UNDERSTANDING THE SOCIO-ECOLOGICAL IMPACT OF URBANIZATION IN THE TRANSFORMATION OF LAKES AND WETLANDS – A CASE STUDY OF EAST KOLKATA WETLANDS, WEST BENGAL

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Abstract

Urban commons including wetlands constitute important socio-ecological systems providing valuable ecosystem services. However, unplanned rapid urbanization has resulted in large-scale decline and transformation of commons, adversely affecting the traditional and vulnerable users. East Kolkata Wetlands (EKW), a network of natural and manmade wetlands, constitutes an important but neglected ecosystem of Kolkata on its eastern fringe. Traditionally maintained by the conventional scientific wisdom of the urban poor, EKW provides a range of valuable ecosystem services. Often considered as the kidneys of Kolkata, the dual benefits of natural sewage treatment of Kolkata, and wastewater fed aquaculture, thereby ensuring livelihood of thousands, makes EKW indeed a unique system. Rapid urban sprawl, constant pressure from real estate have brought about significant changes in the system, its use and management leading to large-scale shrinkage over the years thereby threatening its ecosystem services. In the process of such transformation, the study examines the perceptions of different stakeholders of EKW over the value of wetland, their response to such change and its impact on human-water resource relationship.

1. Background

Urban aquatic environments encompassing lakes and wetlands are of very high ecological value and are now at stake. Today, India witnesses large scale loss of green spaces and numerous wetlands and lakes, which once served as the medium of drinking and irrigation water owing to rapid urbanization. Despite being central to our lives for its high ecological and social value, it has not been the central point of focus in our planning. It is one of the most under-prioritized but over-utilized resources, which have witnessed numerous problems ranging from encroachment, conversion and pollution from industrial and domestic waste (as is evident from the example of the loss of lakes in the city of Bangalore today).

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Moreover, the situation has further worsened with lakes being converted to other land uses, whereby the clogged connecting channels with solid waste have adversely affected the drainage system which once served as the connecting medium of these lakes (Sudhira et al., 2007). The result is acute water shortage and lack of access to water. Conducting surveys in Bangalore and having read some articles including that of T V Ramachandra triggered my interest in this field. It made me ponder over what gives rise to such problems? Who are the losers and winners in the process of rapid change around lakes? Is it solely a natural process or is there a bigger picture to it? Despite rapidly improving insights, many questions remain unanswered relating to the complexity and multifaceted aspect of transformation in lakes and wetlands with urbanization. Reducing this knowledge gap and conducting proper research is relevant to understand the different realities of commons of the place, the discourses and the narratives at a material level to examine its various implications and how the society in turn responds to it.

2. Introduction

Lakes and wetlands, which are part of urban ecological commons, are believed to be rich functional ecosystems providing valuable ecosystem services. These are characterized as provisioning, supporting, cultural and regulating ecosystem services (MEA (Millennium Ecosystem Assessment), 2005). According to a study by Bolund and Hunhamar (1999) in Stockholm, Sweden, wetlands perform six valuable ecosystem services including air filtration, rainwater drainage, and sewage treatment, preventing flooding thus regulating the microclimate of the region coupled with adding cultural and recreational values. Thus, maintaining such ecosystems becomes necessary for environmental sustainability, economic development and well being of urban residents especially those who depend on it (TEEB, 2011; Elmqvist et al., 2010). However, many such rich urban and peri-urban resources are lost while some are in a critical condition with rapid urbanization and privatization.

Massive urbanization accompanied by rapid land-use transformations is widely observed in developing countries in Asia and Africa. Such a trend is also common in India where urban land expansion rates have been the highest in recent years (Seto et al., 2011). The rapid emergence of urban sprawl has been devastatingly evident in sharp decline of valuable agricultural and eco-sensitive (wetlands) lands, higher greenhouse gas emissions from increased private vehicle use and higher energy consumption. In recent years there has been rising concern over the continuous degradation of wetlands owing to unplanned development activities (Ramachandra T. V. et al., 2002). It has been revealed by a field survey of all lakes (2014-15) that slums surround about 38% lakes, 82% witnessed loss of catchment area while those fed with

sewage stood as high as 90%. What demands urgent attention is a need for sustainable management.

In this respect, it is important to note that civilizations knew the importance of water and thus conserved the lakes and wetlands through traditional practices. However, such practices got undermined as canal and large river valley projects got prioritized during the imperial period coupled with lack of management induced by high and oppressive irrigation cess and receding community participation led to massive decimation of irrigation tanks and lakes. The consequences of such projects with a capitalist motive are evident in the silting of thousands of lakes with overall reduction in storage capacities and groundwater recharge. With irresponsible management of natural resources important constituents of landscape (wetlands) get reduced to breeding grounds of disease vectors and emitters of GHG's thus adversely affecting the public health and loss in biodiversity (Ramachandra T.V., Vinay S, 2015). Moreover, the prioritizing of the recreational use of the middle class bourgeoisie over the social and livelihood based uses of urban poor resulting in enclosure and exclusion of commons have been a dominant picture in most Indian cities undergoing rapid urbanization (Baviskar, 2011; D'Souza & Nagendra, 2011).

Often a deep contrast is found to exist between the myths and reality of what actually causes change around lakes and its associated management practices. Empirical evidence of lakes in Bangalore throws light on the numerous wetlands, which are dying a slow death. While some point to rapid climate change to be responsible for it, it is important to delve into the root causes of such rapid loss and deterioration. A study by Indian Institute of Science on the city's water bodies argues that it is poor governance, lack of collective action with loss of sense of belonging and changed perceptions of lakes coupled with regulatory vacuum around wetlands, which have resulted in such a mishap (Khelkar, 2016). In fact, both private dwellers comprising slum dwellers and the real estate sector together with government agencies have been involved in such illegal encroachments contributing equally to the loss of such rich ecosystem resources. While government agencies race to chase and embrace new sources of revenue, regardless of their consequences on ecosystem and society at large (evident in the tradeoff between selling treated water for power production and groundwater recharge through the lake, the corporate world encroach illegally with due diligence from the state (Koliwad, 2016). Such information in fact, rather than clear doubts, raises many questions regarding the political ramifications and future action. The large-scale encroachment in EKW despite the existence of different legal measures, where the West Bengal Government itself grants permission to

build flyovers and for other beautification projects through the wetland area, present a similar scenario. Such faulty decisions of the authorities that are liable to protect the wetland urge the need to go beyond the myth and map the underlying cause of change in such fragile ecosystems thereby questioning the power dynamics existing.

Living in an era where the world is rapidly urbanizing, it is important to note its impact on commons particularly located in peri-urban interfaces of cities. The peri-urban commons which support both ecological functions and provides livelihoods of local communities are facing rapid environmental degradation in most Indian cities owing to socio-economic inequities and lack of clarity about ownership coupled with fragmentation and overlaps in policy and administration (Allen, 2003; Mehta & Karpouzoglou, 2015). Moreover, the implications of rapid urbanization are also largely felt in institutions for management and social demography, which gets transformed thus leading to weakened protection of these contested resources like urban commons by challenging collective management. While talking about urban commons, which encompasses close interaction between nature and society, it must be remembered that these are considered as social-ecological systems. In an era of rapid urban sprawl, understanding such socio-ecological systems and their ecosystem services become vital for building resilient cities, which are sustainable and equitable. For this is needed good governance and ensuring access of vulnerable communities to the valuable ecosystem services (Adger, 2007).

While most literature captures the adverse impact of urbanization on the urban commons including wetlands, none of the papers capture the stories, struggles and negotiations that the local people and traditional users of the resource make to avail services from the lakes with its transformation with time. The perspectives of the local vulnerable groups including fishermen, farmers and the coping mechanisms they deploy as their access to the eco-sensitive water resources get threatened remain largely unheard.

Hence, this research aims to go beyond the normative character of statements and situate a broader understanding of the multivariate effect of rapid urban sprawl on wetlands and thus people's lives. Capturing the different experiences and perceptions of people (both users and non-users) through conducting interviews and through participatory action tools, the study attempts to unravel what is the condition of the wetland in the city from the socio-ecological lens brought about by urbanization, narratives of changes in the East Kolkata wetland and how the society in turn responds to such transformation.

3. Key Objectives

The idea was to gain an understanding on the transformation in the wetland over time and analyze the narratives of different stakeholders on the change in the wetland imposed by urbanization. Accordingly, the three key objectives of the study involved:

1. To understand the evolution of ownership over lakes and wetlands through time. To examine the impact on human-water resource relationship (livelihood based/ recreation based)
2. To assess the challenges faced by the residents (users and non-users of the wetland) and how has the society responded to such change around urban lakes?
3. To analyze the narratives and perceptions of different stakeholders (users, non-users; men and women) arising from the social, ecological and political aspects of such transformation.

4. Study Area

Rapid urbanization and population expansion in almost all cities in India is a major concern today. Like other cities in India and elsewhere in Asia, Kolkata is also no exception, which is expanding rapidly. Supporting a population of as high as 4.5 million with an additional burden of about 6 million floating daytime population (KMC, 2015), the city generates 750 million liters of wastewater and 2,500 metric tonnes of waste per day. While most expanding cities face the challenge of managing, disposing and treating wastewater, Kolkata stands as an exception in this case, where the cost of sewage treatment is among the cheapest in the world due to the wetlands which has been serving as a natural sewage treatment plant for more than a century. East Kolkata Wetlands, often described as the kidneys of the city, is a network of manmade wetlands bordered by green embankments and channels. Covering an area of about 12,500 hectares, the wetlands are spread over 37 mouzas (rural administrative units) in the districts of north and South 24 Parganas in West Bengal, including 7 Panchayats and 2 municipal bodies. These unique wetlands receive nearly 80% of the city's sewage, which passes through a network of wastewater channels and is the largest of its kind in the world (Ghosh, 1999). With the help of sunshine, oxygen and microbial action the wetlands organically treat the sewage and turn it into a nutrient rich water used to feed fish and grow vegetables and paddy. Moreover, about 18,000 MT of fish is produced in the bheris of EKW every year; about 50,000 MT of fresh vegetables from vegetable farms and a yield of about 15,000 MT of winter paddy are obtained from the agricultural fields every year. With 22 % of paddy and about 44 % of fish production of the state coming from EKW,

this part human, part natural ecosystem, thus, plays an important role in ensuring the food security of the city (KEIP, 2013). Moreover, the wetland provides employment opportunities to thousands of people who mainly engage in wastewater pisciculture and vegetable farming and other associated activities. Thus, acting as an ecological subsidy of Kolkata by saving its municipal cost of treating wastewater and by supplying fresh food at an affordable price, these wetlands contribute towards a stable urban fringe where the citizens of Kolkata seem to be the biggest beneficiaries of this phenomenon. The unique functioning of EKW where both wastewater treatment and sewage fed aquaculture are complementary to each other as part of an integrated aquatic system, indeed pose an unique example of a system, where sewage is a nutrient and not a pollutant, maintained by conventional scientific wisdom of the community.

The survey was mainly conducted in the mouzas of Bhagbanpur, Kharki and Deara under Sonarpur block and Hadia and Tardaha Kapashati mouzas under Bhangor I block of East Kolkata Wetlands, located on the eastern fringe of Kolkata. The selection of the mouzas, which are the most threatened areas of East Kolkata Wetlands in terms of encroachment, were primarily based on the suggestion of East Kolkata Wetland Management Authority who was approached for their necessary support for the project.

5. Methodology

i. Research Method and Sampling

A qualitative study was carried out through purposive sampling guided by ecosystems services framework. This involved several field visits whereby semi-structured interviews were conducted to get an understanding on certain targeted aspects in mind as well as analyze other themes arising in the process. Moreover, since different stakeholders hold different perspectives, community dialogue and discussions were held with the EKW dependent communities (including fishermen, farmers), residents of nearby neighborhoods and government officials and activists. This helped to collect information on the change in nature and frequency of lake use, associated problems faced in accessing the wetland over time, conflicts among users, their coping mechanisms to such changes and the varying perceptions of the users and non-users regarding the value of the resource. Analysis was also done on the impact of such transformation of ecological landscape on the social interaction of the people with the wetland. The survey, which began from 12th November, continued till 22nd December 2018. About thirty-six individual interviews were conducted along with two group interviews with group sizes between two to four. 20 interviews were conducted with the EKW users (fishermen and farmers), 10 were held with residents of nearby

neighborhoods, while a number of interviews held with government officials and activists stood at 4 and 2 respectively. Thus, overall the study involved conducting interviews with 45 individuals. The interactions were mostly conducted at and around the fishponds and farms while some were held in the village area. The offices of East Kolkata Wetland Management Authority (EKWMA) entrusted to maintain and conserve the wetland area, and that of Kolkata Municipality Authority under whose jurisdiction EKW falls, and 2 fishery cooperatives in the areas surveyed were also visited during the survey.

ii. Challenges faced

The main challenges faced during the fieldwork revolved around lack of availability of the farmers and fisherfolks in the selected mouzas. Most of the fishermen used to leave for fishing in the bheris as early as 4 am, which was followed by selling the fish in the local markets. Hence, getting access to the fishermen at the appropriate time seemed to be a major problem mainly during the first few days of survey. However, gaining a rough idea of their schedule during the initial visits of my fieldwork made it easy to approach them at appropriate times during the following days. Moreover, another major challenge was that often respondents either refused to participate in the survey or respond freely to the questions asked under the fear that this might create problems once revealed to the government or the local politicians who are largely responsible for their loss of livelihoods. Again, in the face of the area being flooded by researchers over the years while their lives and associated problems saw no improvement, some even doubted if it was of any use to participate in the survey. A 45-year-old farmer asked, "What benefit will we get if we answer your questions?" In such instances, assuring them that the survey conducted is solely for academic purpose and that their confidentiality would be maintained was necessary. It also required engaging with the community in informal conversations initially to make them feel comfortable to share the required information and thus understand the ground reality of the place. Interviews with the government officials who were another category of participants for the project also seemed difficult due to their busy schedule as this involved frequent phone calls and sitting in their office for long hours to get an appointment for a survey.

Thus, discussions and dialogues with the community were held with due attention being paid to the above mentioned challenges and concerns along with ensuring throughout the project that the confidentiality of the participants were maintained and their sensitivities are not hurt in any manner.

6. Findings and Analysis

i. Value of EKW: Ecosystem complementarity and natural treatment of wastewater

Streams of motorbikes, towing 4-wheeled trailers, piled high with vegetables and fat silvery carp were seen being lugged from the wetland towards the city markets as I made my way towards Sonarpur, a block under East Kolkata Wetland. Every morning, large amounts of fish and green vegetables grown in the wetlands make their way to the city markets, sold at considerable prices thereby providing livelihood for many. Moreover, the low-cost traditional and indigenous recycling practices undertaken by the fishermen and farmers in the area have led to mainly 3 eco-environmental practices viz. wastewater fisheries, effluence-irrigated paddy cultivation and vegetable farming on garbage substrates. Such resource recovery practices of the urban poor at EKW are represented through the following diagram (Figure 1).

Ecosystem Services of East Kolkata Wetlands: Changing status of use and users

Service description	Types of services	Remarks
Regulating ecosystem services	• Natural treatment of Kolkata's sewage • Local climate and air quality regulation	• Saves municipality crores to set up STP • Past and continued use
Provisioning ecosystem services Food	• Fish grown on wastewater sold by urban poor; used for self consumption • Cultivation of paddy and vegetables	• Past and continued use by local communities • employment opportunities to thousands of people • Vocation transition with generation • Ensures food security of city
Cultural Ecosystem services Recreation, mental and physical health	• Fisheries provide leisure cum boating resorts facility • Open spaces around wetland used for picnic spots, walking	• Dual benefit of fishery and tourism • Past and continued use • New usage of bheris and open spaces envisaged by community, city dwellers and local officials

Figure 1 showing resource recovery practices in EKW.

The wastewater from Kolkata flows through sewage fed interconnected ponds prepared by fishermen. The wastewater is then turned naturally by the wetland into nutrient rich water ideal for Plankton. This is then used as fish feed for fish cultivation in sewage fed fisheries and for vegetable and paddy cultivation in farms. The fishermen and farmers then sell the fresh supply of fish, vegetables and paddy in local and city markets.

Besides such regulating services including the natural sewage treatment and provisioning services including fresh supply of fish, vegetables and paddy thereby ensuring livelihood for many, this "waste recycling system" also provides cultural services in the form of recreational and different physical health facilities including bheris used for boating and open spaces as picnic spots.

However, EKW which claims the unique distinction of being the world's largest "wastewater fed aquaculture system" where the sewage is recycled for both agriculture and pisciculture" is today groaning under the pressure of urbanization and illegal encroachments which threatens the ecosystem services. Figure 2 shows the ecosystem services provided by EKW and its present status.

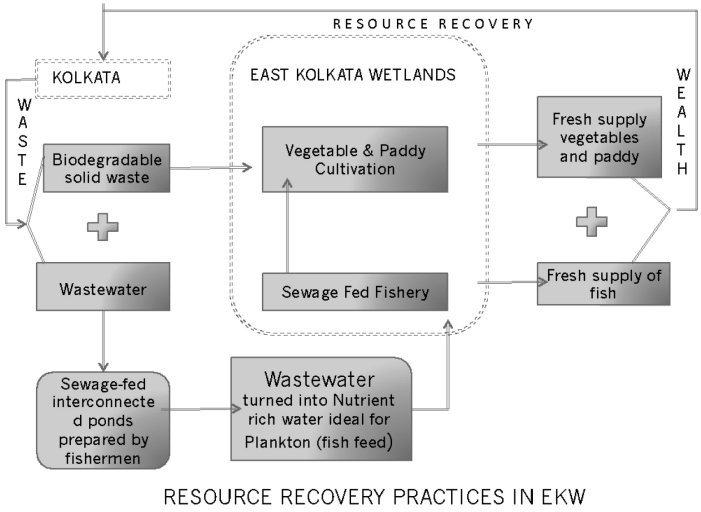

Figure 2 showing ecosystem services of EKW along with the changing status of uses and users

ii. Management of the wetland: Legal initiatives and informal arrangements

The movement for appraising the court to protect the EKW began in 1992 when a PIL was filed by a pressure group called PUBLIC (People United for Better Living in Calcutta) in the Calcutta High Court, which led to the formal regulations for protection of this Waste Recycling Region from encroachment. The remarkable contribution by Dr. Dhrubojyoti Ghosh, a UN Global 500 laureate and recipient of the prestigious Luc Hoffman Award from the International Union for Conservation of Nature in 2016,

who fought bravely for the conservation of EKW for decades deserves mention. It was his efforts, which led EKW to be designated as a Ramsar site thereby making it a wetland of international importance (Ramsar, 2007). He believed that it is not policies but the unique traditional wisdom and love of the people in EKW, which protects it.

The East Kolkata Wetlands Conservation and Management Bill passed in 2006 marked another major legal initiative where about 12,500 hectares was designated under the wetland area. The bill laid severe penalties on any buildings built recently within the designated wetland area while all existing structures were to be destroyed with immediate effect and actions required. The wetland falls under 2 municipal bodies and 7 Panchayats while the bheris are either under private ownership or are governed by fishery cooperatives. However, despite such regulatory interventions involving the High Court order, a national commitment to the Ramsar Convention and a state legislation thereby making it a protected area, hunger for land for development activities and rapid encroachment continue to be a serious concern for the wetland and EKWMA (East Kolkata Wetland Management Authority formed under the East Kolkata Wetland Conservation and Management Act, 2006 for conserving the wetland area). The lack of coordination between the different stakeholders including Kolkata Municipal Corporation (KMC), Kolkata Metropolitan Development Authority, local residents, fishery-cooperatives, NGOs, real estates, and EKWMA remains an obstacle in achieving the required targets. Despite being designated as a Ramsar site in 2002, this fragile ecosystem is yet to possess a wise-use plan and effective interventions and implementation mechanisms necessary for the conservation and sustainable use of the wetlands. Moreover, in the absence of any management plan, most of the projects are sanctioned in an ad hoc manner.

iii. Maintenance by indigenous knowledge systems of the urban poor for decades

The wetland area is sustainably managed by the unique ecological knowledge of the urban poor. The people of the area protect the area whereby the fishermen and farmers have dedicated their life and work day and night towards maintaining the wetland. From excavating the ponds to the correct depth, mixing the suitable quantity of sewage, cleaning the water through applying lime and oil cakes (which many be referred to as khols) and kerosene, when to add spawns, the method to protect the embankments through water hyacinths to allowing the sufficient time to ensure conversion of the waste into fish feed- they know everything. Such close association with the bheris and the mastery of the traditional users over the resource recovery activity is indeed noteworthy and deserves mention.

iv. EKW in transformation: land use change; encroachment

Conversion of once fertile vegetable gardens into illegal developments of leather processing units, drying up of once thriving fishponds to build housing complexes to accommodate the growing population, and construction of new roads have been the major transformations in the wetland under the area surveyed. Many new plastic recycling units have also emerged in recent times. Such illegal conversion of wetland areas by land mafias has significantly increased over the years particularly in Deara and Bhagabanpur. In fact, such large-scale loss of wetland area in Bhagabanpur mouza is evident from the data showing a rapid decline in wetland area from 88% in 2002 when the East Kolkata Wetland was declared as a Ramsar site of international importance to 57% during 2006 to as low as 19% in 2016 (as reported by Dhruba Das Gupta, Project Director of the organization Society for Creative Opportunities and Participatory Ecosystems). This rapid scale of decline is evident in almost all the other 21 villages, which make up the 125 square kilometer of wetland, the only difference being in the degree of shrinkage.

The survey conducted in the area showed that a large number of the residents are migrants who provide cheap labour to the city. Such trend of growing in-migration has largely contributed to the increase in population in the wetland area thereby leading to gradual filling up of the fisheries by residential complexes. Thus, the survey revealed three major types of transformation in land-use patterns: namely, from water body to urban settlement, from agricultural land to settlements and open spaces converted to support housing complexes or industries like plastic units and leather scrap shaving units. Large areas of water bodies have also been converted into paddy cultivation over the last few years.

v. Implications: indigenous knowledge systems threatened; viability of legal initiatives

The implications of such wetland violations have been felt in many spheres. Such loss affects the livelihood whereby local farmers and fishermen are forcefully evicted due to acquisition of wetlands. Moreover, such trends of urban sprawl threaten the hard fought rights particularly of the EKW dependent communities battling for the ecological protection of the wetland. Hence, removal of wetlands largely threatens intergenerational equity. In fact, what is often ignored in the race of capital accumulation is that such short-term price as prime real estate actually threatens the long- term sustainability of the wetland and the society at large. The existence of these illegal developments on a wetland which is protected under laws of international importance, which strictly bars any construction on the wetland, implies the very fact that violence often remains deeply associated with such wetlands

where voices are mainly dominated by power dynamics. An important question arises: Are these laws of the land effective on ground or are observed only in the breach? It is sad to see the lack of awareness of the value of the wetland, a system notable for its unique symbiosis with the sustenance of the metropolis of Kolkata, which is constantly abused rather than preserved. As Dhrubajyoti Ghosh used to say, in the face of such rapid growth of high rises and consequent loss of the valuable ecosystem, it seems that the wetland is treated as any other real estate, a commodity in waiting.

vi. Perceptions of community about desirability of filling up of the wetland

The survey revealed varying perceptions of the local community about desirability of filling up of fisheries and farms for development activities. Most of the people who did not depend on the wetland and worked elsewhere in the city had supported the filling up of sewage-fed fisheries for building roads, industries, houses and educational institutions as they believed that such development activities provide better livelihood opportunities, improve transport amenities and ensure better places to stay. Among those who preferred such development activities, the majority were migrants who have settled recently in the area surveyed from the last 2 or 1 year. “I never heard of EKW nor did I know that such huge wetlands existed”, was the response of Kuldip Sarkar, a resident of Kharki who had migrated there only the previous year. For some, the wetland was nothing but a garbage dump, abode of mosquitoes while a few reported their fish and vegetables coming from the wetland. The drainage services provided by the wetland to keep the city running was hardly known by any. Rushing through a busy day, such a trend of ignorance is commonly observed among commuters who are barely aware of the EKW, which has been quietly treating the waste out of the city’s system for over a century. One might become aware of such invisibility on the Metropolitan Bypass itself, which roughly sets the boundary between the wetland and the thickly populated city. In fact, there is no billboard or sign, which acknowledges its existence or the services it, provides viz. producing much of the city’s food and treating its sewage.

On the other hand, the fishermen and farmers dependent on the wetland for livelihood opposed the idea as sewage fed aquaculture and effluents irrigated paddy cultivation ensured their livelihood. Some fishing families alleged that ponds are being deliberately sabotaged with channels blocked up mainly to force them to abandon their livelihoods. In the face of such power dynamics and illegal encroachments, they struggle hard to protect the wetland. They even felt that even if new employment opportunities were created, they may not fit in the new schemes due to lack of required education and skill.

Interacting with the fishermen and farmers, it was found that income from fishing or farming is not sufficient to support daily needs of life. In such instances, many engage in other activities associated with the bheri or in the village itself thereby supplementing the work in bheri. This additional income helps them particularly when income from fishery is low.

A change in pattern of ownership over the farms and bheris in the East Kolkata Wetland have also been observed. Huge areas which were once owned by the Naskars in Sonarpur (whom many referred to as Babus) have now been bought either by the land grabbers of Kolkata or by the local farmers and fishermen themselves. Today, most of the sewage-fed fisheries in the Sonarpur block surveyed are under private ownership while 3 bheris are under Fishermen's cooperatives and 1 State-owned run by the State-Fisheries Development Corporation. Such change in ownership has benefited the farmers and fishermen as they can enjoy full right over the land and fishponds and the entire income earned and not in parts, which was the case earlier.

vii. Disturbance of ecological Balance: emerging problems; response of the community

EKW, the largest natural treatment system, is witnessing disruption of ecological balance owing to obstruction of wastewater flow due to encroachment, siltation in bheris and change in quality of the water. Moreover, the widening of roads or building of new roads, while improving the transport facilities for the community of the area (based on survey), has adversely affected the sewage supply. "The roads which have been built actually harm the canals thereby lessening the sewage supply to the bheris and aquatic gardens", said Dhruba Das Gupta. While walking along the bheris I observed a large number of fishes lying dead. While talking with a few fishermen, it emerged that since the last 2-3 years a major concern has been the newly observed diseases in fishes, which have resulted in the deaths of many fish species. What caused such diseases remained unclear. However some responded that such diseases might be attributed to change in climate or water quality. Bhola Mondol, one of the fishermen interviewed in Kharki informed that huge sums are often invested in buying medicines, mostly from local markets, to treat the disease and maintain the fish cultivation. The liquid chemicals are then spread over the water. The local fishermen themselves guided by Deepu Mondol, the local head of the bheri, do all the work. However, the problem emerges, as those with small plots cannot afford to buy such expensive medicines and thus suffer due to loss (less fish and hence low income). Today, what has added to the burden is the reduced availability of sewage water, which is used for farming and serves as fish feed. Consequently, the costs of production have increased, as large amounts of

fish feed are purchased which was not the case earlier. In recent years, quality of the limited farming available has reduced further due to degraded soil conditions and sewage water availability besides large plots being filled up for construction purposes.

In response to such reduced wastewater availability, the fishponds are often dredged. A similar project is carried out under the fishery cooperative named Charchariya fishery cooperative in Hadia mouza. Nilkanta Mondol, a committee member of the cooperative informed, "The dredging of the bheri under the ongoing project funded by the government, has increased the water depth from 2 feet earlier to 6 feet at present". Such increase in bheri area is believed to increase the fish cultivation in future and thus will benefit the community. However, what is often ignored is that such activities involving digging out the mud might prove to be harmful as it would disrupt the fish-cycle which is generally nature-determined thereby making the bheri dysfunctional for one whole season to return to its desired condition which would adversely affect the income of the fishermen. "I am not sure whether this deepening of water will avail better fish yield. The fish cultivation might increase or the fish might not thrive in deep water", was the response of Prahlad Patra, a fisherman who works under the Charchariya cooperative. Such doubt in the viability of dredging activities which involves deepening of water in fishponds become evident as fishes in EKW have thrived in water bodies of shallow depths.

The wastewater fed aquaculture might make one wonder: How safe are these fish and food grown in the bheris and farms fed by sewage? A visit to the wetland area and talking to the community who primarily depend on the bheris for their livelihood and also for consumption might provide the answer to such doubts who claimed that the fish and food grown on wastewater is completely safe and is sold daily in the markets and are also used for consumption. However, the illegal mushrooming of the leather processing units have changed the water quality over the years thereby affecting the health of fish species available as claimed by many fishermen. "We don't consume any fish from the bheris nor do we use the water. It's not safe", was the response of another local resident who has recently migrated and blamed the illegal Kolkata Leather Complex located outside the wetland. Such fear and doubt in the safety of the fish cultivation in the bheris, which was not the case earlier, become evident in the face of the emergence of these illegal leather-processing units which not only pollutes the air by releasing noxious fumes but is also harmful for the fish as effluents from these industries find their way into the wastewater canals that feed the bheris. However, a definitive claim can't be made on the specific nature of change in the quality of the sewage.

Hence, such change in water quality and quantity, owing to rapid urbanization and unregulated dirty industrialization, has adversely affected the fish species and farming thus threatening the livelihood of the fishermen and farmers to a great extent.

viii. Lack of consensus among divergent groups on major constraints faced in EKW

An important outcome of the study was the wide variety of perceptions among the stakeholders with regard to the challenges emerging in their production process in the wake of rapid urbanization. The EKW dependent community reported that siltation of canals and water bodies emerged to be the primary challenge while the NGOs complained that it is the lack of designating a clear boundary around the wetland, which creates the problem. For government officials, the existing socio-economic and political setting seems to be the most important constraint where there is a general absence of strong political will and the weakness of the poor communities to fight against the encroachment. It was found that lack of funding required for maintaining the bheri and wastewater recycling practices often stands as a major hurdle in operation as reported by a few members of the fishery cooperative. The other major constraints, which were listed during the interview, included insufficient supply of sewage, the pollution of the water by the untreated effluents disposed by Kolkata leather Complex and general lack of awareness concerning the value of the wetland among the non-users. It is important to note that though several constraints concerning production in the wetland area were reported by every category of respondents interviewed, namely EKW users (including fishermen, farmers), local residents including migrants, government officials and activists, there was a general lack of consensus among the stakeholders with regard to the primary constraints faced. However, silting up of canals and fishponds and increasing encroachment of the wetland area by the real estates was found to be a common problem for all the participants in the survey.

As the EKW falls prey to the cruel teeth of urbanization, such lack of agreement on the issue of major constraints faced in production itself seems to be a major concern as it delays the formulation of effective measures to address the issue thereby enhancing opportunities for real estate speculation.

ix. Transformation in ecosystem services: Threat of beautification projects on livelihood based services

The principal ecosystem service provided by the wetland has been mainly livelihood based where the traditional practice of wastewater aquaculture and fertile vegetable gardens form the sole source of livelihood of many. Moreover, these fisheries also present recreation facilities through development of waterfront sports and entertainment centers.

These include the recreation services in the form of leisure cum boating resorts available at the fishery of Nalban operated by Bansilal Leisure Parks Limited, thereby providing the dual benefit of fishery and tourism. Often, such scope of utilizing the water body for both livelihood generation and recreation is under explored. Considerable attention needs to be given to the immense contribution by the bheris of EKW towards sustainable living in the form of access to clean and cool air, quiet open space and boating services. Such ecosystem services, which are often enjoyed as free goods, can be made to pay by the society, which benefit not only the city dwellers but also the EKW dependent communities through creation of effective economic incentives.

However, with large scale illegal encroachment, sanction of projects by the government in the form of amusement parks, flyovers and widening of roads through the core of the ecologically sensitive wetlands, threat from unplanned urbanization and consequent disappearance of many fertile aquatic gardens and fishponds, we see how aesthetic values associated with modernity and commodification of these natural resources with capitalist motive in this neoliberal era have dominated and thus affected the urban–peri-urban interflow. Hence, the ecosystems services have been transformed with a pattern of 'accumulation by dispossession' where the worst affected have been the communities dependent on EKW.

x. Change in perception and vocation switch of the younger population

Most of the EKW dependent community engaged in traditional vocation primarily involving fishing and agriculture. Those involved in the agricultural sector either practice farming on their own land or work as labor in other's land, while some are fruit vendors. On the other hand, those engaged in fishery sector work either as fishery cooperative members, as bheri manager or practice fishing in the bheri while some are involved in fish business as vendors or fish spawn suppliers (traditionally called Goldar). A few work as hired labor at the bheri, make fish catching instruments and netting. Women particularly do cleaning and guarding the areas around the bheri, as was the case in both Charchariya and Nalban fishery cooperative societies.

However, with scope for better education and lure of modern employment opportunities, the toll of urbanization is also felt with a loss of appeal for fishing and farming among the younger generation. The perception over the value of the wetland and the incentive to maintain the ecosystem is changing where youths no longer believe that fishing or farming can impact their lifestyle in a positive manner. Today, as the children go to school and get educated,

the younger population prefers to engage in jobs in cities or in the nearby Kolkata Leather Complex, which would ensure higher income and thus better lifestyle (as reported by 40% of the farmers and fishermen interviewed). This a major concern as a few farmers and fishermen complained that such changed attitudes and perceptions have led to scarcity of efficient farmers and fishermen to look after the existing wetland area.

xi. Urban sprawl and reduced sewage availability: EKW traditional users battling concretization

The process of urban sprawl has been largely destroying large areas of the ecologically fragile wetland evident in Bhagabanpur, one of the most threatened mouzas of East Kolkata wetlands (often called the kidneys of Kolkata). Today, the rural agro-economy has become a part of urban eastern fringes of Kolkata with the Kolkata Leather Complex and other high-rises existing nearby. However, such rapid urbanization has brought utter mishap in the lives of urban farmers like 45 aged Ratan Patra. Uncertainty dooms their lives whereby they are confronted with a choice between selling their lands or continuing farming given the adverse and changing conditions of the modern era dominated by urban sprawl.

In the midst of an emerging era dominated by its rising urban boom whereby a large number of farmlands of EKW has been lost, Bhagabanpur's story is resembling the current situation throughout the East Kolkata Wetland. With new land use changes in peri-urban areas, farmers' resilience is being largely challenged.

In view of the reduction in wastewater supply of the wetland, the larger ramification is evident in adverse impact of such reduced water availability on the food supply chain through farms like Ratan Patra's whose only source of water to grow vegetables is the wastewater from the wetland which is now under threat. Such a threat was evident from the interaction with the farmers of Bhagabanpur mouza.

With rapid expansion of cities, while some farmers are being forced to leave farming, some are determined to not sell their lands. They continue farming with a belief that it is important for the city especially the urban poor who largely depend on locally sourced food. Moreover, what adds to their burden is a lack of options to shift to some other occupation, as they are skilled only in farming. While such encroachments have snatched away the livelihood of many and compelled them to shift to other jobs, and the lack of incentive and interest of the new generation in fishing or farming, a stark contrast was inferred from the narratives of Ratan, a farmer from Deara mouza. He prefers to continue vegetable farming with the nutrient rich water from the wetland

and carry forward his age-old family occupation. “I have been farming since I was a young boy”- said Ratan with a smile while his face lit up while narrating his childhood memories of working with his father in the fields. He used to see his father work hard to maintain the farm. When something went wrong, he knew what to do with his traditional knowledge. Ratan too struggles to keep his father’s dream alive, to take care of his farm, his only source of income and save it from the greed of land sharks.

His story represents many such farmers and fish folks in whose lives, the wetland still holds immense importance and who struggle daily, against the odds of land grabbing, for the ecological protection of the wetland. Such efforts of the community to safeguard the productive resource, which forms the primary medium of livelihood of thousands, is indeed commendable. In the face of such immense productivity of the resource, an important question arises: Are people willing to let go of this valuable resource? With growing incidence of land grabbing and change in land-use, unraveling such complex issues becomes necessary to understand the impact on human-water resource relationship with urbanization.

7. Conclusion

The survey indeed portrays the impact of rapid urbanization on valuable ecosystems like East Kolkata Wetlands and the changing land uses around the wetland over the years. This is evident in large-scale transformation of sewage fed bheris and vegetable gardens, change in water quality and sewage water availability, the transformation in sense of belonging and perspectives on importance of the wetland with generation and the response of the local communities especially of the urban poor to maintain the rich ecosystem through their indigenous knowledge systems. Moreover, such trend of urbanization not only indicates lack of complementarity between the two alternative agendas of urban planning encompassing wastewater treatment and urban growth in a holistic framework, but also implies the large-scale threat to the indigenous knowledge systems of the urban poor who have maintained the system for more than a century.

In the face of rapid transformation of wetlands, the larger question arises: who are the winners and losers in the process of such change? As the wetland is being lost to several beautification projects, the livelihood-based relationship of the community with the wetland gets largely threatened. Often efforts have been undertaken to protect these resources through creation of fishery cooperatives. However, such efforts for rejuvenation of wetlands have been often done at the cost of alienating the urban marginalized section where party politics at the top level tends to squeeze out money out of the bheris often misleading the fishermen to make wrong decisions. Again, in many

cases the authorities in charge of protecting the wetland are reduced to filing FIRs against such illegal constructions with no sound measures on ground. Going beyond the analysis of who gains and who loses among the different stakeholders in the midst of such rapid transformation of fragile ecosystems, the narratives emerging during the survey provide a glimpse of the effect of urban-environment trajectories of the commodification of commons, which is becoming a perennial problem in peri-urban and urban spaces. EKW is indeed a complex site where the binary between state-led environmentalism largely feeding the capitalistic motive of the middle class and the environmentalism of the poor becomes a dominant picture, a system around which evolves complex and plural arrangements among divergent stakeholders involving the state, civil society and the urban poor. As cities are growing accompanied by rapid encroachment of urban commons, as the authorities and ministries entrusted to protect the natural resources and people's rights are failing to do so, as the urban poor are getting mobilized by the civil society to stand up for their rights, resistance and protests are making their presence in different cities in different ways. In the process, the commons are evolving as sites of politics, power dynamics, constant negotiations and conflict. The East Kolkata Wetlands present a similar case where development agencies and the real estate sector tend to attract investment through urban and industrial development in this region while NGOs like SCOPE and PUBLIC and traditional users of the wetland are fighting for the conservation of the wetland.

In an era of urban sprawl and increasing generation of urban wastewater, the East Kolkata Wetlands present an astounding example of reimagining the way we look at wastewater and the extensive potential of peri-urban ecology to reuse it for variety of purposes thereby generating livelihoods for thousands in the process. The immense significance of this ecosystem needs to be recognized and recorded in view of the constant threat of encroachment to the EKW and thus safeguard the livelihoods of the urban poor. Where most Indian cities are struggling with setting up STPs and maintaining it in the long run, the wetlands on the eastern fringes of Kolkata, saves the municipalities of the city crores to set up a Sewage Treatment Plant, by organically treating it for ages. It must, thus, be noted that decline of such valuable resources like East Kolkata Wetland, would not only threaten the livelihood of thousands of fishermen and farmers, but would also mean loss of the city's natural waste water tank. While praise and credit must be given where it is due, it must be remembered that the government or the civil society alone can't achieve conservation of wetlands, which serve valuable services. Breaking the existing power and political dynamics and binaries, namely government versus citizen action groups which are often regarded as adversaries and not

allies, the need of the hour is a joint effort by all the relevant government ministries together with civil society organizations and the citizens of Kolkata to protect systems like EKW in a meaningful manner and deliver environmental and social justice. It will be then that celebration of days like International Wetland Day will be meaningful in true sense ensuring sustainability of the wetland and thus the society at large.

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