The Calcutta Wetlands: Turning Bad Water Into Good

By Dhrubajyoti Ghosh

Barely five kilometres from the eastern edge of Calcutta, one of the most densely populated megacities of India, an amazing spectacle takes a visitor by surprise: Very large, shallow ponds with sparkling water lie under an eerie silence. But the importance of these *bheris* (as they are known) goes far beyond their natural beauty.

Location Map

The East Calcutta wetlands

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Around the turn of the century, these low-lying areas were flourishing centres of brackish-water fish farms. The wetlands were then fed by the tides of the Bay of Bengal. However, the natural process of delta building, aggravated by human intervention, caused the tidal flow to dry up, and thousands of fisherfolk faced the loss of their livelihood. Then an amazing thing happened: In the 1930's it was found that the domestic wastewater from Calcutta could form an alternative source of water for the fisheries. But how? Isn't wastewater polluted with organic matter? Wouldn't fish die in such water? But since the fish did not die, the water must have somehow been purified in the process. This was further supported by the fact that the water from the fish ponds was found to contain almost no

Calcutta's Integrated Wetland System has been submitted to the Best Practices Initiative of the Habitat II Conference

organic wastes. How, when and where this purification took place was of no concern to the fisherfolk. Nobody took any particular interest in this magnificent system until I discovered the phenomenon in the 1980's.

The Ecology: A 'Natural Kidney' for Urban Wastewater

What happened was this: Retention of wastewater in the ponds, before the initial stocking of fish, allowed bacteria to act upon the organic matter in the sewage and decompose the organic waste. The growth of these beneficial bacteria was supported by the algae that thrived in these shallow ponds under the ample sunshine. The algae also provided food for the fish. This ecosystem provides a natural kidney for the city's organic wastewater. So a double boon was taking place: The organic sewage was being treated by the natural ecosystem, and was producing rich quantities of fish food on which the local varieties thrive.

So stable has the system been that in spite of assaults by developers, the area still supports the world's largest ensemble of wastewater fish ponds, nearly 250 covering about 3,500 hectares. The area has also witnessed a major wetland conservation effort, now known all over the world and recognized by United Nations honours. The best part of this system is that it can be reproduced in poorer parts of the world with ample sunshine, as my colleagues and I have shown at other sites.

Thus the natural beauty of the wetlands conceals outstanding feats of nature and wise local programs that form the bedrock of sustainable development.

Sustainable development must rely on technology drawn from traditional practices. The success rate in this transformation, however, has been low. Thus the East Calcutta wetlands stand out in rustic grace, setting the pace in developing a mainstream technology based on a local practice. Today, drawing lessons from these re-use practices, there are at least three municipalities whose wastewater is treated and re-used in ponds managed entirely by their village communities. This management, in turn, produces enough income to pay the energy costs of pumping wastewater into the ponds. Development of this ecological alternative for wastewater treatment and re-use has taken about 15 years of continuous effort.

The Contrast: From Pollutants to Nutrients

The urban perception of wastewater management has essentially been that of pollution control. Conventional mechanical treatment plants serve this purpose, albeit inadequately. (Such plants are used to enrich dissolved oxygen and reduce cloudiness but they do not entirely remove pathogens). But there is another view. Farmers in many of the poorer areas recognize municipal wastewater as a nutrient pool that can be used in fisheries and agriculture.

The Ganga Action Plan - Replicating Wetland Option for wastewater treatment and reuse

Way back in 1978, a report by the World Bank and the International Development Research Centre drew attention to the poor performance of conventional sewage treatment and the positive role of fisherfolk and farmers in setting up a new approach. In 1992, Agenda 21, the program for sustainable development adopted at the Rio conference, included guidelines to set water-treatment priorities in terms of resource recovery, affordability and community participation. The clear conclusion: Municipal wastewater should be viewed as a resource instead of a pollutant, wastewater management should be a task of conservation rather than of pollution control, and traditional knowledge of local people should be incorporated in planning. In India, the launching of the Ganga Action Plan provided the necessary funds and opportunity to experiment with the new options in wastewater treatment. The basic difference between the conventional treatment plant and the proposed wetland option is that resource recovery is suggestive in the former while it is obligatory in the latter. In the latter it is an integral component of the design, the very basis of its link to the community.

The project we are now developing is a result of one of the earliest efforts in developing community-based technology for

river sanitation. Here the conventional option in wastewater treatment has been replaced by an ecological design in which the task of reducing pollution and re-using nutrients is linked to the enhancement of food supply and development of a livelihood for local residents using nutrient-enriched effluents in fisheries and agriculture. The design of the system still recognizes existing policy and regulatory controls.

Early morning fishing in the East Calcutta wetlands

Introducing fish-farming in the ponds where the water has improved enough actually increases the efficiency of the system because the fish feed on algae that might otherwise smother the ponds, and because the revenue earned is adequate entrepreneurial incentive to operate the system productively.

The Four Necessities: Integrating the Economy

The wetlands program must include fish-farming, agriculture, horticulture and animal husbandry; all these systems have a common nutrient base drawn from municipal wastewater. The productivity of these multiple sources of food goes a long way to strengthen support from the farm families, while the conventional treatment plant is invariably considered a project apart from the basic social and economic activities of a city and its fringe.

Developing wetlands in this way is the least expensive method, at an estimated 3 million rupees ($70,000) per million litres of wastewater a day, including the cost of land. The major cost is indeed the land, which should be a low-lying area at the fringe of a large city. These lands are generally the cheapest and in most cases do not raise more than one crop a year. It is possible to engage displaced farmers, for their new source of income can exceed what they earned before the project. Dhaka, Mumbai (Bombay), Jakarta, Calcutta and Bangkok are only a few of the

cities with marshy backyards.

Early morning fishing in the East Calcutta wetlands

To reverse environmental decay, our technology must be rooted in the wisdom of local communities. The Chinese saying, "From the masses, back to the masses," summarizes the achievement best. The vital phrase for the changemaker is "confidence of the community." Existing engineering and technology invariably ignore this as a matter that merits learning. This is also where modifying engineering education to cater to the needs of sustainable development has remained weakest.

This goal was well explained by the head of a tribal village when I sought to educate myself about the life and livelihood there. A fire was lit upon a one-metre-square bed of rice husks and I, an inquisitive outsider, was asked to walk over the fire to prove my reliability. This was done. Meeting such a challenge to acquire traditional knowledge from isolated villagers is not unusual. It is often a drawn-out affair; it took three years for me to be accepted in the waste-recycling communities in the Calcutta wetlands. But it also took three years to explain to official decision makers that a conventional technology can give way to the traditional one. Yet the time never is wasted. Things have changed, and can change much further. Agenda 21 envisages a growth pattern that will be environmentally sound and will ensure equity for all. This is considered absolutely essential to relieve the great poverty that is deepening in the developing world. But this hope depends on decisive political action to now begin managing resources to ensure both sustainable human progress-and survival. In the Calcutta wetlands, treating wastewater as a resource instead of a pollutant clearly meets the challenge of finding a growth model for a sustainable future. The time is ripe to switch from the

capital-intensive programs of the past to a sustainable alternative where money need not be a constraint.

A duck house on the fish ponds: Snails spread on the ponds, inhibiting the growth of fish. Rural women collect the snails for money, and ducks feed on the snails. Duck droppings are good for the fish.

Municipal sanitation in many cases depends on multinational financing, and it is an obligation of the funding agencies to fulfill the United Nations mandate to avoid the prevailing top-down approach in favor of consultation at the community level and infusion of community wisdom. The top-down, high-tech approach invariably helps vested interests at both the global and local levels, with little or no improvement in the quality of life of the common people in whose name such finance is sought and who ultimately bear the debt burden.

The Lessons: Learning From the Bottom Up

Calcutta's resource-recovery practice is a "tutorial ecosystem" for others and a pointer toward the future of river sanitation in poorer countries. Still, institutionalising community involvement is a recent concept, and it has not been easy to achieve. It will need a deeper understanding of the interests that bind individual groups and market forces. Some barriers to the community-based approach include these:

- A top-down approach assigns specialists as the key personnel, but a community-based approach essentially needs facilitators. This is the kind of perceptual change that does not easily come to the classical mindset of those who promote development.
- The community-based approach draws specialists much closer to the problem and makes them much more directly answerable to the people. At times the

experience can be difficult, and it is not the milieu to which specialists are accustomed.

- Theoretically, a community-based approach seems impractical. As involvement widens, there is a definite risk of far too many views to reach a consensus. This may lead to new conflicts and even political interference.

But it is worth remembering one's first view of the wetlands, the *bheris*, that lie to the east of Calcutta: An area that is, against all odds, rich in beauty and, though still poor, an area that offers hope to the local residents and a model for others.

Dr. Dhrubajyoti Ghosh is a pioneer in incorporating ecological principles into engineering design, and his work in reusing wastewater has been honoured by the United Nations.

Return to Text

October 1998 Journal Home Page

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