

ConRec84.doc

Conservation & Recycling, Vol.7, No.2-4, pp.159-165, 1984
Printed in Great Britain

0361-3658/84

\$03.00/0

Pergamon Press Ltd.

RESOURCE-CONSERVING TRADITIONS AND WASTE DISPOSAL: THE
GARBAGE FARMS AND SEWAGE-FED FISHERIES OF CALCUTTA

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ABSTRACT

In spite of its many waste disposal problems Calcutta is foremost among South Asian cities in the productive use of wastes. Natural processes and informal practices on the metropolitan fringe contribute significantly to waste treatment and promote recycling. The disposal/recycling system that has developed over a century operates with a minimum of technology and engineering. The nineteenth century origins of the garbage farms and sewage-fed fisheries are sketched and the importance of the use of sewage and garbage in food production is assessed. The effects of encroaching urbanisation on the wetlands are noted. The paper argues the need for research and discussion of development alternatives for Asian metropolitan fringe areas.

INTRODUCTION

Large Asian metropolises are infamous for their waste disposal problems, but, on the whole, Asian cities are resource-conserving and display many ways of re-using wastes which reduce the burdens of waste collection and disposal. Many significant resource-conserving activities have evolved from the day-to-day efforts of poor people seeking to exploit their environment and to preserve traditional ways of life amid urban change.

Calcutta is foremost among South Asian cities in the diversity of its informal waste-use traditions and their significance for the city's functioning. The city's swampy environs (Fig.1), a severe handicap for certain urban functions, provide a natural setting for waste treatment and reuse. For over a hundred years farmers, fisherfolk, scavengers and other groups have supported themselves in ecological niches in the extensive wetlands to the east of the city. Here ecological processes sustain socio-economic traditions that provide a living for perhaps a million people and sustain significant production of vegetables and fish for the metropolitan area.

NINETEENTH CENTURY ORIGINS OF CITY WASTE RE-USE

"Cities are like giant vacuum cleaners: they suck in resources from their hinterlands - people, food, goods, energy. But sooner or later we have to empty the bag"[1]. Growing cities look to waste land or water bodies in their hinterlands for places to "empty the bag". Calcutta, the "city in a swamp"[2] initially had no shortage of waste land. Solid wastes were dumped first in the ditches surrounding the British fort, then into any ponds or low lying areas that the settlers wished to fill in for development. The natural inclination was to drain sewage into the Hooghly River[3]. By the early decades of the nineteenth century, however, such convenient and casual practices were being questioned. There were protracted discussions, first on drainage and then on sewerage, with recognition that the natural lie of the land drained towards the "Salt Lakes" to the east of the city and not towards the flood levees of the river. However, distant disposal of solid wastes was hampered by the lack of roads that could support heavy bullock carts, so the concept of municipal garbage dumps removed from the town had to wait until the technology was available to build a light rail system to carry garbage trains. In 1865 the municipal administration acquired a square

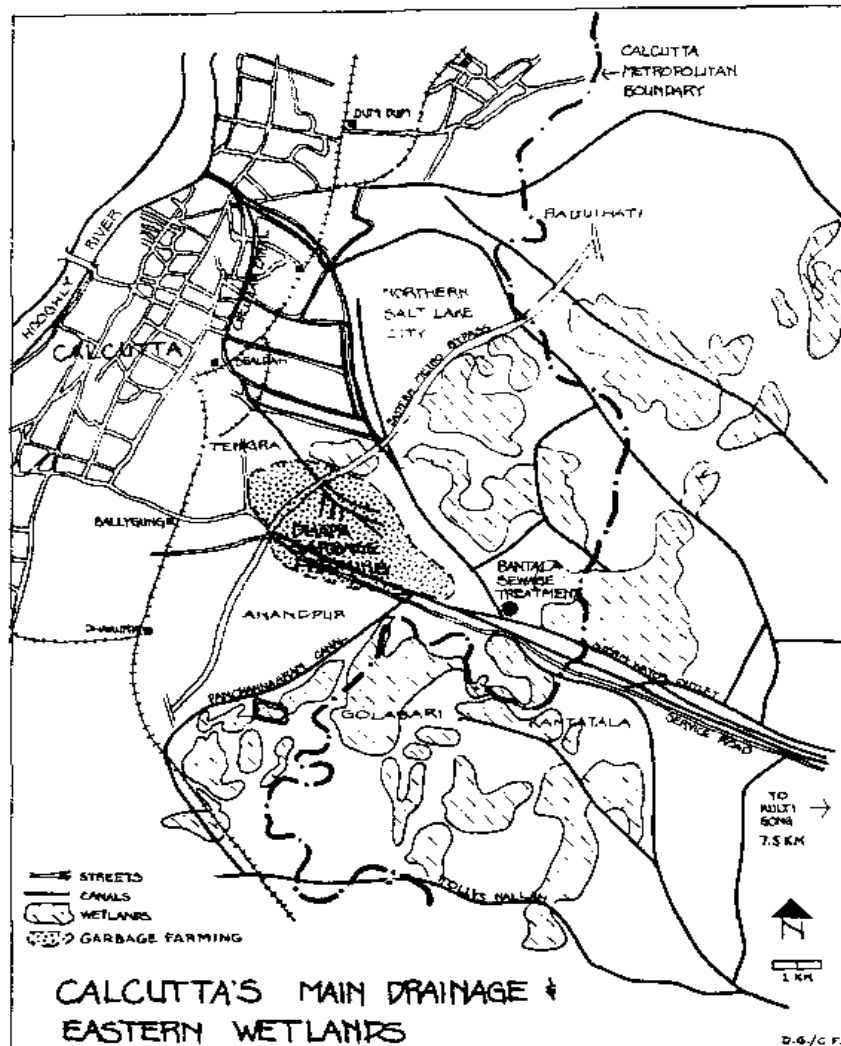


Fig 1. Calcutta's main drainage and Eastern Wetlands

mile site about four miles due east of the city in the marshlands. Embankments were built around the boundaries so that the dumping ground stood out dramatically in the sparsely populated area. For many decades this was referred to as "the Square Mile" and only after infilling had quite obliterated the original boundaries did the dump come to be called Dhapa Dump.

"Sewage cultivation" was mentioned as one of the possible uses of the Square Mile besides the primary one of garbage disposal. Sewage farms were operated by a number of Scottish and English towns[5] and the British settlers anticipated similar potential in their colonial towns. The health officer of Calcutta and the staff of the Botanical Gardens had conducted experiments in sewage farming in the 1860s. However, the Town Council did not initiate food production from wastes, being too preoccupied with putting the basic infrastructure in place. Indeed, the Corporation did not undertake garbage disposal: the Square Mile was leased to a contractor who, at the same time, acquired rights over the traditional fisheries

within the area[6]. His primary interest was in extending the fisheries and maintaining a fish market; as compost from the garbage dumping accumulated he must have come to recognise the rich potential for market gardening in the filled-in areas.

The British residents of Calcutta did not regard the Salt Lakes area so positively. Many believed that the swamps were the primary site of disease-laden vapours, and there were periodic calls to fill in the wetlands in the interests of public health. This was an unthinkable task and, besides, the city engineer argued that the wetlands were not the main cause of Calcutta's high death rate[7]. The nature of the land complicated the drainage and sewage system that the engineers devised but by the mid-1870s a basic system of sewers and canals was carrying sewage and waste waters into the Salt Lakes. At the same time the traditional fisherfolk learnt, either by design or by accident, that the sewage waters enhanced the productivity of fish ponds and they devised ways of siphoning off the desired effluent. Although we do not know the history of these practices, it would appear that by the beginning of this century, sewage-using fish culture was thriving in the wetlands.

SEWAGE-USING FISHERIES

The extent of the fish ponds has varied with environmental and economic conditions. The current estimate is that there are about 4,500 ha of ponds stocked with fish of three main types - common carp, exotic carp and tilapia[8]. The fisheries closest to the urban edge are still held under long term lease from the city; the lease holders employ managers who deal with the fisherfolk who maintain the ponds and catch and market the fish. The average yearly catch over the last thirty years has been about 6,000 tonnes[9]. The fish, caught at dawn in traditional nets, are taken on bicycle and foot to nearby villages where daily auctions are held. From here they are hurried to the Calcutta markets and by 7 a.m. most of the catch has been sold. The wetlands fish represent 10% or more of the metropolitan daily fish consumption and fish is the main protein source for most Calcuttans.

It is a significant but hardly recognised aspect of the wetland fisheries that they function as a natural waste water treatment system for a city that lacks a functioning sewage treatment plant. The waste treatment process that is facilitated in large shallow ponds has ancient origins in Asia and has been scientifically studied in various parts of the world in the last fifteen years [10,11,12]. The essential factors in the purifying process are the shallow ponds (which act as stabilisation tanks), abundant water hyacinth (which accumulates metals), the sun and wind, and multiple forms of plankton, algae and bacteria. The organic matter of the sewage is the basic link in the chains of food on which the fish graze.

It is now well known that growing fish in ponds receiving biological wastes improves the water quality and increases the ponds' capacity for waste absorption[13,14]. The reduction of bacteria in such an environment can be greater than in mechanical, activated sludge plants. Measurements by the West Bengal Department of Fisheries have shown over 99.9% coliform reduction in the well stocked fish ponds of Bantala[15]. Studies elsewhere have demonstrated that natural waste water treatment systems can reduce enterococci to less than 1% and can eliminate salmonella completely[16]. While the fisheries are recognised for their role in the city's food supply, it has only very recently been suggested that their waste purifying functions should be protected and systematically linked to the city's sewage disposal system[17].

GARBAGE FARMS

What we have dubbed the "garbage farms" are plots for vegetables established on the compost soil produced from decades of city dumping. Calcutta's garbage breaks down to good compost because it is largely composed of organic matter, ash and dust[18]. Substantial inorganic materials have been removed by the extensive garbage picking that takes place at several points in the disposal and collection system[19]. Garbage scavenging is a long established tradition in Calcutta having emerged as an organised activity with the development of paper-making in the mid-nineteenth century v/hen rags were the principal raw material. (Hence the term "ragpicking" as the generic one for garbage picking in India.) What is not removed from households, pavements and garbage trucks is again worked over by up to 20,000 pickers at the dump and its surrounds. The only substantial items left after all this picking are coconut shells and broken bricks. The farmers remove these before tilling the soil. Human and animal wastes are also ingredients in the compost soil as the city has a large animal

population, a certain amount of human excreta is mixed with refuse, and there are numbers of cattle, pigs and goats foraging over the dump. The farm workers occasionally draw from the sewage canals and the fish ponds to irrigate their fields.

There are presently some 800 ha of gardens at the dump site. Cauliflower, spinach, radish, pumpkin, cucumber, maize and eggplant are the major crops. The rich soil makes it possible to grow several varieties of vegetables simultaneously. There are estimated to be about 25,000 people working with garbage compost at the dump and adjacent areas[20], The fresh garbage is also prized by private farmers who may arrange to buy loads directly from the Corporation refuse trucks.

There is now a mechanical compost plant operating experimentally at Banatala but it does not appear that its product will be competitive with the direct production and use of compost that has evolved over many decades at Dhapa. Compost production with mechanical plants by municipal corporations in India has generally run into problems of cost effectiveness and distribution. In Calcutta, the farmers come to the naturally produced compost thus eliminating distribution problems.

Fishing and vegetable farming are the lynch pins of production in this resource-conserving environment. Other aspects include duck raising, an activity that fits well with fish farming as the Chinese and Thais have shown for centuries[21]. Washermen use the ponds for their trade, believing that the waters are particularly good for laundering. There are, however, more problematic competing uses such as the disposal of tannery and industrial wastes in the area. The pathways of urban wastes can be followed beyond the immediate wetlands into a deltaic area further east. Paddy farmers draw from the sewage canals that flow towards Kultigong (Fig.1) and at Kulti, about 30 km from the city, prawn farming is being developed in the rich brackish waters of the river system.

At Bantala and Dhapa, then, sun, winds, shallow waters and organisms act together as waste treatment agents, transforming urban wastes into productive soil and into fish food, ensuring supplies of fresh food close to the city markets (Fig.2).

HEALTH HAZARDS FROM TRADITIONAL ACTIVITIES

The above discussion has emphasised the positive aspect of waste re-use in this area, but we cannot ignore the problematic dimensions that require investigation. The scavengers whose work ensures that the garbage is readily compostible, are exposed to persistent health risks whether they work on the city streets or the dump. Their vulnerability to disease and their health needs have never been systematically studied. The use of raw sewage for fertiliser exposes farm workers to the risk of infection and, depending on the crop grown, may spread pathogens in the consuming population. Studies are required of the epidemiological aspects of garbage farming. And, although current tests do not reveal any significant contamination of fish, the testing should be expanded to compare fish from differing pond types. Modes of cooking of fish and vegetables are important, so studies must be made of cooked as well as raw foods. The incidence of industrial pollution of soil and water should be monitored as densities increase in the industrial areas adjoining the wetlands.

EMERGING DEVELOPMENTAL CONFLICTS

Whether the remarkable traditions of waste re-use on Calcutta's fringes will survive and expand in an ecologically sound way is now an open question as this area is now under considerable pressure. The major threats to the wetland ecosystems come from industrial pollution, changes in solid waste management, urban sprawl and new town development.

The tanneries, which the city government relegated to the urban edge in the late nineteenth century, are the main source of industrial pollution. Tanning operations have advanced into the wetland area and tannery wastes are seeping into the nearest fish ponds. Elementary steps are being taken to channel some of the wastes away from the ponds after strong protests by fishermen. "Water hyacinths are able to absorb metal ions but their capacity to deal with wastes directly discharged from the tanneries has not been studied. In general, levels of industrial pollution of soil and water are not known in the fringe area.

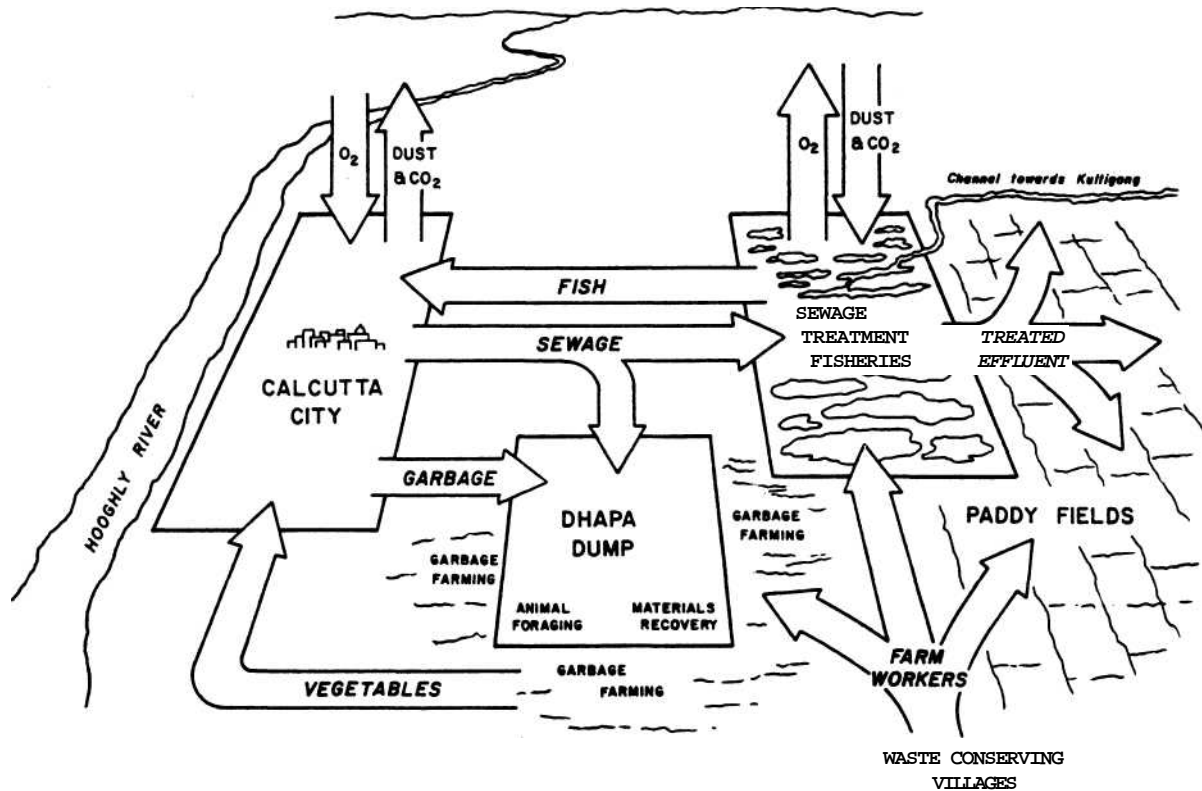


Fig.2. Ecological system of urban waste recycling in Eastern Wetlands, Calcutta

The new solid waste management plan for the city, if implemented, may have implications for the quality of compost produced at the dump. One goal of the new arrangements for collection and disposal in the city is to eliminate street scavenging by cutting off scavengers' access to refuse. If this succeeds, there will inevitably be a shift of pickers to the dump site (with an enhanced possibility of conflict over access there) but even so it seems unlikely that recyclables will be removed as thoroughly as in the past. Changing styles in packing and in consumer habits - for instance, greater use of plastic bags - if accompanied by reduced hand picking, will increase the synthetic content of the garbage.

The greatest threat to the wetland waste re-use systems is urbanisation itself. This is taking two forms spatially: creeping sprawl at the urban edge and systematic new town development. Substantial areas of marsh land were filled in to create the site for Salt Lake City (Fig.1) and two more towns are to be built on reclaimed land further south. Infrastructural developments to service the new towns have also encroached on the marshes and fish ponds. The Eastern Calcutta By-pass has been built through Dhapa to Dum Dum airport as the beginning of a planned network of highways. Land values beside the highway are bound to increase eventually and the adjacent agricultural uses may become uneconomic. Asok Mitra has observed that "Real estate speculators are already hot on the scent." [22],

All human settlement has of course affected the natural ecology of the wetlands but the traditional agrarian activities were not substantially disruptive; Calcutta's current demand for urban living and working space, if satisfied by large-scale land filling, will not treat the fringe area so gently. Unless some creative compromise is accepted and limits to encroachment are established, the wetlands will gradually be eaten up by urban growth, with severe consequences for the drainage, sewage treatment and fresh food production for the city. We hope that growing awareness of the ecology of the wetlands and of the outstanding, resource-conserving traditions of the area will lead to broad-based discussion of metropolitan plans and fringe development. Recent workshops and press articles that have raised these issues are very encouraging [23]. The government of West Bengal acknowledges the need for research and will likely move to reassess urban plans conceived over twenty years ago.

IMPLICATIONS FOR LARGE ASIAN CITIES

Calcutta's dilemmas should be seen in a broader context of options for urban fringes in Asian metropolitan areas. Over a decade ago, Richard Meier wrote of the issues for such areas and suggested that settlement patterns could be designed to preserve the ecology and the productive traditions within fringe wetlands. Recycling of wastes was central to his argument that urban agriculture could provide up to two-thirds of a city's food needs[24]. As yet, few local planners have responded to his ideas by systematically exploring the possibilities suggested. However, problems of food production for large cities and the impact of urbanisation on the wider environment are now being pursued through programmes such as Man and Biosphere of UNESCO and the Food and Fuel for Asian Cities one of the Resource Systems Institute at the East-West Centre[25,26].

Isabel Wade of Urban Resource Systems Inc. has recently written:

"In the developing world, the last two decades have seen a serious loss of agricultural and forest land on the urban fringes, occasioned by the tremendous growth of cities and the heavy demand for fuelwood. Maintaining food production on lands around urban areas is essential to the long term survival of cities. Protecting these lands from housing and industrial development, and guaranteeing landless urban dwellers access to cultivable land, are essential components in the development of successful strategies for urban food production.[27]

In the last twenty years, the attitudes towards wetlands, influenced by the advocacy of ecologists, have undergone a revolution in many parts of the world. It is now recognised that, quite apart from any economic uses, wetlands are precious and unusual environments that contribute to the environmental health of adjacent areas.

In Calcutta, some options are now being articulated: changes in the solid waste management plan, redirection of new town growth to non-wetland areas to the north, a possible shift of garbage dumping, and the gradual conversion of Dhapa dump to vegetable gardens. As the needs of the sewage-fed fisheries are coming to light - mainly through a research project of the Department of Fisheries, West Bengal - the changes and repairs that are needed to the Sewage canals and sewage feeder outlets to the ponds are being specified. Alternatives to the present plan for the area must be developed on a base of empirical knowledge of the linked ecosystems and the socio-economic structures of the wetlands and fringe area, so there is an urgent need for comprehensive and interdisciplinary research.

The Calcutta experience suggests some general points that may be applicable elsewhere. One is that folk ways of dealing with environmental change and of creatively but non-violently exploiting the environment are long-standing ones in Asia and bear examination for solutions to current dilemmas.

Another is that development conflicts are inevitable on the fringes of large Asian metropolises and that waste disposal and re-use will generate key issues in developmental discussions. Part of the metropolitan fringe areas are indeed waste lands, but not in the usual sense of the term. Rather, they are waste-using lands and to the extent that this waste use supplies the urban area with food and other resources, they perform much more important functions than merely to be receptacles of urban wastes. As Newcombe and Bowman have argued: "there can be very considerable coupling of waste generation with food production systems which accord with sound policies on food, nutrition, and environmental protection"[28]. In seeking to promote this coupling, Asian cities can learn from the established practices in their own backyards.

ACKNOWLEDGEMENTS

This research was partly supported by the Social Sciences and Humanities Research Council of Canada and the Faculties of Arts and Environmental Studies, York University.

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