

Spatio-temporal change in land use and land cover pattern and its impacts- A case study of East Kolkata Wetland



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Abstract- Designated by Ramsar convention, East Kolkata Wetland is the largest natural sewage treatment system that is ecologically productive and provides a unique ecosystem with varieties of flora and fauna. East Kolkata wetland is bounded by Kolkata megalopolis in the west and satellite township Rajarhat Newtown in the north. The Kolkata metropolitan city generates more than 800 million litres of sewage everyday which is purified by the natural purifier, East Kolkata Wetland. It is said to be the 'Kidney of Kolkata' as it also sequesters carbon and absorbs the city's storm water during floods.

The importance and benefits of East Kolkata Wetland is immense, but the sad irony lies in the fact that due to certain unplanned and rapid urban expansion of Kolkata city, this great ecosystem is under threat to urbanisation. There has been significant challenge for East Kolkata Wetland with the expansion of Kolkata city and also increase in urban landfills. East Kolkata wetland is bounded by Kolkata megalopolis in the west and satellite township Rajarhat Newtown in the north. In this perspective, the main objective of the paper is to study the temporal land use changes of 30 years and factors responsible for the rapid transformation. Land use and land cover map has been prepared to observe the temporal changes along with the analysis of the perception of local people.

Keywords- *Urbanisation, Environment, Land Use, Land cover, Wetland*

I. INTRODUCTION

Wetlands are ecologically productive areas supporting rich biodiversity. They are of great natural importance and also beneficial to human beings from all aspects. It helps in balancing the ecological system, absorbs carbon dioxide, purifies the waste water and also provides food for the fishes. The economic benefits for humans include a vast range of resources like aquaculture, horticulture, agriculture and ecotourism benefits.

East Kolkata wetland is a unique ecosystem situated in the eastern fringe of Kolkata city that supports rural livelihood and a home to a variety of species. But, in this age of globalization, with the expansion of urban areas there has been a large-scale change in the land use land cover pattern observed in the past decades. However, the impact has been seen in the present

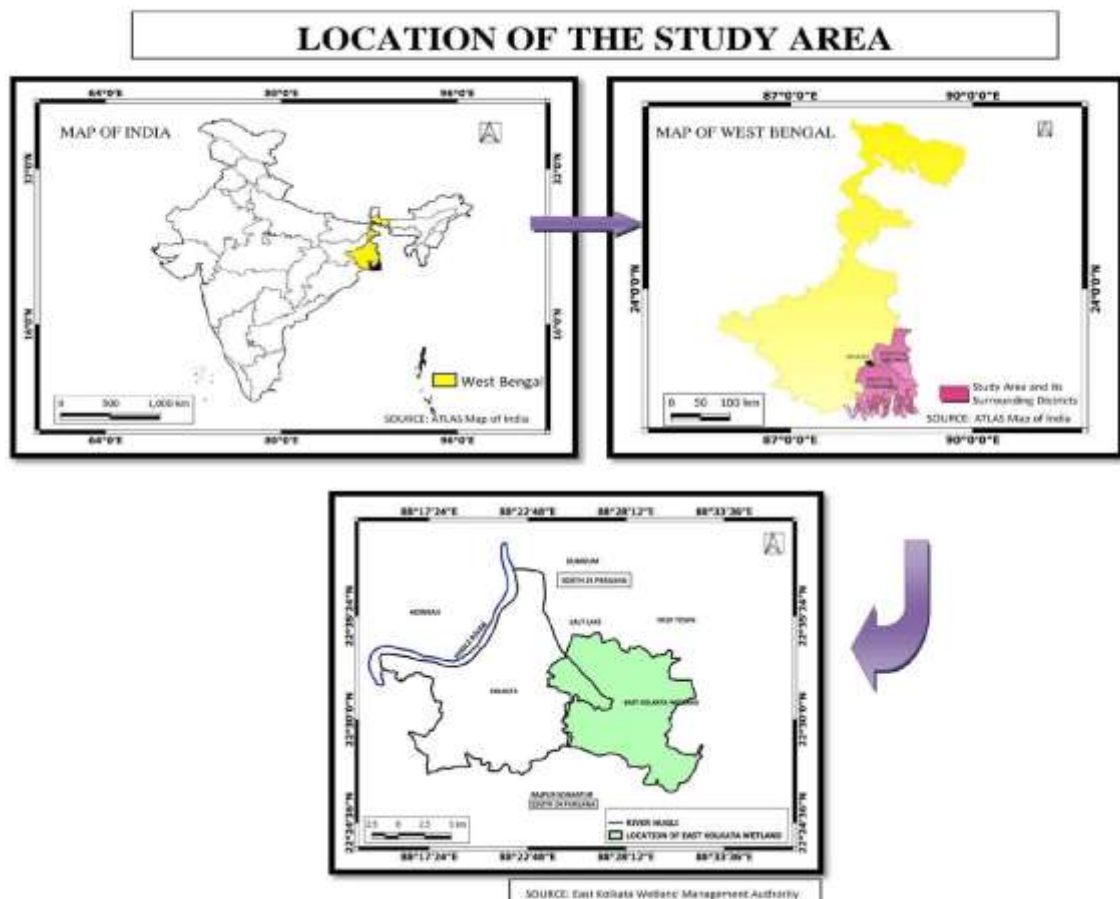
day and it is expected that in future this impact will be intense. In order to accommodate the increasing population of Kolkata city, East Kolkata Wetland has been threatened. However, after the Ramsar convention designation certain policies have been adopted to protect the region but still many illegal activities are widely observed. This paper focuses on the temporal changes in the land use and land cover pattern from 1991- 2021 and the factors contributing to the changing nature of land use and land cover. East Kolkata Wetland is important for rural livelihoods, as their livelihoods are dependent on the primary activities. The changing pattern of the wetland area will create problems environmentally, economically as well as socially. It is very important for us to preserve the wetland area because of its great importance and sustainability. There is also a need to take a strong initiative for the conservation of such a unique ecological system.

II. STUDY AREA

The East Kolkata wetland is situated in the eastern part of Kolkata city. It is a rural urban fringe that covers an area of 12500 hectares. It lies between 22°25' N to 22°40'N latitude and 88°20'E to 88°35' E longitude. After the designation as international significance in 2002 the wetland area covers 37 mouzas.

III. OBJECTIVES

1. To study the changing nature of land use land cover pattern of 30 years from 1991- 2021
2. To study the factors responsible behind changing pattern of land use and land cover and associated problems



IV. ANALYSIS AND DISCUSSION

Metropolitan cities are the centre for productivity and greater opportunities that contribute to the nation's growth and accelerate economic development. In India metropolitan cities emerged from pre colonial times where it first developed in the core area and later it spread outwards to the peripheries and ultimately urban expansion continued with its base attached to core. Since the economic reforms in the 1990s the metropolitan cities in India have been characterized by the exponential growth and rise in population concentration. Partition in India caused migration of huge refugees from the surrounding areas that played an important factor behind the urbanisation of metropolitan cities.

Kolkata is one of the largest metropolitan cities in India that experienced rapid growth until 1961-1971. Since the pre colonial times, the Kolkata urban agglomeration expansion started cantered along the Hugli River. With the development of trading transport many settlements emerged along the banks of the Hugli River. Gradually the British Empire expanded during the second phase of colonial rule. With the emergence of industrialization, transportation networks developed that connected Kolkata with different parts in India which resulted in the development of commuting that also became a factor behind the expansion of Kolkata city. By 19th century the partition led to intense population pressure in Kolkata, the Calcutta metropolitan planning organisation (CMPO) developed for the stable environment around Kolkata, but with increase in population over years during the second plan of Kolkata metropolitan development area planned to develop a satellite township in the eastern fringe of Kolkata to release the pressure from core. For this satellite township, The Rajarhat Newtown project has been developed on the eastern part of Kolkata.

In this perspective, East Kolkata wetland has been juxtaposed between Kolkata and Rajarhat Newtown. East Kolkata wetland has been bordered by these two big industrialised centres and the area became almost saturated making the wetland attractive for the land sharks. Transportation networks from eastern metropolitan bypass and flyovers made the wetland area accessible and easy connection with the main city Kolkata. This became a threat to the wetland area. East Kolkata wetland is surrounded by Kolkata to the west, Saltlake to the north-west and Rajarhat Newtown to the north-east. All these factors contributed to the urban explosion and imposed a real threat on the wetland area. It has become difficult to protect the East Kolkata Wetland area from land sharks and real estates.

V. MAJOR FACTORS RESPONSIBLE FOR THE URBAN EXPLOSION OF EAST KOLKATA WETLAND

- Close proximity to main city Kolkata
- Favourable geographical locations
- Favourable environmental and climatic factors
- Good communication and transport facilities
- Financial hub
- Rise in it real estates

Kolkata wetlands are disappearing at a rapid rate 15 % more than global average, if this trend continues the remaining portion will be destroyed in the next decade (Salam A and Dasgupta A). In recent news Subhro Niyogi, tells that the two storied building of East Kolkata

Wetlands have been demolished and also construction of metalled road continued. They say that the preservation of East Kolkata Wetland is challenging as people want to convert the land into real estate and sell the land and buy it. Dhruba Das Gupta, a wetland researcher said in 1997 the total berries counted were 264 which decreased to 200 in 2014 and it will decrease in future.

The story of Aug 24th, 2021, Times of India/ Kolkata news says that the land sharks were attempting to grab 5 bighas off bypass. The KMC environment department team found the 5 bigha pond where water was pumped out then walled up using corrugated sheets. The encroachment of East Kolkata Wetland has increased after the pandemic. During late 80s Kolkata had 8700 water bodies but in present there are around 3500. Due to the impervious surface waterlogging became a serious problem. Water logging also witnessed along the E.M. Bypass, following disappearance of sewage farms and agricultural lands that shows a massive conversion of wetland area. Paschim Chowbaga, Nonadanga, Chowbagha, Jagatipota, Mukundapur, Atghara, Kulberia, Beonta, Thakdhari, Dhapa manpur, indicating rampant construction.

VI. BENEFITS FROM EAST KOLKATA WETLANDS FOR HUMANBEINGS

RESOURCES	PRIMARY ACTIVITIES	ECOTOURISM	SOURCE OF EMPLOYMENT	EDUCATION AND RESEARCH
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SEWAGE FED FISH FARMING	HORTICULTURE	CATTLE REARING	WASTE COLLECTORS
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RESOURCES	fish farming, agriculture, waste farming and other recreational activities
SEWAGE FED FISH FARMING	This is the prime resource of the wetland. Kolkata city generates huge sewage which is then received by over 200 fish ponds for culturing fish. Nutrients are removed in this process and wastewater treatment is carried out in this way. In January, once in 3 to 4 years through natural evaporation the ponds are left dry in rotation, on the dry bed vegetables are grown.
AGRICULTURE	Agriculture is the major livelihood practice in east Kolkata wetland. Rice is cultivated using water from the bheri. Many have their own farms, also to earn extra incomes they work on other owned farms.
HORTICULTURE	More than 1000 farm plots are there round Dhapa Manpur area that provides employment. The soils are extremely fertile due to the organic waste received that forms the base of horticulture.

WASTE COLLECTORS	. the soiled waste generates from Kolkata city are dumped in the Dhapa area as garbage dumping ground which provides employment to over 20000 people
ECOTOURISM	Due to its soothing climate and fresh air the wetland area became attractive for ecotourism. Eco Parks, picnic spots water parks became famous here
MEDICINAL VALUE, HOUSEHOLD ITEMS	Due to its rich biodiversity it harbours a variety of plant species economically. Plants have immense medicinal value. Some plant species are <i>Enhydra fluctuans</i> , <i>Phragmites karka</i> <i>Ipomea aquatica</i> <i>Bacopa monnieri</i> <i>Typha angustifolia</i>

VII. NATURAL IMPORTANCE OF EAST KOLKATA WETLANDS

ENORMOUS WATER HOLDING CAPACITY	Being the natural depression the east Kolkata wetland has an enormous water holding capacity. During the flood it absorbs the city's stormwater.
REMEDATING THE WATER QUALITY	The wetland system remediates water quality by reducing biochemical oxygen.
CLIMATE REGULATION	Excess flow from rainwater runoff absorbed by the wetland therefore protects the city from flooding.
ACT AS LUNGS OF KOLKATA CITY	It is called the lungs of Kolkata because it purifies the air that flows over the water body.
CARBON REDUCTION	The plankton plays an important role. It sequesters over 60% of carbon.

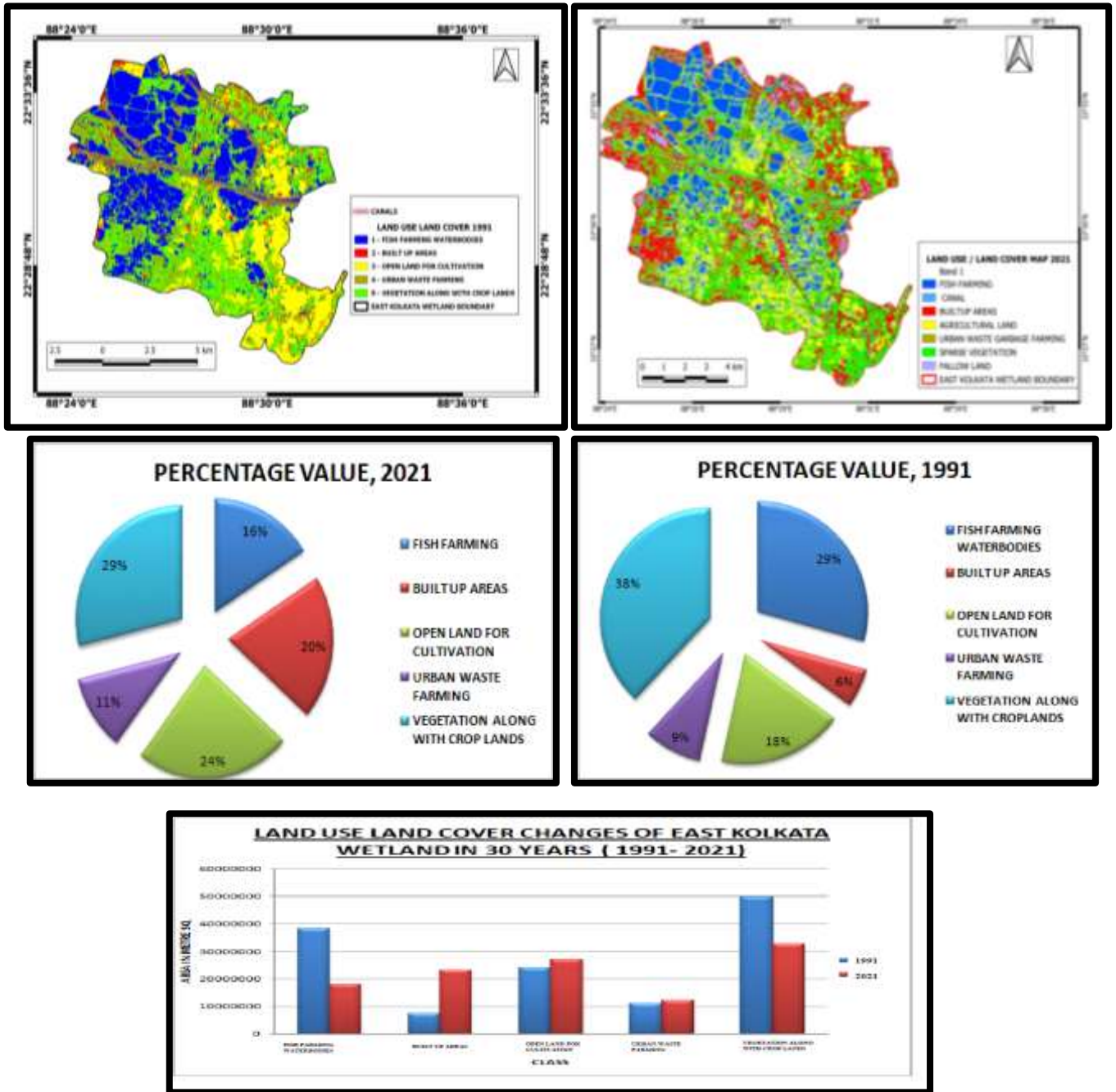
VIII. FACTORS AFFECTING THE LAND USE LAND COVER CHANGE OF EAST KOLKATA WETLAND

URBANISATION	INCREASE IN POPULATION PRESSURE	RAPID RISE IN TECHNOLOGY,	INCREASE IN URBAN LANDFILLS
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Since the post independence period, the major transformation of wetland into real estate has taken place. Construction of satellite township, Rajarhat Newtown and other projects affected the rural-urban fringe interlinked with environmental impact in future. Salt Lake Township began to grow in the 1950s, with the population increasing in Kolkata, in the 1960s; about 58 fisheries of north salt lake area covering 44 hectares were converted to concrete for various residential, industrial purposes to meet the demand. By 1970 more than 2000 hectares had been converted to build up areas. In the eastern part of Kolkata, east Kolkata Township and Patuli Township were created. Since 1950 with the ever increasing population, industrialization, modernization, needs of residential spaces vast acres of the wetland area has been encroached upon and still continuing.

IX. ANALYSIS OF LAND USE LAND COVER CHANGES OF EAST KOLKATA WETLAND

Urban expansion of Kolkata leads to the shrinkage of wetlands over the years. Rapid industrialization, urbanization focused on conversion of land use to built-up areas results in a deep impact on the environment. The East Kolkata Wetland is the natural sewage



treatment system which is degrading at a massive rate due to urban encroachments.

The 30 years temporal change in the east Kolkata wetland shows that from 1991 to 2021 there has been rapid increase in the built up areas from 6% in 1991 to 20% in 2021. The major conversion to built up areas is noticed in the north western part of east Kolkata

wetland, close proximity to Kolkata city and satellite township Newtown Rajarhat. Industrialization and modernization in the Kolkata and Newtown area increased the chances of real estate business in east Kolkata wetland.

Behind the change in land use, the real estate business is the main factor. Increase in built-up area towards the eastern part of Kolkata engaged with many environmental impacts.

There has been deterioration of fisheries in the last 30 years. Fisheries have decreased from 29% to 16%. Selling of aquaculture ponds and converting it to the built-up area is the main reason behind the deterioration. With the increase in population over the decades, the urban landfills have been increased. East Kolkata wetland is used as a dumping ground of urban waste. With the rich soil fertility, organic farming is practiced here in the Dhapa Manpur region of East Kolkata Wetland. The real estate business is one of the main reasons behind the changing pattern of land use. Loss and deterioration of wetland, Ramsar convention in 2002 designated 12500 acres of wetland area under protection. The land use changes have decreased after designation as many laws have been enacted to preserve the valuable services provided by the wetlands but the illegal encroachments continued. Metro railways, concrete roads, and residential complexes all this led to decrease in aquaculture farms and open lands. The rural livelihoods depending on east Kolkata wetland suffer a lot.

X. IMPACTS OF LAND USE AND LAND COVER CHANGES IN EAST KOLKATA WETLAND

Change in land use and land cover impacted the species in wetland	Land use land cover change has affected avian life. Many species are no longer seen. A recent study says that about 129 species are extinct.
Withdrawal of groundwater	Unsustainable withdrawal of groundwater due to urbanization, aquaculture purpose, agriculture has posed a risk of land subsidence
Forcing migratory birds to change their course	Conversion of wetland to built-up area over the decades has forced the migratory birds to change their course. About 1.20 lakh of 63 species have migrated to west Bengal from Siberia and China to get rid of cold winter months. (The Hindu, 2004).

XI. CONCLUSION

This research focused on spatio- temporal changes of land use and land cover of 30 years and associated factors affecting it. East Kolkata wetland management authority established for conservation and management of wetland areas to prevent natural calamities, conservation of wetland is very important. In the study it is found out that many aquaculture ponds, open lands have been converted to build up areas. To promote ecotourism, the northern part of the wetland is converted to many eco parks, amusement parks, and picnic spots. Concretes are

replacing the green and blue spaces. The major threats are rapid urban expansion of Kolkata city. Large part of the wetland has been converted to built-up areas. Especially the western and northern part of east Kolkata wetland. Vast acres of land has been converted to built-up areas. Areas of Paschim Chowbaga, Mukundapur, Atghara, Ranabhutia, Jagatipota are mostly affected areas. Ecology of the wetland is hampering due to constant land use change. Satellite images showed that a large part of the landfill area has been converted to build up area. Livelihoods are also dependent on the collecting of wastes. These major conversions also hampered livelihoods to great extent. East Kolkata wetland is an example of man-environment interaction as without any expense Kolkata gets a large volume of treated water and fresh fish and vegetables. Important steps have to be taken for the wetland preservation. With the increasing effects of global warming and climate change east Kolkata wetland needs to be preserved.

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