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Decay of East Kolkata Wetlands- A threat to socio-ecological welfare and cause for Biodiversity loss

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Abstract

The wetland ecosystems are one of the most essential ecosystems of the world which aids in water cycle replenishing on the globe (CBD, 2015; RCW, 2018). It is the largest carbon stores of the world and has the most extensive net primary productivity (Cronk and Fennessy, 2001; Joosten *et al.*, 2016). Due to its enormous beneficial services like providing food, fuel, fiber, freshwater, sewage management, pollution control, erosion protection, nutrient recycle and enriching biodiversity its referred to as 'Kidneys of the Earth' (Russi *et al.*,2013; Costanza *et al.*,2014; NIE, 2015; RCW, 2018). According to the RCW, 2018 the total wetland cover area of the globe is 12.1 million square kilometers of which 31.8% is in Asia. In India out of the total recorded 2, 01,503 major wetlands (SAC, 2011) spread in 0.15 million square kilometers, there are total 77 Ramsar wetland sites spread across 1.9 million Ha.

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Introduction

The wetland ecosystems are one of the most essential ecosystems of the world which aids in water cycle replenishing on the globe (CBD, 2015; RCW, 2018). It is the largest carbon stores of the world and has the most extensive net primary productivity (Cronk and Fennessy, 2001; Joosten *et al.*, 2016). Due to its enormous beneficial services like providing food, fuel, fiber, freshwater, sewage management, pollution control, erosion protection, nutrient recycle and enriching biodiversity its referred to as 'Kidneys of the Earth' (Russi *et al.*,2013; Costanza *et al.*,2014; NIE, 2015; RCW, 2018). According to the RCW, 2018 the total wetland cover area of the globe is 12.1 million square kilometers of which 31.8% is in Asia. In India out of the total recorded 2, 01,503 major wetlands (SAC, 2011) spread in 0.15 million square kilometers, there are total 77 Ramsar wetland sites spread across 1.9 million Ha.

In India, out of the 77 Ramsar wetland sites, 37 have been designated as of International importance. East Kolkata wetland (EKW) is one of the most popular wetland of India which got its International importance by Ramsar Convention on 19th August 2002. It is geographically located at 22°25' N to 22°40' N Latitudes and 88°22' E to 88°55' E Longitudes. It is one of the world's largest waste water fed aquaculture system spreading in 12,500 ha. EKW naturally treats the sewage fed water bodies and acts as a kidney for the city, and additionally generates livelihood (Pisciculture, agriculture and farming) and resources like fish, paddy and vegetables. EKW naturally treats around 910 MLD of sewage water, produces 13,000 tons of fish/year, 150 tons of vegetables/daily and 16,000 tons of rice/year (Sengupta, 2018; Chakraborty and Das Gupta, 2019). EKW provides livelihood to 0.15 million population living in the 37 Mouzas of this wetlands directly while its enormous potential for eco-tourism also indirectly helps to generate employment for many. EKW was formerly a marshy region that progressively changed into agricultural land some thirty to forty years ago. But in last few decades, due to unlawful development, the area became an urban landscape. The surrounding regions of EKWhas shrunk due to urbanization, unauthorized construction due torising demand for housing and alteration of land cover in recent decades due to unsustainable population expansion.

Theoverexploitation of this delicate ecosystem has caused biodiversity loss, altered soil properties, decrease in sewage quality, depreciation in fundamental physiochemical and hydrological parameters which in turn affects pisciculture and agriculture. The decreasing wastewater quality has reduced concentration of organic carbon thereby disrupting the biogeochemical cycle of water bodies, increased effluents from tanneries and industries has increased heavy metal content leading tothe bioaccumulation of heavy metalsand shrinkage of EKW has enhanced siltation thereby posing a threat to existence of EKW.

Table 1. The tabular representation of the development of EKW since its inception (EKWMA, 2020).

Year	Remarkable Events that lead to EKW formation and its recognition as international importance.
1775-76	Excavation works of silted bed of Adiganga
1800-1803	Poor drainage sysytem due to abandoned canal systems of Central lake channel and Beliaghata Khal
1829-1833	Development of circular canal and expantion of Salt lake
1853-1857	Fresh drainage outline made and acknowledged
1864-1865	Dumping yards allotment done in salt lake
1868-1872	Dumping trash and fish ghat made for first time
1875-1879	Functional operation of fish ghat from Raja's khal began
1882-1897	Dhapa lock and Pangladanga ghat creation and construction done
1906-1910	excavation of Bantala and construction of Kestopur khal
1929	commercial use and pisiculture practice began in these areas
1947-1962	Drainage sysyem of Salk lake constitued and became extensive functional
1992	Waste recycling region
2002	Designated as international importance by getting Ramsar site number 1208
2005	Govt. of West Bengal its conservation and management Ordinance 2005 (No. VII)

The pisciculture practice at EKW yields 10,915 metric tons of fish annually (Raychaudhuri *et al.*, 2008) which is exposed to these heavy metals. The bioaccumulation of heavy metals in fishes might acts as a route for heavy metal entry to human body causing health issues like anemia, inflammation, swelling around the eyes, inflammation of the lungs, cataracts, cognitive deficits, diarrhea, and a decrease in appetite in consumers (Qasem *et al.*, 2021; Lachowicz *et al.*, 2021).

Table 2. The socio-ecological and socio-economic contribution by EKW (EKWMA 2020).

Sewage water treatment/Daynaturally by EKW.	Cost saving for sewage treatment/year
910 ML	400 CRORES

Table 3. Tabular representation of risk factors and its impact on EKW (Mondal *et al.*, 2022).

Risk factors contributing to EKW transformation	Impact of risk factors
Urban expansion	Shrinkage of net area cover of EKW
Conversion of wetlands into agricultural plots.	Reduce of wetland area thereby increasing siltation load and untreated sewage water amount
Aquaculture and Pisciculture practice.	Reduces biodiversity
Population density and growth	Encroachment, acquisition and wetland conversion
Land use and cover changes	Pressure for socio-ecological sustenance.

The sustainable practice can prevent the inflow of toxic ingredients into the wetland ecosystem, help in the sustenance of the healthy microbial community, propagate the production of resources smoothly and enhance the effectively of these ecosystem.

Biodiversity profile in EKW

The earliest records of floral diversity were dated long back in 1927 by Biswas. Later after a long gap, studies were conducted by Dasgupta, 1973 on the vegetation of this region.

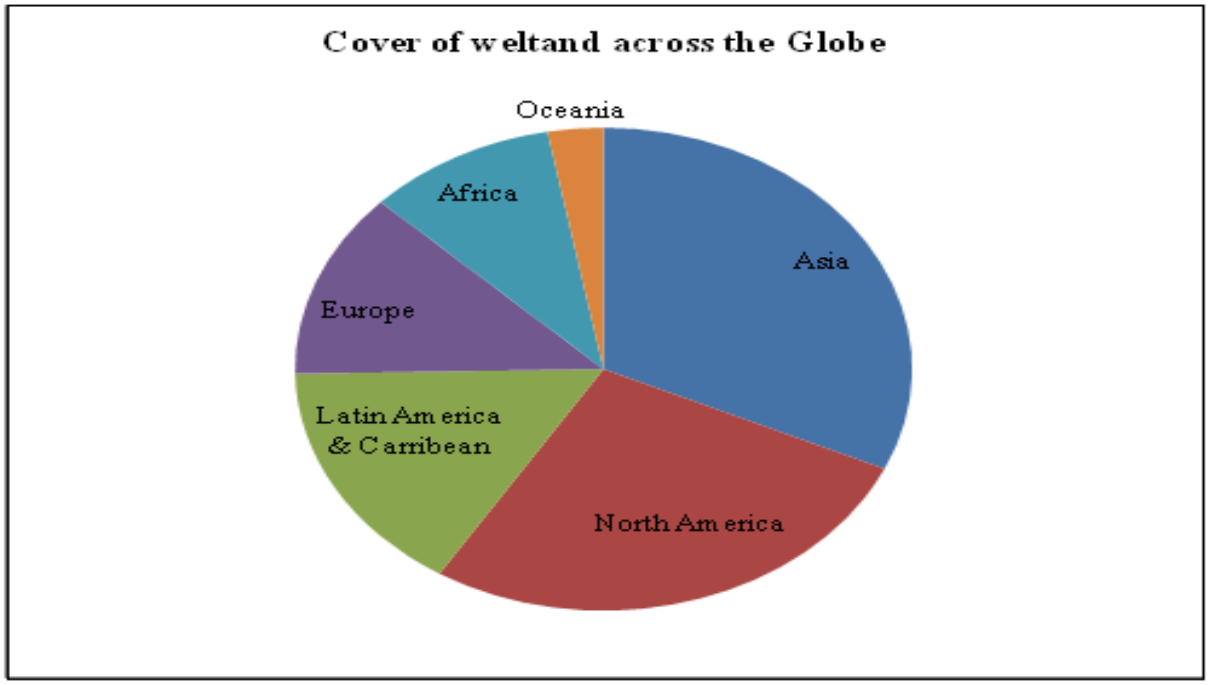

Fig. 1. Wetland cover across the globe (Davison *et al.*, 2018; RCW, 2018).

In 1993, Venkataraman and Das studied few cladocerans while De and Sengupta recorded some species of coleopterans.

The impact of heavy metals and microbial flora on soil microfauna were investigated by Hazra *et al.*, 2007.

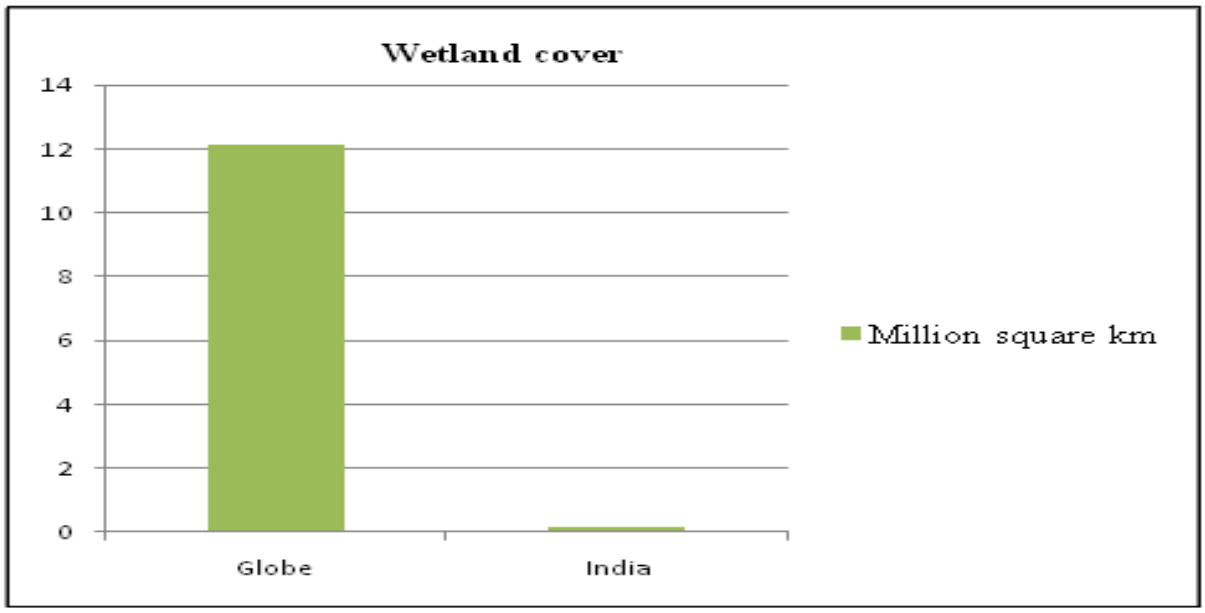

Fig. 2. The spread of wetland cover in the globe to that in India ((Davison *et al.*, 2018; RCW, 2018).

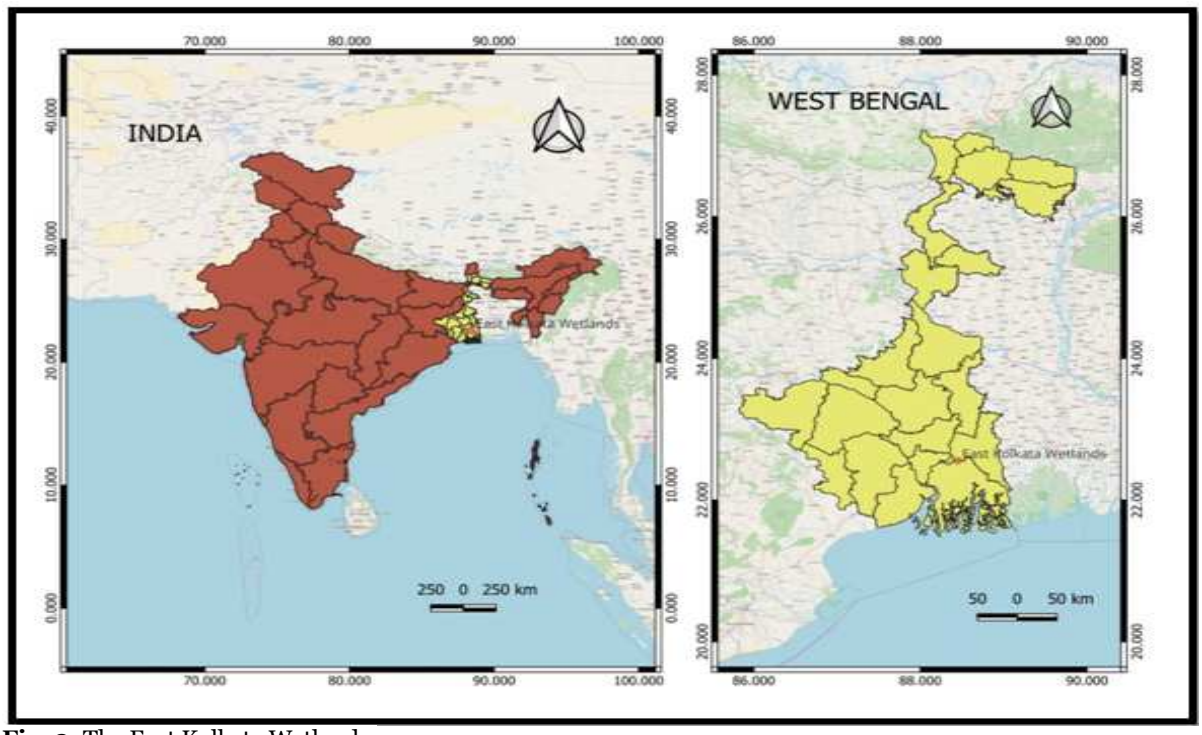

Fig. 3. The East Kolkata Wetlands.

Faunal studies from EKW were recorded since 1850s. Molluscs were reported from ponds of Port canning (Stoliczka, 1869); hydrozoans, polyzoans, medusoids and actinarians (Annadale 1907a, b, c, d); aves (Bhattacharya *et al.*, 2008); Butterflies (Chowdhury and Soren, 2011); Macrozoobenthic community (Roy *et al.*, 2014); euglenophytes (Roy and Pal, 2016); floral and faunal diversity (Sengupta, 2018). Due to agricultural practices around 60 species of agro-flora were reported while due to invasion 61 alien species were reported (Karthikeyen *et al.*, 2020).

The wide range of services (Socio-ecological welfare) provided by the EKW.

Discussion

Threats to EKW**:** The phenomenal increase in population density, encroachment and land

acquisition has made EKW very vulnerable (Sarkar *et al*., 2016; Mondal *et al*., 2017; Ghosh and Das, 2018). The recorded data shows the decrease in the water bodies and adjacent areas to urban clusters. The conversion of these effective areas into concrete towers is not only harmful for the city but also poses risk to wastewater management. Siltation and its impact**:**

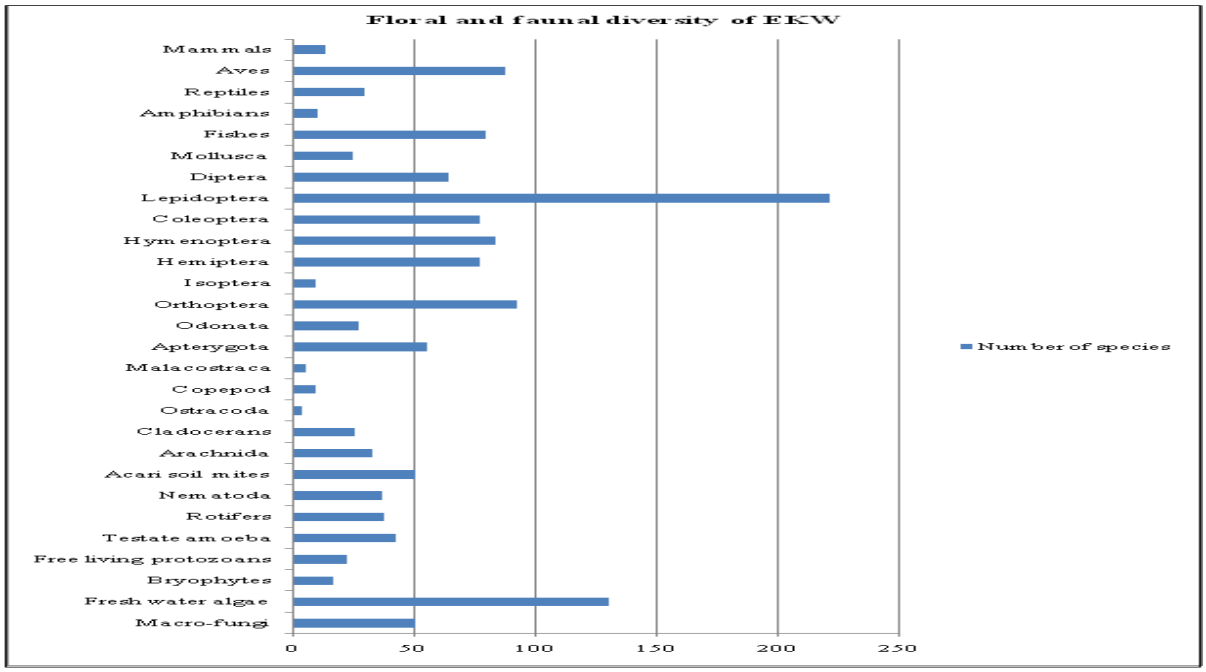

Fig. 4. The Biodiversity profile of East Kolkata Wetland (Chandra *et al*., 2020).

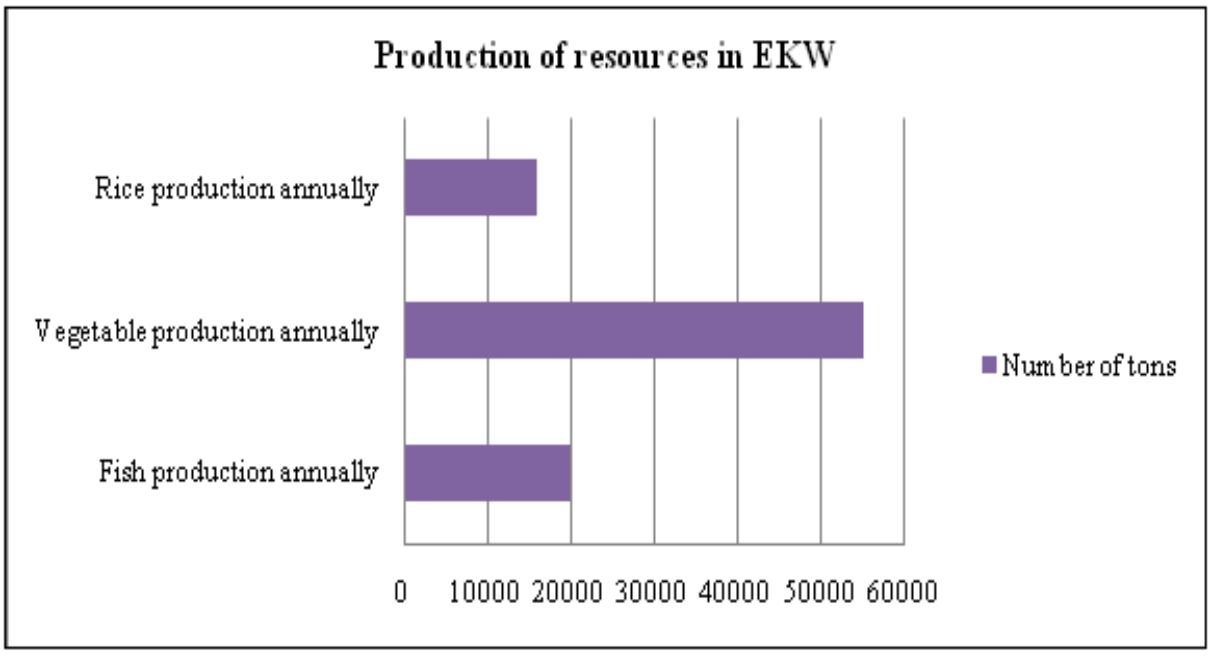

Fig. 5. Annual production of fish, vegetables and rice from EKW (EKWMA, 2020).

The shrinkage of the East Kolkata Wetland (EKW) increased effluent input into the area and decreased microbial diversity results in decrease in sewage water treatment capability.

This results in increased siltation load. The average depth in the EKW is 1 meter but there is an increased siltation of 15-20 cm leading to decrease in average depth of water level in the EKW.

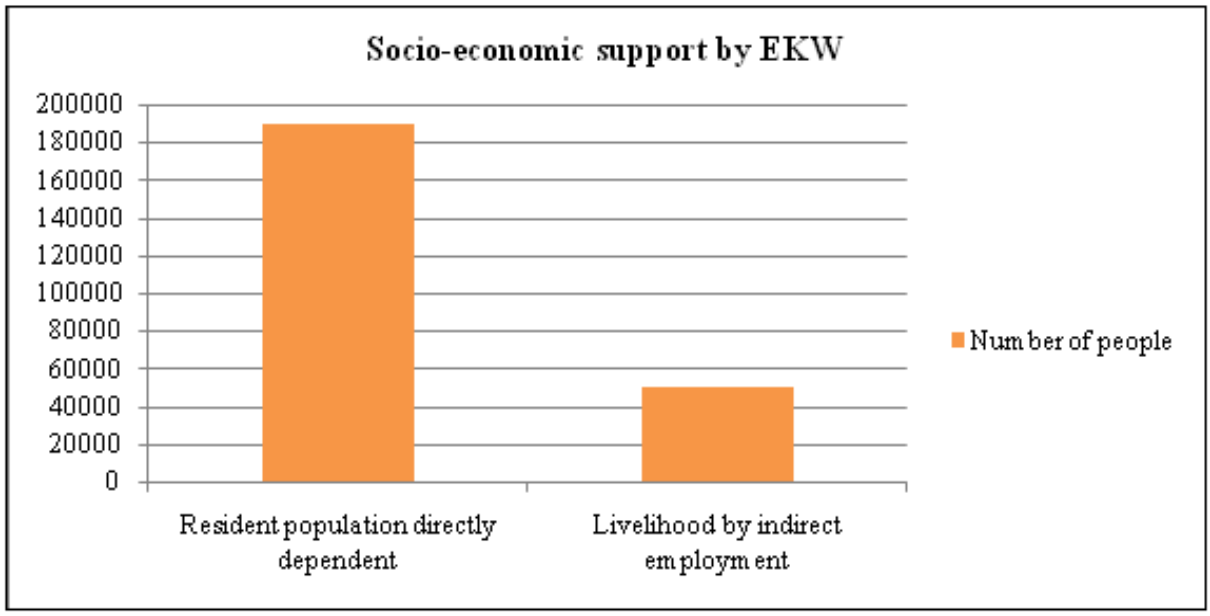

Fig. 6. Population Direct dependent (Pisciculture, agriculture and farming) and indirect (eco-tourism) dependent for livelihood and employment in EKW.

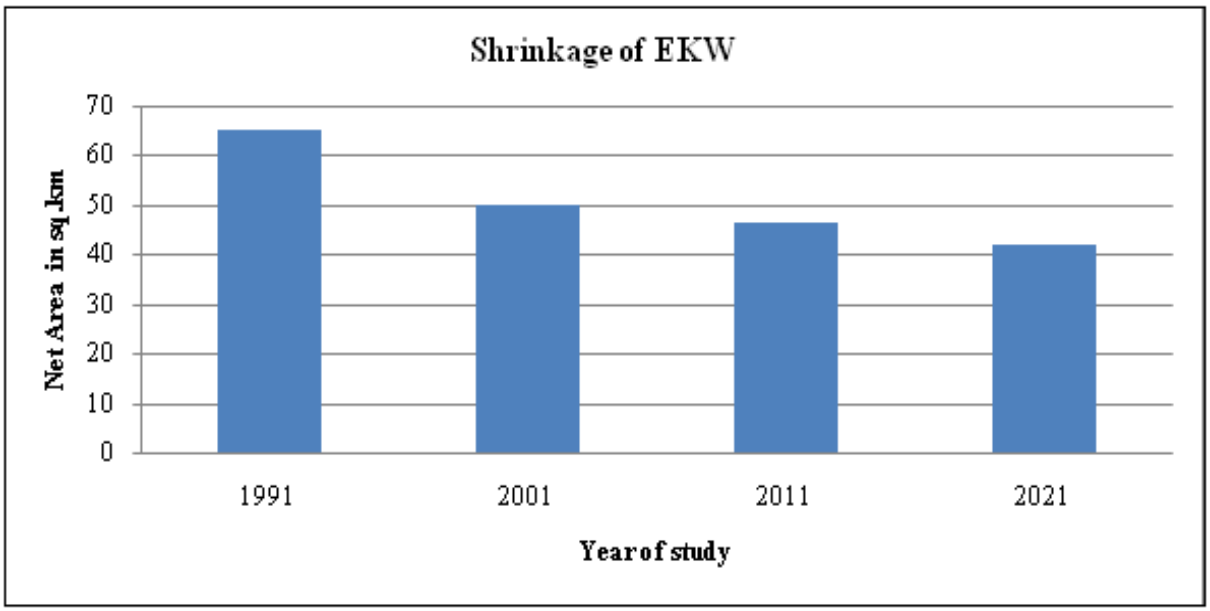

Fig. 7. The net area in sq. km recorded during the years (Mondal *et al.*, 2022).

The canal and there connectivity are disrupted due to road construction which leads to decrease in the natural filtration process of microbial diversity aiding in EKW sewage treatment. The sewage water gets naturally treated due to presence of hydrological ambience in the EKW; and the output is constructively endowed in form of resources serving the mankind economically and ecologically. Over Siltation damages the hydrology and ecological harmony in the EKW, and threatens the sustenance of this fragile ecosystem.

Conclusion

The East Kolkata Wetlands (EKW) is the Kidney of Kolkata which protects the socio-ecological health and socio-economic well-being of resident in and around it.

The anthropogenic activities along with multiple factors led to shrinkage of EKW needs to be more strictly regulated and monitored. Siltation and increased pollutant load needs to get mitigated in order to manage its health and effectively.

Some of the suggested measures to protect the EKW are incorporated here to mitigate the shrinkage challenge.

Measures to protect EKW:

1. Preventing dumping of untreated household and industrial waste in the area.
2. Increased awareness campaign among stake holders and natives to protect EKW.
3. Stringent rules and regulations to prevent its encroachment and conversion.
4. Regulate Eutrophication and pollution to protect biodiversity.
5. Maintain healthy condition of EKW to enable its provision to provide wide range of socio-economic and socio-ecological services.
6. Regular monitoring and effective management by EKWMA to preserve EKW and its biodiversity.
7. Incorporation of local community and enhance their participation along with local and adjacent administrative authorities in protecting EKW.

The wetland is not merely a place for ecological significance but social sustenance also. With the severe changes in the environment due to anthropogenic inputs and climatic turmoil the ecosystem is more vulnerable and susceptible.

The joint effort of people and the authorities together will bring some possible measures to curb the damage. Waste Water purification is a cost consuming process, which gets naturally treated in these wetlands and saves a huge fund of the government. Hence its worth should be appreciated and conserved.

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