

Aquaculture in Artificially Developed Wetlands in Urban Areas: Relationship between Soil and Surface Water in Landscape Ecology

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Abstract

Wetlands show a strong bivariate relationship between soil and surface water. Artificially developed wetlands help to build landscape ecology and make built environments sustainable. The bheries, wetlands of eastern Calcutta (now Kolkata), utilize the city sewage to develop urban aquaculture that supports the local fish industries and opens up a new frontier for sustainable environmental planning research.

1. INTRODUCTION

The classical wastewater management plan for Calcutta, developed by the British, consisted of a network of canals that carried the city's waste to the Bidyadhari and Matla rivers, following the topography of the region (Mitsch et al, 1993). However, in the beginning of the twentieth century, this network of waste management failed when the city started growing rapidly. The excess waste was then accumulated at the low lands of the eastern parts of the city, forming the wastelands of the region (Juniper, 2004). Surprisingly, these wastelands brought back the landscape ecology of the city that was somewhat lost due to rapid urbanization of the region.

2. AQUACULTURE IN THE WETLANDS OF CALCUTTA

The bheries made of the city waste of East Calcutta were the sources of water for aquatic flora and fauna. These wetlands were naturally developed by the accumulation of wastewater that the canals could not carry to the rivers. It was a prior belief that the wetlands formed by sewage water stink and pollute the soil with organic matters. This belief was changed when it was found that, instead of polluting the soil, the wastewater acts as a fertilizer for the growth of certain plants that only survive in wetlands (Ghosh, 1980). These plants also provide shelter for certain fauna including some species of fish and prawn that have market value. Oxygen produced by the wetland plants purifies the water and helps to keep the surrounding air clean.

Fig. 1: Wetlands of East Calcutta



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Wetland soil is known as hydric soil because it remains saturated with water and contains minerals and organic compounds. This type of organic soil acts like a giant sponge that absorbs and holds water. The clayey-loam soil helps to retain water, and its alkaline property provides the living conditions for the flora and fauna. These plants and algae supply food to many species of fish, birds, and mammals and help to develop a food chain to preserve the ecology of the region. The organic compounds of waste water increase fertility of the saturated soil and thus help to develop aquaculture in the wetlands.

Wetlands are the ‘lands where saturation with water is the dominant factor’ that helps to develop habitats of flora and fauna. On the other hand, this natural relationship determines the nature of soil development and types of plant and animal communities living in the soil and on its surface (Cowardin et al, 1979). Wetlands improve water quality by filtering out sediments, nutrients, and toxic substances before water reaches aquifers, rivers, or lakes.

3. RESEARCH FRONTIER

The waste management program of Calcutta suggests that the city waste, which is unavoidable, can have a better use in maintaining the ecology of the region. Wetlands can also be artificially developed based on soil composition, topography, climate, hydrology, water chemistry, vegetation, and other factors (Mitsch et al, 1993). With proper zoning and impact assessment programs, artificially developed wetlands can help to develop the local fish industry, generating employment in the primary sector to create recreational areas at the city fringes and to enhance landscape ecology of the region by developing habitats for flora and fauna.

- The Ecology as a ‘Natural Kidney for Urban Wastewater’: The Calcutta Wetlands could turn bad water into good water, and as Dhrubajyoti Ghosh identifies the role of wetlands in developing the fish industry of the region could play an economic role as well.
- Kolkata: Wonders of the Waste Land: Tony Juniper finds that the wetlands

Fig. 2: Low wetlands of East Calcutta



of East Calcutta are well known all over the world for their multiple uses. However, Juniper identifies that these wetlands are largely manmade, comprising inter-tidal marshes that include salt marshes and salt meadows with significant wastewater treatment areas like sewage farms, settling ponds, and oxidation basins. The East Calcutta wetlands were designated as a Ramsar Site in November 2002.

- In Wastewater-Fed Aquaculture in the Wetlands of Calcutta: Dhrubajyoti



Ghosh presents an overview of the wetland system of Calcutta and identifies the issues to improve its operation. Ghosh mentions that the system has the potential for further development for low cost sanitation technology that will recognize environmental and economic benefits for the urban areas.

- The natural environment is not merely the discrete physical objects but a multidimensional gestalt, which is in a state of synthesis. This multidimensional gestalt can be identified by relating each landscape element with others. See Fredrick Steiner's *The Living Landscape: An Ecological Approach to Landscape planning*, p.116.
- Tony Juniper says that a waste management system consists partly of a rubbish heap and partly of sewage works. Juniper goes on to say that the wetlands of Kolkata are among the world's great ecosystems.

4. CONCLUSIONS

Wetlands show a strong bivariate relationship between soil and surface water. Artificially developed wetlands help to build landscape ecology and make built environments sustainable. The bheries, wetlands of eastern Calcutta (now Kolkata), utilize the city sewage to develop urban aquaculture that supports the local fish industries and opens up a new frontier for sustainable environmental planning research.

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