of fish in a year. This quantity will increase to about 16000 tons if only a little attention towards the system support could be ensured.

The city's sewage, 150 million gallons per day, can get treated through these fisheries which act as stabilisation tanks. At present no more than about a third of the total sewage reaches the fish ponds on account of a lackadaisical manner of wastewater distribution system. The cost of setting up a new treatment plant for the city will be at least Rs.12 crores (about 4.5 million dollars).

In addition to this, the wetland region provides employment at the rate of two persons per hectare throughout the year and is very satisfactory by any standard in this country. Any plan to bring alternative land use in this region will be at the expense of about 20000 families who have to be resettled.

The wetland region to the east of Calcutta is in fact one of the most resource efficient open spaces. Modern planners give much importance to such open spaces. The wetland region has a major contribution towards improving the city's quality of air. Being a lowlying area it also serves as a retention basin to ease the problems of flooding of the city.

Beyond the locational significance of these wetlands for environmental repairing, a few unique features have been recently identified to stake the claim of this ecosystem as one of the most outstanding wetlands of the world:


WASTE RECYCLING REGION
FOR CALCUTTA CITY
TOTAL AREA = 12000 HECTARES
0 1 2 Miles
(Approximate)
LEGEND
Waste Recycling Boundary
C.M.A. Boundary
Drainage Pumping Stn.
Roads & Railways
Channels
More Than 70% Area Garbage Farms
More Than 70% Area Sewage Trement Fisheries
More Than 70% Sewage Farms
TO Kulti River
S.W.F. Channel
Pratap Nagar
Geonta
B.N. DEY ROAD
Bagjola Main Canal
Fishery Feeding Channel
Bantala Sedimentation Tank
Tolly's Nala
Krishnapur Canal
SALT LAKE CITY
DUMDUM
V.I.P. ROAD
Dhapa Lock D.P.S.
DHAPA
Panchannagram Channel
E.M. BY PASS
R.S. Sonarpur
R.S. Garia
R.S. Baghajatin
SONARPUR ROAD
Palmer Bridge
Beleghata Canal
Town Head Cut
Topsia D.P.S.
Ballygunge D.P.S.
R.S. Ballygunge
R.S. Dhakuria
R.S. Jadavpur
Circular Canal
CALCUTTA
TOLLYGUNJ
N.S. BOSE ROAD
HOOGHLY RIVER
HOWRAH

a. the wetland region to the east of Calcutta sustains the world's biggest integrated resource recovery practice that combines agriculture and aquaculture to use the wastewater nutrients;
b. the resource recovery system is also the oldest of its kind over the world;
c. the resource recovery system is considered as one of the foremost examples of viable and self-reliant technology options for city waste disposal.

The desired planning perspective should draw from all the above perspectives that are not only separate but in some cases in conflict with each other.

3. Problems of Physical Planning

It is understandable that settlement stress on the city's fringe is real and a rising land price obeys little institutional control. For this reason planning for the city's wetland fringe, to ensure a sustainable use, is the most difficult challenge to a designer and an appropriate wise use model for these wetlands is crucially needed to strike a balance between conflicting demands.

The task of wise use planning will involve a clear delimitation of the city's growth, so that the remaining wetland area can then be properly developed as a sanitation and resource recovery ecosystem centering around the existing urban agriculture and fishery practices. In this effort to restrict the spontaneous urban sprawl attempt will have to be made to accommodate as much of settlement projects as possible and at the same time to retain a minimum area of fish ponds good enough to treat the city sewage under permissible conditions of organic loading - for safe fish production.

Between the existing edge of the city and the proposed boundary of the resource recovery region, it will be useful to create a 'buffer zone'. The 'buffer zone' will have a mixed land use which can include housing schemes, institutional uses and industrial installations preferably based on reusable waste. (The effluent of any such industry must not contaminate the wastewater channels leading to fisheries and agricultural plots). A provisional concept plan, incorporating the competing forces, has already been worked out on the basis of extensive field survey carried out and settlement plans conceived in this region. An unavoidable pro-

blem of this concept plan is its inability to adopt the Calcutta Metropolitan Area boundary as the territorial limit of its operation. A new authority will be desirable to run the resource recovery region.

Finally, for planning, time will be another important aspect to be taken into consideration. With its passage, the efficiency of control devices on land use options will increasingly become ineffective. The earlier a decision is taken, the easier will be the task of implementing the same.

4. Engineering Problems

Engineering problems in redeveloping the urban agriculture and fisheries are different in (a) the garbage farming area and (b) the wastewater aquaculture area. Not only are they separate systems but historically they have grown in response to different pressures and pulls of the social system. Inspite of being adjacent, there is hardly any interaction between the entrepreneurs and farmers of agriculture and fisheries.

Problems of garbage farms are mainly three-fold:

a. problem of garbage availability;
b. problem of safety and storage of the produce;
c. problem of irrigation.

Previously, there was a system of garbage distribution through a light rail system. This was discontinued in the late sixties. Since then availability of garbage at the agricultural plot heads ran into rough weather. A network of roads or going back to the light rail system or any other efficient alternative will have to be introduced to deliver the garbage to the farmers' plot heads regularly.

Inspite of a reasonably efficient cropping intensity, the cropping pattern can be improved by choosing comparatively higher priced crops. At present the uncertainty of the tenural status of the farmers acts as a bane to such choice of improved cropping. Absence of storage facility is also a reason for distress among farmers and in many cases they do not find any buyer for their produce and are forced to waste it.

Out of 1000 hectares of land under urban agriculture about 300 hectares are retained as waterbodies or *jhil*. These waterbodies were interconnected and obtained municipal sewage from drainage outfall channels. However, these interconnections have largely been destroyed and will need revival to their earlier mode. On the edges of the water-

bodies there are about 300 pump sets which are hired throughout the year to irrigate one or other cultivated plots. It is not yet too late to revive the system of irrigation to its optimal levels and facilitate the farming system.

Technical barriers to redevelopment of fish ponds using sewage are found to be four-fold:

a. problem of wastewater diversion and drainage;
b. problem of desilting the channels and the fish ponds;
c. incomplete integration of resource recovery practices;
d. inefficient pond size.

The sewage from Calcutta flows down the outfall channels for 28 km and then pours into the Kulti estuary. Fish ponds to the north of the outfall channels are fed by a fishery feeding channel that starts from Bantala whereas the fish ponds to the south of the outfall channels are fed by three siphon structures. In addition, a number of private channels carry sewage to various fish ponds. On the whole, this system of diverting the city sewage to the fish ponds is patently inadequate and this wastewater transportation system is in need of a thorough study.

Every fish pond needs a drainage connection to dispose of the clear water effluent. Fish ponds, which are better situated, have separate channels for wastewater loading and clear water disposal. Ideally the level of drainage channel should be such that the fish ponds can release their clear water effluent by gravity. The existing drainage network, a large part of which is private, falls far too short of this requirement. In many cases managers of smaller fish ponds are at the mercy of those of the bigger fish ponds for closing or opening the drainage channels for inlet and release of water and therefore are governed by the requirement of the bigger ponds. Moreover, unplanned bed levels of the branches of channels and lateral drains do not permit timely release of fish pond effluent.

A major problem for the task of redevelopment will be desilting of the fish ponds and of drainage channels. Since 1956, the year when these fisheries were served with a land acquisition notice, very few of such ponds have been desilted. The thickness of silt deposited through these years has been about half a metre.

At present, most of the ponds have become shallow and will need a comprehensive desilting programme to upgrade the productivity and the performance of water quality improvement.

A critical observation of the resource recovery wetlands of Calcutta will expose the absence of a number of major associated cultures like forestry, horticulture, dyke farming and use of non-conventional energy technologies. The undercurrent of uncertainty has been a bane to creative development of the total system. A little attention towards integrating these cultures into the existing resource system will pay large dividends within a short run.

Economics of any production system is likely to be related to its scale of functioning. The fish ponds in the east Calcutta wetlands reflect similar effect of scale on their productivity and performance. However, the distribution of pond size is fairly skewed (see Table 1) and most of the fish ponds are likely to fall under less efficient class of pond sizes. It is also true that reliable data on efficient pond size determination are not available. This can be found out on the basis of two major criteria, viz., permissible land ceiling and efficiency of management.

Table 1: Sizewise Classification of Sewage-fed Fisheries

Size Classes (in hectares)	**Number of Fisheries**
Less than 5	66
5 to less than 10	36
10 to less than 15	14
15 to less than 20	10
20 to less than 25	10
25 to less than 30	2
30 to less than 35	3
35 to less than 40	6
40 to less than 45	3
45 to less than 50	3
50 and above	15
	168

Data for two fisheries are not available.

Source: Directory of Sewagefed Fisheries, 1984.

5. Health Risk

The system of storm water drainage for the city of Calcutta was redesigned by WHO in the late sixties of this century and assumed a two months' frequency of flooding. This is to say that the city can be flooded once in every two months inspite of the provision of the proposed drainage conduits and pumping stations. Very few things can create more health risk than a city flooding. Yet the criterion was so fixed because

- there could not be any better financial provision
- the city has been used to such stresses for more than 50 years.

Calcutta's storm drainage recommendation by WHO has been one of the most pragmatic designs of sanitation facilities and has succeeded in striking a balance between locational specificities and health requirements of the community.

The above example of a rational approach to risk assessment is discussed here to obtain practical guidelines to deal with the specific problem of health risk that may be associated with sewage grown fish or garbage grown vegetables in the wetlands to the east of Calcutta.

Again, discussing the risk of cigarette smoking remains futile when we know that the blast of a public bus exhaust is at times more dangerous than smoking a cigarette and that any Calcuttan any day can have any number of such blasts to inhale. It is in this context that one can appreciate the necessity of finding out the 'relative risk' of contamination as against the prevailing concept of assessing the 'absolute risk'. For the communities in South Korea or Japan who are used to eating raw fish, the permissible count of 10 coliforms per 100 litres of water in fish ponds sounds appropriate. But the same standard for India, where fish are invariably fried deep before consumption, does not apply and the relative risk is much lower than that of raw fish eating communities.

The problem of health risk that may be linked with sewage grown fish and garbage grown vegetables cannot therefore be properly understood without a comparative assessment of such risks to which the target communities are exposed. This can be done by using the same indicators to assess the risk of eating all the major food items commonly consumed by the target community. The resultant matrix of risk values against all the major food items will correctly depict the level of risk that a particular item of food may be causing relative to other agents of contamination.

However, in this area, health risk assessment, by whatever method it may be, is needed.

6. Non-availability of Information

Information is indeed scarce in this uncertain terrain of traditional resource recovery practices. *Aquaculture* has been described by John Bardach as more of an art than a science (Bardach, 1972). In the wetlands to the east of Calcutta this art and science is mostly retained in an oral tradition. This heritage is increasingly becoming endangered. In 1986, a group of three hundred and odd farmers formed an informal co-operative and grabbed a land of over 65 hectares to run a wastewater aquaculture complex. This fish pond area was lying derelict for a long time because of a long drawn legal battle on the tenural status of the land. Although the co-operative enjoyed the privilege of obtaining a prime land without rent and although the supply of sewage was nothing less than desirable, the informal co-operative incurred a loss to the tune of Rs. 10 lakhs ($ 38372) per year. One of the main reasons for this failure has been the lack of overall grasp of such a system of aquaculture. This concept and capability of holistic management is usually present amongst many of the older generation producers and in only some of their present generation pursuers.

Apart from the effort of knowledgeable producers, who are increasingly becoming scarce, the role of scientific management can hardly make any dent because of lack of information on the system. It is necessary to have fairly clear data on loading rate, quality of wastewater, plankton wealth, degree of water quality improvement through fish ponds, stocking density and types of fish stocked, micro-climate of the region and more information on the hydraulic regime. No systematic method of regular record keeping exists in the region.

An example of developing an information system can be seen in the fish ponds of the Mudialy Fishermen's Co-operative Society Limited, Calcutta, where an area of about 70 hectares of waterlogged land has been transformed into an urban fishery ecosystem. In these ponds about 25 million litres per day of wastewater is treated upto secondary treatment plant effluent quality and the annual revenue is more than Rs. 50 lakhs ($ 19000). This has indeed been a striking example of a self-help sanitation model and sets a new trend in municipal sanitation.

Upgrading the urban agriculture and fishery practices of Calcutta wetlands will have to cross over this barrier of information gap even before planning for a Comprehensive Development Plan. Fragmentary information is available and it should be good enough for a good design of experiment and information system planning.

7. Conclusions

It is anticipated that the third world countries will have 54% of their population living in cities by the year 2025. These cities will invariably grow very fast. The edges of the cities will exhibit spontaneous trend of expansion largely inspired by the forces of market. Conserving wetlands on the city's fringe will therefore be a difficult task to perform. It will be more difficult when such wetlands have only the following functions to perform viz., providing open space in a city and cleaning air, functioning as a drainage basin for a city or providing stable occupation for thousands of villagers residing at the edges of the city. The planners will be under serious stress to examine the importance and economic worth of the urban facilities which can be derived from such wetlands and then also the degree of competition between such facilities and the forces of urban expansion.

The practice of urban agriculture and fisheries in the wetlands to the east of Calcutta provides the city with two outstanding urban facilities: it treats the city sewage and recovers nutrients through a fairly efficient food chain where a phenomenal amount of fish and vegetables is available at the end of the chain.

Calcutta has no sewage treatment plant for its 750 million litres per day of wastewater. A sanitation technology for a city like Calcutta, which will be viable and at the same time will be one that works, is difficult, if not impossible to visualize. The cost of setting up a conventional sewage treatment plant and its operation and maintenance is extremely high. The reliability of its operation is also doubtful. Here again it is important to remember that 'resource recovery' in conventional treatment plants essentially remains as an externality except the costly installation of biodigestors, which again, in most cases, do not prove much more than their cosmetic worth. Incidentally a study has been carried out on the prospects of installing bio-gas digestors at Bantala using the city sewage from Calcutta and the recommendation of the study has ruled out any chance of viable production of gas through such a system (Ghosh, 1972).

Nevertheless, to go without any formal provision for wastewater treatment and resource recovery for a city as big as Calcutta will be one of the most unacceptable defaults in city planning.

The integrated resource recovery system provided by the agriculture and fisheries using city waste is a comprehensive answer to the city's sanitation and resource recovery need. A little effort to upgrade the existing resource recovery practices will make the task of municipal sanitation a revenue earning project for the government. No urban planning proposition, anywhere in the world, can ignore the worth of such a wetland ecosystem until there are any other technology options as lowcost, as reliable and as efficient in recovering resources as this.

Technological constraints to upgrade the existing practices of urban agriculture and fisheries are surmountable. A rapid study of these constraints and corresponding solutions need not take much time or money. A provisional area map for the resource recovery region has been prepared by the present worker in 1985 and this can provide basic information to start with. It should not therefore be a problem to delineate the 'wise use map' of this vast wetland area which is already preeminent for its unique environmental attributes and also for the inevitable debate over its chances of survival.

References

Bardach, John E., Ryther, John H., McLarney, William O. (1972). *Aquaculture*, London, New York: John Wiley & Sons.

Ghosh, T.K. (1972). *A Report of an Experimental Investigation on the Possibility of Gas Production from Primary Sludge Available from the Pruss Sedimentation Tanks at Bantala under the Major Scheme for Gas Generation from Calcutta Sewage*; Govt. of West Bengal, Irrigation and Waterways Directorate.