

IMPACT OF URBAN EXPANSION ON EAST KOLKATA WETLAND -A COMPARATIVE ANALYSIS

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Abstract - The East Kolkata Wetland, a Ramsar Site, is a natural ecosystem that serves as a natural sewage treatment system and provides a diverse range of Services to its surrounding areas. It is situated between the Kolkata megalopolis in the west and the satellite township in the north and it is responsible for purifying of over 800 million litres of sewage generated by the Kolkata metropolitan city each day. This wetland plays a crucial role in maintain the ecological balance of the region and is often referred to as the Kidney of Kolkata. In addition, the wetland also sequesters carbon and absorbs the city's storm water during floods.

However, the rapid urban expansion of Kolkata city poses a serious threat to this valuable ecosystem. There has been significant challenge for East Kolkata wetland with the expansion of Kolkata city and also increase in urban landfills. In this perspective, the paper aims is to study the spatial variation of degree of urbanisation of East Kolkata wetland taking distance as a factor from Kolkata city to show the impact of urbanisation on East Kolkata Wetland. As the degree of urbanisation varies, so a comparative analysis has been done by taking four areas from East Kolkata wetland based on their distance from the Kolkata city.

Key Words: East Kolkata Wetland, Urbanisation, Interaction, Distance

1. INTRODUCTION

Wetlands are unique ecosystems that play a crucial role in maintaining ecological balance and supporting a diverse range of plant and animal life. Not only do they serve as a carbon sink, but they also filter wastewater and provide a habitat for fish. Additionally, wetlands offer many economic benefits to humans, such as opportunities for agriculture, horticulture, aquaculture, and ecotourism. However, wetlands located near or within urban areas face numerous threats due to rapid urbanization. One such example is the East Kolkata Wetland, which is situated on the Eastern fringe of Kolkata and supports the livelihoods of rural communities as well as various species of flora and fauna. East Kolkata Wetland acts as a Natural Sewage Treatment Plant. Despite efforts to protect this region following its designation as a Ramsar site, illegal activities continue to pose a threat to its sustainability. In this study, we aim to examine the changes in land use and cover patterns in the East Kolkata Wetland area over the period of 2005-2022, as a result of Kolkata's urban expansion.

2. STUDY AREA

Kolkata City is located by the side of River Hooghly in Ganga Delta Region. The East Kolkata Wetland is situated in the eastern part of Kolkata City. This is a rural-urban fringe area which belongs to the old course of Bidyadhari River. The wetland area covers 37 mouzas, most of which belongs to North and South 24 Parganas. To analyse the impact of urban expansion on the East Kolkata Wetland away from the Kolkata city, four particular areas from different directions have been chosen. These are Paschim Chowbhaga, Kheyadaha, Dharmatala Pachuria and Garal.

3. OBJECTIVES

Main objectives of this study area:

- To measure the interaction between Kolkata and major towns in West Bengal that causes urban expansion which affect the surrounding Urban-Rural fringe area including East Kolkata Wetland
- To show the impact of distance on the interaction of Kolkata with nearby Towns or cities and its impact on the East Kolkata Wetland.
- To conduct a comparative analysis of the Spatio- temporal changes in land use and land cover patterns focusing four areas of East Kolkata wetland taking distance as a factor from Kolkata City.

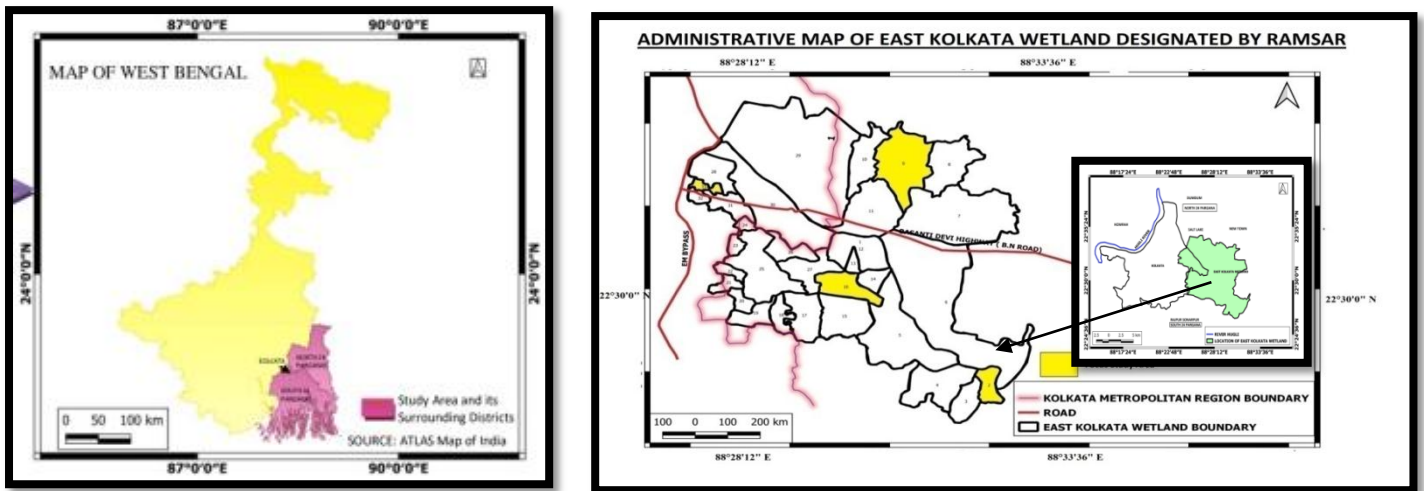


Fig -1: Location of the Study area

4. DATA AND METHODS

- **INITIAL STAGE:** In the initial stage detailed literature study had been done. Pilot survey was done on the study area for better understanding.
- **INTERMEDIATE STAGE:** In this stage primary data were collected from field survey and secondary data were collected from different sources. (Table: 1)
- **FINAL STAGE:** All the maps were processed using different software and the data were tubulised according to the research plan and different diagrams were prepared. (Table:2)

Table -1: Primary and Secondary Data Collection

PRIMARY DATA COLLECTION	SECONDARY DATA COLLECTION
<ul style="list-style-type: none"> • Semi-structured questionnaire based Survey. • Empirical observation around the whole area has also been done to gather information. 	<ul style="list-style-type: none"> • Population data were collected from Census of India, 2011. • LANDSAT images have been downloaded from USGS Earth Explorer. LANDSAT 8 and 9 OLI TRS and LANDSAT 5 images have been downloaded for the Land use and Land cover classification. <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;"> <p>For the preparation and processing of Land use and Land cover maps, supervised classification has been done using QGIS 3.18 software</p> </div> <p style="text-align: center;">↓</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;"> <p>Area calculation for changes in different Land Use and Land Cover has been calculated using QGIS 3.18 Software</p> </div>

Table -2: Statistical Techniques and Softwares Used for the Study

STATISTICAL TECHNIQUES	SOFTWARES USED
RANDOM SAMPLING	MS EXCEL
GRAVITY MODELS	QGIS 3.18
CORRELATION REGRESSION MODELS	GOOGLE EARTH PRO

5. RESULTS AND DISCUSSIONS

Kolkata is one of the largest metropolitan cities in India that experiences rapid growth since 1971. With the emergence of industrialization, transportation networks developed that connected Kolkata with different parts in India which resulted in the development of high level of communication, which is a factor that leads to rapid development of this region. East Kolkata Wetland has been bordered with Kolkata City and Rajarhat Newtown. Being close to these two important centres, this wetland area is drew attention of the land sharks.

5.1. KOLKATA-AS A FUNCTIONAL REGION

According to the Population Potential Analysis, the interaction between different places is directly proportional to the Population size and inversely proportional to the distance between them. The analysis reveals that highest potential value observed around Kolkata and the population potential decreases as we move outwards from the core area. It is noteworthy that areas with high population are also characterized by high levels of interaction, including transportation networks, population flows and supply of goods. East Kolkata wetlands located between the high potential zone bordering Kolkata to the west and Rajarhat- Newtown to the north-east appears to be attractive destination for land developers. Based on the analysis, it can be inferred that East Kolkata Wetlands could serve as a strategic location for real estate development due to its proximity to the high potential zone.

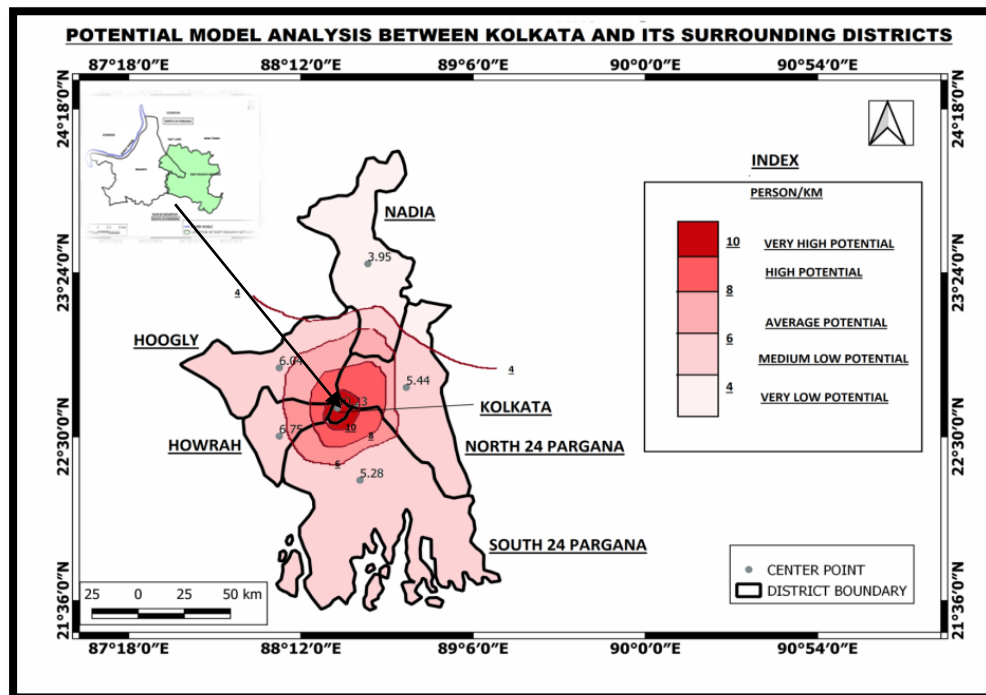


Fig -2: Potential Model Analysis

5.2. IMPACT OF DISTANCE ON THE INTERACTION WITH NEARBY TOWNS FROM KOLKATA CITY

Table -3: Distance and Interaction Value

TOWNS/ CITIES	DISTANCE (km)	INTERACTION
1. HABRA	43.76	0.0715
2. SHANTIPUR	69.63	0.0267
3. BARDHAMAN	79.74	0.0245
4. HALDIA	99.4	0.0092
5. KHARAGPUR	119.37	0.0091
6. BAHARAMPUR	164.56	0.0050
7. MALDAHA	267.4	0.0019
8. SILIGURI	447.99	0.0015

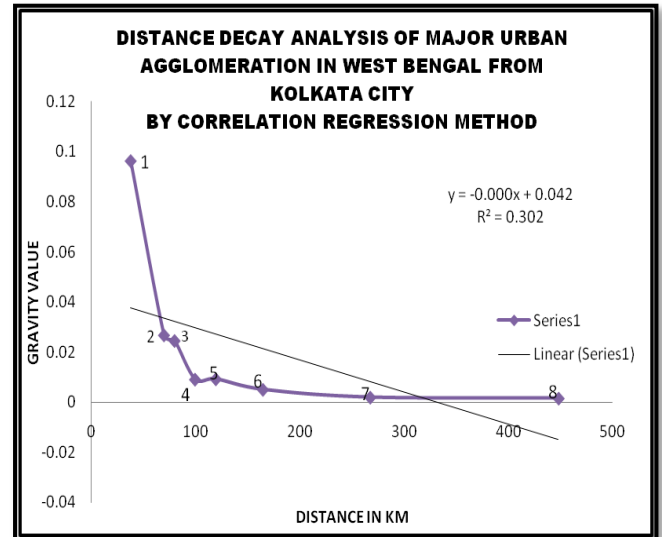


Chart -1: Impact of Distance on the interaction of goods and services

INTERACTION= (P1×P2)/D; Where, P1= Population of Kolkata City, P2= Population of other city, D= Distance

Interaction of goods and people, economic activities is inversely related with the distances between the places. It can be observed from the table 3 and Chart- 1 that with increasing distances, values of interactions are decreasing. The highest interaction value is with Habra and the lowest is with Siliguri. This happened with the East Kolkata Wetland also, with the increasing distance from the main city Kolkata, interaction of goods and people, economic activities area decreasing. (Table: 4, Chart: 2)

5.3. IMPACT OF DISTANCE ON THE INTERACTION WITH THE FOUR DIFFERENT AREAS OF EAST KOLKATA WETLAND FROM KOLKATA CITY

Table - 4: Distance and Interaction Values within East Kolkata Wetland Regions

PLACE	DISTANCE (km)	INTERACTION
1. CHOWBHAGA	8	0.04716
2. DHARMATALA PANCHURIA	12.8	0.00638
3. KHEYADAHA	16.4	0.00322
4. PRATAPNAGAR	27.2	0.00106

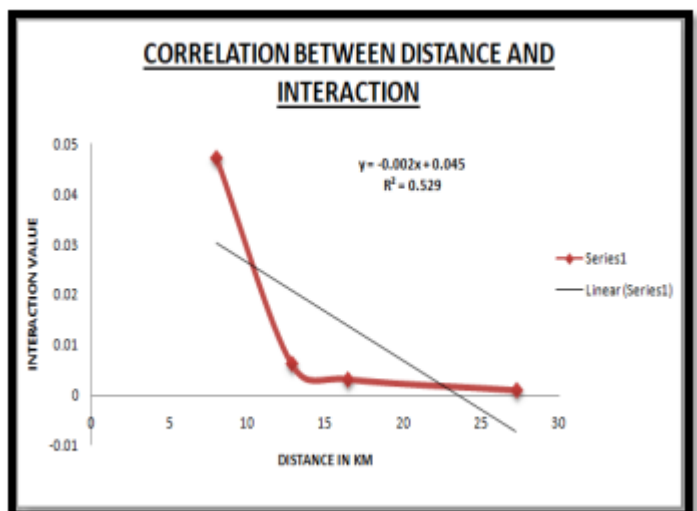


Chart -2: Correlation between Distance and Interaction of Services and goods

INTERACTION= (P1×P2)/D; Where, P1= Population of Kolkata City, P2= Population of other Places, D= Distance

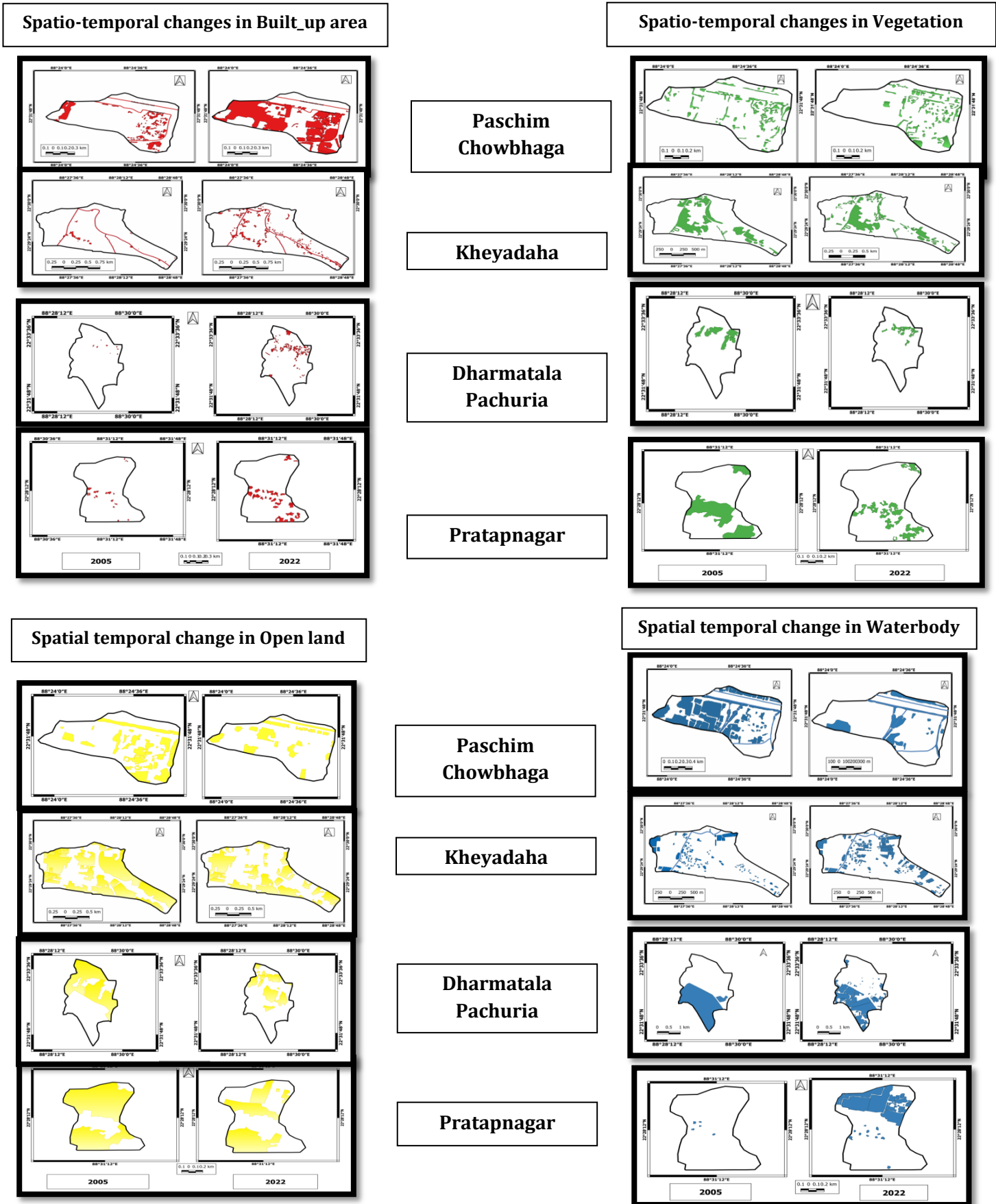


Fig -5: Spatio-Temporal Changes of Landuse and Land Covers in the Focused areas of East Kolkata Wetland

Chowbhaga and Dharmatala Panchuria have strong interaction with Kolkata City, which is mainly due to the close proximity; hence the interaction value is high and strong. Close proximity to the city, Chowbhaga have witnessed high growth in property development. Dharmatala Panchuria has witnessed growth in ecotourism development. EM bypass that connects the main city Kolkata serves the area with good transportation networks and connectivity that allows population flow. As a result property developers real estate agents prefers this areas for development. These two places are under threat to rapid urbanisation and property developers because of adjacent to the Kolkata city.

Whereas on the contrary the distance between Kheyadaha and Pratapnagar from Kolkata is high, as a result the interaction value is less. These two areas are less threatened due to urbanisation. As the distance is higher from the main city Kolkata and satellite township Rajarhat Newtown, the population flow is quiet low and hence less congestion. (Table: 4, Chart: 2)

5.4. COMPARATIVE ANALYSIS OF TEMPORAL CHANGE IN LANDUSE AND LANDCOVERS (2005- 2022)

The comparative analysis examines the Spatio-temporal changes in water bodies, built_up areas, vegetation and open land to determine the degree and intensity of impacts due to urbanisation. It becomes clear that the distance has significant role in the urbanisation process. For the analysis, four areas were selected from the wetland area. Paschim Chowbaga, located close proximity to Kolkata city, Kheyadaha and Pratapnagar situated far from Kolkata city and Dharmatala Panchuria, the fourth area taken from the North-eastern part of the wetland boundary which is near to the satellite township Rajarhat-Newtown area. The study reveals a rapid rise in built up areas, sealing up of ponds, conversion of open land area as well as agricultural land in close proximity to Kolkata city. On the other hand, the area lying far from the Kolkata city has remained unchanged with noticeable improvement in certain areas. (Fig: 5)

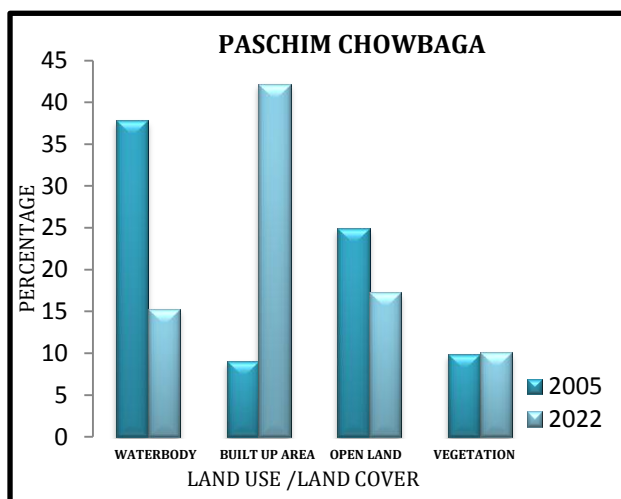


Chart -3: Change in Areal Coverage (%) of different Land Use and Land Cover in Paschim Chowbaga

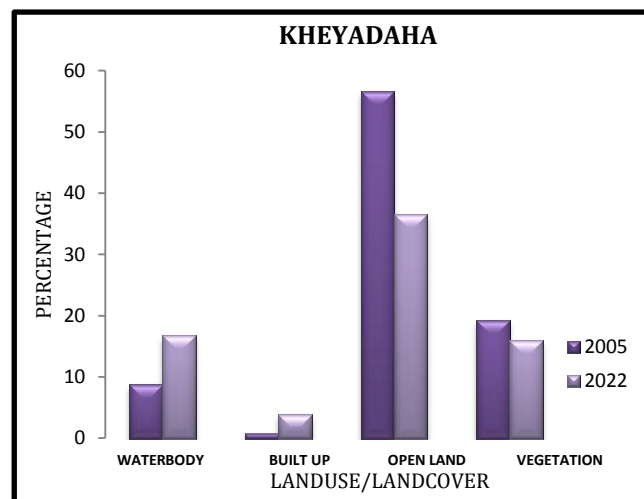


Chart -4: Change in Areal Coverage (%) of different Land Use and Land Cover in Kheyadaha

The percentage of water bodies in Paschim Chowbaga has significantly deteriorated and the reason behind this decline is attributed to the areas proximity to Kolkata city. Due to the increase in real estate business, many land sharks have illegally seized land for development purposes. As a result rampant illegal construction is observed in this region. . Moreover, aqua cultural ponds have been sealed and covered with corrugated sheets, and random modifications of land for industrialization have further impacted the environment. The conversion of wetlands into concrete layers has also led to water logging in many parts of Kolkata. In contrast, Dharmatala Panchuria, located near the satellite township Rajarhat Newtown, has experienced much deterioration of water bodies. (Chart: 3, 4, 5 and 6)

Despite the sealing of some areas of water bodies for construction purposes, they have been well- maintained. Fortunately, there has not been a significant decrease in the size of the water body, in comparison to Paschim Chowbaga, which is located close proximity to the city. In areas such as Dharmatala Panchuria, Kheyadaha, and Pratapnagar fishing is the primary occupation and there has been a significant rise in fisheries production. The built-up areas in all four regions have increased rapidly, with the highest growth rate found in Paschim Chowbaga in terms of area. Behind this changing land use trend, real estate projects are the primary cause. Unfortunately, open lands have also deteriorated, and this is a serious concerns for wetlands. Although there has been a decrease in vegetation cover, it is not at an accelerating rate. Nevertheless, it is important to note that the decrease in wetland area could have potential impacts on the local system.

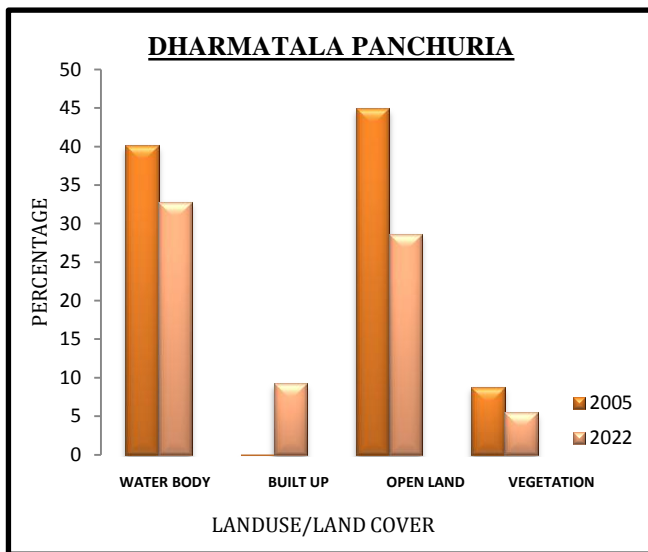


Chart -5: Change in Areal Coverage (%) of different Land Use and Land Cover in Dharmatala Pachuria

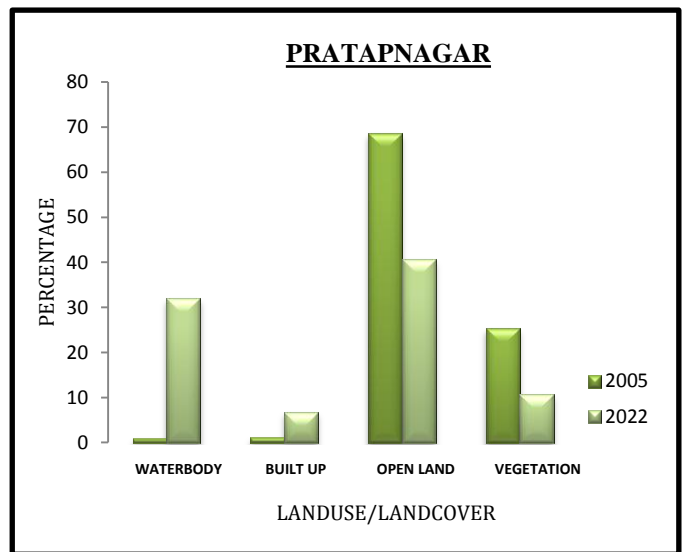


Chart -6: Change in Areal Coverage (%) of different Land Use and Land Cover in Pratapnagar

6. CONCLUSION

The purpose of this study was to find out the impact of urbanisation on the surrounding regions, particularly the areas close to Kolkata and the satellite township of Rajarhat Newtown. The findings revealed that these areas are facing significant threats from urbanisation, with the sealing of bheris and rampant illegal constructions being major concerns in the selected four areas. The wetland conversions to impervious layer were found to be greater in Paschim Chowbaga and Dharmatala panchuria, whereas less built up area conversion was noticed in Kheyadaha and Pratapnagar. The impact of urban expansion on East Kolkata wetland highlights the need for sustainable urban planning and conservation practices. It is crucial that policy makers and stakeholders work together to ensure that the environment and the livelihoods of local communities are protected and preserved for future generations. Considering the increasing effects of global warming and climate change, it is crucial to preserve East Kolkata Wetland. Failure to do so could have disastrous consequences. Therefore appropriate measures need to be taken to ensure the preservation of this vital ecosystem. However, there is still hope for the restoration and conservation of East Kolkata Wetland. The government and various non-governmental organizations have taken steps to protect and preserve the area through initiatives such as Ramsar convention and the east Kolkata wetland management authority. These efforts have focused on sustainable urban development and community based conservation practices.

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